SALT AND NUTRIENT MANAGEMENT PLAN

CENTRAL BASIN AND WEST COAST BASIN
Southern Los Angeles County, California

WRD
WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA

February 12, 2015

WEST BASIN MUNICIPAL WATER DISTRICT

PUBLIC WORKS

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COVER

Center: Map of the Central Basin and West Coast Basin
Upper Left: Photo of the Montebello Forebay Spreading Grounds
Middle Left: Photo of recycled water piping at the Leo J. Vander Lans Advanced Water Treatment Facility
Lower Left: Photo of low impact development in Los Angeles (photo provided courtesy of the Council for Watershed Health)
Upper Right: Photo of groundwater production well
Middle Right: Photo of flowers being watered
Lower Right: Photo of the State Water Project

ACKNOWLEDGMENTS

Many agencies/organizations collaborated to develop the Salt and Nutrient Management Plan (SNMP) for the Central Basin and West Coast Basin (CBWCB). The CBWCB stakeholders would like to recognize and thank everyone who contributed to this tremendous endeavor.

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Multiple agencies/organizations generously dedicated their time to review and comment on project documents, participate in the stakeholder meetings, and provide vital data for the salt and nutrient analysis. We are especially grateful to the Metropolitan Water District of Southern California, Council for Watershed Health, and City of Los Angeles Bureau of Sanitation for their input and contributions.

We would like to express our gratitude to the Los Angeles Regional Water Quality Control Board and Egoscue Law Group for providing invaluable advice and guidance throughout the entire project.

We are truly thankful to the consultant team indicated below who worked tirelessly to facilitate and prepare the SNMP. We greatly appreciated their expertise and patience.

Todd Groundwater
2490 Mariner Square Loop, Suite 215
Alameda, CA 94501
510/747-6920
www.toddgroundwater.com

In cooperation with:

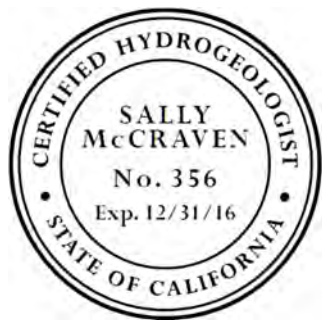
RMC
Water and Environment
2400 Broadway, Suite 300
Santa Monica, CA 90404
310/566-6460
www.rmcwater.com

Nellor
Environmental Associates
4024 Walnut Clay Drive
Austin, TX 78731
512/374-9330

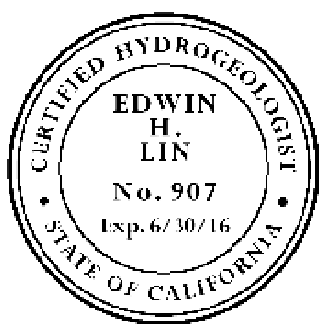
Environmental Science
Associates
626 Wilshire Blvd., Suite1100
Los Angeles, CA 90017
213/599-4300
www.esassoc.com

PROFESSIONAL CERTIFICATION

The Salt and Nutrient Management Plan was prepared under the direct supervision and with the support of the California Professional Geologists whose stamps and signatures appear below. The information contained in this plan has been prepared in accordance with the generally accepted principles and practices of their profession.



Sally McCraven, PG 5427, CHg 356, CEG 1744
Principal Hydrogeologist



Edwin Lin, PG 8312, CHg 907
Senior Hydrogeologist

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List of Acronyms

ADI	Acceptable Daily Intake
AF	Acre-feet
AFY	Acre-feet per year
AGB	Alamitos Gap Seawater Intrusion Barrier
AOP	Advanced oxidation process
APA	Allowed Pumping Allocation
ARRF	Aquifer Recharge and Recovery Facility
ASR	Aquifer Storage and Recovery
AWT	Advanced Water Treatment
AWTF	Advanced Water Treatment Facility
BMPs	Best Management Practices
BOD	Biochemical Oxygen Demand
BPO	Basin Plan Objective
BSBPO	Basin Specific Basin Plan Objective
CASGEM	California Statewide Groundwater Elevation Monitoring Program
CASTNET	Clean Air Status and Trends Network
CCR	California Code of Regulations
CBMWD	Central Basin Municipal Water District
CBWCB	Central Basin and West Coast Basin
CBWA	Central Basin Water Association
CDPH	California Department of Public Health (now the SWRCB Division of Drinking Water)
CEQA	California Environmental Quality Act
CECs	Constituents of Emerging Concern
CIMIS	California Irrigation Management Information System
CIMP	Coordinated Integrated Monitoring Program
COCs	Constituents of Concern
COD	Chemical Oxygen Demand
CR	Colorado River
CREST	Cleaner Rivers through Effective Stakeholder-Led TMDLs
CTAS	Cetyltrimethylammonium Bromide
CWA	Clean Water Act
CWH	Council for Watershed Health
DEET	N,N-Diethyl-meta-toluamide
DGB	Dominguez Gap Seawater Intrusion Barrier
DGSG	Dominguez Gap Spreading Grounds
DME	Designated Monitoring Entity for CASGEM
DTSC	California Department of Toxic Substances Control
DWEL	Drinking Water Equivalent Level
DWR	California Department of Water Resources
EC	Electrical conductivity
EDC	Endocrine Disrupting Compound

List of Acronyms

EIR	Environmental Impact Report
ESR	Engineering Survey and Report
ET	Evapotranspiration
EWMP	Enhanced Watershed Management Plan
ft/d	feet per day
ft^2/d	square feet per day
ft^3/d	cubic feet per day
GAMA	Groundwater Ambient Monitoring and Assessment Program
GBMP	Groundwater Basins Master Plan
GIS	Geographic Information System
GLAC	Greater Los Angeles County
GRIP	Groundwater Reliability Improvement Program
GRIP A	Groundwater Reliability Improvement Program, Recycled Water Project A
GRIP B	Groundwater Reliability Improvement Program, Recycled Water Project B
GSWC	Golden State Water Company
HSU	Hydrostratigraphic Unit
IMP	Integrated Monitoring Program
IRWMP	Integrated Regional Water Management Plan
LABOS	City of Los Angeles Bureau of Sanitation
LACDPW	Los Angeles County Department of Public Works
LADWP	City of Los Angeles Department of Water and Power
LARWMP	Los Angeles River Watershed Monitoring Program
LARWQCB	Los Angeles Regional Water Quality Control Board
LID	Low Impact Development
LUST	Leaking Underground Storage Tank
MAR	Managed Aquifer Recharge
MBAS	Methylene Blue Active Substances
MCL	Maximum Contaminant Level
MF	Microfiltration
MFGWR	Montebello Forebay Groundwater Recharge
MFSGs	Montebello Forebay Spreading Grounds
mg/L	milligrams per liter
MSGBW	Main San Gabriel Basin Watermaster
MS4	Municipal Separate Storm Sewer System
msl	mean sea level
MTBE	Methyl tertiary butyl ether
MWD	Metropolitan Water District of Southern California
N	Nitrogen
ND	Not Detected
NDMA	n-Nitrosodimethylamine
NdN	Nitrification/denitrification
ng/L	nanograms per liter

List of Acronyms

nitrate-N	nitrate as nitrogen
NL	Notification Level
NO_3	Nitrate
NOP	Notice of Preparation
NPDES	National Pollutant Discharge Elimination System
NPR	Non-potable reuse
OCWD	Orange County Water District
OEHHA	California Office of Environmental Health Hazard Assessment
O_3	Ozonation
PBDE	Polybrominated diphenyl ethers
PCE	Tetrachloroethylene
PEIR	Programmatic Environmental Impact Report
PFOS	Perfluorooctane sulfonate
PHG	Public Health Goal
POTWs	Publicly Owned Treatment Works
PPCP	Pharmaceuticals and Personal Care Products
QA/QC	Quality Assurance/Quality Control
RGWMP	Regional Groundwater Monitoring Program
RGWMR	Regional Groundwater Monitoring Report
RHSG	Rio Hondo Spreading Grounds
RO	Reverse Osmosis
RW	Recycled Water
RWQCB	Regional Water Quality Control Board
SAT	Soil Aquifer Treatment
SCCWRP	Southern California Coastal Water Research Project
SDLAC	County Sanitation Districts of Los Angeles County
SED	Substitute Environmental Document
SGRRMP	San Gabriel River Regional Monitoring Program
SGRSG	San Gabriel River Spreading Grounds
SMC	Stormwater Monitoring Coalition
SMCL	Secondary Maximum Contaminant Level
S/N	Salt and Nutrient
SNMP	Salt Nutrient Management Plan
SRWS	Self Regenerating Water Softeners
SSC	Suspended-Sediment Concentration
SWAMP	Surface Water Ambient Monitoring Program
SWP	State Water Project
SWRCB	State Water Resources Control Board
1,1,1-TCA	1,1,1-Trichlorooethane
TCE	Trichloroethylene
TCEP	Tris (2-chloroethyl) phosphate
TCPP	Tris (1-chloro-2-propyl) phosphate

List of Acronyms

TDCP	Tris (2-chloroethyl) phosphate
TDI	Tolerable Daily Intake
TDS	Total Dissolved Solids
TIE	Toxicity Identification Evaluation
TIWRP	Terminal Island Water Reclamation Plant/Advanced Water Purification Facility
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TON	Threshold Odor Number
TSS	Total Suspended Solids
UC Davis	University of California at Davis
µg/L	micrograms per liter
USBOR	United States Bureau of Reclamation
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UV	Ultraviolet Irradiation
UWMPs	Urban Water Management Plans
WBMWD	West Basin Municipal Water District
WBWA	West Basin Water Association
WCBB	West Coast Basin Seawater Intrusion Barrier
WDR	Waste Discharge Requirements
WEMAP	Western Environmental Monitoring and Assessment Program
WIN	Water Independence Now Strategy
WLA	Wasteload Allocation
WMA	Watershed Management Area
WMP	Watershed Management Plan
WQO	Water Quality Objective
WRD	Water Replenishment District of Southern California
WRF	Water Recycling Facility
WRP	Water Reclamation Plant
WRR	Water Recycling Requirements
WRRF	WateReuse Research Foundation
WTF	Water Treatment Facility
WTP	Water Treatment Plant
WY	Water Year

Executive Summary

In accordance with the State Water Resources Control Board's (SWRCB) Recycled Water Policy, this Salt and Nutrient Management Plan (SNMP) was developed through a collaborative process involving major stakeholders in the Central Basin and West Coast Basin (CBWCB), including the Water Replenishment District of Southern California (WRD), Los Angeles County Department of Public Works (LACDPW), West Basin Municipal Water District (WBMWD), Los Angeles Department of Water and Power (LADWP), Sanitation Districts of Los Angeles County (SDLAC), Metropolitan Water District of Southern California (MWD), Council for Watershed Health, City of Los Angeles Bureau of Sanitation, and other interested parties. The CBWCB stakeholders also worked collaboratively with the Los Angeles Regional Water Quality Control Board (LARWQCB) to develop the SNMP. WRD has been the lead agency managing and facilitating development of the CBWCB SNMP.

The purpose of the SNMP is to manage salt and nutrients (S/Ns) from all sources on a basin-wide basis in a manner that facilitates attainment of Water Quality Objectives (WQOs) and preserves beneficial uses. This SNMP will be reviewed and approved by the LARWQCB.

The concept of salt/nutrient management is not new to the CBWCB. For over 50 years, local agencies, including WRD, SDLAC, LACDPW, LADWP, MWD, WBMWD, and numerous other agencies and cities have been collaborating and implementing critical measures, such as water reclamation and reuse, water conservation, improved maintenance of supply and delivery infrastructure, the capture and use of stormwater, and multiple salinity management projects to prevent overdraft, replenish the CBWCB aquifer system, and protect groundwater quality. The use of recycled water in the CBWCB has played a vital role in increasing the reliability and sustainability of the overall water supply.

Background of the Central Basin and West Coast Basin

Two of the most heavily utilized groundwater basins in Southern California are the CBWCB (Study Area), which are located in the southern portion of Los Angeles County. Groundwater resources of the CBWCB meets approximately 40% of the overall water supply needs of nearly 4 million residents and businesses in the 43 cities overlying the basins.

Overall, groundwater in the CBWCB is of high quality, suitable for potable and non-potable uses. While groundwater is a significant source of water supply in the Study Area, that supply is also augmented by imported water and recycled water. As imported water supplies have become more uncertain and expensive, recycled water has become a crucial component of the Study Area's water supply portfolio.

Due to significant historical over-pumping of groundwater, seawater intruded along some coastal areas of the CBWCB. In response, the basins were adjudicated to limit pumping and associated groundwater overdraft, and managed aquifer recharge facilities were constructed to not only halt the seawater intrusion, but also replenish the basins. Three barriers (Dominguez Gap Seawater Intrusion Barrier, Alamitos Gap Seawater Intrusion Barrier, and West Coast Basin

Seawater Intrusion Barrier) are operated to prevent further seawater intrusion. Currently, a blend of treated imported water and an increasing portion of advanced treated recycled water is injected at the barriers, although a future goal is to limit the injected water to recycled water only.

The historical seawater intrusion is most significant in the West Coast Basin where a large seawater-impacted plume is stranded inland of the West Coast Basin Barrier. Two desalter facilities (Robert W. Goldsworthy [Goldsworthy] Desalter and C. Marvin Brewer [Brewer] Desalter) are currently operating to remediate this saline plume.

Management of the CBWCB also entails active replenishment operations. By far the most significant managed aquifer recharge occurring in the Study Area is in the Montebello Forebay (northeast portion of the Central Basin) where spreading grounds are used to recharge stormwater, untreated imported water, and tertiary-treated recycled water.

Tertiary-treated recycled water is also used for irrigation and industrial activities throughout the Study Area, thereby reducing reliance on imported water and groundwater supplies.

Existing Salt and Nutrient Groundwater Quality

From the SNMP analysis, total dissolved solids (TDS), chloride, and nitrate were determined to be the representative indicators of S/Ns in the CBWCB. For the purpose of characterizing the lateral and vertical variability in groundwater quality, the basins were divided into four layers and the Central Basin was further divided into subareas based on hydrogeologic characteristics. Average S/N concentrations were calculated for each basin (and subarea/layer) and compared with the WQOs for nitrate, TDS, and chloride to assess existing groundwater quality and available assimilative capacity.

The SNMP analysis indicates that average TDS and chloride concentrations in the Central Basin are below WQOs, and assimilative capacity is available. Due to saline plumes in the West Coast Basin, average TDS and chloride concentrations exceed WQOs, and as a result there is no available assimilative capacity. If the saline plume inland of the West Coast Basin Barrier is removed from the averaging calculation, average TDS and chloride concentrations in the West Coast Basin are below the WQOs and there is available assimilative capacity. Average nitrate concentrations are very low, well below the WQO in both basins and assimilative capacity is available. There are no significant nitrate loading sources in the CBWCB and thus, nitrate is not considered a water quality concern and is not expected to be a concern in the future.

In the Central Basin, average TDS and chloride concentrations in groundwater are below WQOs and will not exceed WQOs in the future.

In the West Coast Basin, average TDS and chloride concentrations in groundwater currently exceed WQOs due to historical seawater intrusion. However, existing and planned implementation measures ensure that WQOs will be achieved in the future.

Nitrate is not a water quality concern in either the Central Basin or West Coast Basin and is not expected to be a concern in the future.

SNMP Mixing Model and Water Quality Simulations

In order to assess future groundwater quality in the CBWCB, a mixing model was developed for the SNMP. This SNMP mixing model was designed to incorporate the existing volume of groundwater and mass of TDS, chloride, and nitrate in storage and track the annual change in groundwater storage and S/N mass for each model subarea/layer. S/N loading estimates for key inflows (including spreading ground recharge, seawater intrusion barrier injection, irrigation return flow, mountain front and precipitation recharge, and subsurface inflow) and outflows (including groundwater pumping and subsurface outflows) were determined based on available data and volumetric water budgets obtained from an existing groundwater model that was previously developed by the United States Geological Survey (USGS). Selected S/N loading estimates and assumptions were refined to ensure a reasonable agreement between the simulated results and the dominant patterns in actual observed groundwater quality within each model subarea/layer over the 10-year baseline period (Water Year [WY] 2000-01 through 2009-10) through a calibration process. Loading assumptions developed through the baseline period assessment were then applied to the 15-year future planning period (WY 2010-11 through 2024-25) S/N balances.

In recognition of the water supply implications of climate change, drought, and uncertainties and increasing costs associated with imported water supplies, the CBWCB stakeholders have, for many years, been planning and implementing projects, programs, and strategies to maximize the use of recycled water and stormwater, encourage conservation, reduce reliance on potable water supplies, and improve groundwater quality and supply. Over the 15-year future planning period, additional projects are anticipated to be implemented by the CBWCB stakeholders. The SNMP mixing model was used to predict/simulate the impacts of proposed major projects and combinations of these projects (referred to as "scenarios" and listed below) on overall groundwater quality in the CBWCB through WY 2024-25.

- **No Future Projects** – Average of baseline period (WY 2000-01 through 2009-10) conditions (i.e., continuation of existing projects) reproduced for each year of the future planning period (WY 2010-11 through 2024-25). Water quality impacts from this scenario were compared with other project scenarios to quantify the impacts of future projects.
- **Increased Recycled Water for Irrigation** – Increased use of recycled water for irrigation, replacing imported water and groundwater. Two scenarios involving different recycled water quality were simulated:
  - Recycled water quality is equivalent to the average recycled water quality over the 10-year baseline period.
  - Recycled water quality is equivalent to the Secondary Maximum Contaminant Levels (SMCLs) for TDS and chloride and the Maximum Contaminant Level (MCL) for nitrate. These recycled water concentrations are higher than the baseline period averages and currently, permitted recycled water quality limits established for non-potable reuse (irrigation, industrial and recreational

activities) are generally more conservative than the SMCLs established for TDS and chloride.

- **Seawater Intrusion Barriers** – Increased recharge at the three seawater intrusion barriers with recycled water that has undergone advanced water treatment (AWT), thereby completely replacing the imported water that is currently injected. The switch to 100% AWT recycled water at the barriers significantly reduces salt loading because AWT recycled water has lower TDS and chloride concentrations in comparison to imported water. The movement toward 100% AWT recycled water at the barriers has been fully supported by the regulatory agencies, including the LARWQCB and SWRCB Division of Drinking Water (formerly California Department of Public Health [CDPH]).
- **Increased Groundwater Pump and Treat by the Desalters** – Expansion of the Goldsworthy Desalter and increased pump and treat of brackish groundwater by the Goldsworthy Desalter and the Brewer Desalter, both in West Coast Basin.
- **Montebello Forebay Spreading Grounds** – Increased AWT and/or tertiary-treated recycled water recharge at the Montebello Forebay Spreading Grounds (MFSG) to completely replace imported water (up to 21,000 acre-feet per year [AFY]); this project is proposed under WRD's Groundwater Reliability Improvement Program (GRIP). As a result of multiple studies over a number of years to evaluate of a wide spectrum of potential water supply reliability improvement projects, two different GRIP recycled water projects, as described below, were determined to be the best alternatives for implementation and potential water quality impacts were simulated by the SNMP mixing model.
    - GRIP Recycled Water Project A (GRIP A) – A combination of tertiary-treated (11,000 AFY) and AWT (10,000 AFY) recycled water to replace imported water.
    - GRIP Recycled Water Project B (GRIP B) – 100% tertiary-treated recycled water (21,000 AFY) to replace imported water.

These future projects/scenarios were simulated individually and in various combinations to assess future trends in S/N groundwater quality and evaluate the use of available assimilative capacity. The potential effects of population growth, climate change, and drought were also considered as part of the SNMP analysis.

Future Salt and Nutrient Groundwater Quality

The SNMP assessment indicates that future projects that may increase S/N loading are more than offset by projects that reduce loading. Nitrate does not exceed or threaten to exceed its WQO in either the Central Basin or West Coast Basin. Average TDS and chloride concentrations do not exceed or threaten to exceed their WQOs in the Central Basin. In the West Coast Basin, average TDS and chloride concentrations are currently greater than their WQOs due to the existence of trapped inland saline plumes resulting from historical seawater intrusion. However, these WQOs are estimated to be achieved in 2035 as a result of existing and planned implementation measures[1], which include the basin adjudication and associated limits on pumping, operation of the seawater intrusion barriers and desalters, increased recharge and use of AWT recycled water at the barriers, and increased pumping for the desalters.

Assimilative Capacity and Anti-Degradation Analysis

The regional and cumulative impacts analysis presented in this SNMP demonstrates that multiple recycled water projects in the Central Basin will not use more than 10% or 20% of the TDS, chloride, or nitrate assimilative capacity. In the West Coast Basin, where there is no available assimilative capacity, multiple recycled water projects improve groundwater quality with respect to TDS and chloride and have essentially no impact on existing nitrate concentrations. Thus, multiple recycled water projects in the West Coast Basin will not use more than 10% or 20% of the nitrate assimilative capacity and implementation measures in the West Coast Basin will result in achievement of TDS and chloride WQOs in the future.

Nitrate concentrations in the CBWCB remain significantly below the WQO and recycled water projects will not use more than 10% of the assimilative capacity.

In the Central Basin, recycled water projects will use less than 10% of the assimilative capacity for TDS and chloride.

In the West Coast Basin, where there is currently no assimilative capacity for TDS and chloride, recycled water projects will significantly improve groundwater quality and the TDS and chloride WQOs are estimated to be achieved in 2035.

[1] Implementation measures are strategies, projects, or programs that were developed or have been implemented by the stakeholders to control, reduce, or manage (mitigate) salt and nutrient loading to a groundwater basin on a sustainable basis.

Implementation Measures

Due to the importance of the basins as a water supply source, the CBWCB stakeholders have been implementing projects to manage S/Ns in the Central Basin and West Coast Basin for many years. There are over 40 implementation measures that currently exist or will be implemented by the stakeholders prior to 2025 to manage S/Ns on a sustainable basis. The major implementation measures proposed in the CBWCB that were quantitatively[2] assessed for the future planning period include:

- Increased recharge at the three seawater barriers with AWT recycled water, thereby replacing imported water completely.
- Expansion of the Goldsworthy Desalter and increased groundwater pumping for treatment by the Goldsworthy Desalter and Brewer Desalter, both in the West Coast Basin.
- Decreased irrigation return flows in the CBWCB due to decreased imported water use in the Central Basin.
- Increased stormwater capture at the Dominguez Gap Spreading Grounds.

Existing and planned implementation measures are protective of groundwater quality and preserve beneficial uses.

SNMP Monitoring Program

In accordance with the Recycled Water Policy, a *Monitoring Plan* for the SNMP was prepared by the CBWCB stakeholders to describe the S/N Monitoring Program that was developed for the basins. The SNMP *Monitoring Plan* also includes detailed descriptions of other existing monitoring programs in the CBWCB, as well as special studies that have been conducted or are in progress. The intent of the SNMP Monitoring Program is to evaluate S/N concentrations in groundwater with respect to applicable WQOs.

The SNMP Monitoring Program was designed based on an extensive history of managing water quality of the basins, and consists of seventy (70) nested groundwater monitoring wells at 13 locations throughout the most critical areas of the CBWCB, in particular near water supply wells and groundwater recharge projects that utilize recycled water (including the seawater intrusion barriers and the MFSG). In addition to groundwater monitoring, the CBWCB and tributary areas have numerous and extensive monitoring programs for recycled water, wastewater, imported water, and surface water/stormwater, including sampling for TDS, chloride, and nitrate, that are being managed by multiple stakeholder agencies/organizations.

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[2] There are many other existing, planned, and conceptual implementation measures, which are anticipated to improve groundwater quality. However, due to the lack of data regarding these implementation measures/projects, their positive impacts to groundwater quality could not be accurately quantified using the SNMP mixing model.

Monitoring for constituents of emerging concern (CECs) in the Study Area is being conducted for the groundwater recharge projects that utilize recycled water, wastewater treatment plants that discharge to surface water, and for special studies. There are also ongoing leading edge research efforts to further develop analytical methods and understand the health implications of low level detections. As such, no additional CEC monitoring was found to be warranted in the CBWCB and thus, not proposed as part of the SNMP *Monitoring Plan*.

WRD is the designated entity responsible for implementing the SNMP Monitoring Program. Once the LARWQCB has approved the SNMP *Monitoring Plan* and established an SWRCB GeoTracker weblink for the SNMP Monitoring Program for the CBWCB, WRD will implement the SNMP Monitoring Program by collecting TDS, chloride, and nitrate data from the 70 SNMP monitoring wells on a semi-annual basis and uploading this water quality data to the GeoTracker database. Based on results from the SNMP Monitoring Program, the SNMP *Monitoring Plan* will be updated as necessary. Additionally, the SNMP *Monitoring Plan* will be reviewed and updated as necessary as part of the SNMP review every 10 years.

WRD is the designated entity responsible for implementing the SNMP Monitoring Program. On a semi-annual basis, WRD will collect salt and nutrient data from 70 nested groundwater monitoring wells located throughout the most critical areas of the basins and report the data to the LARWQCB via the SWRCB online GeoTracker database.

Benefits of Increased Recycled Water Use in the CBWCB

As demonstrated in this SNMP, negative water quality impacts from recycled water projects in the CBWCB were determined to be minimal and more than offset by implementation measures that improve groundwater quality. Thus, this SNMP may be used to provide a basis for streamlining of the permitting process for recycled water projects in the future, per the Recycled Water Policy. In particular, GRIP A or GRIP B may be implemented with no or minimal water quality impacts. Increased irrigation with recycled water has very small impacts on groundwater quality and thus, permits for individual irrigation sites are not warranted. Further, TDS, chloride, and nitrate limits for recycled water used for irrigation can be equivalent to SMCLs/MCL, while still protecting groundwater quality and preserving beneficial uses.

The SNMP analysis finds that AWT recycled water is one of the highest quality source waters available in the CBWCB and that the use of AWT recycled water is a critical factor in achieving WQOs and restoring beneficial uses in the West Coast Basin, where historical seawater intrusion has degraded groundwater quality in certain areas. Tertiary-treated recycled water is also a critical component of the water supply portfolio in the CBWCB and its use can be safely increased, including implementation of proposed projects that could increase S/N loading.

Increased use of recycled water in the CBWCB is consistent with the goals of the Recycled Water Policy and necessary to ensure a sustainable water supply. Recycled water has been proven to be a safe, reliable, locally-produced, drought-proof water supply and a critical component of the local water supply portfolio. Use of recycled water in the CBWCB is consistent with the maximum benefit of the people of the State of California.

Increased use of recycled water in the CBWCB is consistent with the goals of the Recycled Water Policy and necessary to ensure a sustainable water supply.

Negative water quality impacts from the use of recycled water in the CBWCB were demonstrated to be minimal and more than offset by implementation measures that improve groundwater quality.

Thus, this SNMP may be used to provide a basis for streamlining of the permitting process for recycled water projects in the future.

Associated SNMP Documents and Periodic Updates to the SNMP

Based on the SNMP approved by LARWQCB, a Basin Plan Amendment was prepared by the LARWQCB and adopted (Resolution R15-001) by the LARWQCB Board on February 12, 2015. A Substitute Environmental Document (SED) was also prepared in conjunction with the SNMP to comply with California Environmental Quality Act (CEQA) requirements. LARWQCB was the lead agency for purposes of CEQA, while the CBWCB stakeholders conducted the CEQA analysis and worked in collaboration with LARWQCB to prepare the SED. Both the Draft SED and Draft SNMP were submitted to LARWQCB in August 2014 for their review. The SNMP and SED were both finalized following adoption of Resolution R15-001 by the LARWQCB Board on February 12, 2015.

The SNMP is intended to be a living document, and the S/N management program, including the goals, existing basin conditions, implementation measures, SNMP Monitoring Program, etc., will be reviewed every 10 years by the CBWCB stakeholders with updates made as necessary. However, based on results from the SNMP Monitoring Program, interim updates to the SNMP may be conducted when deemed necessary.

A Basin Plan Amendment based on the SNMP was prepared by the LARWQCB and adopted by the LARWQCB Board on February 12, 2015.

A Substitute Environmental Document was also prepared in conjunction with the SNMP to comply with CEQA requirements.

The SNMP, which includes the *Monitoring Plan*, will be reviewed and updated as necessary every 10 years by the CBWCB stakeholders. However, based on results from the SNMP Monitoring Program, interim updates to the SNMP may be conducted when deemed necessary.

1 Introduction

In accordance with the State Water Resources Control Board's (SWRCB) Recycled Water Policy, this Salt and Nutrient Management Plan (SNMP) was prepared by a consultant team led by Todd Groundwater and developed through a collaborative process involving major stakeholders in the Central Basin and West Coast Basin (CBWCB or Study Area), which are located in Southern Los Angeles County, California. These CBWCB stakeholders include the Water Replenishment District of Southern California (WRD), Los Angeles County Department of Public Works (LACDPW), West Basin Municipal Water District (WBMWD), Los Angeles Department of Water and Power (LADWP), County Sanitation Districts of Los Angeles County (SDLAC), Metropolitan Water District of Southern California (MWD), Council for Watershed Health, City of Los Angeles Bureau of Sanitation, and other interested parties. The CBWCB stakeholders also worked collaboratively with the Los Angeles Regional Water Quality Control Board (LARWQCB) to develop the SNMP. WRD has been the lead agency managing and facilitating development of the CBWCB SNMP and all associated documents.

1.1 Purpose and Scope

As stated in the Recycled Water Policy, the goal of the SNMP is to manage salt and nutrients (S/Ns) from all sources on a basin-wide basis in a manner that facilitates attainment of Water Quality Objectives (WQOs) and preserves beneficial uses. The Recycled Water Policy encourages development of regional S/N management strategies rather than relying on an approach of imposing requirements on individual recycled water projects with no recognition of the relative and cumulative impacts when all projects and loading sources are considered regionally. Accordingly, this SNMP supports and provides justification for elimination of separate anti-degradation analyses and individual site monitoring requirements for proposed recycled water projects so that the permitting process for the vast majority of proposed recycled water projects may be streamlined. The intent of this streamlined permitting process is to expedite the implementation of recycled water projects in a manner that complies with State and Federal water quality laws.

1.2 Regulatory Framework

Guidance for development of this SNMP was provided by the Recycled Water Policy, LARWQCB's *SNMP Regional Water Board Assistance in Guiding Salt and Nutrient Management Plan Development in the Los Angeles Region*, and the *Workplan of the Salt/Nutrient Management Plan, Central Basin and West Coast Basin* that was previously prepared by the CBWCB stakeholders and approved by LARWQCB.

In February 2009, the SWRCB adopted Resolution No. 2009-0011, *Policy for Water Quality Control for Recycled Water* (Recycled Water Policy). The statewide Recycled Water Policy was revised, specifically the monitoring requirements for priority pollutants and constituents of emerging concern, by an Amendment (Resolution No. 2013-0003) that was adopted by the SWRCB on January 22, 2013 and became effective on April 25, 2013. The Recycled Water Policy and its Amendment (http://www.swrcb.ca.gov/water_issues/programs/water_recycling_policy/docs/rwp_revtoc.pdf) are provided as **Appendix A**.

In recognition of the water crisis faced by California due to collapse of the Bay-Delta ecosystem, climate change, and continuing population growth combined with severe drought on the Colorado River and failing levees in the Delta, the Recycled Water Policy strongly encourages, *". . . local and regional water agencies to move toward clean, abundant, local water for California by emphasizing appropriate water recycling, water conservation, and maintenance of supply infrastructure and the use of stormwater (including dry-weather runoff) in these plans; these sources of supply are drought-proof, reliable, and minimize our carbon footprint and can be sustained over the long-term.*" (SWRCB, 2009) Specifically, the Recycled Water Policy establishes the following goals for California:

- Increase the use of recycled water over 2002 levels by at least one million acre-feet per year (AFY) by 2020 and by at least two million AFY by 2030,
- Increase the use of stormwater over use in 2007 by at least 500,000 AFY by 2020 and by at least one million AFY by 2030,
- Increase the amount of water conserved in urban and industrial uses by comparison to 2007 by at least 20% by 2020, and
- Included in these goals is the substitution of as much recycled water for potable water as possible by 2030.

Recognizing that some groundwater basins contain S/Ns that exceed or threaten to exceed WQOs established in the applicable RWQCB Water Quality Control Plans (Basin Plans[3]) and that recycled water can contribute to S/N loading, the Recycled Water Policy requires local water and wastewater entities, together with local S/N contributing stakeholders to develop a SNMP for each groundwater basin and subbasin in California by May 2014. At the request of the CBWCB stakeholders, the LARWQCB issued an approval letter to extend the deadline for submittal of the Draft CBWCB SNMP and the associated Draft SED to LARWQCB for review by August 31, 2014. Upon LARWQCB's review and approval of the SNMP, an Implementation Plan based on the SNMP will be adopted as an amendment to the Basin Plan by the LARWQCB Board. Section 1.3 describes other documents that were prepared in conjunction with the SNMP.

In addition to establishing WQOs, the Basin Plan also defines beneficial uses for waters of the State, strategic planning and implementations, plans and policies, and monitoring and assessment. Chapters 1 through 3 of the LARWQCB Basin Plan are provided as **Appendix B** and the entire Basin Plan can be downloaded from the LARWQCB website:

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[3] The Basin Plan was issued by the Los Angeles Regional Water Quality Control Board (LARWQCB) in 1994 to preserve and enhance water quality and protect the beneficial uses of all regional waters in the Los Angeles Region. Specifically, the Basin Plan designates the beneficial uses for surface water and groundwater, establishes numerical objectives (referred to as Water Quality Objectives [WQOs]) that must be attained or maintained to protect the designated beneficial uses and conform to the State's Anti-degradation Policy, and describes implementation programs to protect all waters in the region.

http://www.waterboards.ca.gov/losangeles/water_issues/programs/basin_plan/basin_plan_documentation.shtml.

On June 28, 2012, the LARWQCB issued the *Regional Water Board Assistance in Guiding Salt and Nutrient Management Plan Development in the Los Angeles Region* (SNMP Assistance Document), which provides guidance for preparation of the SNMP within the Los Angeles Region and the associated Substitute Environmental Document, which is further described in Section 1.3. The SNMP Assistance Document was also used to develop this SNMP and is provided as **Appendix C** and can be downloaded from the LARWQCB website: http://www.swrcb.ca.gov/rwqcb4/water_issues/programs/salt_and_nutrient_management/Stakeholder_Outreach/Regional%20Water%20Board%20SNMP%20Assistance%20Document.PDF.

In 2011, the CBWCB stakeholders prepared the *Workplan of the Salt/Nutrient Management Plan, Central Basin and West Coast Basin* (SNMP Workplan) and submitted this document to the LARWQCB for review. The purpose of the SNMP Workplan was to provide an outline of the SNMP and discuss the major elements to be included in the SNMP. On December 13, 2011, LARWQCB issued an approval letter for the SNMP Workplan. This SNMP was prepared in general accordance with the approved SNMP Workplan. Both the SNMP Workplan and the associated LARWQCB approval letter are provided as **Appendix D** and can be downloaded from the LARWQCB website: http://www.swrcb.ca.gov/rwqcb4/water_issues/programs/salt_and_nutrient_management/Stakeholder_Outreach/Workgroups/central_and_west_coast_Basin.shtml.

SWRCB Resolution No. 68-16 (State Anti-Degradation Policy) is incorporated into all Basin Plans. The intent of the Anti-Degradation Policy is that waters of the State shall be regulated to achieve the highest water quality consistent with the maximum benefit to the people of the State. The Recycled Water Policy allows recycled water projects that result in a lowering of water quality within a basin if an anti-degradation analysis demonstrates that the change is consistent with maximum benefit to people of State, will not unreasonably affect present and potential beneficial uses, and will not result in water quality lower than applicable standards. The Anti-Degradation Policy is provided as **Appendix D** in the SNMP Workplan (CBWCB Stakeholders, 2011). The Anti-Degradation Policy can also be downloaded from the SWRCB website: http://www.swrcb.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf.

1.2 Associated SNMP Documents

A few additional documents were or will be prepared in conjunction with the SNMP, including:

1) *Substitute Environmental Document* (SED) and
2) *Basin Plan Amendment*.

These documents are described further in the subsections below.

1.2.1 Substitute Environmental Document

As set forth in the Recycled Water Policy, the SNMP must comply with the California Environmental Quality Act (CEQA). CEQA requires that State and local agencies determine the potential significant environmental impacts of proposed projects and identify measures to avoid or mitigate these impacts where feasible. The basic objectives of CEQA are to: 1) inform decision makers and public about the potential significant environmental effects of a proposed project, 2) identify ways that environmental damage may be mitigated, 3) prevent significant, avoidable damage to the environment by requiring changes in projects, through the selection of alternative projects or the use of mitigation measures when feasible, and 4) disclose to the public why an agency approved a project if significant effects are involved (California Code of Regulations [CCR], Title 14, § 15002(a)).

In accordance with LARWQCB's SNMP Assistance Document, the LARWQCB is the lead agency for purposes of CEQA, while the CBWCB stakeholders will conduct the CEQA analysis and work in collaboration with LARWQCB. Key elements of the CEQA process are summarized below.

1) Preparation of an SED, consistent with the CCR, Title 23, §3777(a)) and Public Resources Code §21159, is required to support the Basin Plan Amendment and must be submitted to the LARWQCB in conjunction with the SNMP. The SED was prepared by the CBWCB stakeholders and has been submitted to the LARWQCB under separate cover (Environmental Science Associates [ESA], 2014). The SED consists of the following:
    a. Completed Environmental Checklist,
    b. A brief description of the Recommended Program Alternative,
    c. Identification of any significant or potentially significant adverse environmental impacts of the Recommended Program Alternative,
    d. An analysis of reasonable alternatives to the Recommended Program Alternative and mitigation measures to avoid or reduce any significant or potentially significant adverse environmental impacts, and
    e. An environmental analysis of the reasonably foreseeable methods of compliance.
2) A CEQA Scoping Meeting was held on October 21, 2013 to receive comments from the public on the appropriate scope and content of the SED. The purpose of this meeting was to scope the proposed implementation measures and major recycled water projects that were developed by the CBWCB stakeholders to manage S/Ns in the basins and to determine, with input from interested agencies and persons, if those means would result in significant adverse impacts to the environment. At this public meeting, LARWQCB, WRD, and ESA gave presentations describing the Recycled Water Policy, general CEQA process, SNMP findings and implementation measures, proposed major recycled water projects, and environmental criteria for the CEQA evaluation.

    As the lead agency for the CEQA process, LARWQCB prepared and issued the Notification of the CEQA Scoping Meeting to all interested parties and was designated as the entity to receive all public comments regarding the proposed SED scope and content. A 30-day public comment period was established by LARWQCB and comments also were solicited during the October 21st CEQA Scoping Meeting. No comments regarding the proposed environmental analysis were received by LARWQCB by the deadline of October 31, 2013 and thus, there are no responses to public comments presented in the SED.

Although not required as part of the CEQA process, the CBWCB stakeholders also prepared a Project Summary that concisely presented key SNMP findings, implementation measures, and proposed major recycled water projects. The Project Summary was distributed during the October 21st CEQA Scoping Meeting and was also distributed by LARWQCB along with the Notification of the CEQA Scoping Meeting to all interested parties. Documents associated with the CEQA Scoping Meeting, including the meeting Notification, presentations, sign-in sheet, and Project Summary, can be downloaded from the LARWQCB website: http://www.swrcb.ca.gov/rwqcb4/water_issues/programs/salt_and_nutrient_management/index.shtml.

3) A Draft SED and Draft SNMP were prepared and submitted by the CBWCB stakeholders to LARWQCB for their review on August 29, 2014. No comments were received subsequently from LARWQCB regarding both draft documents. The SED and SNMP were both finalized after the LARWQCB Board adopted the Basin Plan Amendment (see Section 1.3.2 below for further details) on February 12, 2015.

1.2.2 Basin Plan Amendment

The Recycled Water Policy states that within one year of the receipt of a proposed SNMP, the RWQCB shall consider adopting an implementation plan, consistent with Water Code Section 13242, for those groundwater basins within their regions where water quality objectives for S/Ns are being, or are threatening to be, exceeded. The implementation plan would be adopted as an amendment to the Basin Plan and shall be based on the SNMP approved by the LARWQCB. For the CBWCB SNMP, a Basin Plan Amendment was prepared by the LARWQCB and adopted (Resolution R15-001) by the LARWQCB Board on February 12, 2015. Resolution R15-001 can be downloaded from the LARWQCB website: http://63.199.216.6/bpa/docs/R15-001_RB_RSL.pdf. This SNMP has been finalized following adoption of Resolution R15-001.

1.3 SNMP Organization

This SNMP is organized into an Executive Summary, 12 sections, and 11 appendices as summarized below. Associated SNMP documents were described in Section 1.3.

Section 1 – Describes the purpose of the SNMP, CBWCB stakeholders, regulatory framework, pertinent time periods assessed in the SNMP, associated SNMP documents, and the report organization.

Section 2 – Summarizes the stakeholder process for development of the SNMP.

Section 3 – Presents the hydrogeologic characteristics, source waters, and management of the CBWCB.

Section 4 – Describes the water inflows and outflows to and from the CBWCB for the baseline and future planning period.

Section 5 – Describes average existing groundwater quality and available assimilative capacity.

Section 6 – Describes the salt and nutrient inflows and outflows to and from the CBWCB.

Section 7 – Describes future groundwater quality and use of assimilative capacity by major recycled water and other projects proposed in the CBWCB.

Section 8 – Presents the anti-degradation analysis.

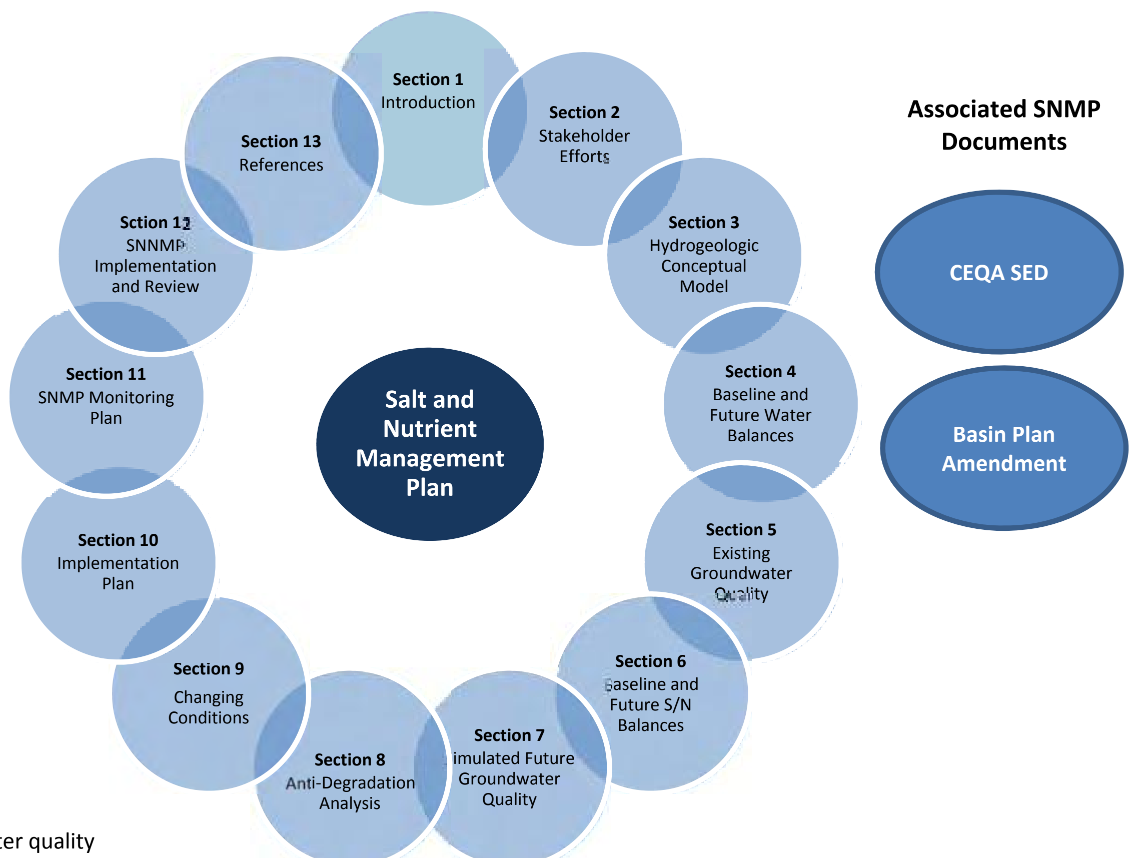
Section 9 – Describes changing conditions including population growth, climate change, drought, and greenhouse gas emissions associated with SNMP projects and implementation measures.

Section 10 – Summarizes proposed major recycled water projects and implementation measures.

Section 11 – Summarizes the SNMP Monitoring Program.

Section 12 – Describes the SNMP implementation plan including schedule and performance measures.

Section 13 – Provides the references cited in the SNMP and its appendices.



Notes:
WQ – water quality
AC – assimilative capacity
S/N – salt and nutrient
SNMP – Salt and Nutrient Management Plan
CEQA – California Environmental Quality Act
SED – Substitute Environmental Document

Supporting materials are attached as the following appendices to this SNMP.

Appendix A – State Water Resources Control Board *Recycled Water Policy for Water Quality Control for Recycled Water* (Recycled Water Policy), Resolution No. 2013-0003, Revised January 22, 2013 and Effective April 25, 2013 (originally approved as Resolution No. 2009-0011 on May 14, 2009)

Appendix B – Los Angeles Regional Water Quality Control Board *Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties*, June 13, 1994 (only Chapters 1 through 3 are provided herein)

Appendix C – Los Angeles Regional Water Quality Control Board, June 28, 2012, *Regional Water Board Assistance in Guiding Salt and Nutrient Management Plan Development in the Los Angeles Region*

Appendix D – *Final Revised Workplan of the Salt/Nutrient Management Plan, Central Basin and West Coast Basin*, October 24, 2011 and Los Angeles Regional Water Quality Control Board, December 13, 2011, Approval letter for Workplan for the Salt and Nutrient Management Plan for Central Basin and West Coast Groundwater Basins

Appendix E – *List of Definitions* provides definitions for key terms used in this SNMP and the appendices.

Appendix F – *Stakeholder Process* describes the CBWCB stakeholders involved in the development of the SNMP and the stakeholder communication/participation process.

Appendix G – *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality* describes the hydrogeologic conditions of the CBWCB and existing S/N groundwater quality and available assimilative capacity.

Appendix H – *Baseline and Future Water Balances* presents the 10-year baseline period (WY 2000-01 to 2009-10) and 15-year future planning period (WY 2010-11 to 2024-25) water balances. The water balances document all of the water inflows and outflows of the CBWCB and these water balances provide the basis for S/N balances.

Appendix I – *Simulated Baseline and Future Salt and Nutrient Groundwater Quality* describes the baseline and future planning period S/N balances. A mixing model was developed to simulate baseline and future planning period S/N groundwater quality. This appendix describes the SNMP mixing model, the baseline period calibration process, and assimilative capacity that was calculated for the basins. The S/N balances document all of the S/N inflows and outflows of the CBWCB and provide the basis for future groundwater quality projections. This appendix quantifies the use of available assimilative capacity by recycled water projects and based on that use, presents an anti-degradation analysis.

Appendix J – *Implementation Plan* describes implementation measures and proposed major recycled water projects that were developed by the CBWCB stakeholders to manage S/Ns in the basins on a sustainable basis.

Appendix K – *Monitoring Plan* describes the S/N monitoring program that was developed for the CBWCB. This SNMP *Monitoring Plan* also provides detailed descriptions of other existing monitoring programs in the CBWCB, as well as special studies that have been conducted or are in progress. In accordance with the Recycled Water Policy, the SNMP *Monitoring Plan* was developed to evaluate S/N concentrations in groundwater with respect to applicable WQOs. Although the SNMP *Monitoring Plan* is provided as Appendix K, it was prepared as a stand-alone document with its own set of figures, so that this document could be easily changed out in the event revisions need to be made to the SNMP *Monitoring Plan* in the future.

1.4 Time Periods for the SNMP Analysis

There are three time periods used in this SNMP to assess water quality conditions with respect to S/Ns, including:

1. In accordance with the Recycled Water Policy, the average S/N concentrations of the basin or subbasin were estimated using the most recent five years of available data. At the time the SNMP analysis was initiated[4], the last available sampling event for some wells occurred in 2011. Therefore, samples collected from January 2007 through mid-2012 (5-year water quality averaging period) were used to calculate the average existing groundwater quality and available assimilative capacity.
2. Water quality was simulated over a 10-year baseline period from WY 2000-01 to 2009-10 and compared with the dominant regional observed groundwater trends to assess and adjust (if warranted) loading factors. This baseline period included a range of precipitation conditions from very wet to very dry to normal.
3. In accordance with the Recycled Water Policy, the water quality impacts of major recycled water projects in the CBWCB were assessed over a 15-year future timeframe. A 10-year future planning period originally was established and described in the SNMP Workplan, but the planning period was extended to 15 years at the recommendation of the LARWQCB. This 15-year future planning period (WY 2010-11 to 2024-25) is used to simulate future projects and their impacts to groundwater quality and use of assimilative capacity.

[4] The CBWCB SNMP data collection and analysis process began in May 2012.

2 Stakeholder Efforts to Develop the SNMP

Stakeholders in the CBWCB have been meeting and collaborating to develop the SNMP since the Recycled Water Policy was issued by the SWRCB in 2009. The stakeholder process was conducted in accordance with the Recycled Water Policy (Appendix A) and the LARWQCB's SNMP Assistance Document (Appendix C). As explained further in this section, key elements of the stakeholder process include public outreach, workshops/meetings to elicit input and feedback, review of interim project-related documents, and data gathering/sharing.

Stakeholders in the CBWCB that participated in the SNMP process and collaborated to develop the SNMP include water and wastewater entities, regulatory agencies, water purveyors, water associations, and environmental groups. WRD has been the lead agency managing and coordinating development of the SNMP. Funding partners for the SNMP consist of WRD, LACDPW, WBMWD, LADWP, and SDLAC. These agencies, as well as other key stakeholders, including MWD, the Council for Watershed Health (CWH), and LARWQCB, were actively involved in developing and reviewing all technical documents associated with the SNMP. Many other stakeholders also participated in the SNMP development process and were notified of the SNMP workshops/meetings, progress, and links to technical documents to provide opportunity for comments and input. The complete list of CBWCB stakeholders and their roles and responsibilities in this process are described in more detail in Table F-1 in **Appendix F** *Stakeholder Process*.

2.1 Stakeholder Outreach and Participation

In the beginning of the SNMP development process in 2009, the CBWCB stakeholders attended multiple conferences and reviewed all available documents to gather information that could assist in the preparation of the SNMP. As the project progressed, seven CBWCB SNMP workshops and multiple stakeholder meetings were hosted by WRD in order to inform the stakeholders of the SNMP process and findings and to seek stakeholder input. As described in Section 1.3, a CEQA Scoping Meeting was held on October 21, 2013 to receive comments from the public on the appropriate scope and content of the SED. The dates, topics, key agenda items, and purpose of key SNMP workshops/meetings are summarized in Table F-2 in Appendix F.

An e-mail address (wrd@saltnutrient.com) and a SNMP website (http://www.wrd.saltnutrient.com/) was established by the CBWCB stakeholders to promote communication, allow sharing of project documents, and allow the submittal of comments and questions throughout the SNMP development process. Stakeholders and other interested parties could use the website to learn more about the CBWCB SNMP, sign up to be on the distribution list for upcoming stakeholder workshops, or submit comments/questions. In addition, a File Transfer Protocol (FTP) site was created to allow data to be shared easily amongst the CBWCB SNMP stakeholders.

The CBWCB stakeholders were notified via e-mail of the posting of technical documents for public review and upcoming SNMP workshops/meetings. All CBWCB SNMP workshops were open to the public. Each workshop included a presentation with ample time allocated for comments, questions, and answers. Stakeholder participation was tracked via sign-in sheets.

After each CBWCB SNMP workshop and the October 21, 2013 CEQA Scoping Meeting, the presentation, a workshop summary documenting the presentation and discussion, and the sign-in sheet were posted on the CBWCB SNMP website. Other CBWCB SNMP information, including technical memoranda, reports, guidance documents, and related weblinks, were also posted on the CBWCB SNMP website.

To further encourage stakeholder participation and promote data sharing to develop the SNMP, WRD presented information about the CBWCB SNMP to other regional water planning groups, including two local Integrated Regional Water Management Plan (IRWMP) Stakeholder Groups (Greater Los Angeles Region IRWMP and Los Angeles Gateway Region IRWMP) in 2012. In addition, WRD, at the request of LARWQCB, gave a presentation to the SWRCB Board on March 5, 2013 regarding the SNMP development efforts in the CBWCB. The CBWCB stakeholders have also given presentations and/or attended multiple conferences related to S/N management to elicit feedback and/or gather information that would be useful for the SNMP development.

The LARWQCB hosted four annual workshops beginning in 2010 to provide direction for SNMP development and facilitate interaction and information sharing within and among groundwater basin stakeholder groups in the Los Angeles Region. WRD and other CBWCB stakeholders attended the LARWQCB SNMP Workshops and WRD gave presentations on the status of CBWCB SNMP development efforts at three of the four LARWQCB Workshops. The LARWQCB also established a website (http://www.swrcb.ca.gov/rwqcb4/water_issues/programs/salt_and_nutrient_management/index.shtml) related to SNMPs in the Los Angeles Region where they provide notices, agendas, and presentations for their workshops, as well as information related to the CBWCB SNMP including the October 21, 2013 CEQA Scoping Meeting and a link to the CBWCB SNMP website. The LARWQCB also maintains an e-mail subscription list to provide notifications to interested parties.

2.2 Data Collection Process

As discussed earlier, the CBWCB SNMP was developed in accordance with all Recycled Water Policy requirements. Development of the SNMP was a multi-year process that engaged CBWCB stakeholders and the LARWQCB at all stages of plan development to elicit feedback and direction. Collection and assessment of a tremendous amount of data was necessary to support the SNMP analysis and the methodologies applied are technically-sound, scientifically-defensible, and appropriate to the basin-specific conditions encountered in the CBWCB. The SNMP methodologies and findings were vetted by CBWCB stakeholders and LARWQCB through an inclusive process that relied on multiple workshops and review/feedback of intermediate documents or technical memoranda (TMs).

The CBWCB stakeholders were invaluable in providing data, future plans, and quality control and quality assurance (QA/QC) for the data used and analysis conducted for the CBWCB SNMP. **Table 1** provides a summary of the major data components provided and the data sources.

Table 1 Summary of Key SNMP Data and Sources

Description of Data	Type of Data		Source of Data
	Volume	Water Quality	
Source water used for supply in the CBWCB (baseline and future)			
Colorado River (imported water)	x	x	MWD, WRD, DWR
State Water Project (imported water)	x	x	MWD, WRD, DWR
Los Angeles Aqueduct (imported water)	x	x	LADWP
Groundwater (local and imported water)	x	x	WRD, DWR, COW, SWC, CDWC, SGVWC, CDPH
Adjacent groundwater basin inflow	x	x	USGS, CDPH, OCWD, ULARA
Recycled water for irrigation (baseline and future)	x	x	SDLAC, WBMWD
Recycled water recharge (baseline and future)	x	x	SDLAC, WBMWD, WRD, LADWP/LABOS, LACDPW
Stormwater recharge (baseline and future)	x	x	LACDPW, CWH, planning documents
Imported water recharge (baseline and future)	x	x	SDLAC, WBMWD, WRD, LADWP/LABOS, LACDPW
Precipitation recharge	x	x	LACDPW, USGS, WRD
Irrigation return flow	x	x	WRD, DWR, SDLAC, WBMWD, LADWP, LACDPW, technical literature
Mountain front recharge	x	x	WRD, USGS
Leaking water lines	x	x	LACDWP, WBMWD, water purveyors
Leaking sewer lines	x	x	SDLAC, LABOS
Septic systems	x	x	SDLAC
Discharge to streams	x	x	LACDPW, USGS
Subsurface outflow	x	x	USGS
Goals and objectives (recycled water, stormwater capture, conservation, imported water, groundwater, MAR, LID)	N/A	N/A	CBWCB stakeholders and planning documents
Aquifer parameters	N/A	N/A	WRD, USGS
Well locations and construction	N/A	N/A	WRD, USGS
Environmental release site data	N/A	N/A	GeoTracker, WRD
CEC monitoring	N/A	N/A	SDLAC, WBMWD, GAMA, WRD, LACDPW, LABOS, USGS
Land use	N/A	N/A	WRD

MWD – Metropolitan Water District of Southern California
WRD – Water Replenishment District of Southern California
DWR – California Department of Water Resources
CDPH – California Department of Public Health (now the SWRCB Division of Drinking Water)
LADWP – City of Los Angeles Department of Water and Power
LACDPW – Los Angeles County Department of Public Works
LABOS – Los Angeles Bureau of Sanitation
OCWD – Orange County Water District
ULARA – Upper Los Angeles River Area
SDLAC – Sanitation Districts of Los Angeles County
WBMWD – West Basin Municipal Water District
COW – City of Whittier
SWC – Suburban Water Company
CDWC – California Domestic Water Co.
SGVWC – San Gabriel Valley Water Company
CWH – Council for Watershed Health
USGS – United States Geological Survey
SWRCB – State Water Resources Control Board
GeoTracker – State Water Resources Control Board online database (http://geotracker.waterboards.ca.gov/)
GAMA – California State Groundwater Ambient Monitoring Assessment program
MAR – managed aquifer recharge
LID – low impact development
N/A – Not applicable

Data collection, entry, conversion to consistent units, verification, and compilation took multiple months and required significant outreach efforts. Six interim technical memoranda (TMs) were prepared to present the Goals and Objectives (TM-1), *Definitions, Concepts, and Approach* (TM-2), *Hydrogeologic Conceptual Model* (TM-3), SNMP *Monitoring Plan* (TM-4), *Future Water Quality and Assimilative Capacity and Anti-Degradation Analysis* (TM-5), and *Implementation Measures* (TM-6). These TMs were made available via the CBWCB SNMP website for public review and comment and the TM topics were also presented at the CBWCB SNMP Stakeholder Workshops to elicit feedback and input from the CBWCB stakeholders and LARWQCB.

3 Hydrogeologic Conceptual Model

3.1 Study Area Physiography

The Study Area consists of the Central Basin and West Coast Basin, which are two groundwater subbasins located within the Coastal Plain of the Los Angeles Groundwater Basin (Coastal Plain), as defined by the California Department of Water Resources (DWR, 2004) (**Figure 1**). These two subbasins are referred to as basins in this SNMP in order to be consistent with the naming convention commonly used by stakeholders in the Study Area. The hydrogeologic conceptual model of the CBWCB is described in more detail in **Appendix G** *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality.*

The Coastal Plain is bounded by the Santa Monica Mountains on the north, the low-lying Elysian, Repetto, Merced, and Puente Hills on the northeast, the County line between Los Angeles County and Orange County on the southeast, the Palos Verdes Hills on the southwest, and the Pacific Ocean on the south and west (DWR, 1961). The Newport-Inglewood Uplift, separating the Central Basin and the West Coast Basin, is a series of discontinuous faults and folds that form a prominent line of northwest trending hills (see Figure 1).

3.2 Land Use and Population Growth

The CBWCB covers approximately 420 square miles in southern Los Angeles County and consists of 43 cities. Land uses in the Study Area are predominantly urban residential, commercial, and industrial. As a result, the CBWCB ground surface is mostly covered with buildings and paved surfaces, which limit natural groundwater recharge.

The Study Area has a population of nearly 4 million residents and is mostly urbanized and essentially fully developed. According to the California Department of Finance, the State's population as a whole is projected to increase by more than 35% while Los Angeles County's is projected to increase by approximately 18% by 2050 (USBOR, LACFCD, LACDPW, 2013). Growth within the CBWCB would be through redevelopment and infill development. Although the Study Area population is predicted to increase modestly, use of potable supplies (imported water and groundwater) is projected to remain near 2010 levels through the end of the SNMP future planning period (2025). This maintenance of 2010 imported and groundwater use levels is achieved through increased use of recycled water (replacing and supplementing imported water) and water conservation efforts to reduce total water demand. Also, much of the predicted countywide increase in population will likely occur through development outside of the CBWCB.

3.3 Groundwater Basins, Subareas and Layers

The Central Basin and West Coast Basin are characterized by a multi-layered aquifer/aquitard system[5] as described by DWR (1961). The Central Basin covers approximately 280 square miles

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[5] Where sediments are thick and transmissive enough to supply sufficient quantities of water to wells for potable use, they are termed aquifers. An aquitard or confining unit is the less permeable (low hydraulic conductivity) silt and clay layers that separate the aquifers.

and is hydrogeologically divided into four subareas including the Los Angeles Forebay, Montebello Forebay, Whittier Area, and Pressure Area (Figure 1). The forebays are areas where confining layers are thin or absent and infiltration of precipitation and surface water can recharge deeper potable water supply aquifers. The Montebello Forebay is the most significant area of recharge in the Central Basin. The Central Basin Pressure Area, largest of the four subareas, is characterized by aquifers that are generally confined by relatively impermeable clay layers over most of the area, but areas of semi-permeable confining layers allow some interaction between the aquifers (DWR, 1961).

The West Coast Basin covers approximately 140 square miles and aquifers in the West Coast Basin are generally confined and receive the majority of their natural recharge from adjacent groundwater basins or from the Pacific Ocean (seawater intrusion). The Newport-Inglewood Uplift and associated faulting acts as a partial barrier to groundwater flow between the Central Basin and West Coast Basin.

Between 1900 and the 1950s, groundwater was an important factor in accelerating the urbanization of the CBWCB, which led to increasing demand for groundwater that far exceeded natural freshwater recharge. Excessive over-pumping in the basins caused severe overdraft and created a hydraulic gradient that resulted in seawater intrusion, which contaminated coastal groundwater aquifers. To address this problem, barrier wells (**Figure 2**) were constructed along the coast by LACDPW: the West Coast Basin Seawater Intrusion Barrier (WCBB) in the mid-1950s, the Alamitos Gap Seawater Intrusion Barrier (AGB) in the early 1960s, and the Dominguez Gap Seawater Intrusion Barrier (DGB) in the early 1970s.

While the water injection activities at the barriers were successful in halting further seawater intrusion, these efforts could not address the seawater which had already intruded into the CBWCB before the barriers were constructed. These plumes of seawater-impacted groundwater, referred to as "saline plumes," are trapped inland of the injection wells, thereby degrading a significant volume of groundwater with high concentrations of chloride and total dissolved solids (TDS) and decreasing the ability of affected aquifers to provide groundwater storage for potable use.

For purposes of characterizing groundwater quality and assimilative capacity, the Study Area was divided into various areas for water quality assessment, as listed in **Table 2** and illustrated in Figure 2, and into four layers as listed in **Table 3**. The division of the basins into subareas/layers for the SNMP analysis was performed to better understand the lateral and vertical distribution of S/Ns and help inform and prioritize potential implementation measures to manage S/Ns. See Section 5.2 for further discussion of the water quality analysis methodology.

Due to seawater intrusion, coastal areas (i.e., areas seaward of the three seawater barriers) are both included and excluded from the basin water quality averages. The coastal areas are unlikely to ever be used for groundwater supply due to high levels of TDS and chloride. The LARWQCB has recognized such impacted areas by previously removing the designation of municipal groundwater use for two selected areas seaward of the barriers, referred to as "de-designation." As such, these areas in the West Coast Basin, shown in **Figure 3,** are no longer recognized to have municipal beneficial uses by the LARWQCB, due to degradation from

Table 2 CBWCB Areas Assessed for Current and Future Water Quality and Assimilative Capacity

Groundwater Basins	**Subareas in the Central Basin**
Central Basin (area seaward of AGB excluded)	Montebello Forebay
Central Basin (area seaward of AGB included)	Los Angeles Forebay
West Coast Basin (areas seaward of DGB and WCBB excluded)	Whittier Area
West Coast Basin (areas seaward of DGB and WCBB included)	Pressure Area (area seaward of AGB excluded)
West Coast Basin (areas seaward of DGB and WCBB and WCBB-inland saline plume excluded) [a]	Pressure Area (area seaward of AGB included)
Coastal Areas (i.e., areas seaward of the AGB, DGB, and WCBB) [b]	

AGB – Alamitos Gap Seawater Intrusion Barrier
DGB – Dominguez Gap Seawater Intrusion Barrier
WCBB – West Coast Basin Seawater Intrusion Barrier
a – This basin area only used for current basin average and assimilative capacity calculations
b – Average groundwater quality and assimilative capacities for the coastal areas were calculated for both the West Coast Basin and Central Basin

Table 3 CBWCB Aquifer Systems and Model Layers

Age	Formation	DWR-Defined Aquifer/Aquitard	USGS Model Layer and Aquifer System [a]
Holocene (Recent)	Active Dune Sand	Semi-Perched Aquifer	1 - Recent Aquifer System
	Alluvium	Bellflower Aquitard (mostly absent in the Montebello Forebay)	
		Gaspur Aquifer	
Upper Pleistocene	Older Dune Sand	Semi-Perched Aquifer	2 - Lakewood Aquifer System
	Lakewood	Exposition-Artesia Aquifer	
		Gardena-Gage Aquifer	
Lower Pleistocene	San Pedro	Hollydale Aquifer	3 - Upper San Pedro Aquifer System
		Jefferson Aquifer	
		Lynwood Aquifer	
		Silverado Aquifer	
		Sunnyside Aquifer	4 - Lower San Pedro Aquifer System
		Lower San Pedro Aquifer	
Upper Pliocene	Pico		Pico Unit

a – In 2003, the United States Geological Survey (USGS) developed a regional groundwater flow model (MODFLOW) of the CBWCB. As part of the groundwater conceptual model used for flow modeling, the USGS simplified the DWR-defined aquifers into four aquifer systems based on review of geophysical logs along with ancillary information; these four aquifer systems constitute the four model layers simulated in the USGS and recent Groundwater Basins Master Plan (GBMP) (CH2MHILL, 2012b) modeling work, which served as the basis for layers used in the SNMP mixing model.

seawater intrusion (LARWQCB, 1998 and 2011). The de-designation of these coastal areas supports the assumption that other coastal areas are impacted to the extent that groundwater production for potable use is unlikely in the foreseeable future. For the existing average groundwater quality in the West Coast Basin, the saline plume stranded inland of the WCBB (depicted in Figure 2) was both included and excluded from the S/N averaging calculations in order to assess the impact of the plume on overall basin water quality.

3.4 Aquifer Properties

Aquifer properties describe the ease with or rate at which groundwater travels through the subsurface and how much water is contained within an aquifer or confining unit. In 2003, the United States Geological Survey (USGS) developed a groundwater flow model (MODFLOW) of the CBWCB. Particle tracking was conducted to assess groundwater velocities in two selected areas: 1) near the Montebello Forebay and 2) near the seawater intrusion barriers. Based on flow paths presented by the USGS, the groundwater velocity in the vicinity of the Montebello Forebay is about 3 feet per day (ft/d), while the USGS reported average velocities from 0.1 to 2.1 ft/d along Santa Monica Bay and from 0.1 to 1.0 ft/d along San Pedro Bay in the West Coast Basin. The volume of water contained in the each model layer is used to calculate the volume-weighted average groundwater quality of the combined layers, subareas, and basins. The USGS (2003) assigned a constant specific yield[6] of 0.075 to Model Layers 2 through 4. Accordingly, a value of 0.075 is used for all layers to calculate the basin mixing volumes used in estimating average groundwater quality.

3.5 Managed Aquifer Recharge

Managed aquifer recharge (MAR) or artificial replenishment is the process of supplementing natural groundwater recharge with additional recharge. A significant amount of MAR occurs in the CBWCB. MAR includes recharge of:

- Untreated imported water, tertiary-treated recycled water, and local stormwater at the Montebello Forebay Spreading Grounds (MFSG) and instream along the San Gabriel River in the Montebello Forebay;
- Local stormwater at the Dominguez Gap Spreading Grounds (DGSG);
- Treated imported water and recycled water that has undergone advanced water treatment (AWT) that is delivered to the seawater intrusion barriers, including the WCBB, DGB, and AGB, for injection; and
- Local stormwater at other facilities and through low impact development (LID) projects.

To address increasingly unreliable and expensive imported water supplies, the CBWCB stakeholders have been moving toward more reliance on recycled water supplies. During the future planning period, imported water will be completely replaced with either tertiary-treated recycled water or a blend of tertiary-treated/AWT recycled water at the MFSG (this recycled water project is proposed under WRD’s Groundwater Reliability Improvement Program) and at all three seawater intrusion barriers where recharge will be increased with 100% AWT recycled water, thereby completely replacing imported water at these three areas of use.

[6] Specific yield is the ratio of the volume of water that the aquifer yields by gravity drainage to the total volume of aquifer and is a measure of the volume of water in the formation.

3.6 Water Sources

Sources of water for use and recharge in the CBWCB include surface water/stormwater, imported water, groundwater, and recycled water.

3.6.1 Surface Water/Stormwater

Three main stream channels, the Los Angeles River, San Gabriel River, and Rio Hondo flow into the Study Area from interior valleys (Figure 1). The Los Angeles River flows southward across the Central Basin and West Coast Basin prior to discharging into San Pedro Bay. The Los Angeles River is lined throughout most of the Study Area except for a small stretch in the West Coast Basin east of the Dominguez Gap Barrier. MAR facilities and lined and unlined portions of the major rivers are shown in **Figure 4**.

The Rio Hondo flows southwesterly across the Central Basin and converges with the Los Angeles River just west of the Montebello Forebay. The Rio Hondo is lined throughout the Study Area.

The San Gabriel River flows southerly across the Central Basin and West Coast Basin and discharges into Alamitos Bay before entering san Pedro Bay. The San Gabriel River is unlined through most of the Montebello Forebay and becomes lined approximately nine miles downstream of the Whittier Narrows Dam just before entering the Central Basin Pressure Area. The unlined portion of San Gabriel River in the Montebello Forebay is a losing reach[7] and instream facilities (inflatable dams) have been installed along its length to promote groundwater recharge as part of the Montebello Forebay spreading operations (Figure 4).

Surface water/stormwater is not used for direct water supply in the Study Area; however, it is actively captured and recharged through replenishment operations conducted by LACDPW at the MFSG, instream recharge along the San Gabriel River in the Montebello Forebay, and at the DGSG (Figure 4). There are also a number of stormwater retention basins and LID projects in the Study Area, which also recharge runoff and stormwater. In December 2012, the LARWQCB adopted a new MS4 Permit (Order No. R4-2012-0175; http://www.waterboards.ca.gov/rwqcb4/water_issues/programs/stormwater/municipal/index.shtml) that replaced the 2001 MS4 Permit. The MS4 Permit encourages permittees to infiltrate stormwater as a fundamental aspect of permit implementation. It is anticipated that the MS4 Permit will lead to increase stormwater capture in the CBWCB. Surface water and stormwater may also be naturally recharged along unlined stream stretches; although, most streams in the CBWCB are concrete lined as shown in Figure 4 and natural stream recharge is minimal. Stormwater is also recharged naturally at unpaved areas (parks, golf courses, landscaped areas, dirt lots, residential lawns and gardens, etc.) where the geology promotes deep percolation.

[7] A losing reach of a river or stream is where surface water recharges groundwater. A gaining reach is where groundwater recharges surface water.

3.6.2 Imported Water

Imported water is used for water supply (i.e., drinking water, irrigation, commercial/industrial activities, etc.) and replenishment in the CBWCB. A small amount of the imported water used for irrigation recharges the basins through deep percolation. Water is imported to the CBWCB by the MWD, the City of Los Angeles, City of Whittier, Suburban Water Company, California Domestic Water Company, and San Gabriel Valley Water Company.

MWD imports water from the Colorado River (CR) and State Water Project (SWP); untreated imported water from both the CR and SWP is delivered to the Montebello Forebay spreading facilities and treated imported water is injected into the three seawater intrusion barriers and also used for water supply. The barriers currently receive AWT recycled water and imported water that is a blend of treated water from the CR and SWP supplied by the MWD's Jensen and Diemer Water Treatment Plants (WTPs). Water from MWD's Jensen, Diemer, and Weymouth WTPs is used for water supply in the CBWCB. The source water at the Jensen WTP is from the SWP. The source water at the Diemer and Weymouth WTPs is from both the CR and SWP. The blend of CR and SWP water delivered to the MFSG, seawater barriers, and used for water supply can vary considerably from year to year, which affects the S/N loading to the basins because the S/N quality of CR and SWP water is different, as discussed in Section 6.1.4.

The City of Los Angeles imports water from the Owens Valley-Mono Basin and the treated water is used for water supply in the CBWCB. The City of Whittier, Suburban Water Company, California Domestic Water Company, and San Gabriel Valley Water Company import groundwater that is extracted from the San Gabriel Basin and used for water supply in the Study Area.

3.6.3 Groundwater

Groundwater is extracted from the CBWCB and used for water supply (i.e., drinking water, irrigation, commercial/industrial activities, etc.). Currently, groundwater provides about 40% of the water supply in the Study Area. A small percentage of groundwater used for irrigation recharges the CBWCB through deep percolation. There are currently over 400 active production wells in the CBWCB.

Groundwater from adjacent groundwater basins recharges the CBWCB as subsurface inflow.

3.6.4 Recycled Water

In the CBWCB, recycled water has many uses, primarily groundwater recharge, urban landscape irrigation, industrial and commercial process water. Recycled water has been utilized for groundwater recharge at the MFSG for over 50 years. Thus, use of recycled water in the CBWCB has proven to be a safe and reliable resource and has played a vital role in increasing the sustainability of the overall water supply. Treatment plants in the CBWCB that produce recycled water are owned and operated by the SDLAC, WBMWD, City of Los Angeles, and WRD. Tertiary-treated recycled water produced by the Pomona, San Jose Creek, and Whittier Narrows Water Reclamation Plants (WRPs) which are owned and operated by the SDLAC is used for MAR in the Montebello Forebay. Tertiary-treated recycled water from SDLAC's Long Beach, Los Coyotes, and San Jose Creek WRPs is used for irrigation and commercial/industrial applications in the Central

Basin. The WRPs provide primary treatment, nitrification/denitrification (NdN) activated sludge biological treatment, granular media filtration, disinfection, and dechlorination. The San Jose Creek, Pomona, Long Beach, and Los Coyotes WRPs use sequential chlorination for disinfection; the Whittier Narrows WRP uses ultraviolet irradiation (UV).

AWT recycled water produced by the Leo J. Vander Lans Advanced Water Treatment Facility (Vander Lans AWTF), owned by WRD and operated and maintained by the Long Beach Water Department, is injected at the AGB. The source water for the Vander Lans AWTF is tertiary-treated recycled water produced by SDLAC's Long Beach WRP. Current treatment processes at the Vander Lans AWTF include microfiltration (MF), reverse osmosis (RO), UV, and advanced oxidation (AOP) through the addition of peroxide. AWT recycled water is projected to fully replace imported water at the AGB in WY 2014-15, since the Vander Lans AWTF was expanded at the end of 2014 to produce from 3,360 AFY to 8,960 AFY of AWT recycled water. The plant expansion also included the addition of advanced oxidation (AOP) through the use of peroxide as part of its treatment train. It is anticipated that minor volumes of treated imported water, supplied by MWD, may be utilized as necessary through the future due to temporary operational and maintenance issues that may be encountered at the Vander Lans AWTF or at the AGB.

The Edward C. Little Water Recycling Facility (WRF), owned by WBMWD, receives secondary effluent from the City of Los Angeles' Hyperion Wastewater Treatment Plant (WTP) as source water to produce five different recycled water quality levels, including tertiary-treated and AWT recycled water. Recycled water produced by the Edward C. Little WRF is used for irrigation (tertiary-treated) in the West Coast Basin, injected (AWT) at the WCBB, and used for industrial purposes (treatment level depends on application). Treatment processes at the Edward C. Little WRF currently includes MF, RO, AOP, ozonation (O_3), and chemical stabilization. AWT recycled water is projected to fully replace imported water at the WCBB in WY 2013-14 now that the Edward C. Little WRF has been expanded to produce from 14,000 AFY to 19,600 AFY of recycled water. However, minor volumes of treated imported water, supplied by MWD, may be utilized as necessary through the future due to temporary operational and maintenance issues that may be encountered at the Edward C. Little WRF or at the WCBB.

AWT recycled water produced by the City of Los Angeles' Terminal Island Water Reclamation Plant/Advanced Water Purification Facility (TIWRP) is injected at the DGB. Treatment processes at the TIWRP include MF, RO, and chlorination. The TIWRP is planned for expansion in WY 2018-19 to produce from 5,700 to 22,880 AFY of recycled water and treatment train is anticipated to be modified to include O_3.

3.7 Basin Adjudications and Management

Prior to the adjudication of the Central Basin and West Coast Basin in the early 1960s, annual production (pumping) reached levels as high as 292,000 acre-feet (AF) in the Central Basin and 94,000 AF in the West Coast Basin. This was more than double the 173,400 AF of natural safe yield[8] of the basins determined by DWR in 1962. Due to this serious overdraft, water levels declined, groundwater was lost from storage, and seawater intruded into the aquifers along the coast. To remedy this problem, the courts adjudicated the Central Basin and West Coast Basin to put limits on pumping. The West Coast Basin adjudicated pumping was set at 64,468 AFY. The Central Basin adjudicated pumping was set at 267,900 AFY; although, the judgment set a lower allowed pumping allocation (APA) at 217,367 AFY to impose stricter control. As a result, the current amount allowed to be pumped from both basins is 281,835 AFY (WRD, 2012).

The adjudicated pumping amounts are greater than the natural replenishment of the groundwater aquifers, creating an annual deficit or annual overdraft, under natural recharge conditions. Accordingly, WRD was established in 1959 under the California Water Code to provide the needed supplemental replenishment water to make up the difference between the adjudicated amounts and the natural safe yield, specifically at the MFSG and three seawater intrusion barriers.

3.8 Desalters

As a result of significant historical (through the mid-1900s) over-pumping for potable supply and industrial uses, seawater intruded the Central Basin and West Coast Basin forming saline plumes, particularly in the West Coast Basin and to a lesser extent in the Central Basin. Hence, the WCBB, DGB, and AGB were constructed between the 1950s and 1970s and continue to operate today to prevent further seawater intrusion.

To remediate the saline plume inland of the WCBB, there are two desalters operating inland of the WCBB. The desalters remove salt (using reverse osmosis membranes) from seawater-impacted groundwater and the treated water is distributed as drinking water. The C. Marvin Brewer (Brewer) Desalter has a design capacity of 1,200 AFY. The Robert W. Goldsworthy (Goldsworthy) Desalter has a design capacity of 2,800 AFY. In 2015, the total plant capacity of the Goldsworthy Desalter will be expanded to 5,500 AFY[9] to allow increased groundwater pump and treat. Average groundwater pumping for treatment by the Brewer Desalter is also projected to increase in the future planning period relative to average baseline period pumping.

3.9 Groundwater Levels and Flow

In order to obtain accurate data for specific aquifers from which to infer localized water level (and water quality conditions), depth-specific (nested) monitoring wells that tap discrete aquifer zones (more than 300 nested wells at over 55 locations) were installed by WRD and are evaluated as part of WRD’s Regional Groundwater Monitoring Program (RGWMP).

Before the 20th century, groundwater flowed from the CBWCB south and westward, toward the Santa Monica Bay and San Pedro Bay. Since then, discharge has been dominated by pumping from wells. By the 1920s, owing to development of groundwater resources, water levels were

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[8] The natural safe yield is the amount of groundwater that can be withdrawn from the aquifer without adverse impacts (DWR, 2011), assuming natural replenishment of the aquifer generally from runoff and precipitation.

[9] Personal communication from Ted Johnson of WRD, November 14, 2012.

below sea level in much of the CBWCB, resulting in seawater intrusion along the coastal areas (USGS, 2004). Adjudication of the basins in the early 1960s limited pumping and associated drawdown and operation of the three seawater intrusion barriers led to increased local groundwater levels and significantly reduced the inland flow of seawater past the barriers. These management activities along with the significant MAR in the Montebello Forebay have resulted in generally increased and stabilized groundwater levels in the CBWCB.

Figure 5 shows the Fall 2010 groundwater elevation contour map for the Upper San Pedro Aquifer System (Model Layer 3), the zone from which most groundwater extraction occurs. The general direction of groundwater flow is shown by the arrows on Figure 5. Both the Newport-Inglewood Uplift and the Charnock Fault (in the West Coast Basin) are partial barriers to groundwater flow, causing differences in water levels on opposite sides of each fault system; although some subsurface groundwater flows between the Central Basin and the West Coast Basin across the Newport-Inglewood Uplift.

With the exception of the Montebello Forebay and along the WCBB, the majority of groundwater levels in the Study Area are below sea level, which is why continued injection at the seawater intrusion barriers is needed to prevent saline intrusion. In the Central Basin, groundwater flows from the northeastern side of the basin toward pumping depressions near the southwestern side of the basin. Due to the significant managed recharge in the Montebello Forebay, there is a mound in the groundwater table and a radial pattern of flow away from the Forebay. In the West Coast Basin, groundwater levels are highest along the WCBB (about 10 feet above mean sea level [msl]) and decrease inland reaching the lowest elevation near a pumping depression near the Newport-Inglewood Uplift. Groundwater flow in the West Coast Basin is generally from west to east. These are the consistent dominant groundwater flow patterns observed in recent years, resulting in essentially closed basins (i.e., no subsurface outflow) and inflow of subsurface groundwater from adjacent groundwater basins.

Because most (about 80%) of the active groundwater extraction is from Model Layer 3 (Table 3), vertical groundwater flow directions are downward from Model Layer 1 to Model Layer 2 to Model Layer 3 in all basins and subareas (USGS, 2003; CH2MHILL, 2012b). In the Montebello Forebay, Los Angeles Forebay, Whittier Area, and Central Basin Pressure Area, there is also a downward vertical gradient from Model Layer 3 to Model Layer 4. In the West Coast Basin, the vertical gradient between Model Layer 3 and 4 is mixed depending on the year, but the net vertical gradient is typically upward from Layer 4 to Layer 3.

4 Baseline and Future Planning Period Water Balances

In order to estimate the baseline and future planning period S/N balances in the CBWCB, it is necessary to have an understanding of the associated groundwater inflows and outflows (i.e., the water balances). The baseline period water balances change from year to year based on replenishment activities, precipitation, availability of imported water supplies, subsurface inflow and outflow, and groundwater extraction. The difference between the basin inflow and outflow is the annual change in groundwater storage.

The data supporting the various baseline period historical groundwater inflows and outflows are reported by WRD in their annual *Engineering Survey and Report* (accessed at: http://www.wrd.org/engineering/groundwater-engineering-reports.php) and by the Central Basin and West Coast Basin Watermaster[10] in their annual *Watermaster Service* reports (accessed at: http://www.water.ca.gov/watermaster/aboutwatermaster/index.cfm). A calibrated groundwater flow model previously developed for the Study Area by the USGS was recently updated as part of the Groundwater Basins Master Plan (GBMP) (USGS, 2003; CH2MHILL, 2012b). Water balances developed as part of these groundwater modeling efforts were relied upon for some components of the SNMP water balances.

The development of future water balance components was facilitated by several ongoing planning efforts in the region, including the 2012 and 2013 update to the Greater Los Angeles County (GLAC) Integrated Regional Water Management Plan (IRWMP) (RMC. 2012b; GLAC IRWMP, 2014), the Draft Groundwater Basins Mater Plan (GBMP) (CH2MHILL, 2012b), permits and planning documents for groundwater recharge projects, and other planning documents. Target volumes and objectives developed for the SNMP were also coordinated with work being conducted as part of the Los Angeles Gateway Region IRWMP.[11] Preliminary water balance component volumes developed for the SNMP were reviewed and refined with information provided by the CBWCB stakeholders.

Some future planning period water balance components are not expected to change significantly and are projected to remain at the baseline period average throughout the future planning period. The baseline and future water balances are briefly discussed below with details of the water balances presented in **Appendix H** *Baseline and Future Water Balances.*

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[10] As a result of the Judgment issued on December 18, 2013, the California Department of Water Resources is no longer Watermaster of the Central Basin. Beginning July 1, 2014, the Watermaster is now comprised of three entities: 1) Administrative Body, 2) Water Rights Panel, and 3) Storage Panel. The Water Replenishment District of Southern California has been designated as the Administrative Body and will be responsible for preparing the annual *Watermaster Service* reports and submitting them to the Water Rights Panel. The Water Rights Panel is ultimately responsible for submitting the final *Watermaster Service* reports to the Superior Court of the State of California for filing.

[11] The Los Angeles Gateway Region includes 26 mainland cities and small portions of unincorporated areas in Southeastern Los Angeles County, a subset of the Central Basin. See http://www.gatewayirwmp.org/.

4.1 Groundwater Recharge (Inflows)

Major sources of groundwater inflows to the CBWCB include:

- Managed aquifer recharge in spreading grounds, instream facilities, and at the seawater intrusion barriers;
- Deep percolation of precipitation;
- Irrigation return flows;
- Percolation of runoff from surrounding uplands (mountain front recharge); and
- Subsurface groundwater inflow from adjacent groundwater basins.

Other minor potential sources of groundwater recharge include leaking pipes, septic systems, and stream losses (not associated with managed aquifer recharge). In the CBWCB, losses from leaking pipes and septic systems are believed to be small in comparison to the major sources. Natural stream recharge (other than the managed aquifer recharge in the San Gabriel River in the Montebello Forebay) is also limited, as most major rivers and streams are concrete lined.

The largest volume of recharge in the Central Basin occurs in the Montebello Forebay via the spreading grounds and instream facilities (i.e., check dams) along the San Gabriel River. Other sources of recharge in the Central Basin include injection at the AGB, subsurface groundwater inflow, deep percolation of precipitation, irrigation return flows, and mountain front recharge.

In the West Coast Basin, aquifers are generally confined and natural replenishment is dominated by subsurface inflows (CH2MHILL, 2012b). Sources of recharge in the West Coast Basin includes injection at the WCBB and DGB, subsurface groundwater inflow, deep percolation of precipitation, mountain front recharge, irrigation return flows, and the DGSG.

4.1.1 Montebello Forebay Spreading Grounds

The MFSG are located in the Montebello Forebay, which is the northeastern portion of the Central Basin (Figure 4), and consist of two separate but linked facilities: the Rio Hondo Spreading Grounds (RHSG) and the San Gabriel River Spreading Grounds (SGRSG). These spreading grounds are unpaved recharge ponds engineered in geologically suitable areas where surface water can be captured, held, and allowed to sink down into the subsurface through the vadose zone and down to the saturated zone. The RHSG and SGRSG are located downstream of the Whittier Narrows Dam adjacent to the Rio Hondo and San Gabriel River channels, respectively. The RHSG consists of off-channel recharge ponds, while the SGRSG consist of both off-channel recharge ponds and the instream recharge facilities (i.e., unlined portions and rubber dams) located along the San Gabriel River in the Montebello Forebay.

The MFSG are owned, operated, and maintained by the LACDPW. Currently, water delivered to the MFSG for groundwater recharge includes a mix of tertiary-treated recycled water, untreated imported water, and stormwater. The MFSG are the principal groundwater recharge facilities for the entire CBWCB, providing for nearly half of all the groundwater replenishment activities, both natural and artificial, in the two groundwater basins by combining natural river diversions with supplemental imported and recycled water (WRD, 2014).

During the future planning period, a recycled water project under WRD's Groundwater Reliability Improvement Program (GRIP) is expected to be implemented to supply AWT and/or increased tertiary-treated recycled water for recharge at the MFSG to completely replace imported water (up to 21,000 AFY). As a result of multiple studies over a number of years to evaluate of a wide spectrum of potential water supply reliability improvement projects, including consideration of different levels of recycled water treatment and blending, modifications to existing wastewater treatment facilities, continued imported water deliveries, alternative imported water supplies, desalination, and increased stormwater capture (MWH, 2009; RMC, 2011b; SDLAC, 2012; and CH2MHILL, 2012c), two GRIP project alternatives, as described below, were determined to be the best alternatives for implementation. Both alternatives would result in the same total recharge volumes at the MFSG; however, the recycled water quality would be different under the different scenarios.

- GRIP Recycled Water Project A (GRIP A) – A combination of tertiary (11,000 AFY) and AWT (10,000 AFY) recycled water to replace imported water.
- GRIP Recycled Water Project B (GRIP B) – 100% tertiary-treated recycled water (21,000 AFY) to replace imported water.

At this time, GRIP A and GRIP B are being further evaluated by WRD in terms of feasibility and cost and a Draft Environmental Impact Report (EIR) was issued for public review in March 2014 (accessed at: http://www.wrd.org/business/water-replenishment-grip.php). In the Draft EIR, GRIP A is identified as the "proposed project," while GRIP B is identified as an "alternative" to the "proposed project" (AECOM, 2014). As a result, it is anticipated that GRIP A likely would be the project to be implemented by WRD. However, this is subject to change until the Final EIR is prepared and certified by WRD.

The average annual amount of water recharged in the Montebello Forebay during the baseline period was about 118,000 AFY and this is projected to increase slightly to about 125,000 AFY by WY 2024-25 due to recent improvements in stormwater capture and increased use of recycled water, which is a more reliable supply compared to imported water.

4.1.2 Dominguez Gap Spreading Grounds

The DGSG is located along the Los Angeles River near the southern boundary between the Central Basin and West Coast Basin (Figure 4) and recharges local stormwater. The DGSG are owned, operated, and maintained by the LACDPW. The proposed DGSG West Basin Percolation Enhancement Project will install vertical trenches/drains through poorly draining strata underlying the bottom of the DGSG's west basins to increase their percolation capacity. The DGSG historically recharged both the Central Basin and West Coast Basin, but due to conversion of some of the facilities to wetlands, the spreading grounds now only recharge the West Coast Basin. The average annual amount of water recharged at the DGSG during the baseline period was about 760 AFY and this is expected to increase to about 1,760 AFY by WY 2017-18[12].

[12] Personal communication, Greg Jaquez, LACDPW, August 16, 2012.

4.1.3 Alamitos Gap Seawater Intrusion Barrier

The AGB is located at the southern end of the Central Basin, specifically at the Los Angeles-Orange County border about two miles inland from the mouth of the San Gabriel River (Figure 4). The AGB, which is jointly owned by LACDPW and Orange County Water District and is operated/maintained under the direction of the AGB Joint Management Committee, consists of a series of injection wells that create a hydraulic gradient that prevents seawater intrusion and recharge both the Central Basin and Orange County Basin with imported water and AWT recycled water. Historically, the AGB received only treated imported water (supplied by MWD), but began also utilizing AWT recycled water in 2005. During the SNMP baseline period, an average of about 5,200 AFY of imported and AWT recycled water was injected/recharged in the AGB. AWT recycled water is projected to fully replace imported water at the AGB beginning in WY 2014-15 with an estimated increase to 7,200 AFY.

4.1.4 West Coast Basin Seawater Intrusion Barrier

The WCBB, owned and operated by LACDPW, is located along the western coast of the West Coast Basin (Figure 4) and consists of a series of injection wells to create a hydraulic gradient that prevents seawater intrusion. Historically, the WCBB received only treated imported water (supplied by MWD), but began also utilizing AWT recycled water in 1995. During the SNMP baseline period, an average of about 15,000 AFY of imported and AWT recycled water was injected/recharged at the WCBB. AWT recycled water is projected to fully replace imported water at the WCBB with an estimated increase to 17,000 AFY beginning in WY 2013-14.

4.1.5 Dominguez Gap Seawater Intrusion Barrier

The DGB, owned and operated by LACDPW, is located in the southern portion of the West Coast Basin (Figure 4) and consists of a series of injection wells to create a hydraulic gradient that prevents seawater intrusion. Historically, the DGB received only treated imported water, but began also utilizing AWT recycled water in 2006. During the SNMP baseline period, an average of about 7,000 AFY of imported and AWT recycled water was injected/recharged in the DGB. AWT recycled water is projected to fully replace imported water at the DGB beginning in WY 2018-19 with an estimated increase to 7,500 AFY.

4.1.6 Direct Percolation of Precipitation

The volume of precipitation that percolated to groundwater over the 10-year SNMP baseline period is based on estimates provided by groundwater modeling conducted in the Study Area (USGS, 2003; CH2MHILL, 2012b) and assumptions described in Appendix H. Total average deep percolation over the baseline period was estimated to be about 25,000 AFY in the CBWCB. Deep percolation of precipitation throughout the future planning period is assumed to be the average of the baseline period for each year from WY 2010-11 to 2024-25.

4.1.7 Mountain Front Recharge

Mountain front recharge is surface water runoff from the hills abutting the basins that recharges at the edges of the basins near the hills. The volumes of mountain front recharge is based on estimates provided by USGS/GBMP groundwater model (USGS, 2003; CH2MHILL, 2012b). The average mountain front recharge over the baseline period was about 9,000 AFY in the CBWCB. Mountain front recharge throughout the future planning period is assumed to be the average of the baseline period for each year from WY 2010-11 to 2024-25.

4.1.8 Irrigation Return Flows

Source waters for irrigation in the Study Area include imported water, groundwater, and recycled water. The volume of water used for irrigation in the Study Area is assumed to be 40% of the total imported water and groundwater supply plus the recycled water volumes used for irrigation. As described in Appendix H*,* it is estimated that of the total applied irrigation volume, 3.6% percolates to groundwater after evapotranspiration (ET).

Total imported water use (and associated use for irrigation) in the Central Basin is projected to decrease from the baseline period average of about 181,300 AFY to about 121,000 AFY by WY 2024-25. Total imported water use (and associated use for irrigation) in the West Coast Basin is projected to increase from the baseline period average of about 151,300 AFY to about 155,600 AFY by WY 2024-25. This results in a decrease in overall imported water use for irrigation in the CBWCB of 56,000 AFY between the baseline period and 2025. Therefore, irrigation return flows from imported water use during the future planning period will decrease compared with the baseline period.

Over the baseline period, an average of about 196,600 AFY of groundwater was extracted from the Central Basin and about 44,700 AFY from the West Coast Basin, which totals 241,300 AFY for the Study Area. For the future planning period, groundwater production in the CBWCB is assumed to be the average of the baseline period (Johnson, 2012). Therefore, irrigation return flows from groundwater use during the future planning period also remain the same as the average of the baseline period.

Use of recycled water for irrigation is projected to increase over the SNMP future planning period. As discussed further in Appendix H, recycled water would replace some imported water and groundwater for irrigation. The baseline period average for recycled water used for irrigation was about 10,600 AFY and is projected to increase to about 23,100 AFY in WY 2024-25 in the CBWCB.

Overall irrigation return flows in the Central Basin are projected to decrease slightly over the SNMP future planning period while return flows in the West Coast Basin are projected to increase very slightly and thus, there will be a net decline for the entire CBWCB. The average irrigation return flow volume for the baseline period is estimated to be about 8,400 AFY in the CBWCB declining to about 7,900 AFY by WY 2024-25.

4.1.9 Other Stream Recharge

As shown in Figure 4, major streams in the Study Area are mostly lined with concrete. Because of this, stream losses to groundwater are assumed to be negligible, except for recharge in the unlined portions of the San Gabriel River within the Montebello Forebay, which is accounted for in the Montello Forebay spreading operations. This assumption is consistent with the USGS/GBMP modeling water balances, which also assumed river recharge/discharge was minimal (USGS, 2003; CH2MHILL, 2012b).

4.1.10 Other Distributed Sources of Recharge

Other areally distributed potential sources of recharge included leaking water and sewer pipes, stormwater capture facilities such as basins and LID projects, and septic systems. While not individually quantified in the USGS/GBMP model or for this SNMP study, these distributed sources are represented in the interior recharge volumes of the calibrated USGS/GBMP groundwater model (USGS, 2003; CH2MHILL, 2012b).

Of the distributed sources, only sewer line leakage and septic system losses would have significantly different water quality than precipitation infiltration and irrigations return flows. Cities and agencies in the CBWCB, including the City of Los Angeles Bureau of Sanitation (LABOS) and SDLAC, generally have inspection and maintenance programs in place to quickly identify and fix any leaking sewer lines. For this reason, sewer line leakage is assumed to be negligible in terms of the overall S/N loading assumptions. Similarly, SDLAC indicated that there are only a small number of parcels (478 parcels of approximately 859,500 parcels in the Study Area) currently relying on septic systems for wastewater handling. Accordingly, septic system recharge to groundwater in the CBWCB is assumed to be negligible.

4.1.11 Subsurface Groundwater Inflow from Adjacent Basins and Ocean

Because of the pumping depressions in the Study Area, subsurface groundwater from adjacent basins (Santa Monica, Hollywood, San Fernando, San Gabriel, and Orange County basins) and minor inflow from the ocean (Santa Monica Bay and San Pedro Bay) flows into and recharges the CBWCB. The locations of adjacent basins are shown in Figure 1. Groundwater also flows between the Central Basin subareas and between the Central Basin and West Coast Basin. Subsurface inflows for the 10-year SNMP baseline period were extracted from the USGS/GBMP model. The average subsurface inflow over the 10-year baseline period is about 41,400 AFY in the Central Basin and about 12,600 AFY in the West Coast Basin. Throughout the future planning period, annual subsurface inflows and outflows are assumed to be the average of the baseline period.

4.2 Groundwater Discharge (Outflows)

Groundwater can leave the CBWCB by:

- Pumping, including extraction associated with the desalters,
- Subsurface outflow to adjacent basins and the ocean, and
- Groundwater discharge to surface water.

Of these, groundwater pumping is the most significant outflow from both the Central Basin and West Coast Basin. Due to their locations in the stranded saline plume inland of the WCBB, desalter wells remove significant S/N mass. Due to the large pumping depressions in both basins, very little groundwater leaves the Study Area as subsurface outflow and while there is some minor outflow to adjacent areas, the overall net subsurface flow is into the Study Area. Similarly, as discussed above, because most streams are concrete-lined, there is little opportunity for groundwater discharge to surface water and thus, this source of discharge is assumed to be negligible.

4.2.1 Groundwater Pumping and Desalters

Groundwater production wells are the main source of groundwater extraction and usage in the CBWCB. There are currently over 400 active production wells in the CBWCB. Over the baseline period, an average of about 196,600 AFY was extracted from the Central Basin and about 44,700 AFY from the West Coast Basin, which totals 241,300 AFY for the Study Area. Throughout the future planning period, annual groundwater production is assumed to be the average of the baseline period (Johnson, 2012).

There are two desalters (Brewer Desalter and Goldsworthy Desalter) operating in the West Coast Basin, specifically inland of the WCBB. The desalters (reverse osmosis membranes) remove salts from seawater-impacted groundwater and the treated water is distributed for potable supply. Approximately 500 AFY of brackish groundwater was pumped for treatment by the Brewer Desalter during the baseline period, and this volume is projected to increase to an average of 900 AFY by WY 2024-25. Approximately 1,800 AFY of brackish groundwater was pumped for treatment by the Goldsworthy Desalter during the baseline period. There are plans to expand the Goldsworthy Desalter and it is estimated that about 5,500 AFY of seawater-impacted groundwater will be pumped for treatment beginning in WY 2014-2015 and continue through the remainder of the future planning period.

4.3 Overall Water Balance and Change in Groundwater Storage

Figure 6 illustrates the baseline period annual water balances and cumulative change in groundwater storage. The Central Basin water balance is shown on the top of the figure and the West Coast Basin water balance is depicted on the bottom of the figure. As shown in the Figure 6, the MFSG (with minor contributions from the DGSG) recharge is the largest inflow to the Central Basin, followed by subsurface inflow, deep percolation of precipitation, mountain front recharge, irrigation return flows, and the AGB injection. Groundwater pumping is the major outflow along with a small amount of subsurface outflow to the West Coast Basin. Annual change in storage varies considerably from year to year, with an overall cumulative loss in storage over the 10-year baseline period.

As shown in the Figure 6, in the West Coast Basin, the seawater intrusion barriers are the largest source of recharge; subsurface inflow from adjacent basins and minor inflow from the ocean also provide recharge, followed by deep percolation of precipitation. Smaller components of recharge include irrigation return flows, mountain front recharge, and the DGSG. As with the Central Basin, annual change in groundwater storage can vary from year to year. Groundwater pumping is the only outflow as there is no subsurface outflow. Over the SNMP baseline period, there is a cumulative gain in storage in the West Coast Basin.

Two future planning period water balance scenarios are presented in **Figure 7** (No Future Projects Scenario) and **Figure 8** (All Projects Scenario). The No Future Projects Scenario water balances assume that average baseline period inflows and outflows continue for every year of the future planning period. The All Projects Scenario water balances assume that all future projected changes in inflows and outflows described above are implemented, including increased recharge at the MFSG, DGSG, and seawater intrusion barriers, slightly decreased irrigation return flow in the Central Basin, slightly increased irrigation return flow in the West

Coast Basin, and increased pumping for the desalters. Other inflows and outflows, including precipitation return flow, mountain front recharge, and subsurface flows are maintained at the average baseline period volumes for each year of the future planning period. The No Future Projects Scenario water balances are needed so that the S/N impacts from the various proposed projects and combinations of projects can be compared with a scenario where S/N loading and unloading remains at average baseline conditions.

As shown in Figure 7 (No Future Projects Scenario water balances for the Central Basin and West Coast Basin over the future planning period), average baseline period inflows and outflows were duplicated for each year from WY 2010-11 through 2024-25. By 2025 in the Central Basin, there is an annual loss of storage of about 6,100 acre-feet (AF) and a cumulative loss in storage (over the future planning period) of approximately 92,000 AF. By 2025 in the West Coast Basin, there is an annual gain in storage of about 2,300 AF and a cumulative gain in storage (over the future planning period) of approximately 34,000 AF.

As presented in Figure 8 (All Projects Scenario water balances for the Central Basin and West Coast Basin over the future planning period), average baseline period inflows and outflows are duplicated for each year from WY 2010-11 through 2024-25 and projected future changes (due to implementation of various proposed projects) are superimposed on this average baseline condition. The All Projects Scenario recharges additional water to the basins compared with the No Future Projects Scenario. By 2025 in the Central Basin, there is an average annual gain in storage of about 1,500 AF and a cumulative increase in storage (over the future planning period) of approximately 22,400 AF. By 2025 in the West Coast Basin, there is an average annual gain in storage of about 2,600 AF and a cumulative increase in storage (over the future planning period) of approximately 38,500 AF.

4.4 Future Groundwater Levels

Given the projected increase in recharge and storage over the future planning period for the All Projects Scenario, groundwater levels are expected to rise in the future in the CBWCB. The estimated increase in groundwater levels is discussed in more detail in Appendix H.

5 Existing Groundwater Quality

The Recycled Water Policy requires the SNMP to include identification of S/N sources, calculation of assimilative capacity and loading estimates, and description of the fate and transport of S/Ns in groundwater. The following subsections describe the methodologies that were developed to determine existing groundwater quality and the water quality results of the assessment of S/Ns in groundwater. Further details regarding the groundwater quality analysis are presented in Appendix G *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality*.

In general, groundwater in the main producing aquifers of the CBWCB is of good quality. However, localized areas of marginal to poor quality water do exist, primarily at the basin margins where seawater intrusion occurred in the past and also in shallow groundwater near "environmental release sites." Environmental release sites are commercial and industrial properties where improper activities (e.g., leaking aboveground and underground storage tanks, leaking pipelines, spills, illegal discharges, etc.) have contaminated groundwater with localized plumes of petroleum fuels, solvents, and other constituents of concern. In general, these plumes are predominantly limited to shallow groundwater. However, as the aquifers and confining layers in the CBWCB are typically inter-fingered, the quality of groundwater in the deeper production aquifers is threatened by the migration of pollutants from the upper aquifers. This is particularly true in the Forebay areas. Environmental release sites in the CBWCB have been or are being investigated/remediated under the oversight of Federal and State regulatory agencies, including the United States Environmental Protection Agency, the LARWQCB, and the California Department of Toxic Substances Control.

5.1 Indicator Constituents for Salt and Nutrients in the CBWCB

After an evaluation of constituents of concern in the CBWCB, TDS, chloride, and nitrate as nitrogen (nitrate-N) were selected as the most representative indicator constituents of salt and nutrients in the Study Area. The criteria and section process are described in detail in Appendix G.

Common pollutants associated with environmental release sites, special recycled water studies for 1,4-dioxane and n-nitrosodimethylamine (NDMA), and constituents of emerging concern (CECs) are also discussed Appendix G. Existing and proposed monitoring for CECs are discussed in Appendix K *Monitoring Plan* for the SNMP.

Water Quality Objectives (WQOs) in the CBWCB were established by the LARWQCB and are provided in Chapter 3 of the Basin Plan (LARWQCB, 1994). In this SNMP, WQOs can also be referred to as Basin Plan Objectives (BPOs). There are basin-specific Basin Plan Objectives (BSBPOs) for TDS and chloride in the Central Basin and West Coast Basin and a single BPO (equivalent to the Maximum Contaminant Level) for nitrate-N in both basins. **Table 4** summarizes the water quality criteria for TDS, chloride, and the various forms of nitrate.

Table 4 Water Quality Criteria for Salt and Nutrients in Groundwater

Constituent	Primary MCL (mg/L)	SMCL (mg/L)	Basin Plan Objective (mg/L)	
			Central Basin	West Coast Basin
TDS	NA	1,000	700	800
Chloride	NA	500	150	250
Nitrate as Nitrate (NO_3)	45	NA	45	45
Nitrate as Nitrogen (NO_3-N) [a, b]	10	NA	10	10
Nitrite as Nitrogen (NO_2-N) [b]	1	NA	1	1
Nitrate plus Nitrite, sum as Nitrogen (NO_3-N + NO_2-N) [b]	10	NA	10	10

mg/L - milligrams per liter
µg/L - micrograms per liter
TON - Threshold Odor Number
MCL – Maximum Contaminant Level
SMCL – Secondary Maximum Contaminant Level
NA – not applicable
a – MCL based on NO_3-N plus NO_2-N
b – NO_3-N was used to represent these nitrogen compounds for the SNMP (see Section 5.1.3 *Nitrate* and Appendix G for additional discussions)

5.1.1 Total Dissolved Solids (TDS)

Total salinity is commonly expressed in terms of TDS as milligrams per liter (mg/L). Because TDS monitoring data are widely available for source waters (both inflows and outflows) in the CBWCB and because TDS is a general indicator of total salinity, it is appropriate to designate TDS as an indicator for other salts and nutrients.

As established by the SWRCB Division of Drinking Water (formerly CDPH), the recommended Secondary Maximum Contaminant Level (SMCL)[13] for TDS is 500 mg/L, with an upper limit of 1,000 mg/L and a short-term limit of 1,500 mg/L. While TDS can be an indicator of anthropogenic impacts, there are also natural background TDS levels in groundwater. The BSBPOs for TDS in the Central Basin and West Coast Basin are 700 mg/L and 800 mg/L, respectively.

Elevated TDS concentrations are undesirable for aesthetic reasons related to taste, odor, or appearance of the water and not for health reasons; however, elevated TDS concentrations in water can damage crops, affect plant growth, and damage municipal and industrial equipment. Reduced salinity (lower TDS concentrations) increases the life of plumbing systems and appliances, increases equipment service life, decreases industrial costs for water treatment,

[13] A Secondary Maximum Contaminant Level (SMCL) is a water quality standard established to manage drinking water for aesthetic considerations, such as taste, color, and odor. Contaminants with only SMCLs are not considered to pose a risk to human health.

increases agricultural yields, reduces the amount of water used for leaching, reduces brine disposal costs and improves the capability to use recycled water (MWD and USBOR, 1999).

The background TDS concentrations in groundwater can vary considerably based on purity and crystal size of the minerals, rock texture and porosity, the regional structure, origin of sediments, the age of the groundwater, and many other factors (Hem, 1989). TDS is generally detected below the SMCL of 1,000 mg/L in production wells (i.e., ambient groundwater) in the CBWCB.

5.1.2 Chloride

Chloride is an inorganic salt that is naturally-occurring in groundwater and is commonly expressed in terms of mg/L. High concentrations of chloride near the coast may indicate seawater influence. Historical seawater intrusion is a significant groundwater contamination problem in the West Coast Basin and Central Basin. Chloride is the constituent used in the CBWCB to provide a general indicator of seawater intrusion and is therefore an appropriate indicator of salt. The chloride concentration of seawater is about 19,000 mg/L.

As established by the SWRCB Division of Drinking Water (formerly CDPH), the Recommended SMCL for chloride is 250 mg/L, with an upper limit of 500 mg/L and a short-term limit of 600 mg/L. The BSBPO for chloride is 150 mg/L and 250 mg/L in the Central Basin and West Coast Basin, respectively. Chloride is generally detected below the SMCL of 500 mg/L in production wells (i.e., ambient groundwater) in the CBWCB.

Similar to TDS, elevated chloride concentrations are undesirable for aesthetic reasons related to taste, odor, or appearance of the water and not for health reasons; however, elevated chloride concentrations in water can damage crops, affect plant growth, and damage municipal and industrial equipment. Reduced salinity (lower chloride concentrations) increases the life of plumbing systems and appliances, increases equipment service life, decreases industrial costs for water treatment, increases agricultural yields, reduces the amount of water used for leaching, reduces brine disposal costs and improves the capability to use recycled water (MWD and USBOR, 1999).

5.1.3 Nitrate

Nitrate is a colorless, odorless, and tasteless compound that is present in some groundwater and is commonly expressed in terms of mg/L. Nitrate is a health concern due to methemoglobinemia, or "blue baby syndrome," which affects infants. Elevated levels may also be unhealthy for pregnant women (SWRCB, 2010). High levels of nitrate in groundwater are associated with agricultural activities, septic systems, confined animal facilities, landscape fertilization, and wastewater treatment facilities. Additionally, airborne nitrogen compounds discharged from industry and automobiles are deposited on the land in precipitation and as dry particles, referred to as dry deposition. These sources also contribute to nitrate loading to groundwater. Nitrate is the primary form of nitrogen detected in groundwater.

The BPOs for nitrate and other nitrogen compounds are equivalent to their respective primary Maximum Contaminant Levels[14] (MCLs). Natural nitrate as nitrate (nitrate-NO_3) levels in groundwater in the CBWCB, are generally very low (typically less than 10 mg/L as NO_3) and well below the MCL/BPO of 45 mg/L. Nitrate as nitrogen (nitrate-N) plus nitrite as nitrogen (nitrite-N) has an MCL/BPO of 10 mg/L.

Table 4 lists other nitrogen compounds in addition to nitrate-N, and includes nitrate-NO_3, nitrite-N, and nitrate-N plus nitrite-N. Nitrate-NO_3 is equivalent to nitrate-N and a simple calculation can be used to convert one to the other (nitrate-NO_3 = nitrate-N x 4.425). In reviewing the data, it was determined that more of the source water data was reported in nitrate-N, so it was selected as the constituent to represent nitrogen/nutrient loading. In cases where only nitrate-NO_3 data are available, it was converted to nitrate-N for use in the SNMP loading analysis. As nitrate is the primary form of oxidized nitrogen found in groundwater, it was selected to represent all other nitrogen compounds and other nutrients in the CBWCB.

5.1.4 TDS, Chloride, and Nitrate Fate and Transport

Fate and transport describes the way a salt or nutrient moves through an environment or media. Groundwater flow directions and rates, the characteristics of the constituent, and the characteristics of the aquifer determine fate and transport of any given constituent. Vertical and horizontal groundwater flow direction and velocity were described in Section 3.9 *Groundwater Levels and Flow.*

Salt and nutrients (S/Ns) in source waters recharging the CBWCB may be increased through use and movement through the vadose zone and aquifer. This can occur through fertilizer use, which adds nitrogen that is not completely removed by plant uptake. S/Ns in irrigation return flows can also be concentrated by evapotranspiration (ET). Additionally, dry deposition, the process by which airborne pollutants are deposited to the earth, can contribute to increased S/Ns in percolating water. As precipitation and irrigation water infiltrates, S/Ns in the shallow soils can be picked up from the surface soils. S/Ns also exist in subsurface materials and can be leached via dissolution as water percolates.

Some S/Ns, such as TDS and chloride, are considered conservative in that they are not readily attenuated in the environment. In contrast, processes that affect the fate and transport of nitrogen compounds are complex, with transformation, attenuation, uptake and leaching in various environments. Nitrate is soluble in water and can easily pass through soil to the groundwater table. It can also be added to percolating water through dissolution of formation media. Nitrate can persist in groundwater for decades and accumulate to high levels as more nitrogen is applied to the land surface each year. Nitrate can be removed naturally from water through denitrification.

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[14] The primary Maximum Contaminant Level (MCL) is the highest level of a contaminant that is allowed in drinking water and is protective of human health. Primary MCLs are established by the United States Environmental Protection Agency and the State Water Resources Control Board, Division of Drinking Water (formerly California Department of Public Health) and reflect not only the chemicals' health risks but also factors such as their detectability and treatability, as well as the cost of treatment.

Assumptions regarding fate and transport processes and potential chemical reaction rates for S/Ns are described in **Appendix I** *Simulated Baseline and Future Salt and Nutrient Groundwater Quality*.

5.2 Water Quality Analysis Methodologies

The methodologies used to calculate average groundwater quality and assimilative capacity are described in this section. Further details are provided in Appendix G *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality.*

5.2.1 Average Salt and Nutrient Concentrations in Groundwater

Sampling results from wells in the CBWCB during the recent five years (January 2007 through mid-2012) were used to calculate current groundwater quality. The water quality data set for the Study Area is very extensive and includes semi-annual monitoring of the network of WRD nested wells and other data sets such as the SWRCB Division of Drinking Water (formerly CDPH) well database. Water quality from a small number of wells associated with environmental release sites were used to help establish Model Layer 1 water quality concentrations near the DGB and AGB, where nested and production well data were not available.

The median[15] TDS, chloride, and nitrate-N concentrations in wells in each model layer for the recent 5-year water quality averaging period (2007 through 2012) was plotted on maps (**Figure 9**) with different size and color circles representing median concentrations (dots maps). Wells were assigned to model layers based on the elevations of their screened intervals.

The TDS, chloride, and nitrate-N dots maps were then used to develop concentration contour maps for each layer and subarea using geographical information system (GIS) spatial analysis tools (**Figure 10**). Chloride concentration contour maps previously prepared by the LACDPW for each seawater instrusion barrier were also considered in developing the chloride concentration contours in the vicinity of the seawater barriers. GIS spatial analysis tools were then used to extract the average concentrations for each subarea and layer.

In addition, the average water quality for all layers in each subarea was calculated by weighting the average concentration in each layer by the volume of water in each layer. Finally, the water quality from all subareas and layers within each basin were amalgamated into a single average value for the Central Basin and West Coast Basin. For each basin, two average concentrations were calculated: one average includes the coastal areas (i.e., areas seaward of the barriers) and the other average excludes these coastal areas (see Figure 2). For the West Coast Basin, a third average groundwater quality estimate was calculated excluding the WCBB-inland saline plume and coastal areas (see Figure 2) in order to evaluate the impact of this saline plume on overall basin groundwater quality.

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[15]Medians were used instead of arithmetic averages because: 1) well medians can be reliably calculated for datasets with mixed censored and non-censored data (detects and not detects), which was common in the nitrate dataset; and 2) well medians allow for use of the entire water quality dataset while minimizing the skewing effect of potential data outliers and do not rely on parametric statistical methods that assume normal data distribution to remove potential outliers.

5.2.2 Assimilative Capacity

The average TDS, chloride, and nitrate-N concentrations for each subarea/layer and for the Central Basin and West Coast Basin both with and without the coastal areas, and the West Coast Basin without the coastal areas and without the WCBB-inland saline plume were compared to the respective BPO/BSBPO to determine the existing available assimilative capacity. The available assimilative capacity is the difference between the average groundwater quality and the BPO/BSBPO.

5.2.3 Water Quality Trends

The Mann-Kendall statistical trend test was used to assess whether TDS, chloride, and nitrate-N concentrations in WRD nested monitoring wells and production wells are increasing, decreasing, or showing no significant change. The trend analysis results along with visual assessment of time-concentration plots were used to help assess the dominant regional water quality trends in the basins and subareas. Simulated groundwater quality trends were compared with actual observed dominant regional trends and loading factors were adjusted, if warranted. This process is further described in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality.*

5.3 Salt and Nutrient Groundwater Quality Results

As discussed in the subsections below, the water quality assessment indicates that average TDS and chloride concentrations in the Central Basin are below BSBPOs, and assimilative capacity is available. Due to saline plumes in the West Coast Basin, average TDS and chloride concentrations exceed BSBPOs, and as a result there is no available assimilative capacity. If the WCBB-inland saline plume is removed from the averaging calculation, the average TDS and chloride concentrations in the West Coast Basin are below the BSBPOs and there is available assimilative capacity. In general, TDS and chloride trends are either stable or decreasing in both basins.

Average nitrate-N concentrations are very low, well below the BPO in both basins and as a result, assimilative capacity is available. There are no significant nitrate loading sources in the CBWCB and thus, nitrate is not considered a water quality concern and is not expected to be a concern in the future.

Additional details regarding the S/N groundwater quality results and the S/N trend analysis are provided in Appendix G *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality* and Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality*, respectively.

5.3.1 TDS Results

5.3.1.1 TDS Data from Groundwater Wells

Figure 9 (dot maps) shows median TDS, chloride, and nitrate-N concentrations for monitoring wells and production wells in each model layer for the recent 5-year water quality averaging period (2007 through 2012). Note that Model Layer 1 does not exist across the entire Study Area and its extent for determining groundwater quality is shown by gray shading in the figures in the top row of Figure 9. TDS medians are shown in the left column of the figure with Layer 1 on top and Layer 4 on the bottom.

In the Central Basin, TDS was detected above the BSBPO of 700 mg/L in some wells in all four layers; although, the majority of wells are below the BSBPO. Elevated concentrations were detected in isolated wells in all of the subareas.

In the West Coast Basin, elevated TDS concentrations above the BSBPO of 800 mg/L were detected more frequently in Model Layers 2, 3, and 4 due to saline plumes caused by historical seawater intrusion.

Figure 10 shows the TDS concentration contour maps along the left column of charts shown in the figure. As shown in Figure 10, there are a few hot spots of TDS concentrations above the BSBPO of 700 mg/L in the Central Basin, but the majority of the groundwater in the basin is below the BSBPO. In the West Coast Basin, large areas of elevated TDS concentrations above the BSBPO are observed near and inland of the seawater intrusion barriers and elsewhere as isolated hot spots.

5.3.1.2 Average TDS Concentrations and Assimilative Capacity

Based on the concentration contour maps (Figure 10), the average TDS concentrations were calculated for each subarea/layer, the Central Basin and West Coast Basin (both with and without the coastal areas), and the West Coast Basin without the coastal areas and WCBB-inland saline plume; and for just the coastal areas seaward of the barrier for the combined CBWCB. **Table 5** and **Figure 11** present the average TDS concentrations, BSBPOs, and available assimilative capacity.

For the Central Basin, average TDS concentrations in all layers and the volume-weighted total average for the entire basin, both including and excluding the coastal area, are below the BSBPO of 700 mg/L. For the Central Basin, Model Layer 2 within the Los Angeles Forebay exceeds the TDS BSBPO; the average TDS concentration is weighted by the existence of only one well with a relatively high TDS concentration. Similarly, there is only one data point in the Whittier Area and as a result, Model Layers 3 and 4 and the overall subarea average exceed the TDS BSBPO. The distribution of higher TDS levels with depth in the Whittier Area indicates that the cause is likely naturally occurring conditions at depth, not a surface release. If a surface release were the source of the elevated TDS, one would expect higher TDS concentrations in the shallowest zones, which is not observed. Dissolution of formation materials high in silts and clays and/or of marine origin in the Whittier Area can result in naturally high TDS concentrations in ambient groundwater. The Puente Hills located north of the Whittier Area provide some of the source materials for the Whittier Area aquifers as well as for the Puente

Table 5 Average TDS, Chloride, and Nitrate Concentrations in Subareas/Layers and in the Central Basin and West Coast Basin

GROUNDWATER QUALITY IN SUBAREAS/MODEL LAYERS AND IN THE CBWCB (all concentrations in mg/L)

Model Layer	Los Angeles Forebay			Montebello Forebay			Whittier Area			Central Pressure Area (including coastal area)			Central Pressure Area (no coastal area)			Central Basin (including coastal area)			Central Basin (no coastal area)			West Coast Basin (including coastal areas)			West Coast Basin (no coastal areas)			West Coast Basin (no coastal areas & no saline plume)			Coastal Areas [a] (seaward of seawater barriers)		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS [b]	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
1	NA	NA	NA	486	79	1.94	NA	NA	NA	658	130	0.17	619	107	0.18	555	100	1.23	538	90	1.25	2,150	851	0.04	1,223	293	0.01	1,223	293	0.01	2,427	1,028	0.05
2	788	105	0.08	482	80	1.95	636	73	1.81	621	108	0.08	602	96	0.08	623	102	0.43	610	93	0.44	2,067	884	0.15	1,072	365	0.20	1,052	371	0.20	4,029	1,904	0.03
3	672	83	0.22	551	86	1.18	966	111	0.42	470	59	0.15	459	50	0.15	540	69	0.31	533	63	0.32	1,247	646	0.04	781	276	0.05	676	179	0.05	2,170	1,379	0.00
4	479	63	0.02	555	102	0.13	1,410	184	0.00	435	51	0.02	417	42	0.02	493	64	0.03	480	57	0.03	1,396	585	0.00	972	327	0.00	729	233	0.00	2,252	1,099	0.00
Average of all layers	640	81	0.15	534	88	1.13	1,007	121	0.57	485	65	0.10	470	55	0.10	538	73	0.28	529	67	0.28	1,424	660	0.04	890	306	0.05	747	224	0.05	2,464	1,343	0.01
BPO/BSBPO	700	150	10.00	700	150	10.00	700	150	10.00	700	150	10.00	700	150	10.00	700	150	10.00	700	150	10.00	800	250	10.00	800	250	10.00	800	250	10.00	700/ 800	150/ 250	10.00
Assimilative Capacity	60	69	9.85	166	62	8.87	-307	29	9.43	215	85	9.90	230	95	9.90	162	77	9.72	171	83	9.72	-624	-410	9.96	-90	-56	9.95	53	26	9.95	-1,764/ -1,664	-1,193/ -1,093	9.99

TDS - total dissolved solids

Cl - chloride

NO_3-N - nitrate as nitrogen

NA - not applicable; no Model Layer 1 in these areas

Averages based on groundwater concentration contour maps; average of all layers is a weighted average based on area and aquifer thickness

Negative numbers indicate there is no available assimilative capacity

BPO/BSBPO - Basin Plan Objective or Basin Specific Basin Plan Objective

- Average concentration indicated exceeds BPO

- Model Layer 1 not included; typically unsaturated within the Los Angeles Forebay and of very limited extent Whittier Area (see explanation in Appendix G Section 2.6.3)

a - Includes both Central Basin and West Coast Basin

b - Elevated TDS and chloride concentrations in the Whittier Area are likely naturally occurring as discussed in Section 5.3.1.2

Subbasin located north of the Puente Hills. These source materials are relatively fine-grained and have also resulted in high ambient TDS concentrations in the Puente Subbasin.

The Montebello Forebay, Central Basin Pressure Area (with and without the coastal area), and the entire Central Basin (with and without the coastal area), are all below the TDS BSBPO in all layers and in the overall average of all layers. The average TDS concentrations for the entire Central Basin both including and excluding the coastal area are below the BSBPO. There is 162 mg/L of available existing assimilative capacity for TDS in the Central Basin when the coastal area is included and 171 mg/L of available capacity when the coastal area is excluded.

For the West Coast Basin, average TDS concentrations in all layers and the volume-weighted total average for the entire basin, both including and excluding the coastal areas, exceed the BSBPO of 800 mg/L. With the coastal areas excluded, the average TDS concentration in Model Layer 3 is just below the BSBPO, while all other layers and the combined layers exceed the BSBPO. There is -624 mg/L of assimilative capacity in the West Coast Basin when the coastal areas are included and -90 mg/L of assimilative capacity when the coastal areas are excluded. The negative numbers indicate that there is no existing available assimilative capacity for TDS in the West Coast Basin as a result of historical seawater intrusion. Nonetheless, existing implementation measures including the seawater barriers and desalters are reducing overall TDS levels in the basin. When the coastal areas and the WCBB-inland saline plume are both removed from the West Coast Basin average, there is 53 mg/L of available assimilative capacity for TDS, illustrating the significant impacts of saline plumes on the overall basin average.

For the coastal areas, average TDS concentrations in all layers and the volume-weighted total average for all layers exceed the BSBPOs of 700 mg/L and 800 mg/L in the Central Basin and West Coast Basin, respectively. There are -1,764 and -1,664 mg/L of assimilative capacity in the coastal areas in the Central Basin and West Coast Basin, respectively. The negative numbers indicate that there is no existing available assimilative capacity for TDS in the coastal areas as a result of seawater intrusion. The results for the coastal areas also illustrate the significant impact that the coastal areas have on overall basin averages. Based on the high TDS levels, groundwater production for potable use is unlikely to occur in the foreseeable future in the coastal areas.

5.3.1.3 TDS Concentration Trends

Table 6 presents the results of the Mann-Kendall test for TDS, chloride, and nitrate-N trends for each subarea, basin, and the entire CBWCB. Numbers shown in the table are the quantity of wells observed within each trend category. A breakdown of the trend results for each of the layers is provided in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality.*

As indicated in Table 6, TDS trend data are mixed with some wells increasing, some decreasing, and some showing no trends; however, the majority of wells in both the Central Basin and West Coast Basin show no trends. Thus, overall for the CBWCB, TDS concentrations are predominantly stable, with most wells showing no TDS concentration trends (197), 91 wells show increasing trends, and 59 wells show decreasing trends.

Table 6 Water Quality Trend Analysis of Subareas and Basins of the CBWCB

Model Layer	Los Angeles Forebay			Montebello Forebay			Whittier Area			Central Presssure Area			Central Basin [a]			West Coast Basin			Total [b]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
Increasing Trend	8	7	2	14	42	7	1	1	0	38	62	6	61	112	15	30	35	1	91	147	16
No Trend	4	4	5	60	42	42	4	4	4	81	71	61	149	121	112	48	42	67	197	163	179
Decreasing Trend	1	3	1	21	11	25	0	0	1	21	21	5	43	35	32	16	17	3	59	52	35

Mann-Kendall Trend analysis was conducted only for wells with 10 or greater sampling events; 95 percent confidence interval was applied

TDS - total dissolved solids Cl - chloride NO_3-N - nitrate as nitrogen

NA - not applicable; no Model Layer 1 in these areas

- Increasing Trend
- Decreasing Trend
- No Trend

a - Sum of Los Angeles Forebay, Montebello Forebay, Whittier Area, and Central Pressure Area

b - Sum of Central Basin and West Coast Basin

Wells in the Central Basin subareas, with the exception of the Los Angeles Forebay, predominantly have stable TDS concentrations (i.e., no trends). In the Los Angeles Forebay, more wells (8) show increasing TDS concentration trends than either decreasing trends (1 well) or no trends (4 wells) (Table 6). While it is difficult to determine the reason for this trend pattern in the Los Angeles Forebay, examination of the trend data for two WRD multiple-completion monitoring wells shows higher TDS concentrations and more steeply increasing trends in the shallower wells compared with the deeper wells. These observations suggest loading from the surface as the reason for the increasing trends. It is noted that TDS concentrations in the Montebello Forebay and the MFSG blended recharge water are well below concentrations in the Los Angeles Forebay. The Montebello Forebay provides subsurface recharge to the Los Angeles Forebay and MAR in the Montebello Forebay are improving TDS groundwater quality overall in the Los Angeles Forebay. By summing the number of wells for all the subareas, the Central Basin as a whole has stable TDS concentrations, with most wells showing no trends.

In the West Coast Basin, a greater number of wells (48) show no TDS concentration trends, while 30 wells show increasing trends and 16 wells show decreasing trends (Table 6). While more wells have increasing rather than decreasing TDS concentrations, many of the wells with increasing trends are located in or near saline plumes, indicating that they are likely influenced by the migration of saline plumes associated with historical seawater intrusion across the basin and not by current TDS loading. Given that the ambient background TDS concentrations are impacted by historical seawater intrusion, and ongoing mitigation measures such as the operation of the desalters and injection of high quality water at the seawater barriers for more than 40 years, ambient background TDS concentrations are declining overall in the West Coast Basin.

5.3.2 Chloride Results

5.3.2.1 Chloride Data from Groundwater Wells

The middle column of plots on Figure 9 show median chloride concentrations for wells in each model layer, with Model Layer 1 on top and Model Layer 4 on the bottom.

In the Central Basin, chloride was detected below the BSBPO of 150 mg/L in most wells in all four layers. Elevated chloride concentrations were detected in one well near the coast in Model Layer 1, likely due to historical seawater intrusion.

In the West Coast Basin, elevated chloride concentrations above the 250 mg/L BSBPO are detected more frequently in Model Layers 2, 3, and 4, due to saline plumes.

Figure 10 shows the contoured chloride maps along the middle column of the figure, with Model Layer 1 on top and Model Layer 4 on the bottom. As shown in Figure 10, chloride concentrations in most of the Central Basin are below the BSBPO of 150 mg/L. In the West Coast Basin, large areas of elevated chloride concentrations are detected near and inland of the seawater intrusion barriers as well as in isolated hot spots.

5.3.2.2 Average Chloride Concentrations and Assimilative Capacity

Based on the groundwater quality contour maps, the average chloride concentrations were calculated. Table 5 and **Figure 12** present the average chloride concentrations, the BSBPOs, and available assimilative capacity.

For the Central Basin, average chloride concentrations in all layers and the volume-weighted total average for the entire basin, both including and excluding the coastal area, are below the BSBPO of 150 mg/L. Model Layer 4 in the Whittier Area exceeds the BSPO; although, the average of all layers in the Whittier Area is below the BSBPO. Similar to the results for TDS, elevated chloride at depth in the Whittier Area is likely due to naturally occurring conditions associated with marine source rocks in the underlying aquifers. There is 77 mg/L of available assimilative capacity in the Central Basin when the coastal area is included and 83 mg/L of available assimilative capacity when the coastal area is excluded.

For the West Coast Basin, average chloride concentrations in all layers and the volume-weighted total average for the entire basin, both including and excluding the coastal areas, exceed the BSBPO of 250 mg/L. There is -410 mg/L of assimilative capacity in the West Coast Basin when the coastal area is included and -56 mg/L of assimilative capacity when the coastal areas are excluded. The negative numbers indicate that there is no existing available assimilative capacity for chloride in the West Coast Basin due to historical seawater intrusion. Nonetheless, existing implementation measures are reducing overall chloride levels in the basin. When the coastal areas and the WCBB-inland saline plume are both removed from the West Coast Basin average, there is 26 mg/L of available assimilative capacity for chloride, illustrating the significant impacts of saline plumes on the overall basin average.

For the coastal areas, average chloride concentrations in all layers and the volume-weighted total average for all layers exceed the BSBPOs of 150 mg/L and 250 mg/L in the Central Basin and West Coast Basin, respectively. There is -1,193 and -1,093 mg/L of assimilative capacity in the coastal areas in the Central Basin and West Coast Basin, respectively. The negative numbers indicate that there is no existing available assimilative capacity for chloride in the coastal areas as a result of seawater intrusion. The results for the coastal areas also illustrate the significant impact that the coastal areas have on overall basin averages. Based on the high chloride levels, groundwater production for potable use is unlikely to occur in the foreseeable future in the coastal areas.

5.3.2.3 Chloride Concentration Trends

Table 6 presents the results of the Mann-Kendall test for water quality trends for chloride for each subarea, basin, and the entire CBWCB. For the entire CBWCB, chloride concentrations are generally stable, with a greater number of wells (163) showing no trends; in comparison, 147 wells show increasing trends and 52 wells show decreasing trends.

For each Central Basin subarea, as indicated in Table 6, the trend data shows that chloride concentrations in most wells are either stable (i.e., no trend) or increasing, with fewer wells showing a decreasing trend. Although the entire Central Basin shows a greater number of wells (121) with no chloride trends (as compared to 112 wells showing increasing trends and 35 wells showing decreasing trends). As shown in Table I-3 in Appendix I, increasing chloride trends are more prevalent at shallower depths (Model Layers 1, 2, and 3) as compared with deeper depths (Model Layer 4). The reason for the significant number of wells with increasing chloride concentrations in the Central Basin is uncertain. It could be related to surface loading, but could also be related to dissolution of formation minerals in a system not at equilibrium. It should be noted that the average chloride concentration in the Central Basin is low (67 mg/L) and significantly below the BSBPO of 250 mg/L.

In the West Coast Basin, a greater number of wells (42) show no chloride concentration trends, while 35 wells show increasing trends and 17 wells show decreasing trends. Similar to the findings for TDS, while there are more wells with increasing rather than decreasing chloride concentrations, many of the wells with increasing trends are located in or near existing saline plumes and are likely influenced by the migration of these saline plumes and not by current chloride loading. Given that saline plumes have been and continue to be actively remediated for more than 40 years through the injection of significant volumes of high quality water at the seawater barriers and the operation of the desalters, ambient background chloride concentrations are declining overall in the West Coast Basin.

5.3.3 Nitrate Results

5.3.3.1 Nitrate Data from Groundwater Wells

The right column of maps on Figure 9 shows median nitrate-N concentrations for wells in each model layer, with Model Layer 1 on top and Model Layer 4 on the bottom.

In the Central Basin, nitrate-N is below the MCL/BPO of 10 mg/L in most wells in all four layers, with a few exceptions. A few wells with higher concentrations but below the MCL were observed in the Montebello Forebay (Model Layers 1, 2, and 3), Los Angeles Forebay (Model Layers 2 and 3), and Whittier Area (Model Layer 2). Two wells with elevated concentrations above the MCL were observed in the Central Basin Pressure Area (Model Layer 3) and in the Los Angeles Forebay (Model Layer 3).

In the West Coast Basin, a few wells with elevated nitrate-N concentrations but below the 10 mg/L MCL were observed in Model Layers 2 and 3; only two of the wells (in Layer 2) have median concentrations that exceed the MCL.

Figure 10 shows the nitrate-N concentration contour maps in the right hand column of the figure. As shown in the figure, only isolated hotspots of elevated nitrate-N concentrations are detected in Model Layers 1, 2, and 3 in both the Central Basin and West Coast Basin.

5.3.3.2 Average Nitrate Water Quality and Assimilative Capacity

Based on the groundwater quality contour maps (Figure 10), the average nitrate-N concentration was calculated. Table 5 and **Figure 13** present the average nitrate-N concentrations, the MCL/BPO of 10 mg/L, and available assimilative capacity. Overall, nitrate-N concentrations in the CBWCB are significantly below the MCL and thus, nitrate is not a constituent of concern in either the Central Basin or the West Coast Basin and there is available assimilative capacity in both basins.

In the Central Basin, average nitrate-N concentrations in all subareas and layers are significantly below the MCL of 10 mg/L. The volume-weighted average nitrate-N concentrations in the Central Basin, both including and excluding the coastal area, are also below the MCL. There is 9.72 mg/L of available assimilative capacity in the Central Basin whether the coastal area is excluded or included.

For the West Coast Basin, average nitrate-N concentrations in all layers and the volume-weighted total average for the entire basin, both including and excluding the coastal areas, are significantly below the MCL of 10 mg/L. There is 9.96 mg/L of available assimilative capacity in the West Coast Basin when the coastal areas are included and 9.95 mg/L of available assimilative capacity when the coastal areas are excluded.

5.3.3.3 Nitrate Concentration Trends

Table 6 presents the results of the Mann-Kendall test for water quality trends for nitrate for each subarea, basin, and the entire CBWCB. As indicated in Table 6, the trend data generally show that nitrate concentrations are stable (i.e., no trend) in most wells in each subarea and basin, with a relatively small number of wells with decreasing nitrate trends outnumbering those with increasing trends.

In the Central Basin as a whole, nitrate concentrations are mainly stable, with most wells (112) showing no trends, 32 wells showing decreasing trends, and 15 wells showing increasing trends. In the West Coast Basin, nitrate concentrations are also stable, with most wells (67) showing no trends, one well showing an increasing trend, and 3 wells showing decreasing trends.

Overall for the CBWCB, nitrate concentrations are primarily stable, with most wells (179) showing no nitrate concentration trends, 16 wells showing increasing trends, and 35 wells showing decreasing trends.

6 Baseline and Future Planning Period Salt and Nutrient Balances

The S/N balances in the CBWCB consider the source water volumes of inflow and outflow and their associated TDS, chloride, and nitrate concentrations. The balances also consider any added TDS, chloride, and nitrate from use as well as other fate and transport processes, which can either increase and decrease concentrations. The methodology and data used to estimate key S/N loading and unloading factors and identify their individual and cumulative effects on groundwater quality in the CBWCB over the SNMP baseline period (WY 2000-01 to 2009-10) and future planning period (WY 2010-11 to 2024-25) are summarized below and described in more detail in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality*.

6.1 Source Water Quality

The average TDS, chloride, and nitrate-N quality of source waters for the baseline period are summarized in **Table 7**. The different water sources are listed from top to bottom, from lowest to highest relative concentration of TDS. The existing average S/N concentrations in groundwater in the Central Basin and the West Coast Basin are also included in the table. As illustrated in Table 7, following precipitation, AWT recycled water is the highest quality source water with respect to TDS and chloride (as well as being very low in nitrate) recharging the CBWCB. Accordingly, recharge of AWT recycled water significantly improves the ambient groundwater quality in the CBWCB. Imported water from the Owens River/Mono Basin and SWP, along with stormwater also serve as very high quality recharge water.

6.1.1 Precipitation

Precipitation recharges the groundwater basins through deep percolation. Generally, precipitation is very low in S/Ns. The average precipitation source water concentrations for TDS, chloride, and nitrate-N during the baseline period are presented in Table 7.

6.1.2 Recycled Water

Relevant to the S/N balances is recycled water used for replenishment operations and irrigation in the Study Area; other recycled water uses, such as industrial operations, do not recharge the groundwater basins. The average TDS, chloride, and nitrate-N concentrations of AWT and tertiary-treated recycled water during the baseline period are presented in Table 7. AWT recycled water injected at the seawater intrusion barriers represents the highest quality water, following precipitation, recharged in the CBWCB with respect to TDS. Tertiary-treated recycled water is used for irrigation in the CBWCB and also blended with imported water and local water/stormwater for recharge at the MFSG.

6.1.3 Surface Water/Stormwater

Surface water/stormwater represents a high quality source of recharge in the CBWCB. Surface water is recharged at the MFSG and DGSG. The average TDS, chloride, and nitrate-N concentrations in surface water recharged at the MFSG were used to represent mountain front recharge water quality. Table 7 presents the average surface water/stormwater quality during the baseline period.

Table 7 Average TDS, Chloride, and Nitrate Concentrations in Various Source Waters During Baseline Period

Type of Water	TDS [a] (mg/L)	Chloride [a] (mg/L)	NO_3–N [a] (mg/L)
Precipitation	2	0 [b]	0.18
Edward C. Little WRF AWT RW [c]	65	9	0.26
TIWRP AWT RW [c]	98	37	0.79
Leo J Vander Lans AWTF AWT RW [c]	66	14	1.13
Owens River/Mono Basin IW [d]	218	25	0.09
Orange County Basin [e]	237	13	<0.1
Untreated SWP IW [f]	251	68	0.67
MFSG Intake – Stormwater [g]	259	40	1.58
Stormwater Station S10 [g]	297	46	1.16
Jensen WTP IW [d,h]	297	70	0.61
San Gabriel Basin IW [d]	346	44	3.6
San Gabriel Basin [e]	455	68	1.73
Weymouth WTP IW [d]	473	83	0.43
Diemer WTP IW [d,h]	481	84	0.42
Central Basin Groundwater [i]	**529**	**67**	**0.28**
Hollywood Basin [e]	533	66	<0.1
San Jose Creek West WRP Tertiary RW [f,j]	533	109	5.63
Pomona WRP Tertiary RW [f]	545	126	4.41
Whittier Narrows WRP Tertiary RW [f]	550	105	6.31
San Fernando Basin [e]	598	79	2.07
Long Beach WRP Tertiary RW [j]	616	122	5.14
Untreated Colorado River IW [f]	624	88	021
San Jose Creek East WRP Tertiary RW [f,j]	626	149	3.41
Edward C. Little WRF Tertiary RW [j]	705	211	1.01
Los Coyotes WRP Tertiary RW [j]	825	207	5.16
Santa Monica Basin [e]	889	109	3.42
West Coast Basin Groundwater [i]	**890**	**306**	**0.05**
Groundwater Seaward of Barriers [e,k]	2,464	1,343	0.01

TDS – total dissolved solids
mg/L – milligrams per liter
NO_3-N – nitrate as nitrogen
AWT – advanced water treatment
RW – recycled water
IW – imported water
WTP – Water Treatment Plant
WRF – Water Recycling Facility
WRP – Water Reclamation Plant
AWTF – Advanced Water Treatment Facility
WTP – Water Treatment Plant
WY – Water Year
MFSG – Montebello Forebay Spreading Grounds
DGSG – Dominguez Gap Spreading Grounds
TIWRP – Terminal Island Water Reclamation Plant/Advanced Water Purification Facility
WRD – Water Replenishment District of Southern California
WBMWD – West Basin Municipal Water District
MWD – Metropolitan Water District of Southern California

a – Data are provided in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality;* concentrations are averages of the 10-year baseline period from WY 2000-01 to 2009-10
b - zero values indicate non detects; no detection limits provided
c – Recharged at the seawater intrusion barriers
d – Imported water used for water supply
e – Source of subsurface groundwater inflow
f – Recharged at the MFSG
g – Stormwater recharged at the MFSG and used to represent mountain front recharge; Station S10 is located near the DGSG and is representative of stormwater recharged at the DGSG
h – Recharged at the seawater intrusion barriers
i – Averages exclude coastal areas (i.e., seawater side of the seawater intrusion areas) based on 5-year averaging period
j – Tertiary-treated recycled water used for irrigation
k – Average groundwater quality seaward of the seawater intrusion barriers were used to represent groundwater quality of inflow from the ocean

6.1.4 Imported Water

The S/N quality of imported water varies depending on the source. Imported water is used for water supply and replenishment in the CBWCB. Untreated MWD imported water is recharged at the MFSG and treated MWD imported water is injected at the seawater intrusion barriers. Water imported from the Owens River/Mono Basin and SWP serves as very high quality recharge water. CR water is higher in TDS than these other imported sources, as is the water from MWD treatment plants that include a blend of SWP/CR water. The average TDS, chloride, and nitrate-N concentrations in treated and untreated imported water during the baseline period are presented in Table 7.

6.1.5 Groundwater

Groundwater used for irrigation recharges the CBWCB through deep percolation. Groundwater from adjacent basins flows into the CBWCB as subsurface inflow. Groundwater pumping, including the extraction for the desalters, represent S/N outflows. S/Ns in groundwater can also leave the CBWCB as subsurface outflow, although this is very minor due to basin pumping depressions. The average TDS, chloride, and nitrate-N concentrations in groundwater in the Central Basin and West Coast Basin for the 5-year averaging period are presented in Table 7. Average baseline period S/N concentrations in groundwater for the adjacent basins that provide subsurface inflow are also shown in Table 7. A small amount of subsurface inflow to the CBWCB is from the ocean. The S/N concentrations of this inflow are represented by the average groundwater quality seaward of the seawater intrusion barriers (i.e., coastal areas), as shown in Table 7.

The average TDS and chloride concentrations used to represent groundwater pumped from the West Coast Basin were adjusted to account for the effect of the seawater-impacted areas, since most production wells are located outside of the WCBB-inland saline plume. Average S/N concentrations in groundwater in the West Coast Basin were calculated using individual active well pumping volumes and quality (volume-weighted average of pumping wells), not the basin-wide averages presented in Table 7. Since nitrate concentrations do not vary across the West Coast Basin, nitrate was not adjusted. The average S/N concentrations in groundwater extracted/pumped from the West Coast Basin is presented in **Table 8**. Given that the seawater-impacted area in the Central Basin is small, the TDS and chloride concentrations used to represent groundwater pumped from the Central Basin were not adjusted to account for the effect of seawater-impacted area.

The Brewer Desalter and Goldsworthy Desalter treat brackish groundwater pumped from the WCBB-inland saline plume. The desalters help to remediate this trapped inland saline plume and the treated water is used for potable supply. Groundwater extraction for the desalters is projected to increase in the future planning period as described in Section 4.2.1. The median concentrations of TDS and chloride in the raw groundwater pumped for the desalters from 2007 to 2012 is presented in **Table 9**. Since nitrate concentrations do not vary across the West Coast Basin, the average nitrate-N concentrations presented in Table 7 were used to represent groundwater quality pumped from the desalter wells.

Table 8 Average TDS, Chloride, and Nitrate-N Concentrations in Groundwater Pumped from the West Coast Basin

WATER YEAR	EXTRACTED GROUNDWATER QUALITY IN WEST COAST BASIN [a] (volume-weighted average in mg/L)		
	TDS	Cl	NO_3-N
2000-01	937	469	0.05 [b]
2001-02	937	469	
2002-03	937	469	
2003-04	937	469	
2004-05	937	469	
2005-06	937	469	
2006-07	937	469	
2007-08	937	469	
2008-09	937	469	
2009-10	937	469	
Average	937	469	

TDS - total dissolved solids
mg/L - milligrams per liter
Cl - chloride
NO_3-N - nitrate as nitrogen

a - Pumping volume-weighted average; data from WRD water quality database; quality representing groundwater extraction was calculated as the average concentration of active production wells weighted based on their respective average annual production from WY 2000-01 through 2009-10; the median concentration from 2007-2012 was applied directly for wells with TDS and chloride data; for wells lacking TDS and chloride data, interpolated values from the median (2007-2012) TDS and chloride concentration contour maps were applied; for wells screened across multiple layers, the average concentration from each pertinent layer was applied; one calculated value was used for all 10 years of the baseline period because the well water quality data are insufficient to support calculation of different annual averages

b - Nitrate value based on West Coast Basin (no coast) average from Table 5; subsequent year nitrate concentrations estimated with mixing model

Table 9 Average TDS, Chloride, and Nitrate-N Concentrations in Groundwater Pumped and Treated by the Desalters

WATER YEAR	EXTRACTED GROUNDWATER QUALITY FOR BREWER DESALTER [a] (concentrations in mg/L)			EXTRACTED GROUNDWATER QUALITY FOR GOLDSWORTHY DESALTER [a] (concentrations in mg/L)		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
2000-01	4,700	2,200	0.05 [b]	1,900	670	0.05 [b]
2001-02	4,700	2,200		1,900	670	
2002-03	4,700	2,200		1,900	670	
2003-04	4,700	2,200		1,900	670	
2004-05	4,700	2,200		1,900	670	
2005-06	4,700	2,200		1,900	670	
2006-07	4,700	2,200		1,900	670	
2007-08	4,700	2,200		1,900	670	
2008-09	4,700	2,200		1,900	670	
2009-10	4,700	2,200		1,900	670	
Average	4,700	2,200		1,900	670	

TDS - total dissolved solids

mg/L - milligrams per liter

Cl - chloride

NO_3-N - nitrate as nitrogen

a - Data from WRD water quality database; the median concentration from 2007-2012 was applied directly for wells with TDS and chloride data; one calculated value was used for all 10 years of the baseline period because the well water quality data are insufficient to support calculation of different annual averages

b - Nitrate value based on West Coast Basin (no coastal areas) average from Table 5; subsequent year nitrate concentrations estimated with mixing model

6.2 Montebello Forebay Spreading Water Quality

Water recharged in the Montebello Forebay includes untreated imported water (from CR and SWP), recycled water, and local water/stormwater. These source waters and their volumes recharged at the MFSG between WY 2000-01 through 2009-10 are described in Appendix H *Baseline and Future Water Balances*. The relative percentages of each source water and its quality (volume-weighted average) were used to estimate the S/N inflow from the managed aquifer recharge in the Montebello Forebay. **Table 10** shows the estimated baseline and future planning period annual average S/N concentrations in water recharged at the MFSG, as well as the projected quality of the recharge water for both GRIP A and GRIP B (Scenarios 6 and 7, respectively, simulated by the SNMP mixing model, as discussed in Section 7.3). The projected water quality is a volume-weighted average of the source waters. The baseline period average water quality is used to represent future source water quality for imported water, stormwater, and tertiary-treated recycled water.

Table 10 Annual Average TDS, Chloride, and Nitrate-N Concentrations in Water Recharged at the MFSG

Water Year	AVERAGE BASELINE QUALITY OF RECHARGE WATER AT MFSG [a] (volume-weighted average in mg/L)					
	TDS	Cl	NO_3-N			
2000-01	418	84	2.46			
2001-02	492	102	2.27			
2002-03	411	85	2.24			
2003-04	380	83	2.49			
2004-05	286	37	1.45			
2005-06	480	93	2.96			
2006-07	460	107	2.15			
2007-08	385	82	2.31			
2008-09	435	93	3.07			
2009-10	444	91	2.23			
Baseline Average 2001 to 2010	419	86	2.36			
Water Year	**PROJECTED QUALITY OF BLENDED RECHARGE WATER AT MFSG [a] (volume-weighted average in mg/L)**					
	SCENARIO 6 - GRIP A 11,000 AFY tertiary & 10,000 AFY AWT Recycled Water [b]			**SCENARIO 7 - GRIP B 21,000 AFY Tertiary Recycled Water**		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
2010-11	418	86	2.42	418	86	2.42
2011-12	425	89	2.48	425	89	2.48
2012-13	425	89	2.48	425	89	2.48
2013-14	425	89	2.48	425	89	2.48
2014-15	438	92	2.62	460	98	2.85
2015-16	438	92	2.62	460	98	2.85
2016-17	438	92	2.62	460	98	2.85
2017-18	415	87	2.67	460	98	2.85
2018-19	415	87	2.67	460	98	2.85
2019-20	415	87	2.67	460	98	2.85
2020-21	415	87	2.67	460	98	2.85
2021-22	415	87	2.67	460	98	2.85
2022-23	415	87	2.67	460	98	2.85
2023-24	415	87	2.67	460	98	2.85
2024-25	415	87	2.67	460	98	2.85
Average 2011 to 2025	422	89	2.60	450	95	2.75

TDS - total dissolved solids
AWT - advanced water treatment
Cl - chloride
AFY - acre-feet per year
NO_3-N - nitrate as nitrogen
AWTF - advanced water treatment facility
MFSG - Montebello Forebay Spreading Grounds
mg/L - milligrams per liter
GRIP - Groundwater Reliability Improvement Program
GRIP A - GRIP Recycled Water Project A
GRIP B - GRIP Recycled Water Project B

a - Concentrations calculated based on spreading grounds source volumes and source water concentrations (volume-weighted average)

b - AWT recycled water quality represented by average baseline concentrations from WRDs Leo J. Vander Lans AWTF

For the AWT recycled water, the average baseline period water quality from WRD's Vander Lans AWTF was used to represent AWT recycled water for the volume-weighted averages for GRIP A. The projected TDS, chloride, and nitrate concentrations in the MFSG recharge water are higher for the 100% tertiary-treated recycled water scenario (GRIP B) compared with baseline conditions. This is because the average imported water quality is slightly better than the tertiary-treated recycled water. The AWT/tertiary-treated recycled water blend (GRIP A) has similar average TDS, chloride, and nitrate concentrations to baseline conditions. The projected recharge water quality is well below BPO/BSBPOs for TDS, chloride, and nitrate for both GRIP A and GRIP B.

6.3 Seawater Barrier Injection Water Quality

The seawater intrusion barriers currently receive treated MWD imported water, which is a blend of CR and SWP water, and AWT recycled water. These source waters and relative volumes are described in Appendix H *Baseline and Future Water Balances*. The delivered water quality (annual S/N concentrations) is reported in **Table 11** for each seawater intrusion barrier for the baseline period. During the future planning period, AWT recycled water will replace imported water at all three barriers and overall injection volumes are projected to increase. AWT recycled water is projected to fully replace imported water at the AGB in WY 2014-15, at the WCBB in WY 2013-14, and at the DGB in WY 2018-19. Table 11 shows the projected S/N concentrations in the recharge water for each barrier. The projected water quality is a volume-weighted average of the source waters. As shown in the table, the transition to 100% AWT recycled water significantly reduces TDS and chloride concentrations in the injected water and results in lowering TDS and chloride concentrations in groundwater. Nitrate concentrations do not change significantly, since they are very low in both imported water and AWT recycled water.

6.4 Irrigation Return Flow Water Quality

Water used for irrigation in the CBWCB includes imported water, groundwater, and recycled water. In order to determine the average S/N concentrations in irrigation return flows that percolate to groundwater, the relative volumes of each source water (described in Appendix H *Baseline and Future Water Balances*) were multiplied by their S/N concentrations to determine the irrigation water quality.

In addition to the S/Ns in the source water, S/Ns can become concentrated or attenuate due to evapotranspiration, removal by plant uptake, attenuation processes, or through fertilizer use as described in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality*. Nutrient plant uptake is the process by which plants absorb nutrients from applied water and surrounding soil. **Table 12** presents the TDS, chloride, and nitrate-N concentrations in raw irrigation water (consisting of treated imported water, groundwater, and recycled water) and irrigation return flows, assuming the effects on water quality due to fertilizer use, evapotranspiration, and nitrogen attenuation.

Table 11 Annual Average TDS, Chloride, and Nitrate-N Concentrations in the Water Delivered to the Seawater Intrusion Barriers for Injection

Water Year	AVERAGE BASELINE QUALITY OF WATER DELIVERED TO BARRIERS FOR INJECTION (volume-weighted average in mg/L)								
	Alamitos Gap Barrier [a]			West Coast Basin Barrier [b]			Dominguez Gap Barrier [c]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
2000-01	277	65	0.49	309	62	0.51	277	65	0.49
2001-02	407	81	0.46	344	73	0.52	407	81	0.46
2002-03	313	88	0.63	261	68	0.41	313	88	0.63
2003-04	275	71	0.61	197	105	0.49	275	71	0.61
2004-05	299	57	0.57	229	41	0.38	299	57	0.57
2005-06	164	30	0.69	227	42	0.34	182	57	0.79
2006-07	197	38	0.86	245	48	0.47	155	53	0.79
2007-08	358	64	0.76	390	66	0.41	211	77	1.15
2008-09	403	65	0.75	581	86	0.37	168	59	0.80
2009-10	323	54	1.11	413	66	0.47	357	131	0.89
Baseline Average 2001 to 2010	302	61	0.69	320	66	0.44	264	74	0.72
Water Year	**PROJECTED QUALITY OF WATER DELIVERED TO BARRIERS FOR INJECTION (volume-weighted average in mg/L)**								
2010-11	257	54	0.74	206	41	0.41	262	60	0.64
2011-12	257	54	0.74	234	48	0.44	261	60	0.64
2012-13	257	54	0.74	135	25	0.33	278	63	0.62
2013-14	257	54	0.74	65	9	0.26	171	47	0.72
2014-15	66	14	1.13	65	9	0.26	171	47	0.72
2015-16	66	14	1.13	65	9	0.26	171	47	0.72
2016-17	66	14	1.13	65	9	0.26	171	47	0.72
2017-18	66	14	1.13	65	9	0.26	171	47	0.72
2018-19	66	14	1.13	65	9	0.26	98	37	0.79
2019-20	66	14	1.13	65	9	0.26	98	37	0.79
2020-21	66	14	1.13	65	9	0.26	98	37	0.79
2021-22	66	14	1.13	65	9	0.26	98	37	0.79
2022-23	66	14	1.13	65	9	0.26	98	37	0.79
2023-24	66	14	1.13	65	9	0.26	98	37	0.79
2024-25	66	14	1.13	65	9	0.26	98	37	0.79
Average 2011 to 2025	117	25	1.03	90	15	0.29	156	45	0.74

TDS - total dissolved solids
Cl - chloride
NO_3-N - nitrate as nitrogen
DGB - Dominguez Gap Barrier
mg/L - milligrams per liter
WRD - Water Replenishment District of Southern California
WBMWD - West Basin Municipal Water District
LADWP - Los Angeles Department of Water and Power
AWT - advanced water treatment

a - Data for baseline period provided by WRD; future planning period water quality calculated as a volume weighted average of source water volumes and average baseline period water quality

b - Data for baseline period provided by WBMWD; future planning period water quality calculated as a volume weighted average of source water volumes and average baseline period water quality

c - Water quality data for baseline period delivered water provided by Michael Hanson, LADWP; no data available for NO_3 for DGB for 2005-2006 so 2006-07 data used; future planning period water quality calculated as a volume weighted average of source water volumes and TDS and chloride sampling from July/August 2013 provided by Seung Tag Oh, LADWP, and nitrate data from LADWP 2011 Harbor Water Recycling/DGB Project 2011 Annual Report (February 2012)

Table 12 Annual Average TDS, Chloride, and Nitrate-N Concentrations in Raw Irrigation Water and Return Flows

WATER YEAR	RECYCLED WATER, IMPORTED WATER, GROUNDWATER BLEND FOR IRRIGATION RAW WATER AND IRRIGATION RETURN FLOW CONCENTRATIONS USED FOR FUTURE PLANNING PERIOD (volume-weighted average in milligrams per liter)																							
	APPLIED RECYCLED WATER [c], IMPORTED WATER [d], AND GROUNDWATER [e] BLEND QUALITY												RETURN FLOW RECYCLED WATER [c], IMPORTED WATER [d], AND GROUNDWATER [e] QUALITY											
	Scenario 2 Recycled Water Quality at Average of Baseline Period						Scenario 3 Recycled Water Quality at MCL/SMCL						Scenario 2 Recycled Water Wuality at Average of Baseline Period						Scenario 3 Recycled Water Qualit/SMCL					
	Central Basin			West Coast Basin			Central Basin			West Coast Basin			Central Basin			West Coast Basin			Central Basin			West Coast Basin		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS [a]	Cl [a]	NO_3-N [b]	TDS [a]	Cl [a]	NO_3-N [b]	TDS [a]	Cl [a]	NO_3-N [b]	TDS [a]	Cl [a]	NO_3-N [b]
2000-01	425	31	0.56	316	91	0.33							3,823	279	0.61	2,843	818	0.58						
2001-02	470	35	0.56	409	101	0.30							4,227	318	0.61	3,680	910	0.58						
2002-03	431	41	0.73	347	107	0.45							3,877	365	0.62	3,122	963	0.59						
2003-04	430	38	0.71	317	92	0.40							3,872	340	0.62	2,856	827	0.59						
2004-05	442	31	0.74	321	78	0.41							3,974	276	0.62	2,889	706	0.59						
2005-06	426	28	0.71	311	75	0.34							3,834	253	0.62	2,796	674	0.58						
2006-07	429	30	0.69	303	78	0.38							3,865	266	0.62	2,729	706	0.59						
2007-08	494	36	0.60	484	107	0.32							4,445	320	0.61	4,355	962	0.58						
2008-09	509	33	0.57	534	113	0.25							4,585	295	0.61	4,803	1,013	0.58						
2009-10	500	31	0.59	513	112	0.24							4,503	279	0.61	4,617	1,012	0.57						
Baseline Average 2001 to 2010 or MCL/SMCL	456	66	0.79	387	96	0.34	1,000	500	10.00	1,000	500	10.00	4,101	299	0.61	3,469	859	0.58	9,000	4,500	3.55	9,000	4,500	3.55
2010-11	465	67	0.74	392	110	0.36	471	74	0.84	400	117	0.60	4,182	603	0.62	3,532	987	0.59	4,235	669	0.63	3,602	1,056	0.61
2011-12	466	67	0.75	392	109	0.36	472	75	0.86	400	117	0.61	4,190	605	0.62	3,529	984	0.59	4,248	677	0.64	3,600	1,054	0.61
2012-13	467	67	0.76	390	108	0.37	474	76	0.88	398	116	0.61	4,199	607	0.63	3,506	974	0.59	4,262	685	0.64	3,578	1,044	0.61
2013-14	467	68	0.76	389	108	0.37	475	77	0.90	397	116	0.61	4,207	609	0.63	3,502	970	0.59	4,275	693	0.64	3,574	1,041	0.61
2014-15	468	68	0.77	389	107	0.37	476	78	0.91	397	115	0.61	4,215	611	0.63	3,498	967	0.59	4,288	701	0.64	3,571	1,038	0.61
2015-16	469	68	0.78	388	107	0.37	478	79	0.93	396	115	0.62	4,223	613	0.63	3,494	963	0.59	4,301	709	0.64	3,567	1,035	0.61
2016-17	470	68	0.79	388	107	0.37	479	80	0.95	396	115	0.62	4,232	615	0.63	3,490	960	0.59	4,315	718	0.64	3,563	1,032	0.61
2017-18	471	69	0.80	387	106	0.37	481	81	0.97	396	114	0.62	4,240	617	0.63	3,486	957	0.59	4,328	726	0.65	3,560	1,029	0.61
2018-19	472	69	0.81	387	106	0.37	482	82	0.98	395	114	0.62	4,249	619	0.63	3,482	954	0.59	4,342	734	0.65	3,556	1,027	0.61
2019-20	473	69	0.81	386	106	0.37	484	83	1.00	395	114	0.63	4,257	621	0.63	3,478	951	0.59	4,355	743	0.65	3,553	1,024	0.61
2020-21	474	69	0.82	386	105	0.37	485	83	1.02	394	113	0.63	4,265	623	0.63	3,474	948	0.59	4,368	751	0.65	3,550	1,021	0.61
2021-22	475	70	0.83	386	105	0.37	487	84	1.04	394	113	0.63	4,274	626	0.63	3,471	945	0.59	4,382	759	0.65	3,546	1,019	0.61
2022-23	476	70	0.84	385	105	0.38	488	85	1.06	394	113	0.63	4,282	628	0.63	3,467	942	0.59	4,396	768	0.66	3,543	1,016	0.61
2023-24	477	70	0.85	385	104	0.38	490	86	1.07	393	113	0.63	4,291	630	0.63	3,463	939	0.59	4,409	776	0.66	3,540	1,014	0.61
2024-25	478	70	0.85	388	107	0.37	491	87	1.09	396	115	0.62	4,299	632	0.64	3,495	962	0.59	4,422	784	0.66	3,568	1,034	0.61
Average 2011 to 2025	471	69	0.80	388	107	0.37	481	81	0.97	396	115	0.62	4,240	617	0.63	3,491	960	0.59	4,328	726	0.65	3,565	1,032	0.61

TDS - total dissolved solids
Cl - chloride
NO_3-N - nitrate as nitrogen
MCL - primary maximum contaminant level
ET - evapotranspiration
WRPs - water reclamation plants
WRF - water reclamation facility
SMCL - secondary maximum contaminant level
SDLAC - Sanitation Districts of Los Angeles County
WBMWD - West Basin Municipal Water District
mg/L - milligrams per liter

See Section 4.8 of Appendix I *Baseline and Future Salt and Nutrient Groundwater Quality* for additional discussion of irrigation return flow loading assumptions

a - TDS and chloride concentrations increased 9 fold due to ET based on initial potential 30 fold increase adjusted downward based on mixing model calibration

b - Fertilizer application rate - net loading to groundwater is 8.9 pounds of nitrogen per acre based on UC Davis (2012 study) application rate of 45 pounds/acre, 36 pounds lost prior to leaching. 5.5 mg/L added; nitrate attenuated 90% based on mixing model calibration

c - Baseline recycled water quality is a volume-weighted blend of effluent from SDLAC's San Jose Creek, Los Coyotes, and Long Beach WRPs in Central Basin and effluent from WBMWD's Edward C. Little WRF in the West Coast Basin; for future planning period average of baseline period used for volume-weighted averages

d - Baseline imported water quality is a volume-weighted mix of treated imported water sources; for future planning period, baseline average used for volume-weighted average

e - Baseline groundwater quality used in volume-weighted averages is basin average for Central Basin and basin average excluding refinery industrial wells for the West Coast Basin; for future planning period, baseline average used for volume-weighted average

6.5 Precipitation Percolation Water Quality

Precipitation recharges the groundwater basins through deep percolation. Generally, precipitation is low in S/Ns. Precipitation can pick up or leach salts and nutrients in the surface soils, vadose zone, and aquifer (mineral dissolution). Because precipitation water quality is so low with respect to TDS and chloride, it was assumed that precipitation will react with surface soils and subsurface media to leach these salts. Thus, the TDS and chloride loading was adjusted to account for dissolution.

The process by which airborne pollutants are deposited to the earth is known as dry deposition. Nitrogen is one of the pollutants commonly associated with dry deposition. For the SNMP analysis, nitrogen leaching from dry deposition is assumed to be negligible. This is consistent with the UC Davis Study (2012), which assumed nitrogen in urbanized areas runs off with stormwater flows or is removed by nitrogen-fixing processes in turf areas. **Table 13** provides the water quality for raw precipitation and the adjusted percolation water quality for the baseline period. The average of the baseline period was used for the precipitation return flows for the future planning period.

6.6 Overall Salt and Nutrient Balances

TDS, chloride, and nitrate-N balances were developed for the 10-year baseline period (WY 2000-01 to 2009-10) and the future planning period (WY 2010-11 through 2024-25) based on the water quality described above. Salt and nutrient balances for various scenarios, as described in Section 7.3 *Future Projects and Simulated Scenarios,* were estimated for the future planning period from WY 2010-11 through 2024-25. The S/N mass balances are discussed in more detail in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality.* TDS, chloride, and nitrate balances are the basis for the mixing model water quality predictions discussed in the next section.

Table 13 Annual Average TDS, Chloride, and Nitrate-N Concentrations in Raw and Return Flow Precipitation

WATER YEAR	RAW PRECIPITATION [a]			ADJUSTED PRECIPITATION RETURN FLOW		
	TDS	Cl [b]	NO_3-N	TDS [c]	Cl [c]	NO_3-N
2000-01	2	0	0.18	150	20	0.18
2001-02	2	0	0.16	150	20	0.16
2002-03	2	0	0.20	150	20	0.20
2003-04	2	0	0.16	150	20	0.16
2004-05	2	0	0.16	150	20	0.16
2005-06	2	0	0.12	150	20	0.12
2006-07	2	0	0.19	150	20	0.19
2007-08	2	0	0.24	150	20	0.24
2008-09	2	0	0.12	150	20	0.12
2009-10	2	0	0.13	150	20	0.13
Average	2	0	0.16	150	20	0.16

All values in milligrams per liter (mg/L)

TDS - total dissolved solids

EC - electrical conductivity

Cl - chloride

NO_3-N - nitrate as nitrogen

a - Data from USEPA CASTNET; Station Converse (CON186); San Bernardino County; TDS calculated from EC

b - zero values indicate non detects; no detection limits provided

c - TDS and chloride concentrations increased through mineral dissolution based on mixing model calibration (see Appendix I Section 5.1.1 *Mixing Model Baseline Period Calibration*)

7 Simulated Future Groundwater Quality

7.1 SNMP Mixing Model and Simulation Methodology

An SNMP mixing model was developed to simulate/estimate future planning period groundwater quality and evaluate the effects of planned future projects on overall groundwater quality and use of assimilative capacity in the CBWCB through WY 2024-25. The mixing model was developed in Microsoft Excel™ and is effectively a set of linked spreadsheets used to represent "continuously-stirred" mixing volumes (basin/subarea/layer). At the request of LARWQCB, these spreadsheets were provided to the LARWQCB in October 2013. The mixing model was designed to: 1) account for the current groundwater volume and S/N mass in storage within the CBWCB, and 2) track the loading/unloading of S/Ns through major groundwater sources and sinks under current (baseline period) and future land use/water use conditions (various scenarios for the future planning period). The mixing model is further described in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality.*

The estimated current groundwater volume (provided by the MODFLOW regional groundwater flow model [USGS, 2003 and CH2MHILL, 2012b]) and associated S/N mass in storage (concentrations provided by estimated existing average S/N groundwater quality) within the CBWCB served as initial inputs into the mixing model. Consideration of the groundwater volume and S/N mass in storage is necessary for predicting future groundwater quality concentrations in order to compare simulated concentrations with BPO/BSBPOs and anti-degradation thresholds (assimilative capacity) defined in the Recycled Water Policy.

In recognition of the variable hydrogeologic and groundwater quality conditions and different BSBPOs established for the Central Basin and West Coast Basin, the CBWCB was divided into discrete mixing volumes (subareas/layers) in the SNMP mixing model. For the future planning period, several different scenarios were simulated, as described in Section 7.3 *Future Projects and Simulated Scenarios.* The scenarios were based on projects that were proposed by the CBWCB stakeholders for implementation during the future planning period.

To address the uncertainty in estimating S/N loading for each individual S/N source, the baseline period (WY 2000-01 through 2009-10) was used to compare simulated concentration trends with actual observed concentration trends on a basin/subarea-scale, identify S/N loading factors with the highest level of significance, and of those factors modify the ones with the highest level of uncertainty, if warranted, to provide a reasonable match between actual observed and simulated concentrations. Adjustments to the S/N loading factors made as a result of the baseline period calibration process are discussed in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality.*

The primary assumption of the SNMP mixing model is that S/N mixing within a given mixing volume (basin/subarea/layer) is complete during each annual time step. While the CBWCB is divided into discreet mixing volumes to account for variable loading and non-uniform concentrations across the basins, it is recognized that the assumption of complete mixing can result in two potential errors: 1) overestimation or underestimation of the S/N concentration assigned to subsurface flows between neighboring mixing volumes, and 2) overestimation of the effect of S/N loading changes associated with a point-source projects in one basin/subarea on neighboring basin/subareas. The effect of the two potential errors on vertical S/N transport between layers (e.g., Layer 1 to Layer 2 in a given subarea) is limited for two reasons: 1) vertical flows are generally fairly consistent across each mixing volume; therefore, the volume-weighted average concentration for each model layer is a representative concentration for vertical S/N fluxes, and 2) insofar as S/Ns migrate vertically but are maintained in a respective basin/subarea, they do not affect the volume-weighted average concentration for that basin/subarea.

Examination of concentration contour maps and future simulation results indicate that the two potential errors associated with the assumption of complete S/N mixing within mixing volumes likely contributed to the slight overestimation of the TDS and chloride concentrations assigned to horizontal subsurface flowpaths (e.g., Layer 1 to adjacent subarea Layer 1; Layer 2 to adjacent subarea Layer 2, etc.) from the Los Angeles Forebay, Montebello Forebay, and Whittier Area to the Central Basin Pressure Area. These errors resulted in a conservative overestimation of groundwater quality for the Central Basin Pressure Area and help to explain partly why this subarea is projected to experience the highest concentration increase and the greatest use of current available assimilative capacity with respect to TDS and chloride.

Simulation results also indicate that some of the projected TDS and chloride concentration increases in the Central Basin Pressure Area were caused by two local factors: 1) loading from irrigation return flows within the Central Basin Pressure Area, and 2) limited unloading from pumping; most of the pumping in the Central Basin Pressure Area is by wells screened in Model Layer 3, which has lower TDS and chloride concentrations compared to the subarea volume-weighted average concentration for all layers. In addition to these two factors, some of the TDS and chloride concentration increases in the Central Basin Pressure Area are also a result of S/N loading associated with subsurface inflows from the Los Angeles Forebay, Montebello Forebay, and Whittier Area. Volume-weighted average TDS and chloride concentrations are higher in these upgradient areas than in the Central Basin Pressure Area. However, concentration contour maps indicate that the volume-weighted average TDS and chloride concentrations in Model Layers 2 and 3 in the Los Angeles Forebay and Whittier Area are higher than respective concentrations along the boundary shared with the Central Basin Pressure Area. Thus, S/N fluxes along these boundaries are slightly overestimated.

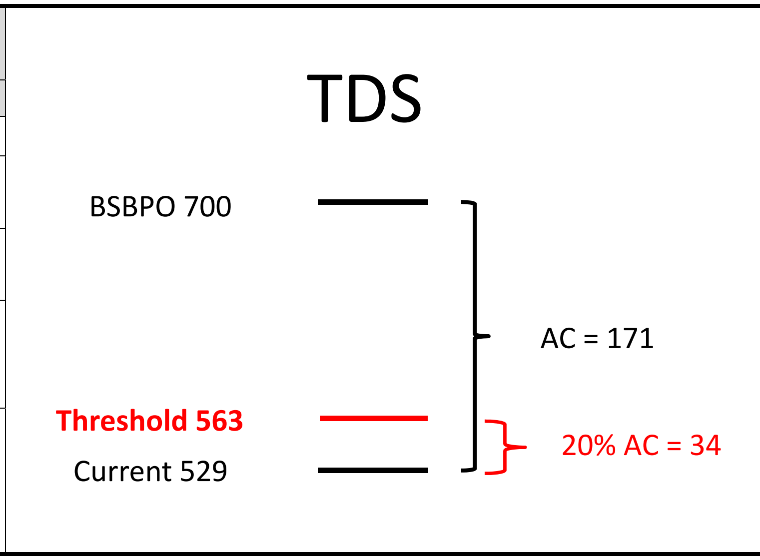
7.2 Assimilative Capacity Threshold

In accordance with the SWRCB Recycled Water Policy, single recycled water projects utilizing less than 10% and multiple projects utilizing less than 20% of the available assimilative capacity in a basin/sub-basin need only conduct an anti-degradation analysis verifying the use of the assimilative capacity, until such time as a SNMP is adopted. Accordingly, single and multiple recycled water projects proposed in the CBWCB were assessed in terms of 10% and 20% of the existing available assimilative capacity, respectively.

Table 14 provides an example of how the 20% assimilative capacity threshold was calculated for TDS groundwater quality in the Central Basin. The existing average TDS concentration in the basin was subtracted from the BSBPO to calculate the available assimilative capacity. 20% of the calculated available assimilative capacity was then added to the average TDS concentration to determine the assimilative capacity threshold. Similar steps were used to calculate the 20% and 10% assimilative capacity threshold for each S/N for each basin.

Table 14 Calculation of Assimilative Capacity Threshold

	Central Basin (no coastal area)		
	TDS	Cl	NO_3-N
BPO/BSBPO	700	150	10.0
Average Concentration	529	67	0.28
Assimilative Capacity	171	83	9.72
20% Assimilative Capacity	**34**	17	1.94
20% Assimilative Capacity Threshold	**563**	84	2.22



All values in milligrams per liter
TDS – total dissolved solids
Cl – chloride
NO_3-N – nitrate as nitrogen
BPO/BSBPO – Basin Plan Objective/Basin-Specific Basin Plan Objective
AC – assimilative capacity
Coastal area – Seaward side of the seawater intrusion barrier

7.3 Future Projects and Simulated Scenarios

For the future planning period, several changes in the water and S/N balances are anticipated due to the implementation of proposed projects in the CBWCB. Appendix H *Baseline and Future Water Balances* identifies baseline period (WY 2000-01 through 2009-10) and future planning period (WY 2010-11 through 2024-25) water balances for groundwater, imported water, and recycled water use; stormwater capture; and all other basin inflows and outflows. **Table 15** summarizes the major proposed projects or “scenarios” that were simulated by the SNMP mixing model to determine future water quality and assess assimilative capacity impacts.

Table 15 List of Scenarios Simulated by the SNMP Mixing Model

Scenario No.	Description
1	**No Future Projects** – Average of baseline period conditions (i.e., continuation of only existing projects and no implementation of proposed projects) reproduced for each year of the future planning period (Water Year [WY] 2010-11 through 2024-25).
2	**Increased Recycled Water for Irrigation (Baseline Period Average Water Quality)** – This is a proposed project in the Central Basin and West Coast Basin (CBWCB) that would increase the use of recycled water for irrigation (replacing imported water and groundwater). Recycled water used for irrigation is anticipated to increase from the 10-year baseline period (WY 2000-01 through 2009-10) average of about 10,600 acre-feet per year (AFY) to about 23,100 AFY by WY 2024-25. For this scenario, recycled water quality for salt and nutrients (S/Ns) is equivalent to the baseline period average (see Table I-9 in Appendix I). For the CBWCB Salt and Nutrient Management Plan (SNMP), S/Ns specifically refers to nitrate as nitrogen (nitrate-N), total dissolved solids (TDS), and chloride.
3	**Increased Recycled Water for Irrigation (Water Quality Equivalent to MCL/SMCLs)** – This is a proposed project in the CBWCB that would increase the use of recycled water for irrigation (replacing imported water and groundwater). Recycled water used for irrigation is anticipated to increase from a baseline period average of about 10,600 AFY to about 23,100 AFY by WY 2024-25. For this scenario, recycled water quality is equivalent to: • Nitrate as nitrogen (nitrate-N) – Primary Maximum Contaminant Level (MCL) of 10 milligrams per liter (mg/L), • TDS – Secondary Maximum Contaminant Level (SMCL) of 1,000 mg/L, and • Chloride – SMCL of 500 mg/L. These recycled water concentrations are higher than the baseline period averages (Scenario 2). Currently, permitted recycled water quality limits established for non-potable reuse (irrigation, industrial and recreational activities) are generally more conservative than the SMCLs established for TDS and chloride.
4	**Seawater Intrusion Barriers** – This scenario consists of planned projects that would increase injection volumes and increase the use of recycled water that has undergone advanced water treatment (AWT) to completely replace imported water at the West Coast Basin Seawater Intrusion Barrier, Alamitos Gap Seawater Intrusion Barrier, and Dominguez Gap Seawater Intrusion Barrier. Total AWT recycled water used for injection at the barriers is anticipated to increase from a baseline period average of about 9,500 AFY to about 31,700 AFY by WY 2018-19. The switch to AWT recycled water from imported water significantly reduces TDS and chloride in the recharge water (changes in nitrate concentrations are not significant). As a result, these planned seawater barrier projects were designated as an implementation measure, as further discussed in Appendix J.

Scenario No.	Description
5	**Increased Groundwater Pump and Treat by the Desalters in the West Coast Basin** – This scenario consists of planned projects that would increase the amount of groundwater pumped and treated by the two existing desalter facilities in the West Coast Basin. The Robert W. Goldsworthy Desalter will be expanded and the associated groundwater pumping will increase from a baseline period average of about 1,900 AFY to about 5,500 AFY by WY 2014-15. Groundwater pumping for treatment by the C. Marvin Brewer Desalter is also expected to increase from a baseline period average of about 500 AFY to an average of about 900 AFY in the future planning period. Since these planned desalter projects are expected to improve groundwater quality, they were designated as an implementation measure, as further discussed in Appendix J.
6	**Groundwater Reliability Improvement Program, Recycled Water Project A (GRIP A)** – This is a planned project in the Central Basin that would increase the use of recycled water, specifically a combination of AWT recycled water (10,000 AFY) and tertiary-treated recycled water (11,000 AFY) to completely replace imported water for recharge at the Montebello Forebay Spreading Grounds (MFSG) beginning WY 2017-18.
7	**GRIP Recycled Water Project B (GRIP B)** – This is a proposed project in the Central Basin that would increase the use of tertiary-treated recycled water (21,000 AFY) to completely replace imported water for recharge at the MFSG beginning WY 2014-15.
8	**Combined Projects/Scenarios** – A combination of Scenarios 2 (increased recycled water for irrigation at baseline period average S/N concentrations), 4, 5, 6 (GRIP A), and minor future changes (includes increased and decreased imported water for supply in the West Coast Basin and Central Basin, respectively, and increased stormwater capture).
9	**Combined Projects/Scenarios** – A combination of Scenarios 2 (increased recycled water for irrigation at baseline period average S/N concentrations), 4, 5, 7 (GRIP B), and minor future changes (includes increased and decreased imported water for supply in the West Coast Basin and Central Basin, respectively, and increased stormwater capture).
10	**Combined Projects/Scenarios** – A combination of Scenarios 3 (increased recycled water for irrigation at SMCLs/MCL), 4, 5, 6 (GRIP A), and minor future changes (includes increased and decreased imported water for supply in the West Coast Basin and Central Basin, respectively, and increased stormwater capture).
11	**Combined Projects/Scenarios** – A combination of Scenarios 3 (increased recycled water for irrigation at SMCLs/MCL), 4, 5, 7 (GRIP B), and minor future changes (includes increased and decreased imported water for supply in the West Coast Basin and Central Basin, respectively, and increased stormwater capture).

SNMP – Salt and Nutrient Management Plan
S/N – salt and nutrient
MCL – Maximum Contaminant Level
SMCL – Secondary Maximum Contaminant Level
Nitrate-N – nitrate as nitrogen
TDS – total dissolved solids
mg/L – milligrams per liter
CBWCB – Central Basin and West Coast Basin
AFY – acre-feet per year
WY – Water Year
GRIP – Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A
GRIP B – GRIP Recycled Water Project B
MFSG – Montebello Forebay Spreading Grounds

As shown in Table 15, a total of 11 scenarios were simulated by the SNMP mixing model and results from the simulations were compared to Scenario 1 (i.e., continued baseline period average conditions in the future). Scenarios 1 through 7 were assessed to determine water quality impacts of individual projects in isolation. In reality, some combination of these projects will be implemented in the future planning period, so Scenarios 8 through 11 were simulated to assess the impacts of various combinations of projects. As described in Table 15, Scenarios 8 through 11 also include the following minor future changes:

- Decreased imported water use for supply in the Central Basin (from a baseline period average of 129,300 AFY to about 121,000 AFY by WY 2024-25) and slightly increased imported water for supply in the West Coast Basin (from a baseline period average of about 143,000 AFY to about 155,600 AFY by WY 2024-25). This results in a net decrease in imported water supply in the CBWCB and a reduction in S/N loading from irrigation return flows.
- Increased stormwater capture at the DGSG from a baseline period average of about 760 AFY to about 1,760 AFY by WY 2017-18.

Unchanged factors over the future planning period include subsurface basin inflows and outflows, groundwater pumping (except for the increase associated with the desalters), precipitation infiltration, mountain front recharge, and source water quality. These unchanged factors are represented as the average of the 10-year baseline period for each year of the future planning period.

The simulated conditions for the SNMP mixing model scenarios are summarized in **Table 16**.

7.4 Future Project Impacts on Groundwater Quality

Table 17 shows the water quality changes simulated by the SNMP mixing model and percentage use of assimilative capacity between 2010 and 2025 for each scenario for each subarea and for the basins as a whole. S/N concentrations and the assimilative capacity in 2010 represent the existing average groundwater quality and available assimilative capacity (see Table 5). Impacts to water quality and assimilative capacity were quantified and summarized in Table 17 for the following conditions: 1) No Future Projects Scenario – average baseline conditions continued through the future planning period, 2) Overall Scenario – the indicated future project/scenario in combination with average baseline conditions continued through the future planning period, and 3) Scenario minus Baseline Conditions – the indicated future project/scenario excluding or subtracting average baseline conditions.

Figures 14, **15**, and **16** illustrate the groundwater quality impacts and use of assimilative capacity (results from Table 17) graphically for TDS, chloride, and nitrate-N, respectively, for (from top to bottom) the Los Angeles Forebay, Montebello Forebay, Whittier Area, and Central Basin Pressure Area, as well as for the entire Central Basin and West Coast Basin. In the figures, the “Overall Scenario” results (which include baseline conditions) are depicted along the first and third columns from the left and the “Scenario minus Baseline Conditions,” which provides the impacts of the project/scenario in isolation of baseline conditions or background loading associated with existing projects, are depicted along the second and fourth columns from the left. Impacts in terms of the S/N concentration (two far left columns) and use of assimilative

Table 16 Summary of Simulated Conditions for the SNMP Mixing Model Scenarios

Scenario [a]	SIMULATED CONDITIONS										
		Irrigation with Recycled Water			WCBB/DGB/AGB		Desalters		MFSG		
	Average Baseline Precipitation and Mountain Front Infiltration, Pumping, Subsurface Flows	Average Baseline	Increased Volume and Baseline Average WQ	Increased Volume and WQ at MCL/SMCLs	Average Baseline	Increased Injection Volume with AWT Recycled Water	Average Baseline	Increased Well Pumping & Treatment	Average Baseline	Tertiary-Treated and AWT Recycled Water	Tertiary-Treated Recycled Water
1. No Future Projects	✓	✓			✓		✓				
2. Increased Recycled Water for Irrigation (baseline period average WQ)	✓		✓		✓		✓		✓		
3. Increased Recycled Water for Irrigation (WQ at MCL/SMCLs)	✓			✓	✓		✓		✓		
4. Seawater Intrusion Barriers (increased injection volume and AWT RW)	✓	✓				✓	✓		✓		
5. Desalters – Increased Groundwater Pump & Treat (West Coast Basin only)	✓	✓			✓			✓	✓		
6. GRIP A (10K AFY AWT & 11K AFY tertiary-treated RW)	✓	✓			✓		✓			✓	
7. GRIP B (21K AFY tertiary-treated RW)	✓	✓			✓		✓				✓
8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)	✓		✓			✓		✓		✓	
9. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)	✓		✓			✓		✓			✓
10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)	✓			✓		✓		✓		✓	
11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)	✓			✓		✓		✓			✓

a – Minor Future Changes, as referenced for all combined scenarios (8, 9, 10, and 11), include decreased imported water use for supply in the Central Basin, slightly increased imported water for supply in the West Coast Basin, and increased stormwater capture at the DGSG and other facilities

WQ – water quality
MCL – primary maximum contaminant level
SMCL – secondary maximum contaminant level
K – thousand
AFY – acre-feet per year
DGSG – Dominguez Gap Spreading Grounds
MFSG – Montebello Forebay Spreading Grounds
GRIP – Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A
GRIP B – GRIP Recycled Water Project B
AGB – Alamitos Gap Seawater Intrusion Barrier
DGB – Dominguez Gap Seawater Intrusion Barrier
WCBB – West Coast Basin Seawater Intrusion Barrier
AWT – advanced water treatment
RW – recycled water

(green) – baseline conditions
(peach) – future change

Table 17 Future Projects – Groundwater Quality Impacts and Use of Available Assimilative Capacity

Scenario	FUTURE PROJECTS - CHANGE IN GROUNDWATER QUALITY AND USE OF AVAILABLE ASSIMILATIVE CAPACITY																																
	1. No Future Projects			2. Increased Recycled Water Irrigation (Baseline period average RW quality)						3. Increased Recycled Water Irrigation (RW quality at MCL/SMCLs)						4. Seawater Barriers						5. Desalters						6. GRIP A (Tertiary and AWT RW)					
Subarea/Basin				Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
LOS ANGELES FOREBAY [e]																																	
Change (2010 to 2025) (mg/L)	2.4	1.3	0.15	4.0	1.7	0.15	1.6	0.4	0.00	4.7	2.5	0.15	2.3	1.2	0.0	2.4	1.3	0.15	0.0	0.0	0.00	2.4	1.3	0.15	0.0	0.0	0.00	2.4	1.3	0.15	0.0	0.0	0.00
A.C. Used (2010 to 2025) (%)	4.0%	1.9%	1.5%	6.7%	2.4%	1.5%	2.7%	0.6%	0.0%	7.9%	3.7%	1.5%	3.9%	1.8%	0.0%	4.0%	1.9%	1.5%	0.0%	0.0%	0.0%	4.0%	1.9%	1.5%	0.0%	0.0%	0.0%	4.0%	1.9%	1.5%	0.0%	0.0%	0.0%
MONTEBELLO FOREBAY [e]																																	
Change (2010 to 2025) (mg/L)	-62.9	-2.1	0.02	-61.8	-1.9	0.02	1.1	0.2	0.00	-61.7	-1.4	0.02	1.2	0.6	0.0	-62.9	-2.1	0.02	0.0	0.0	0.00	-62.9	-2.1	0.02	0.0	0.0	0.00	-64.7	-0.8	0.16	-1.8	1.2	0.14
A.C. Used (2010 to 2025) (%)	-37.9%	-3.4%	0.3%	-37.3%	-3.0%	0.2%	0.7%	0.3%	0.0%	-37.2%	-2.3%	0.3%	0.7%	1.0%	0.0%	-37.9%	-3.4%	0.3%	0.0%	0.0%	0.0%	-37.9%	-3.4%	0.3%	0.0%	0.0%	0.0%	-39.0%	-1.4%	1.8%	-1.1%	2.0%	1.6%
WHITTIER AREA [e]																																	
Change (2010 to 2025) (mg/L)	-36.1	-2.9	0.05	-34.8	-2.5	0.05	1.3	0.3	0.00	-34.2	-1.8	0.05	1.9	1.1	0.0	-36.1	-2.9	0.05	0.0	0.0	0.00	-36.1	-2.9	0.05	0.0	0.0	0.00	-36.1	-2.9	0.05	0.0	0.0	0.00
A.C. Used (2010 to 2025) (%)	NC	-9.8%	0.5%	NC	-8.6%	0.5%	NC	1.2%	0.0%	NC	-6.0%	0.5%	NC	3.8%	0.0%	NC	-9.8%	0.5%	NC	0.0%	0.0%	NC	-9.8%	0.5%	NC	0.0%	0.0%	NC	-9.8%	0.5%	NC	0.0%	0.0%
CENTRAL BASIN PRESSURE AREA [e]																																	
Change (2010 to 2025) (mg/L)	21.5	7.9	0.13	22.5	8.2	0.13	1.0	0.3	0.00	22.9	8.7	0.13	1.5	0.8	0.0	19.0	7.5	0.13	-2.5	-0.4	0.00	21.5	7.9	0.13	0.0	0.0	0.00	21.7	8.1	0.13	0.3	0.2	0.00
A.C. Used (2010 to 2025) (%)	9.3%	8.4%	1.3%	9.8%	8.6%	1.3%	0.5%	0.3%	0.0%	10.0%	9.2%	1.3%	0.6%	0.8%	0.0%	8.2%	8.0%	1.3%	-1.1%	-0.4%	0.1%	9.3%	8.4%	1.3%	0.0%	0.0%	0.0%	9.4%	8.5%	1.3%	0.1%	0.2%	0.0%
CENTRAL BASIN [e]																																	
Change (2010 to 2025) (mg/L)	**4.6**	**5.1**	**0.11**	**5.8**	**5.4**	**0.11**	**1.2**	**0.3**	**0.00**	**6.2**	**5.9**	**0.11**	**1.6**	**0.8**	**0.00**	**2.8**	**4.8**	**0.11**	**-1.8**	**-0.3**	**0.00**	**4.6**	**5.1**	**0.11**	**0.0**	**0.0**	**0.00**	**4.1**	**5.5**	**0.14**	**-0.5**	**0.4**	**0.03**
A.C. Used (2010 to 2025) (%)	**2.7%**	**6.1%**	**1.1%**	**3.4%**	**6.4%**	**1.1%**	**0.7%**	**0.3%**	**0.0%**	**3.6%**	**7.1%**	**1.1%**	**0.9%**	**1.0%**	**0.0%**	**1.6%**	**5.8%**	**1.1%**	**-1.1%**	**-0.3%**	**0.0%**	**2.7%**	**6.1%**	**1.1%**	**0.0%**	**0.0%**	**0.0%**	**2.4%**	**6.6%**	**1.4%**	**-0.3%**	**0.5%**	**0.3%**
WEST COAST BASIN [e]																																	
Change (2010 to 2025) (mg/L)	**-23.0**	**-23.6**	**0.07**	**-21.3**	**-23.0**	**0.07**	**1.7**	**0.6**	**0.00**	**-20.6**	**-22.4**	**0.07**	**2.4**	**1.3**	**0.00**	**-41.0**	**-28.3**	**0.06**	**-18.0**	**-4.7**	**0.00**	**-36.6**	**-29.4**	**0.07**	**-13.6**	**-5.8**	**0.00**	**-23.0**	**-23.6**	**0.07**	**0.0**	**0.0**	**0.00**
A.C. Used (2010 to 2025) (%)	**NC**	**NC**	**0.7%**	**NC**	**NC**	**0.7%**	**NC**	**NC**	**0.0%**	**NC**	**NC**	**0.7%**	**NC**	**NC**	**0.0%**	**NC**	**NC**	**0.6%**	**NC**	**NC**	**0.0%**	**NC**	**NC**	**0.7%**	**NC**	**NC**	**0.0%**	**NC**	**NC**	**0.7%**	**NC**	**NC**	**0.0%**

Scenario	1. No Future Projects			7. GRIP B (Tertiary RW)						8. Combined Projects/Scenarios (2 + 4 + 5 + 6 + Minor Future Changes) [d]						9. Combined Project/Scenarios (2 + 4 + 5 + 7 + Minor Future Changes) [d]						10. Combined Projects/Scenarios (3 + 4 + 5 + 6 + Minor Future Changes) [d]						11. Combined Projects/Scenarios (3 + 4 + 5 + 7 + Minor Future Changes) [d]					
Subarea/Basin				Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a]			Scenario minus Baseline Conditions [b]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
LOS ANGELES FOREBAY [e]																																	
Change (2010 to 2025) (mg/L)	2.4	1.3	0.15	2.5	1.3	0.15	0.1	0.0	0.00	-1.3	0.8	0.15	-3.7	-0.5	0.00	-1.2	0.8	0.15	-3.6	-0.5	0.00	-0.6	1.6	0.15	-3.0	0.3	0.00	-0.5	1.6	0.15	-2.9	0.4	0.00
A.C. Used (2010 to 2025) (%)	4.0%	1.9%	1.5%	4.2%	1.9%	1.5%	0.2%	0.0%	0.0%	-2.2%	1.1%	1.5%	-6.2%	-0.8%	0.0%	-2.0%	1.1%	1.5%	-6.0%	-0.7%	0.0%	-1.0%	2.4%	1.5%	-5.0%	0.5%	0.0%	-0.9%	2.4%	1.5%	-4.9%	0.5%	0.0%
MONTEBELLO FOREBAY [e]																																	
Change (2010 to 2025) (mg/L)	-62.9	-2.1	0.02	-45.7	3.8	0.22	17.2	5.9	0.20	-66.4	-1.1	0.16	-3.5	1.0	0.14	-47.4	3.6	0.22	15.5	5.7	0.20	-66.1	-0.7	0.16	-3.2	1.4	0.14	-47.1	4.0	0.22	15.8	6.0	0.20
A.C. Used (2010 to 2025) (%)	-37.9%	-3.4%	0.3%	-27.5%	6.2%	2.5%	10.4%	9.5%	2.2%	-40.0%	-1.7%	1.8%	-2.1%	1.6%	1.6%	-28.6%	5.8%	2.5%	9.4%	9.1%	2.2%	-39.8%	-1.1%	1.8%	-1.9%	2.2%	1.6%	-28.4%	6.4%	2.5%	9.5%	9.8%	2.2%
WHITTIER AREA [e]																																	
Change (2010 to 2025) (mg/L)	-36.1	-2.9	0.05	-36.1	-2.9	0.05	0.0	0.0	0.00	-42.1	-3.8	0.05	-6.0	-0.9	0.00	-42.1	-3.8	0.05	-6.0	-0.9	0.00	-41.5	-3.1	0.05	-5.4	-0.2	0.00	-41.5	-3.1	0.05	-5.4	-0.2	0.00
A.C. Used (2010 to 2025) (%)	NC	-9.8%	0.5%	NC	-9.8%	0.5%	NC	0.0%	0.0%	NC	-12.8%	0.5%	NC	-3.1%	0.0%	NC	-12.8%	0.5%	NC	-3.1%	0.0%	NC	-10.5%	0.5%	NC	-0.7%	0.0%	NC	-10.5%	0.5%	NC	-0.7%	0.0%
CENTRAL BASIN PRESSURE AREA [e]																																	
Change (2010 to 2025) (mg/L)	21.5	7.9	0.13	22.9	8.4	0.13	1.4	0.4	0.01	18.4	7.6	0.13	-3.1	-0.4	0.01	19.5	7.9	0.14	-2.0	-0.1	0.01	18.8	8.2	0.13	-2.6	0.2	0.01	20.0	8.4	0.14	-1.5	0.5	0.01
A.C. Used (2010 to 2025) (%)	9.3%	8.4%	1.3%	9.9%	8.9%	1.3%	0.6%	0.5%	0.1%	8.0%	8.0%	1.4%	-1.3%	-0.4%	0.1%	8.5%	8.3%	1.4%	-0.8%	-0.1%	0.1%	8.2%	8.6%	1.4%	-1.1%	0.2%	0.1%	8.7%	8.9%	1.4%	-0.6%	0.5%	0.1%
CENTRAL BASIN [e]																																	
Change (2010 to 2025) (mg/L)	**4.6**	**5.1**	**0.11**	**7.7**	**6.4**	**0.15**	**3.1**	**1.3**	**0.04**	**0.7**	**5.0**	**0.14**	**-4.0**	**-0.1**	**0.03**	**4.2**	**5.9**	**0.15**	**-0.4**	**0.8**	**0.04**	**1.1**	**5.6**	**0.14**	**-3.5**	**0.5**	**0.03**	**4.7**	**6.5**	**0.15**	**0.1**	**1.3**	**0.04**
A.C. Used (2010 to 2025) (%)	**2.7%**	**6.1%**	**1.1%**	**4.5%**	**7.7%**	**1.5%**	**1.8%**	**1.5%**	**0.4%**	**0.4%**	**6.0%**	**1.4%**	**-2.3%**	**-0.1%**	**0.3%**	**2.5%**	**7.1%**	**1.5%**	**-0.2%**	**0.9%**	**0.4%**	**0.7%**	**6.7%**	**1.4%**	**-2.0%**	**0.6%**	**0.3%**	**2.8%**	**7.8%**	**1.5%**	**0.1%**	**1.6%**	**0.4%**
WEST COAST BASIN [e]																																	
Change (2010 to 2025) (mg/L)	**-23.0**	**-23.6**	**0.07**	**-23.0**	**-23.6**	**0.07**	**0.1**	**0.0**	**0.00**	**-57.4**	**-34.7**	**0.06**	**-34.4**	**-11.1**	**0.00**	**-57.3**	**-34.7**	**0.06**	**-34.3**	**-11.1**	**0.00**	**-56.8**	**-34.1**	**0.06**	**-33.8**	**-10.5**	**0.00**	**-56.7**	**-34.1**	**0.06**	**-33.7**	**-10.4**	**0.00**
A.C. Used (2010 to 2025) (%)	**NC**	**NC**	**0.7%**	**NC**	**NC**	**0.7%**	**NC**	**NC**	**0.0%**	**NC**	**NC**	**0.6%**	**NC**	**NC**	**0.0%**	**NC**	**NC**	**0.6%**	**NC**	**NC**	**0.0%**	**NC**	**NC**	**0.6%**	**NC**	**NC**	**0.0%**	**NC**	**NC**	**0.6%**	**NC**	**NC**	**0.0%**

TDS - total dissolved solids
AWT - advanced water treatment
MCL - maximum contaminant level
Cl - chloride
SMCL - secondary MCL
NO_3-N - nitrate as nitrogen
mg/L - milligrams per liter
NC - No assimilative capacity available
A.C. - assimilative capacity
GRIP - Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A
GRIP B - GRIP Recycled Water Project B
Baseline - The period of time from water year 2000-01 to 2009-10 used for assessment of salt and nutrient inflows and outflows

a - "Overall Scenario" quantifies the impacts of the indicated future project/scenario in combination with existing projects in the CBWCB, i.e. including average baseline conditions (No Future Projects Scenario) continued through the future planning period

b - "Scenario minus Baseline Conditions" quantifies the impacts of the indicated future project/scenario solely, without existing projects in the CBWCB, i.e. excluding average baseline conditions (No Future Projects Scenario) or background loading

c - Positive value indicates the scenario is increasing concentrations or using additional available assimilative capacity; negative value indicates the scenario is improving groundwater quality or increasing available assimilative capacity

d -Minor Future Changes, as referenced for all combined scenarios (8, 9, 10, and 11), include decreased imported water use for supply in the Central Basin, slightly increased imported water for supply in the West Coast Basin, and increased stormwater capture at the DGSG and other facilities

e - 2010 year values used to calculate changes in concentrations and use of assimilative capacity are the average existing groundwater quality and available assimilative capacity (See Table 5) capacity (two far right columns) are provided. As shown in Figures 14 and 15, there is no available assimilative capacity in the West Coast Basin for TDS and chloride due to historical seawater intrusion. In the Whittier Area, there is no available assimilative capacity for TDS due to naturally occurring conditions associated with marine source rocks in the underlying aquifers (see Section 5.3.1.2 for further details).

7.4.1 Scenarios 2 and 3 – Increased Recycled Water for Irrigation

As described in Section 7.3, Scenarios 2 and 3 were simulated by the SNMP mixing model to determine potential groundwater quality impacts associated with increased use of recycled water for irrigation. For Scenario 2, S/N concentrations in the recycled water are equivalent to baseline period average concentrations. For Scenario 3, S/N concentrations in the recycled water are equivalent to the SMCLs for TDS and chloride and the MCL for nitrate, which are greater than the baseline period average S/N concentrations.

Figures 14 and 15 and Table 17 show that increased recycled water use for irrigation only slightly increases TDS and chloride concentrations in groundwater and uses a minimal amount of the available assimilative capacity (significantly less than 10%). Thus, recycled water with higher salt concentrations (TDS and chloride at SMCLs) results in slightly higher salt loading than recycled water with baseline period average salt concentrations. The increased recycled water use for irrigation has no impact on nitrate loading (Figure 16). Overall, Figures 14 through 16 illustrate that the use of recycled water impacts all subareas and the basins as a whole at similar levels, since irrigation occurs in all areas. However, recycled water use for irrigation has minimal impacts on groundwater quality and these minor impacts are more than offset by other projects that reduce S/N loading.

Because the negative water quality impacts of increased recycled water use for irrigation have been demonstrated in this SNMP to be minor and more than offset by implementation measures and projects that improve groundwater quality, this SNMP may be used to modify currently permitted recycled water quality limits established for non-potable reuse (irrigation, industrial and recreational activities) and provide a basis for streamlining the permitting process for future recycled water projects, per the Recycled Water Policy and the Governor's recent drought proclamations (refer to Section 9.3). In particular, irrigation with recycled water has very minor impacts on groundwater quality and thus, permits for individual irrigation sites do not appear warranted. As a result, TDS, chloride, and nitrate limits for recycled water used for irrigation and other non-potable reuse applications can be set equivalent to SMCLs/MCL, while still protecting groundwater quality and preserving beneficial uses.

7.4.2 Scenario 4 – Seawater Intrusion Barriers

As described in Section 2.3, Scenario 4 was simulated by the SNMP mixing model to determine potential groundwater quality impacts associated with proposed seawater intrusion barrier projects that would increase injection volumes and increase the use of AWT recycled water to completely replace imported water at all three seawater barriers (AGB, DGB, and WCBB). Figures 14 and 15 and Table 17 show that Scenario 4 would decrease TDS and chloride concentrations in the Central Basin Pressure Area, the entire Central Basin, and the entire West Coast Basin, since these are the areas where the seawater barriers are located. Scenario 4 has no impact on nitrate loading (Figure 16) because nitrate concentrations in imported water and AWT recycled water are similar and both very low. Overall, the proposed seawater barrier projects would significantly improve TDS and chloride groundwater quality in both basins, especially in the West Coast Basin and accordingly, these projects were designated as an implementation measure, as further discussed in **Appendix J** *Implementation Plan*. As a result, this SNMP may be used to provide a basis for streamlining the permitting process for future AWT recycled water projects, per the Recycled Water Policy.

7.4.3 Scenario 5 – Desalters

As described in Section 7.3, Scenario 5 was simulated by the SNMP mixing model to determine potential groundwater quality impacts associated with proposed desalter projects that would increase the pumping and treatment of seawater-impacted groundwater in the West Coast Basin. Figures 14 and 15 and Table 17 show that Scenario 5 would decrease TDS and chloride concentrations in the West Coast Basin, where the desalters are located. The desalters have no impact on nitrate loading (Figure 16) because nitrate concentrations in this saline plume are the same as in ambient groundwater. Overall, the desalter projects would significantly improve TDS and chloride groundwater quality in the West Coast Basin and accordingly, these projects were designated as an implementation measure, as further discussed in Appendix J *Implementation Plan*.

7.4.4 Scenarios 6 and 7 – GRIP A and GRIP B

As stated in Section 4.1.1, WRD established GRIP to completely replace imported water (up to 21,000 AFY) with reliable alternative water supplies (e.g. recycled water) for recharge at the MFSG. Two project alternatives, GRIP A (Scenario 6) and GRIP B (Scenario 7), are currently being evaluated for implementation, so their potential groundwater quality impacts were simulated separately by the SNMP mixing model. Both project alternatives would result in the same total recharge volumes at the MFSG; however, the recycled water quality would be different under the different scenarios.

Figures 14, 15, and 16 and Table 17 show that impacts of the GRIP scenarios are greatest in the Montebello Forebay, where the project will be implemented. GRIP A has negligible impacts on groundwater quality, decreasing TDS very slightly, and increasing chloride and nitrate very slightly in the Central Basin. This is because the AWT/tertiary-treated recycled water blend ratio for GRIP A mirrors the average imported water quality that it is replacing for recharge at the MFSG. GRIP B would increase TDS, chloride, and nitrate concentrations compared with the No Future Projects Scenario. However, GRIP B would not cause S/N concentrations to exceed BPO/BSBPOs or utilize more than 10% of the available assimilative capacity in the Central Basin. Minor negative groundwater quality impacts associated with GRIP B are more than offset by the positive impacts of other projects and implementation measures.

While the groundwater quality impacts from GRIP B are greater than GRIP A, the costs to implement GRIP A are significantly higher than GRIP B[16]. Thus, water quality benefits must be weighed against costs and other evaluation criteria. Because of the negligible impacts of GRIP A and the minor water quality impacts of GRIP B overall in the Central Basin, this SNMP may be used to provide a basis for streamlining the permitting process for GRIP projects (and other recycled water projects) in the future, per the Recycled Water Policy and the Governor's recent drought proclamations (refer to Section 9.3).

7.4.5 Scenarios 8, 9, 10, and 11 – Combined Projects/Scenarios

As described in Section 7.3, Scenarios 8 through 11 were simulated by the SNMP mixing model to determine potential groundwater quality impacts associated with combinations of proposed projects/scenarios, which also include minor future changes (i.e., increased and decreased imported water for supply in the West Coast Basin and Central Basin, respectively, and increased stormwater capture). Figures 14, 15, and 16 and Table 17 show that Scenarios 8 through 11 would result in small increases in TDS, chloride, and nitrate concentrations in groundwater in the Central Basin. However, S/N concentrations do not exceed the BPO/BSBPOs by 2025 and multiple recycled water projects do not utilize more than 20% (or even 10%) of the available assimilative capacity in the Central Basin. In the West Coast Basin, Scenarios 8 through 11 would result in decreasing TDS and chloride concentrations in groundwater. There is a very small increase in nitrate concentrations, which is insignificant given the very low ambient concentration of nitrate in groundwater.

7.4.6 Summary of Impacts of Future Scenarios

Table 18 summarizes overall changes in groundwater quality, impacts on BPO/BSBPOs, and use of assimilative capacity for each of the scenarios in terms of TDS, chloride, and nitrate in groundwater in the Central Basin. The table quantifies the impacts of average baseline conditions continued through the future planning period (No Future Projects Scenario) plus the indicated future project or project combinations. **Table 19** quantifies the impacts of future project(s) solely, i.e., excluding the impact of average baseline conditions continued through the future planning period. Thus, Table 18 illustrates total impacts, while Table 19 illustrates the impacts of just the project or combined projects without the contributions of baseline conditions or background loading associated with existing projects. **Tables 20** and **21** show similar predictions for the West Coast Basin for the overall scenarios and for the isolated project or project combinations, respectively. Increased Stormwater Capture is listed as a scenario in Tables 18 through 21 to summarize the expected general impacts. Because stormwater capture projects could not be quantified in terms of increased recharge volumes and S/N concentrations (with the exception of stormwater capture in the MFSG and DGSG), this

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[16] Estimated costs for GRIP A are $490M, while estimated costs for GRIP B are $183M (CH2MHILL 2012a). Capital costs include construction of treatment and conveyance facilities; injection; flow equalization; sewer connection fees and flow diversion costs; and O&M costs including facilities O&M, recycled water purchase, and sewer surcharge fee.

Table 18 Summary of Groundwater Quality Impacts of Overall Scenarios [b] in the Central Basin in 2025

Scenario [a]	CENTRAL BASIN WATER QUALITY IMPACTS IN 2025								
	TDS			Chloride			Nitrate-N		
	Concentration	BSBPO 700 mg/L	Use of AC	Concentration	BSBPO 150 mg/L	Use of AC	Concentration	BPO 10 mg/L	Use of AC
1. No Future Projects (baseline conditions only)	Increase 4.6 mg/L	Not exceeded	2.7%	Increase 5.1 mg/L	Not exceeded	6.1%	Increase 0.11 mg/L	Not exceeded	1.1%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 533 mg/L and AC of 167 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 72 mg/L and AC of 78 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.39 mg/L and AC of 9.61 mg/L in 2025		
2. Increased Recycled Water for Irrigation (baseline period average WQ)	Increase 5.8 mg/L	Not exceeded	3.4%	Increase 5.4 mg/L	Not exceeded	6.4%	Increase 0.11 mg/L	Not exceeded	1.1%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 534 mg/L and AC of 166 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 72 mg/L and AC of 78 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.39 mg/L and AC of 9.61 mg/L in 2025		
3. Increased Recycled Water for Irrigation (WQ at SMCLs/MCL)	Increase 6.2 mg/L	Not Exceeded	3.6%	Increase 5.9 mg/L	Not exceeded	7.1%	Increase 0.11 mg/L	Not exceeded	1.1%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 535 mg/L and AC of 165 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 73 mg/L and AC of 77 mg/L in 2035			NOT A CONCERN (BELOW BPO) Projected concentration of 0.39 mg/L and AC of 9.61 mg/L in 2025		
4. Seawater Barriers (increased injection volume and AWT RW)	Increase 2.8 mg/L	Not exceeded	1.6%	Increase 4.8 mg/L	Not exceeded	5.8%	Increase 0.11 mg/L	Not exceeded	1.1%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 531 mg/L and AC of 169 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 71 mg/L and AC of 79 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.39 mg/L and AC of 9.61 mg/L in 2025		
5. Desalters (increased groundwater pump and treat)	Increase 4.6 mg/L	Not Exceeded	2.7%	Increase 5.1 mg/L	Not exceeded	6.1%	Increase 0.11 mg/L	Not exceeded	1.1%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 533 mg/L and AC of 167 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 72 mg/L and AC of 78 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.39 mg/L and AC of 9.61 mg/L in 2025		
6. GRIP A (10K AFY AWT & 11K tertiary-treated RW)	Increase 4.1 mg/L	Not Exceeded	2.4%	Increase 5.5 mg/L	Not exceeded	6.6%	Increase 0.14 mg/L	Not exceeded	1.4%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 533 mg/L and AC of 167 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 72 mg/L and AC of 78 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.42 mg/L and AC of 9.58 mg/L in 2025		
7. GRIP B (21K AFY tertiary-treated RW)	Increase 7.7 mg/L	Not exceeded	4.5%	Increase 6.4 mg/L	Not exceeded	7.7%	Increase 0.15 mg/L	Not exceeded	1.5%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 536 mg/L and AC of 164 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 73 mg/L and AC of 77 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.43 mg/L and AC of 9.57 mg/L in 2025		
8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)	Increase 0.7 mg/L	Not exceeded	0.4%	Increase 5.0 mg/L	Not exceeded	6.0%	Increase 0.14 mg/L	Not exceeded	1.4%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 529 mg/L and AC of 171 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 72 mg/L and AC of 78 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.42 mg/L and AC of 9.58 mg/L in 2025		
9. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)	Increase 4.2 mg/L	Not exceeded	2.5%	Increase 5.9 mg/L	Not exceeded	7.1%	Increase 0.15 mg/L	Not exceeded	1.5%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 533 mg/L and AC of 167 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 73 mg/L and AC of 77 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.43 mg/L and AC of 9.57 mg/L in 2025		
10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)	Increase 1.1 mg/L	Not exceeded	0.7%	Increase 5.6 mg/L	Not exceeded	6.7%	Increase 0.14 mg/L	Not exceeded	1.4%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 530 mg/L and AC of 170 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 72 mg/L and AC of 78 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.42 mg/L and AC of 9.58 mg/L in 2025		
11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)	Increase 4.7 mg/L	Not exceeded	2.8%	Increase 6.5 mg/L	Not exceeded	7.8%	Increase 0.15 mg/L	Not exceeded	1.5%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 533 mg/L and AC of 167 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 73 mg/L and AC of 77 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.43 mg/L and AC of 9.57 mg/L in 2025		
Increased Stormwater Capture	Decrease	Not exceeded	Not available	Decrease	Not exceeded	Not available	Decrease	Not exceeded	Not available

a – Minor Future Changes, as referenced for all combined scenarios (8, 9, 10, and 11), include decreased imported water use for supply in the Central Basin, slightly increased imported water for supply in the West Coast Basin, and increased stormwater capture at the DGSG and other facilities

b - Quantifies the impacts of average baseline conditions continued through the future planning horizon (No Future Projects Scenario) plus the indicated future project/scenario

WQ – water quality
MCL – primary maximum contaminant level
SMCL – secondary maximum contaminant level
mg/L – milligrams per liter
Nitrate-N – nitrate as nitrogen
TDS – total dissolved solids
(green box) – groundwater quality improvement

BPO – Basin Plan Objective
BSBPO – Basin-Specific Basin Plan Objective
GRIP – Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A
GRIP B – GRIP Recycled Water Project B
DGSG – Dominguez Gap Spreading Grounds
(orange box) – groundwater quality decline

AWT – advanced water treatment
RW – recycled water
AC – assimilative capacity
AFY – acre-feet per year
K – thousands

Table 19 Summary of Groundwater Quality Impacts of Future Scenarios Minus Baseline Conditions [b] in the Central Basin in 2025

Scenario [a]	CENTRAL BASIN WATER QUALITY IMPACTS IN 2025								
	TDS			Chloride			Nitrate-N		
	Concentration	BSBPO 700 mg/L	Use of AC	Concentration	BSBPO 150 mg/L	Use of AC	Concentration	BPO 10 mg/L	Use of AC
1. No Future Projects (baseline conditions only)	Increase 4.6 mg/L	Not exceeded	2.7%	Increase 5.1 mg/L	Not exceeded	6.1%	Increase 0.11 mg/L	Not exceeded	1.1%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 533 mg/L and AC of 167 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 72 mg/L and AC of 78 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.39 mg/L and AC of 9.61 mg/L in 2025		
2. Increased Recycled Water for Irrigation (baseline period average WQ)	Increase 1.2 mg/L	Not exceeded	0.7%	Increase 0.3 mg/L	Not exceeded	0.3%	No change 0.0 mg/L	Not exceeded	0%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 530 mg/L and AC of 170 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 67 mg/L and AC of 83 mg/L in 2025			NO EFFECT ON WQ Projected concentration of 0.28 mg/L and AC of 9.72 mg/L in 2025		
3. Increased Recycled Water for Irrigation (WQ at SMCLs/MCL)	Increase 1.6 mg/L	Not Exceeded	0.9%	Increase 0.8 mg/L	Not exceeded	1.0%	No Change 0.0 mg/L	Not exceeded	0%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 530 mg/L and AC of 170 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 67 mg/L and AC of 83 mg/L in 2035			NO EFFECT ON WQ Projected concentration of 0.28 mg/L and AC of 9.72 mg/L in 2025		
4. Seawater Barriers (increased injection volume and AWT RW)	Decrease -1.8 mg/L	Not exceeded	-1.1%	Decrease -0.3 mg/L	Not exceeded	-0.3%	No change 0.0 mg/L	Not exceeded	0%
	WQ IMPROVEMENT Projected concentration of 527 mg/L and AC of 173 mg/L in 2025			WQ IMPROVEMENT Projected concentration of 66 mg/L and AC of 84 mg/L in 2025			NO EFFECT ON WQ Projected concentration of 0.28 mg/L and AC of 9.72 mg/L in 2025		
5. Desalters (increased groundwater pump and treat)	No Change 0.0 mg/L	Not Exceeded	0%	No change 0.0 mg/L	Not exceeded	0%	No change 0.0 mg/L	Not exceeded	0%
	NO EFFECT ON WQ Projected concentration of 529 mg/L and AC of 171 mg/L in 2025			NO EFFECT ON WQ Projected concentration of 67 mg/L and AC of 83 mg/L in 2025			NO EFFECT ON WQ Projected concentration of 0.28 mg/L and AC of 9.72 mg/L in 2025		
6. GRIP A (10K AFY AWT & 11K tertiary-treated RW)	Decrease -0.5 mg/L	Not Exceeded	-0.3%	Increase 0.4 mg/L	Not exceeded	0.5%	Increase 0.03 mg/L	Not exceeded	0.3%
	WQ IMPROVEMENT Projected concentration of 528 mg/L and AC of 172 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 67 mg/L and AC of 83 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.31 mg/L and AC of 9.69 mg/L in 2025		
7. GRIP B (21K AFY tertiary-treated RW)	Increase 3.1 mg/L	Not exceeded	1.8%	Increase 1.3 mg/L	Not exceeded	1.5%	Increase 0.04 mg/L	Not exceeded	0.4%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 532 mg/L and AC of 168 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 68 mg/L and AC of 82 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.32 mg/L and AC of 9.68 mg/L in 2025		
8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)	Decrease -4.0 mg/L	Not Exceeded	-2.3%	Decrease -0.1 mg/L	Not exceeded	-0.1%	Increase 0.03 mg/L	Not exceeded	0.3%
	WQ IMPROVEMENT Projected concentration of 525 mg/L and AC of 175 mg/L in 2025			WQ IMPROVEMENT Projected concentration of 67 mg/L and AC of 83 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.31 mg/L and AC of 9.69 mg/L in 2025		
9. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)	Decrease -0.4 mg/L	Not exceeded	-0.2%	Increase 0.8 mg/L	Not exceeded	0.9%	Increase 0.04 mg/L	Not exceeded	0.4%
	WQ IMPROVEMENT Projected concentration of 528 mg/L and AC of 172 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 67 mg/L and AC of 83 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.32 mg/L and AC of 9.68 mg/L in 2025		
10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)	Decrease -3.5 mg/L	Not exceeded	-2.0%	Increase 0.5 mg/L	Not exceeded	0.6%	Increase 0.03 mg/L	Not exceeded	0.3%
	WQ IMPROVEMENT Projected concentration of 525 mg/L and AC of 175 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 67 mg/L and AC of 83 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.31 mg/L and AC of 9.69 mg/L in 2025		
11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)	Increase 0.1 mg/L	Not exceeded	0.1%	Increase 1.3 mg/L	Not exceeded	1.6%	Increase 0.04 mg/L	Not exceeded	0.4%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 529 mg/L and AC of 171 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 68 mg/L and AC of 82 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.32 mg/L and AC of 9.68 mg/L in 2025		
Increased Stormwater Capture	Decrease	Not exceeded	Not available	Decrease	Not exceeded	Not available	Decrease	Not exceeded	Not available

a – Minor Future Changes, as referenced for all combined scenarios (8, 9, 10, and 11), include decreased imported water use for supply in the Central Basin, slightly increased imported water for supply in the West Coast Basin, and increased stormwater capture at the DGSG and other facilities

b - Quantifies the impacts of average baseline conditions continued through the future planning horizon (No Future Projects Scenario) plus the indicated future project/scenario

WQ – water quality
MCL – primary maximum contaminant level
SMCL – secondary maximum contaminant level
mg/L – milligrams per liter
Nitrate-N – nitrate as nitrogen
TDS – total dissolved solids
(green box) – groundwater quality improvement
BPO – Basin Plan Objective
BSBPO – Basin-Specific Basin Plan Objective
GRIP – Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A
GRIP B – GRIP Recycled Water Project B
DGSG – Dominguez Gap Spreading Grounds
(orange box) – groundwater quality decline
AWT – advanced water treatment
RW – recycled water
AC – assimilative capacity
AFY – acre-feet per year
K – thousands

Table 20 Summary of Groundwater Quality Impacts of Overall Future Scenarios [b] in the West Coast Basin in 2025

Scenario [a]	WEST COAST BASIN WATER QUALITY IMPACTS IN 2025								
	TDS			Chloride			Nitrate-N		
	Concentration	BSBPO 800 mg/L	Use of AC	Concentration	BSBPO 250 mg/L	Use of AC	Concentration	BPO 10 mg/L	Use of AC
1. No Future Projects (baseline conditions only)	Decrease -23.0 mg/L	Currently exceeded	None available	Decrease -23.6 mg/L	Currently exceeded	None available	Increase 0.07 mg/L	Not exceeded	0.7%
	WQ IMPROVEMENT Projected concentration of 867 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 282 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.12 mg/L and AC of 9.88 mg/L in 2025		
2. Increased Recycled Water for Irrigation (baseline period average WQ)	Decrease -21.3 mg/L	Currently exceeded	None available	Decrease -23.0 mg/L	Currently exceeded	None available	Increase 0.07 mg/L	Not exceeded	0.7%
	WQ IMPROVEMENT Projected concentration of 869 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 283 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.12 mg/L and AC of 9.88 mg/L in 2025		
3. Increased Recycled Water for Irrigation (WQ at SMCLs/MCL)	Decrease -20.6 mg/L	Currently exceeded	None available	Decrease -22.4 mg/L	Currently exceeded	None available	Increase 0.07 mg/L	Not exceeded	0.7%
	WQ IMPROVEMENT Projected concentration of 869 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 284 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.12 mg/L and AC of 9.88 mg/L in 2025		
4. Seawater Barriers (increased injection volume and AWT RW)	Decrease -41.0 mg/L	Currently exceeded	None available	Decrease -28.3 mg/L	Currently exceeded	None available	Increase 0.06 mg/L	Not exceeded	0.6%
	WQ IMPROVEMENT Projected concentration of 849 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 278 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.11 mg/L and AC of 9.89 mg/L in 2025		
5. Desalters (increased groundwater pump and treat)	Decrease -36.6 mg/L	Currently exceeded	None available	Decrease -29.4 mg/L	Currently exceeded	None available	Increase 0.07 mg/L	Not exceeded	0.7%
	WQ IMPROVEMENT Projected concentration of 853 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 276 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.12 mg/L and AC of 9.88 mg/L in 2025		
6. GRIP A (10K AFY AWT & 11K tertiary-treated RW)	Decrease -23.0 mg/L	Currently exceeded	None available	Decrease -23.6 mg/L	Currently exceeded	None available	Increase 0.07 mg/L	Not exceeded	0.7%
	WQ IMPROVEMENT Projected concentration of 867 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 282 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.12 mg/L and AC of 9.88 mg/L in 2025		
7. GRIP B (21K AFY tertiary-treated RW)	Decrease -23.0 mg/L	Currently exceeded	None available	Decrease -23.6 mg/L	Currently exceeded	None available	Increase 0.07 mg/L	Not exceeded	0.7%
	WQ IMPROVEMENT Projected concentration of 867 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 282 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.12 mg/L and AC of 9.88 mg/L in 2025		
8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)	Decrease -57.4 mg/L	Currently exceeded	None available	Decrease -34.7 mg/L	Currently exceeded	None available	Increase 0.06 mg/L	Not exceeded	0.6%
	WQ IMPROVEMENT Projected concentration of 833 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 271 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.11 mg/L and AC of 9.89 mg/L in 2025		
9. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)	Decrease -57.3 mg/L	Currently exceeded	None available	Decrease -34.7 mg/L	Currently exceeded	None available	Increase 0.06 mg/L	Not exceeded	0.6%
	WQ IMPROVEMENT Projected concentration of 833 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 271 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.11 mg/L and AC of 9.89 mg/L in 2025		
10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)	Decrease -56.8 mg/L	Currently exceeded	None available	Decrease -34.1 mg/L	Currently exceeded	None available	Increase 0.06 mg/L	Not exceeded	0.6%
	WQ IMPROVEMENT Projected concentration of 833 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 272 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.11 mg/L and AC of 9.89 mg/L in 2025		
11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)	Decrease -56.7 mg/L	Currently exceeded	None available	Decrease -34.1 mg/L	Currently exceeded	None available	Increase 0.06 mg/L	Not exceeded	0.6%
	WQ IMPROVEMENT Projected concentration of 833 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 272 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.11 mg/L and AC of 9.89 mg/L in 2025		
Increased Stormwater Capture	Decrease	Currently exceeded	Not available	Decrease	Currently exceeded	Not available	Decrease	Not exceeded	Not available

a – Minor Future Changes, as referenced for all combined scenarios (8, 9, 10, and 11), include decreased imported water use for supply in the Central Basin, slightly increased imported water for supply in the West Coast Basin, and increased stormwater capture at the DGSG and other facilities

b - Quantifies the impacts of average baseline conditions continued through the future planning horizon (No Future Projects Scenario) plus the indicated future project/scenario

WQ – water quality
MCL – primary maximum contaminant level
SMCL – secondary maximum contaminant level
mg/L – milligrams per liter
Nitrate-N – nitrate as nitrogen
TDS – total dissolved solids
(green) – groundwater quality improvement

BPO – Basin Plan Objective
BSBPO – Basin-Specific Basin Plan Objective
GRIP – Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A
GRIP B – GRIP Recycled Water Project B
DGSG – Dominguez Gap Spreading Grounds
(orange) – groundwater quality decline

AWT – advanced water treatment
RW – recycled water
AC – assimilative capacity
AFY – acre-feet per year
K – thousands

Table 21 Summary of Groundwater Quality Impacts of Future Scenarios Minus Baseline Conditions [b] in the West Coast Basin in 2025

Scenario [a]	WEST COAST BASIN WATER QUALITY IMPACTS IN 2025								
	TDS			Chloride			Nitrate-N		
	Concentration	BSBPO 800 mg/L	Use of AC	Concentration	BSBPO 250 mg/L	Use of AC	Concentration	BPO 10 mg/L	Use of AC
1. No Future Projects (baseline conditions only)	Decrease -23.0 mg/L	Currently exceeded	None available	Decrease -23.6 mg/L	Currently exceeded	None available	Increase 0.07 mg/L	Not exceeded	0.7%
	WQ IMPROVEMENT Projected concentration of 867 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 282 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.12 mg/L and AC of 9.88 mg/L in 2025		
2. Increased Recycled Water for Irrigation (baseline period average WQ)	Increase 1.7 mg/L	Currently exceeded	None available	Increase 0.6 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	NOT A CONCERN (MINIMAL IMPACT) Projected concentration of 892 mg/L and increase is minimal			NOT A CONCERN (MINIMAL IMPACT) Projected concentration of 307 mg/L and increase is minimal			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
3. Increased Recycled Water for Irrigation (WQ at SMCLs/MCL)	Increase 2.4 mg/L	Currently exceeded	None available	Increase 1.3 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	NOT A CONCERN (MINIMAL IMPACT) Projected concentration of 892 mg/L and increase is minimal			NOT A CONCERN (MINIMAL IMPACT) Projected concentration of 284 mg/L and increase is minimal			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
4. Seawater Barriers (increased injection volume and AWT RW)	Decrease -18.0 mg/L	Currently exceeded	None available	Decrease -4.7 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	WQ IMPROVEMENT Projected concentration of 872 mg/L and concentration are declining			WQ IMPROVEMENT Projected concentration of 301 mg/L and concentration are declining			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
5. Desalters (increased groundwater pump and treat)	Decrease -13.6 mg/L	Currently exceeded	None available	Decrease -5.8 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	WQ IMPROVEMENT Projected concentration of 876 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 300 mg/L and concentrations are declining			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
6. GRIP A (10K AFY AWT & 11K tertiary-treated RW)	No Change 0.0 mg/L	Currently exceeded	None available	No Change 0.0 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	NO EFFECT ON WQ Projected concentration of 890 mg/L and concentrations are declining			NO EFFECT ON WQ Projected concentration of 306 mg/L and concentrations are declining			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
7. GRIP B (21K AFY tertiary-treated RW)	Increase 0.1 mg/L	Currently exceeded	None available	No Change 0.0 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	NOT A CONCERN (MINIMAL IMPACT) Projected concentration of 890 mg/L and increase is minimal			NO EFFECT ON WQ Projected concentration of 306 mg/L and concentrations are declining			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)	Decrease -34.4 mg/L	Currently exceeded	None available	Decrease -11.1 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	WQ IMPROVEMENT Projected concentration of 856 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 295 mg/L and concentrations declining			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
9. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)	Decrease -34.3 mg/L	Currently exceeded	None available	Decrease -11.1 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	WQ IMPROVEMENT Projected concentration of 856 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 295 mg/L and concentrations are declining			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)	Decrease -33.8 mg/L	Currently exceeded	None available	Decrease -10.5 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	WQ IMPROVEMENT Projected concentration of 856 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 295 mg/L and concentrations are declining			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)	Decrease -33.7 mg/L	Currently exceeded	None available	Decrease -10.4 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	WQ IMPROVEMENT Projected concentration of 856 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 295 mg/L and concentrations are declining			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
Increased Stormwater Capture	Decrease	Currently exceeded	Not available	Decrease	Currently exceeded	Not available	Decrease	Not exceeded	Not available

a – Minor Future Changes, as referenced for all combined scenarios (8, 9, 10, and 11), include decreased imported water use for supply in the Central Basin, slightly increased imported water for supply in the West Coast Basin, and increased stormwater capture at the DGSG and other facilities

b - Quantifies the impacts of average baseline conditions continued through the future planning horizon (No Future Projects Scenario) plus the indicated future project/scenario

WQ – water quality
MCL – primary maximum contaminant level
SMCL – secondary maximum contaminant level
mg/L – milligrams per liter
Nitrate-N – nitrate as nitrogen
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BSBPO – Basin-Specific Basin Plan Objective
GRIP – Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A
GRIP B – GRIP Recycled Water Project B
DGSG – Dominguez Gap Spreading Grounds
AWT – advanced water treatment
RW – recycled water
AC – assimilative capacity
AFY – acre-feet per year
K – thousands

(green) – groundwater quality improvement
(orange) – groundwater quality decline

scenario could not be simulated by the SNMP mixing model. Nonetheless, increased stormwater capture is expected to improve groundwater quality due to the relatively high quality water associated with surface water and stormwater. Various enhanced stormwater capture projects are in place and planned for the CBWCB and the new Waste Discharge Requirements for Municipal Separate Sewer System (MS4) discharges within the coastal watersheds of Los Angeles County are expected to result in increased stormwater recharge and improved surface water quality (LARWQCB, 2012b) and thus, were designated as implementation measures (see Appendix J).

While some scenarios increase S/N concentrations, the increases over the future planning period are small and S/N concentrations will not exceed BPO/BSBPOs in the Central Basin. Additionally, multiple recycled water projects do not use more than 20% (or even 10%) of the available assimilative capacity. Future projects generally will improve groundwater quality in the West Coast Basin. While increased recycled water for irrigation will increase S/Ns in groundwater during the future planning period, the increases are very small. Due to existing elevated TDS and chloride concentrations in the West Coast Basin associated with historical seawater intrusion, there is no available assimilative capacity for these constituents. Nonetheless, TDS and chloride concentrations are anticipated to achieve BPO/BSBPOs beyond the future planning period as discussed in Section 7.5 *Groundwater Quality Projections Beyond WY 2024-25*.

7.5 Groundwater Quality Projections Beyond WY 2024-25

When groundwater quality projections were presented at the December 2012 CBWCB SNMP stakeholder workshop, two questions were raised by the CBWCB stakeholders:

- When will TDS and chloride in the West Coast Basin reach BSBPOs?
- Will the 20% assimilative capacity threshold for TDS and chloride be reached in the Central Basin Pressure Area in the future?

In order to answer these questions, the SNMP mixing model was used to simulate future conditions through WY 2049-50 and results are presented in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality*. It is noted, that as projections are extended further into the future, uncertainties increase with respect to underlying baseline condition assumptions and future projects and implementation measures. Therefore, the projected dates are considered estimates. Based on the analysis, the BSBPOs for TDS (800 mg/L) and chloride (250 mg/L) are estimated to be reached by about 2034 and 2035, respectively, under Scenarios 8 through 11 (combined projects/scenarios) in the West Coast Basin.

The WY 2049-50 projections indicate that the 20% assimilative capacity threshold for TDS and chloride in the Central Basin Pressure Area (or any other subareas or basins) are not anticipated be reached by WY 2049-50 under the combined scenarios. TDS and chloride concentrations show asymptotic trends or a leveling off of the increasing trends in the future.

The simulation of water quality conditions through WY 2049-50 was conducted solely for informational purposes. As part of the 10-year periodic review of the SNMP, basin conditions will be updated based on the most current available data and groundwater quality projections will be adjusted accordingly.

8 Anti-Degradation Assessment

The anti-degradation analysis is described in detail in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality* and is summarized below. In accordance with the Recycled Water Policy, an anti-degradation analysis is required in the SNMP and must comply with SWRCB Resolution No. 68-16. Until such time that the SNMP is adopted, compliance with Resolution No. 68-16 may be demonstrated by an anti-degradation analysis verifying the use of the baseline assimilative capacity as follows:

- A single proposed recycled water project utilizing less than 10% of the available assimilative capacity in a basin/sub-basin or
- Multiple proposed projects utilizing less than 20% of the available assimilative capacity in a basin/sub-basin.

Accordingly, these criteria are used to assess potential groundwater quality impacts of planned recycled water projects in the CBWCB. Table 17 and Figures 14, 15, and 16 illustrate the use of available assimilative capacity by major proposed projects in the basins. These projects were evaluated individually and in combination and are referred to as "scenarios". As demonstrated in Table 17, individual projects and multiple combined projects use 10% or less of the available assimilative capacity for TDS, chloride, and nitrate in the Central Basin and less than 10% of the available assimilative capacity for nitrate in the West Coast Basin. In the West Coast Basin, there is no existing available assimilative capacity for TDS and chloride due to historical seawater intrusion; however, due to existing and planned implementation measures, including the proposed projects, the BSBPOs will be achieved in the future.

In addition to the minimal negative, and in some cases positive, water quality impacts associated with the proposed recycled water projects in the CBWCB, the Recycled Water Policy and the Governor's recent drought proclamations (see Section 9.3) recognize the tremendous need for and benefits of increased recycled water use in California. As stated in the Recycled Water Policy, "*The collapse of the Bay-Delta ecosystem, climate change, and continuing population growth have combined with a severe drought on the Colorado River and failing levees in the Delta to create a new reality that challenges California's ability to provide the clean water needed for a healthy environment, a healthy population and a healthy economy, both now and in the future. . . . We strongly encourage local and regional water agencies to move toward clean, abundant, local water for California by emphasizing appropriate water recycling, water conservation, and maintenance of supply infrastructure and the use of stormwater (including dry-weather urban runoff) in these plans; these sources of supply are drought-proof, reliable, and minimize our carbon footprint and can be sustained over the long-term."* (SWRCB, 2009)

Clearly, the benefits in terms of sustainability and reliability of recycled water use cannot be overstated. The SNMP analysis finds that AWT recycled water is one of the highest quality source waters available (higher quality than imported water in terms of TDS and chloride) and that use of AWT recycled water is a critical component in achieving WQOs/BPOs and preserving beneficial uses in the West Coast Basin where historical seawater intrusion has degraded groundwater quality in certain areas. Tertiary-treated recycled water is also a critical component of the water supply portfolio in the CBWCB and its use can be safely increased, including implementation of higher S/N loading projects including GRIP B (which has higher S/N loading compared with GRIP A) and the increased use of recycled water for irrigation with S/N concentrations at equivalent to SMCLs/MCL (which results in higher S/N loading compared with recycled water at baseline period S/N averages), while still protecting groundwater quality and preserving beneficial uses. Increased use of recycled water reduces reliance on potable water supplies, in particular increasingly uncertain and costly imported water supplies. Thus, the increased use of recycled water ensures that the water supply in the CBWCB is sustainable through the future. **Table 22** presents the results of the anti-degradation assessment of the proposed recycled projects in the CBWCB in accordance with SWRCB Resolution No. 68-16 (Anti-Degradation Policy).

Table 22 Anti-Degradation Assessment

SWRCB Resolution No. 68-16 Component	Anti-Degradation Assessment Result
Water quality changes associated with proposed recycled water project(s) are consistent with the maximum benefit of the people of the State. The water quality changes associated with proposed recycled water project(s) will not unreasonably affect present and anticipated beneficial uses. The water quality changes will not result in water quality less than prescribed in the Basin Plan.	• Water quality changes associated with proposed recycled water projects in the Central Basin and West Coast Basin (CBWCB) are consistent with the maximum benefit of the people of the State. • The water quality changes associated with proposed recycled water projects in the CBWCB will not unreasonably affect present and anticipated beneficial uses. • The water quality changes associated with proposed recycled water projects in the CBWCB will not result in water quality less than prescribed in the Basin Plan. • GRIP A and GRIP B will not use more than 10% of the available AC in the Central Basin. • GRIP A and GRIP B will not cause groundwater quality to exceed BPO/BSBPOs in the Central Basin. • Use of recycled water for GRIP A and GRIP B to replace imported water is consistent with the SWRCB Recycled Water Policy, which encourages reliance on local, drought-proof water supplies. • Seawater intrusion barrier projects are utilizing AWT recycled water and imported water improve groundwater quality in both basins. • Use of recycled water at the seawater intrusion barriers to replace imported water is consistent with the SWRCB Recycled Water Policy, which encourages increased reliance on local, drought-proof water sources. • Recycled water used for irrigation will not use more than 10% of the available AC in either basin.

SWRCB Resolution No. 68-16 Component	Anti-Degradation Assessment Result
	• Recycled water used for irrigation will not cause groundwater quality to exceed BPO/BSBPOs. • Use of recycled water for irrigation to replace imported water and groundwater is consistent with the SWRCB Recycled Water Policy, which encourages increased reliance on local, drought-proof water sources.
The projects are consistent with the use of best practicable treatment or control to avoid pollution or nuisance and maintain the highest water quality consistent with the maximum benefit to the people of the State.	• The proposed recycled water projects in the CBWCB are consistent with the use of the best practicable treatment or control to avoid pollution or nuisance and maintain the highest water quality consistent with the maximum benefit to the people of the State. • The proposed GRIP recycled water project will use either tertiary-treated and/or AWT recycled water; higher loading associated with GRIP B will not use more than 10% of the available AC or cause groundwater to exceed BPO/BSBPOs. • The benefit to the people of the State for GRIP A versus GRIP B must consider the significantly higher costs associated with production and use of AWT recycled water. • The ongoing seawater intrusion barrier projects currently use AWT recycled water. • Recycled water used for irrigation is currently tertiary-treated and this is the appropriate level of treatment for this very minor component of S/N loading, as determined from the SNMP analysis.
The proposed project(s) is necessary to accommodate important economic or social development.	• The proposed recycled water projects in the CBWCB are necessary to accommodate important economic and social development. • Given the uncertainties and increasing costs of imported water, increasing use of recycled water ensures a diversified and more reliable water supply. • The proposed GRIP recycled water project provides a sustainable and reliable water source to replenish the groundwater basins, maintains high-quality groundwater, complies with pertinent regulatory requirements by employing an institutionally feasible approach, minimizes costs to agencies using groundwater, and engages stakeholders in the decision-making process. • Ongoing operation of the seawater intrusion barriers are necessary to prevent seawater intrusion and replenish the groundwater basins.

SWRCB Resolution No. 68-16 Component	Anti-Degradation Assessment Result
Implementation measures are being or will be implemented to help achieve BPOs in the future.	• Implementation measures are being implemented and additional implementation measures have been proposed in the CBWCB to help achieve or remain below BPO/BSBPOs. • BPO/BSBPOs are being achieved and will not be exceeded in the Central Basin. • The ongoing operation of the seawater intrusion barriers and desalters are improving groundwater quality in the West Coast Basin and TDS and chloride levels will eventually achieve BSBPOs in the future.

CBWCB – Central Basin and West Coast Basin
GRIP – Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A; this project alternative utilizes a blend of tertiary-treated & AWT recycled water to replace imported water for recharge at the Montebello Forebay Spreading Grounds
GRIP B – GRIP Recycled Water Project B; this project alternative utilizes 100% tertiary-treated recycled water to replace imported water for recharge at the Montebello Forebay Spreading Grounds
BPO – Basin Plan Objective
BSBPOs – Basin-Specific Basin Plan Objectives
SWRCB – State Water Resources Control Board
SNMP – Salt and Nutrient Management Plan
S/Ns – salt and nutrients
AWT – advanced water treatment
AC – assimilative capacity

9 Changing Conditions

This section describes changing conditions, including population growth, climate change, and drought, that could affect future groundwater quality and supply and how these factors were addressed by the CBWCB stakeholders as part of the SNMP.

9.1 Population Growth

According to the California Department of Finance, the State's population as a whole is projected to increase by more than 35% while Los Angeles County's population is projected to increase by approximately 18% by 2050 (USBOR, LACFCD, LACDPW, 2013). Although the population in the CBWCB is predicted to increase, use of potable supplies (imported water and groundwater) is projected to remain near 2010 levels through the end of the SNMP future planning period, i.e., 2025 (see Appendix H *Baseline and Future Water Balances* for further details). This is due to the increased use of recycled water (replacing and supplementing imported water) and overall reduced water demand due to conservation. The Study Area is mostly urbanized and essentially fully developed, so much of the predicted county-wide increase in population will likely occur through development outside the CBWCB.

9.2 Climate Change

The effects of climate change in California present many water supply challenges and unknowns. The sustainability of water supply sources will likely be impacted by warmer winter storms, reduced precipitation, winter snowpack, and surface water flows, significant dips in groundwater levels, more intense winter and spring runoff (due to precipitation occurring as rain instead of snow), and more extreme hydrologic variability between drier drought periods and wetter winter periods. Rainfall patterns locally are also likely to change with heavier rainfall periods (but reduced events) that potentially could overwhelm the flood control system, leading to less conserved stormwater, more property damage, and greater maintenance and operational demands (USBOR, LACFCD, and LACDPW, 2013). In addition, sea level along the Southern California Coast is projected to rise 5 to 25 inches above 2000 levels by 2025 due to global climate change (NRCC, 2012). Rising sea water levels have the potential to increase seawater intrusion along the coastal areas of the CBWCB.

It is noted that 7 of the last 10 seasonal years (July 1 to June 30) (2003-04, 2005-06, 2006-07, 2007-08, 2008-09, 2011-12, 2012-13) have seen below normal rainfall in Los Angeles, resulting in a lower than expected stormwater capture for recharge at the MFSG. This has led the LARWQCB to approve a longer, from 5 years to 10 years, averaging period for calculation of the relative contribution of recycled water for recharge at the MFSG (LARWQCB, 2013). Additionally, the LARWQCB increased the permitted maximum quantity of recycled water recharged at the MFSG from 35% to 45% of the total inflow from all sources (i.e., imported water, recycled water, and stormwater) in any 10-year period (LARWQCB, 2014).

In recognition of the water supply implications of greenhouse gas emissions, climate change, drought, and uncertainties and increasing costs associated with imported water supplies, the CBWCB stakeholders have been planning and implementing projects to maximize the use of recycled water and stormwater, encourage conservation, and address seawater level rise.

Thus, consideration of climate change was a key factor in the development of projects and implementation measures (see Section 10) to reduce reliance on expensive, energy-intensive (due to pumping, distribution, and other costs), and increasingly unreliable imported water supplies by replacing these supplies with drought-proof, reliable, safe, and sustainable recycled water at the MFSG, seawater intrusion barriers, and for irrigation. Various measures and studies to increase stormwater capture have also been implemented and planned, including low impact development (LID) projects, new retention basins, rubber dams along the San Gabriel River, increasing the height of water storage behind the Whittier Narrows Dam, and the MFSG interconnection pipeline, among others. It is anticipated that projects and programs associated with the MS4 Permit will also result in increased stormwater capture.

As recognized in the Department of Water Resources (DWR) Public Review Draft of the Water Plan Update 2013 (DWR, 2013), conservation is a fundamental component of the South Coast region's water management planning. The South Coast Region includes all of Orange County and portions of Ventura, Los Angeles (including the CBWCB), San Bernardino, Riverside, and Sana Diego counties. Water agencies in the South Coast have been aggressively implementing water conservation since the 1990s. The GLAC IRWMP (GLAC IRWMP Leadership Committee, 2014) has been developed to define a clear vision and direction for the sustainable management of water resources in the GLAC Region for the next 20 years.

The Water Conservation Act of 2009 (Senate Bill [SB] x7-7) requires each urban retail agency to establish in its Urban Water Management Plan (UWMP) a reduction goal to help California achieve a 20% statewide reduction in daily per capita water use by 2020. The UWMPs indicate the South Coast Hydrologic Region had a population-weighted baseline average water use of 188 gallons per capita per day with an average population-weighted 2020 target of 159 gallons per capita per day. In addition, although the population in the CBWCB is predicted to increase, conservation programs are helping to maintain the use of potable supplies (imported water and groundwater) near 2010 levels through the end of the SNMP future planning period, i.e., 2025.

9.3 Drought

Historically, California has experienced frequent periods of prolonged drought. Based on scientific projections, drought is expected to occur more frequently and for longer intervals due to climate change. With significant below-normal rainfall since 2012, the current drought is being described as the driest period in the State's recorded history. There was less rain in 2013 than in any year since California became a state in 1850. Locally, there has been approximately 5.6 inches of rain since October 1, 2013 (when the "water year" starts from a record-keeping standpoint), approximately 37% of the normal precipitation for this period. A Sierra Mountain snow survey conducted by the DWR at the end of February and March 2014 found the snowpack's statewide water content at about 25% of average. According to the United States Drought Monitor, a majority of the State is designated in either Exceptional Drought (including the CBWCB) or Extreme Drought (http://droughtmonitor.unl.edu/Home/StateDroughtMonitor.aspx?CA).

The current drought, as a result of the lack of precipitation, has impacted the following areas, which has affected imported water and groundwater supplies in the CBWCB:

- San Gabriel Mountains and Valley which feed runoff to rivers leading to recharge at the Montebello Forebay Spreading Grounds;
- Sierra Nevada Mountains which feed the Owens River, the Los Angeles Aqueduct, Northern California, the Sacramento-San Joaquin River Delta, and the California Aqueduct;
- Western United States and the Rocky Mountains which feed the Colorado River; and
- Groundwater – In the Montebello Forebay, which supplies many production wells and also serves as the conduit to supply groundwater to "downstream" areas of the Central Basin and West Coast Basin, groundwater levels have fallen over 50 feet since 2011 due to the extended drought. Water levels have dropped to their lowest levels in over 35 years, causing some production wells to have lowered pumps to keep up with the decline.

Due to seriously diminished water supplies in the State, on January 17, 2014, Governor Jerry Brown declared a State of Emergency (Proclamation No. 1-17-2014, http://www.gov.ca.gov/news.php?id=18368). As part of his proclamation, the Governor directed State officials to take all necessary actions to prepare for drought conditions. On April 25, 2014, Governor Brown issued an Executive Order (Proclamation No. 4-25-2014, http://gov.ca.gov/news.php?id=18496) declaring a continued state of emergency due to severe drought conditions, with an emphasis on statewide conservation and included directives to strengthen the State's ability to manage water effectively under drought conditions. Directive No. 10 in the Executive Order states, "The Water Board [SWRCB] will adopt statewide general waste discharge requirements to facilitate the use of treated wastewater that meets standards set by the Department of Public Health, in order to reduce demand on potable water supplies." (Office of California Governor Edmund G. Brown, Jr., 2014b).

In direct response to the Governor's April 2014 Executive Order, the SWRCB adopted *General Waste Discharge Requirements for Recycled Water Use* (General Order No. WQ 2014-0090-DWQ; http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2014/wqo2014_0090_dwq_revised.pdf) on June 3, 2014 to streamline permitting for recycled water use (i.e., relieve producers, distributors, and users of recycled water from the lengthy permit approval process) throughout the State. This General Order is intended to increase local water supplies by promoting the non-potable use of recycled water in communities grappling with drought conditions. Additionally, the General Order is consistent with the Recycled Water Policy that was adopted by the SWRCB in 2009 and amended in 2013, which required the development of SNMPs for all groundwater basins in California. Thus, all uses of recycled water allowed by the General Order must be consistent with the SNMPs that will be approved by the Regional Water Quality Control Boards. Importantly, the General Order did not modify existing permitted recycled water quality limits established for irrigation. If this was the case, this would have significantly limited the sustainable and cost effective use of recycled water to offset demand for raw and potable water supplies in the CBWCB.

Currently, permitted recycled water quality limits established for non-potable reuse (irrigation, industrial and recreational activities) are generally more conservative than the SMCLs established for TDS and chloride. As part of the SNMP, the CBWCB stakeholders, in close consultation with the LARWQCB, modeled the impacts on groundwater quality from the increased use of recycled water for irrigation at the SMCLs/MCL for S/Ns. As discussed further in Section 7.4.1, the modeling results showed that there were minimal potential impacts to the basins when utilizing recycled water for irrigation at these generally higher concentrations, even at increased volumes. Therefore, the CBWCB stakeholders believe that modification of existing permit levels for recycled water for non-potable reuse are warranted to further reduce dependency on potable water supplies, meet the goals set forth in the Recycled Water Policy to increase the use of recycled water (as discussed in Section 1.2), and more fully embrace the spirit of the Governor's drought proclamations.

In addition to the modification of existing permit levels for recycled water for non-potable reuse, the CBWCB stakeholders have proposed other recycled water projects (refer to Section 10.1 and Appendix J) for implementation in the basins. As discussed further in Section 7 and Appendix I, impacts to groundwater quality from the proposed recycled water projects were estimated using the mixing model that was developed as part of the SNMP. The SNMP modeling results clearly demonstrate that future recycled water projects that may increase S/N loading are more than offset by projects that reduce S/N loading and thus, groundwater quality overall in the CBWCB is either improving or remaining well below BPOs, for S/Ns. Since some of the proposed recycled water projects in the CBWCB actually reduce S/N loading or improve groundwater quality, they were also identified as implementation measures, as discussed further in Section 10.2 and Appendix J. Thus, the proposed recycled water projects and implementation measures developed by the CBWCB stakeholders directly address the impacts of drought, while improving or maintaining high-quality groundwater in the basins.

Recognizing the implications of changing climatic conditions, WRD and SNMP stakeholders have developed a number of plans and programs to reduce reliance on imported water by increasing use of stormwater and recycled water. WRD has developed the Water Independence Now (WIN) program, which is a series of projects that will fully utilize stormwater and recycled water sources to restore and protect the groundwater resources. WIN seeks to completely eliminate dependence on imported water to ensure the future security of the CBWCB by developing local resources to create a locally sustainable groundwater supply.

To complement the WIN program, WRD and CBWCB stakeholders have developed the GBMP (CH2MHILL, 2012b) to identify and assess impacts of potential projects and programs to enhance basin replenishment, increase the reliability of groundwater resources, improve and protect groundwater quality, and ensure that the groundwater supplies are suitable for beneficial uses. This GBMP identifies opportunities to develop supplemental replenishment water supplies to further utilize the CBWCB. The key objective for creating additional replenishment water supply is to significantly reduce imported water use by providing for increased pumping from the CBWCB. Various scenarios and alternatives were developed and evaluated with the updated USGS MODFLOW groundwater flow model with the goal of maximizing the development of groundwater supplies.

9.4 Greenhouse Gas Emissions

Greenhouse gases, measured and evaluated in terms of carbon dioxide, are generated from the combustion of carbon-based fuels, principally wood, coal, oil, and natural gas. Greenhouse gas emissions are known to cause climate change at various scales, including local and regional. The amount of energy associated with various water sources depends on many factors, including the quality of the source water, the energy required for water treatment, the efficiency of conveyance and distribution systems, and the distance to approved end uses. In the CBWCB, recycled water and groundwater require significantly less distance for transport to approved end uses compared with imported supplies, and thus results in substantial overall energy savings, mainly due to delivery.

From an energy standpoint, greater reliance on water conservation, recycled water, and stormwater provides significant energy benefits compared with imported water. These energy benefits provide significant reductions in greenhouse gas emissions in direct relation to their energy savings.

The CBWCB stakeholders have recognized the importance of reducing greenhouse gas emissions. For over 50 years, recycled water and stormwater have been used in the Montebello Forebay for groundwater recharge, thus reducing reliance on more energy-intensive imported water supplies. Water conservation programs are currently in place (thus, conservation was identified as an implementation measure; see Appendix J), which not only conserve energy but may also result in reduced S/N loading, thus improving groundwater quality. To further meet the goals of the Recycled Water Policy and the Governor's drought proclamation, multiple projects have been proposed by the CBWCB stakeholders to increase the use of recycled water (replacing and supplementing more energy-intensive imported water supplies), as further discussed in Section 10.2. The use of recycled water in the CBWCB has been proven to be an energy-efficient, safe, and reliable resource and has played a vital role in increasing the sustainability of the overall water supply. Impacts to air quality, including greenhouse gas emissions, will be evaluated as part of the CEQA process for the individual projects in the basins and was also assessed for the program alternatives presented in the SED.

10 Implementation Plan

Appendix J *Implementation Plan* presents a detailed discussion of the proposed major recycled water projects, as well as the many existing and planned implementation measures developed by the stakeholders for the CBWCB to manage S/N loading on a sustainable basis[17] and ensure reliable water supplies by promoting the use of recycled water. The Recycled Water Policy states that within one year of the receipt of a proposed SNMP, the RWQCBs shall consider for adoption revised implementation plans, consistent with Water Code Section 13242, for those groundwater basins within their regions where WQOs or BPOs for S/Ns are being, or are threatening to be exceeded.

10.1 Implementation Measures

Implementation measures are projects or programs established to control, reduce, or manage (mitigate) S/N loading on a sustainable basis. Implementation measures can impact the groundwater basins in two ways: 1) they can decrease the S/N loading, and/or 2) they can decrease the concentration of S/Ns in groundwater. This distinction is important in understanding the different types of benefits of implementation measures in the context of S/N management. The impacts are differentiated by the source water quality and whether one source water replaces another of different water quality.

The need for, or lack of need for implementation measures was determined by comparing average existing and simulated future groundwater quality with BPO/BSBPOs. The SNMP analysis shows that nitrate does not exceed or threaten to exceed its BPO in either the Central Basin or West Coast Basin. Average TDS and chloride concentrations do not exceed or threaten to exceed their BSBPOs in the Central Basin. In the West Coast Basin, the overall basin average TDS and chloride concentrations currently exceed BSBPOs due to the existence of trapped inland saline plumes caused by historical seawater intrusion, but the BSBPOs are expected to be achieved in the future (approximately 2035; see Section 7.5) as a result of existing and planned implementation measures, which include the basin adjudication and associated limits on pumping, operation of the seawater intrusion barriers and desalters, and increased recharge and use of AWT recycled water at the barriers combined with increased groundwater pump and treat by the desalters in the future.

In accordance with the Recycled Water Policy, implementation measures are warranted for the West Coast Basin. While not strictly required by the Recycled Water Policy, implementation measures were also developed for the Central Basin. Existing and planned implementation measures ensure that S/Ns are managed on a sustainable basis in the CBWCB and beneficial uses are preserved. Nonetheless, the S/N management process is intended to be active and ongoing. S/Ns in groundwater will be monitored to track basin water quality and trends, and

[17] "Sustainable" in this context means using a resource such that the resource, i.e., groundwater, is not depleted or permanently damaged.

the need for additional implementation measures will be reassessed when the SNMP is updated in 10 years.

Over 40 existing and planned implementation measures are described in Appendix J. Some examples include measures to control seawater intrusion (e.g. barriers and desalters), groundwater recharge (e.g. spreading grounds improvements to increase stormwater capture), institutional controls (e.g. basins adjudications), stormwater management (e.g. MS4 permits), wastewater S/N source control (e.g. wastewater nitrogen treatment), public education (e.g. Council for Watershed Health website), conservation (e.g. reduced irrigation return flows), regulatory/non-regulatory (e.g., recycled water reuse regulations), and land use regulation (e.g. irrigation efficiency ordinance). Appendix J provides a description of the full list of implementation measures that were developed for the CBWCB.

Some implementation measures described in Appendix J are expected to improve groundwater quality, but were not simulated by the SNMP mixing model due to uncertainties in the details of their implementation. For example, the Municipal Separate Storm Sewer System (MS4) permit that was issued by the LARWQCB in 2012 for 84 cities and a majority portion of the unincorporated areas of Los Angeles County regulates the discharge of runoff from MS4s or storm drains, and prohibits non-stormwater discharges into the storm drain system and discharges to receiving waters that would cause or contribute to a violation of water quality standards. This MS4 permit will result in increased stormwater recharge and improved stormwater/surface water and groundwater quality. While the groundwater quality impacts of this permit implementation will undoubtedly be positive, the impacts cannot be simulated because the changes in volumes and concentrations of recharge to the groundwater basins cannot be quantified at this time.

The major implementation measures proposed in the CBWCB with quantified water quality impacts and thus, were able to be simulated by the SNMP mixing model, include:

- Increased recharge at the seawater barriers with AWT recycled water completely replacing imported water at the WCBB, AGB, and DGB;
- Expansion of the Goldsworthy Desalter and increased groundwater pumping for treatment by the Goldsworthy Desalter and Brewer Desalter, both in the West Coast Basin;
- Decreased irrigation return flows due to decreased imported water use in the Central Basin; and
- Increased stormwater capture at the DGSG.

The analysis presented in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality* demonstrates that for the West Coast Basin, the existing and planned implementation measures are improving groundwater quality. Specifically, average TDS and chloride concentrations are expected to decline in the West Coast Basin through 2025 and are estimated to achieve BSBPOs in about 2035.

Based on the SNMP analysis, no additional implementation measures beyond what has been implemented and are planned through 2025 are warranted. Nonetheless, the S/N management process in the CBWCB is active and ongoing. S/N groundwater quality will continue to be monitored through the future to determine if water quality improvement objectives are met and the need for additional implementation measures will be reassessed when the SNMP is updated in 10 years.

10.2 Proposed Major Recycled Water Projects

Recognizing the potential negative impacts of greenhouse gas emissions, climate change, and drought, the use of recycled water by stakeholders in the CBWCB has played a vital role in increasing the reliability and sustainability of the overall water supply. Because one of the goals of the Recycled Water Policy is increased use of recycled water to reduce dependency on expensive, energy-intensive (due to pumping, distribution, and other costs), and increasingly uncertain imported water supplies, the CBWCB stakeholders have proposed some major recycled water projects for implementation while still protecting groundwater quality and preserving beneficial uses.

The major recycled water projects proposed in the CBWCB are described in detail in Appendix J and they include seawater intrusion control projects (increased AWT recycled water for injection at the seawater barriers), groundwater recharge projects (GRIP A/GRIP B), and non-potable recycled water reuse projects (increased recycled water for irrigation and permitted limits at SMCLs/MCL). These projects are expected to be implemented by or before the SNMP 2025 planning horizon. Some of the proposed recycled water projects are also identified as implementation measures, since they are expected to reduce S/N loading and/or improve groundwater quality. The proposed recycled water projects identified in Appendix J are not inclusive of all recycled projects that may be implemented in the future in the CBWCB. As other recycled water projects are proposed throughout the SNMP future planning period, it is expected that each project will be implemented in accordance with all applicable regulations, including the California Environmental Quality Act (CEQA). The SNMP will be updated every 10 years, and the list of proposed recycled water projects will be updated accordingly.

All the major recycled water projects described in Appendix J were quantitatively assessed for their S/N groundwater quality impacts and use of assimilative capacity using the SNMP mixing model, as discussed further in Section 7.4. The SNMP analysis demonstrated that projects that degrade groundwater quality are more than offset by projects (implementation measures) that improve groundwater quality. Further, an implementation plan that includes any of the combinations of projects described in Section 7.3 *Future Projects and Simulated Scenarios*, even including those that slightly degrade groundwater quality, is protective of groundwater quality and preserves beneficial uses. None of the identified major recycled water projects use more than 10% of the available assimilative capacity of the Central Basin, and in the West Coast Basin, where there is no available assimilative capacity, the combined projects improve groundwater quality with respect to TDS and chloride and have essentially no impact on nitrate in groundwater, which is not a water quality concern in either basin. Overall, the SNMP analysis demonstrated that implementation of the proposed major recycled water projects will result in groundwater quality remaining below BPO/BSBPOs in the Central Basin and BSBPOs for chloride and TDS being achieved in the future in the West Coast Basin. Nitrate in groundwater in both basins remains significantly below the BPO through the future.

Because the negative groundwater quality impacts of the proposed major recycled water projects have been demonstrated in this SNMP to be minimal and more than offset by implementation measures that improve groundwater quality, this SNMP may be used to provide a basis for streamlining of the permitting process for recycled water projects in the future in the CBWCB, per the Recycled Water Policy.

11 SNMP Monitoring Plan

The Recycled Water Policy requires that the SNMP include a Monitoring Plan that describes a reasonable, cost-effective means to determine whether concentrations of S/Ns are consistent with applicable WQOs, essentially assess water quality of the groundwater basin. The SNMP *Monitoring Plan*, provided as Appendix K, was developed in accordance with the Recycled Water Policy and includes a detailed description of the SNMP Monitoring Program and other existing monitoring programs in the CBWCB, as well as special studies that have been conducted or are in progress. Although the SNMP *Monitoring Plan* is provided as Appendix K, it was prepared as a stand-alone document with its own set of figures, so that this document could be easily updated in the event revisions need to be made to the SNMP *Monitoring Plan* in the future.

For many decades, groundwater has been, and continues to be, monitored throughout the CBWCB, in particular near recycled water recharge sites, in drinking water wells, and through a large network of multiple completion monitoring wells. Groundwater from more than 1,500 wells[18] is sampled on a daily to annual basis and hundreds of chemicals/analytical parameters are tested each year.

All of the existing groundwater monitoring programs are under direct oversight of regulatory agencies, except for voluntary programs such as WRD's Regional Groundwater Monitoring Program (RGWMP). The existing monitoring programs have for many years and will continue in the future to provide a comprehensive and continuing assessment of the overall health of the basins and allow for proper management of S/N loading on a sustainable basis.

Currently, WRD's RGWMP consists of a network of over 300 nested groundwater monitoring wells installed at over 55 locations throughout the CBWCB (see Figure K-20 in Appendix K). Annually, WRD collects nearly 600 groundwater samples from its monitoring well network and analyzes them for over 100 constituents to produce nearly 60,000 individual data points to help track groundwater quality. Each year, WRD publishes a Regional Groundwater Monitoring Report (RGWMR) that provides water quality summary tables (including data for TDS, chloride, nitrate) for each of the nested monitoring wells, water quality maps for the nested wells and drinking water wells, and maps and hydrographs depicting groundwater level data.

The SNMP Monitoring Program was developed based on WRD's RGWMP. Seventy (70) WRD nested groundwater monitoring wells (referred to as the SNMP monitoring wells) at 13 locations (see Figure K-1 in Appendix K) throughout the CBWCB have been selected for S/N sampling and reporting as part of the SNMP Monitoring Program. Each well is screened in a

[18] The total number of wells that are sampled in the CBWCB on a regular basis far exceeds 1,500 because this estimated quantity only includes nested groundwater monitoring wells owned and sampled by WRD, existing production wells, and permit compliance monitoring wells associated with ongoing large recycled water projects in the basins, such as the Montebello Forebay Spreading Grounds and the three seawater intrusion barriers. This quantity does not include the numerous groundwater monitoring wells associated with existing environmental release sites in the CBWCB.

specific aquifer, which allows the assessment of S/Ns in all the major aquifers of the CBWCB. These wells are located throughout the most critical areas of the basins, particularly their proximity to water supply wells and groundwater recharge projects that utilize recycled water, including the seawater intrusion barriers and the MFSG.

WRD is the designated entity responsible for collecting TDS, chloride, and nitrate samples (on a semi-annual basis) from the SNMP monitoring wells and compiling and reporting this data to the LARWQCB via the SWRCB's online GeoTracker database (http://geotracker.waterboards.ca.gov/). In addition, WRD's annual RGWMR provides maps depicting chloride, TDS, and nitrate concentrations in the all the nested wells and active production wells, chloride and TDS trend graphs for the SNMP monitoring wells, and a discussion of S/N concentrations/trends in groundwater with respect to WQOs to assess overall groundwater quality in the CBWCB. These analyses provide the performance measures and evaluation of the effectiveness of the CBWCB SNMP implementation measures. Both WRD's RGWMP and the SNMP Monitoring Program provide the means for comprehensive assessment and reporting of S/N levels in groundwater in the CBWCB.

In addition to groundwater monitoring, the CBWCB and tributary areas have numerous and extensive monitoring programs for recycled water, wastewater, imported water, and surface water/stormwater, including sampling for TDS, chloride, and nitrate, that are being managed by multiple stakeholder agencies/organizations. The existing and planned augmentation of these monitoring programs, as further described in Appendix K, are robust and therefore, fully comply with the Recycled Water Policy. The data currently being collected and reported allow complete characterization of groundwater quality and potential impacts from recycled water projects (e.g. irrigation and groundwater recharge). Further, given the large number of wells monitored, many with depth discrete completions, additional site-specific monitoring at recycled water irrigation sites were not found to be warranted in the CBWCB.

Monitoring for CECs in the Study Area is being conducted for the groundwater recharge projects that utilize recycled water, wastewater treatment plants that discharge to surface water, and for special studies. There are also ongoing leading edge research efforts to further develop analytical methods and understand the health implications of low level detections of CECs. As such, no additional CEC monitoring was found to be warranted in the CBWCB and thus, not proposed as part of the SNMP Monitoring Program.

The SNMP *Monitoring Plan* (see Appendix K) will be reviewed and updated as necessary as part of the SNMP update every ten years.

12 SNMP Implementation and Periodic Review

This section describes the process for implementing the CBWCB SNMP including the key stakeholder responsibilities, performance measures and evaluation, adaptive management measures, cost analysis for preparing and implementing the SNMP, and the plan implementation schedule moving forward.

12.1 Key Stakeholder Responsibilities

Stakeholders in the CBWCB that participated in the SNMP development process will be involved in the implementation of the SNMP, including water and wastewater entities, regulatory agencies, water purveyors, water associations, and environmental groups. Key stakeholders include the WRD, LACDPW, WBMWD, LADWP, SDLAC, MWD, LARWQCB, CWH, and the cities in the Study Area. These stakeholders have in the past and will continue to be involved in executing the SNMP *Implementation Plan* to manage S/Ns. Refer to Section 10 for a description of the SNMP *Implementation Plan*, which includes implementation measures and proposed major recycled water projects.

WRD has been the lead agency managing and facilitating development of the SNMP and SED and will be the lead agency for implementation of the SNMP *Monitoring Plan*. WRD will conduct S/N monitoring of groundwater and reporting this data to the online SWRCB GeoTracker database. See Section 11 for a further discussion of the SNMP Monitoring Program.

For the SNMP, the LARWQCB has been the lead agency for purposes of CEQA, while the CBWCB stakeholders conducted the CEQA analysis and collaborated with the LARWQCB to prepare the SED, which has been submitted to the LARWQCB under separate cover. The CBWCB stakeholders also supported the LARWQCB in the CEQA process by preparing a Project Summary and participating in the CEQA Scoping Meeting, as further described in Section 1.3.1.

The Recycled Water Policy states that within one year of the receipt of a proposed SNMP, the RWQCB shall consider adopting an implementation plan, consistent with Water Code Section 13242, for those groundwater basins within their regions where water quality objectives for S/Ns are being, or are threatening to be, exceeded. The implementation plan would be adopted as an amendment to the Basin Plan and shall be based on the SNMP approved by the LARWQCB. A Basin Plan Amendment based on the approved CBWCB SNMP was prepared by the LARWQCB and adopted by the LARWQCB Board on February 15, 2015.

12.2 Performance Measures and Evaluation

Performance measures were developed to evaluate the effectiveness of the implementation measures that have been proposed by the CBWCB stakeholders to manage S/N loading in the basins. Performance measures include the SNMP Monitoring Program, specifically the collection, analysis, and reporting of S/N data in groundwater throughout the basins, as further discussed in Section 11. To further assess S/Ns in groundwater, WRD's annual RGWMRs will provide maps depicting chloride, TDS, and nitrate concentrations in the all the WRD nested monitoring wells and in purveyors' active drinking water wells; chloride and TDS trend graphs for the SNMP monitoring wells; and a discussion of S/N concentrations/trends in groundwater with respect to WQOs established in the Basin Plan to assess overall groundwater quality in the CBWCB. Thus, both WRD's RGWMP and the SNMP Monitoring Program provide the means for the assessment and reporting of S/N levels in groundwater in the CBWCB and ongoing evaluation of the effectiveness of the existing and planned implementation measures specified in the SNMP.

12.3 Adaptive Management Measures

Every 10 years, the CBWCB stakeholders will review the SNMP for its consistency with the SWRCB Recycled Water Policy (refer to Appendix A), the LARWQCB Basin Plan (refer to Appendix B), the SWRCB Anti-Degradation Policy (included as an appendix within Appendix D SNMP Workplan), and other applicable regulatory documents. The SNMP will be updated as necessary to reflect current and estimated future conditions in the CBWCB. Salt and nutrient (i.e., chloride, TDS, and nitrate) management strategies and options will be updated in accordance with actions that have been taken (or in response to potential expanded salinity problems due to any action not taken) since the previous review. Additionally, based on results from the SNMP Monitoring Program, interim updates to the SNMP may be conducted when deemed necessary.

12.4 Cost Analysis for Salt and Nutrient Management in the CBWCB

Managing S/Ns in the CBWCB has been and continues to be a costly endeavor. Costs for construction of existing implementation measures are not readily available, since measures such as the construction of the seawater barriers date to the 1950s and 1960s. Annual water purchases and maintenance costs alone for the barriers are considerable. It is reported (Cheng and Ouazar, 2004) that in WY 2000-01, the cost of water purchases for the barriers were $10.3M, $2M, and $2.5M and annual maintenance costs were $2.5M, $1M, and $1M for the WCBB, DGB, and AGB, respectively. Costs for planned implementation measures are included in Table J-6 in Appendix J *Implementation Plan* and total between $540.7M and $847.7M depending on the GRIP recycled water project alternative considered. The consulting costs to produce this SNMP currently total $640K, which does not consider the in-kind services and resources provided by each of the stakeholder agencies. WRD has estimated that the SNMP Monitoring Program (i.e., data collection and reporting) will cost approximately $30K per year. This does not consider the costs of nested well construction already incurred or the considerable costs of all the other media monitoring conducted in the Study Area. While high, the costs of existing and planned implementation measures are deemed necessary to manage S/Ns and preserve the beneficial uses of these critically important groundwater basins which provide potable water supply to millions of residents and visitors to the region.

12.5 Implementation Schedule

At the request of the CBWCB stakeholders, the LARWQCB issued an approval letter to extend the deadline for submittal of the Draft CBWCB SNMP and the associated Draft SED to LARWQCB for review by August 31, 2014. Both the Draft SED and Draft SNMP were submitted to LARWQCB on August 28, 2014 for their review. The LARWQCB indicated that three to four months would be required for their review. Following LARWQCB review and approval, the LARWQCB prepared a Basin Plan Amendment based on the approved SNMP. The Basin Plan Amendment (Resolution R15-001) was presented and adopted by the LARWQCB Board on February 12, 2015 and the SNMP and SED were both finalized following adoption. The chart below presents the SNMP implementation schedule.

SNMP Implementation Schedule

Task	2014					2015	
Month	A	S	O	N	D	J	F
Draft SNMP (including Monitoring Plan) and Draft SED submitted to LARWQCB for review	X						
LARWQCB review of SNMP and SED	■	■	■	■	■		
LARWQCB approves SNMP (including Monitoring Plan) and SED						X	
LARWQCB prepared Basin Plan Amendment							X
LARWQCB Board Adopts Basin Plan Amendment based on approved SNMP							X

mo - month
LARWQCB - Los Angeles Regional Water Quality Control Board
SNMP - Salt and Nutrient Management Plan
SED - Substitute Environmental Document

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Figures

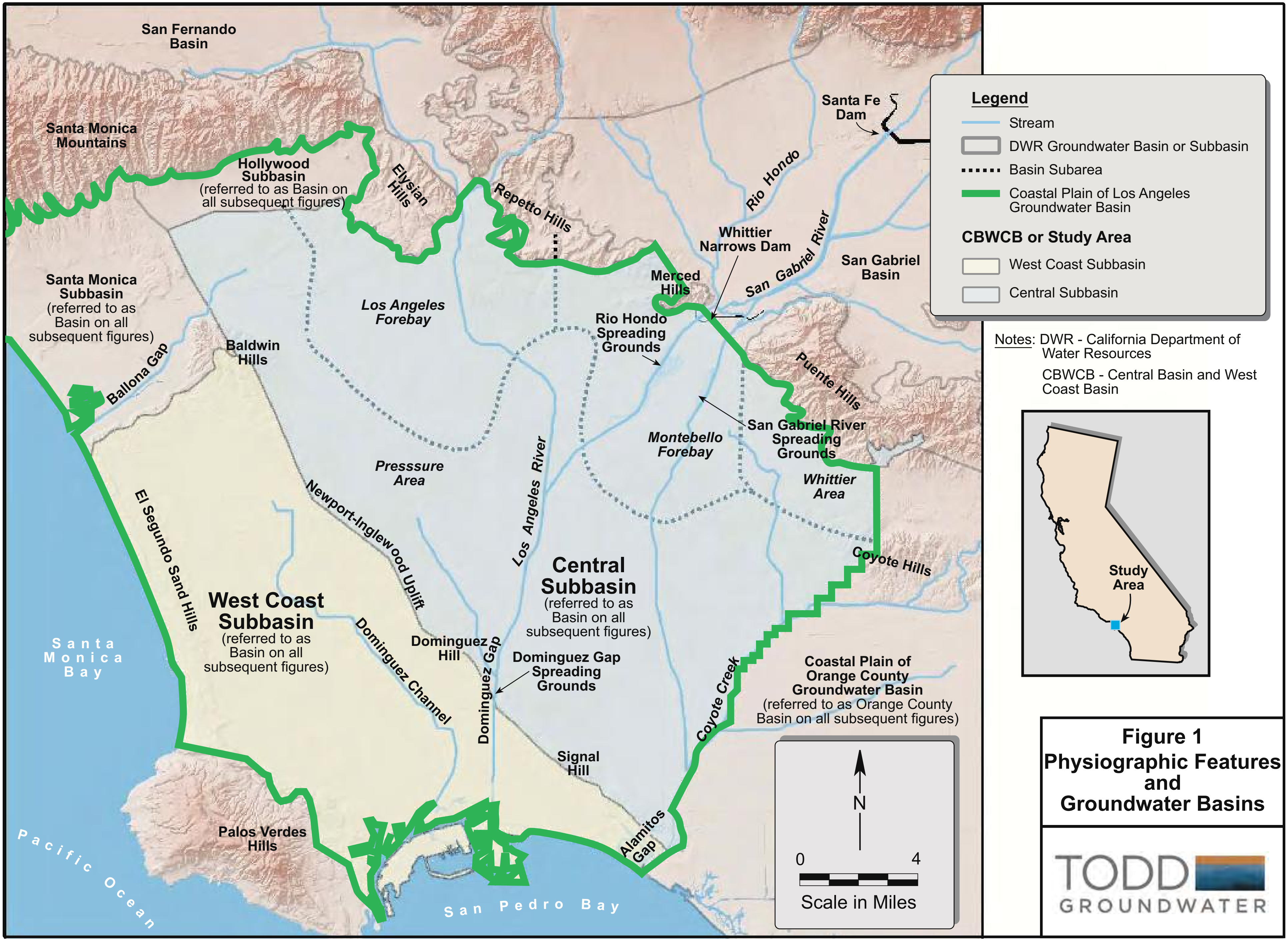
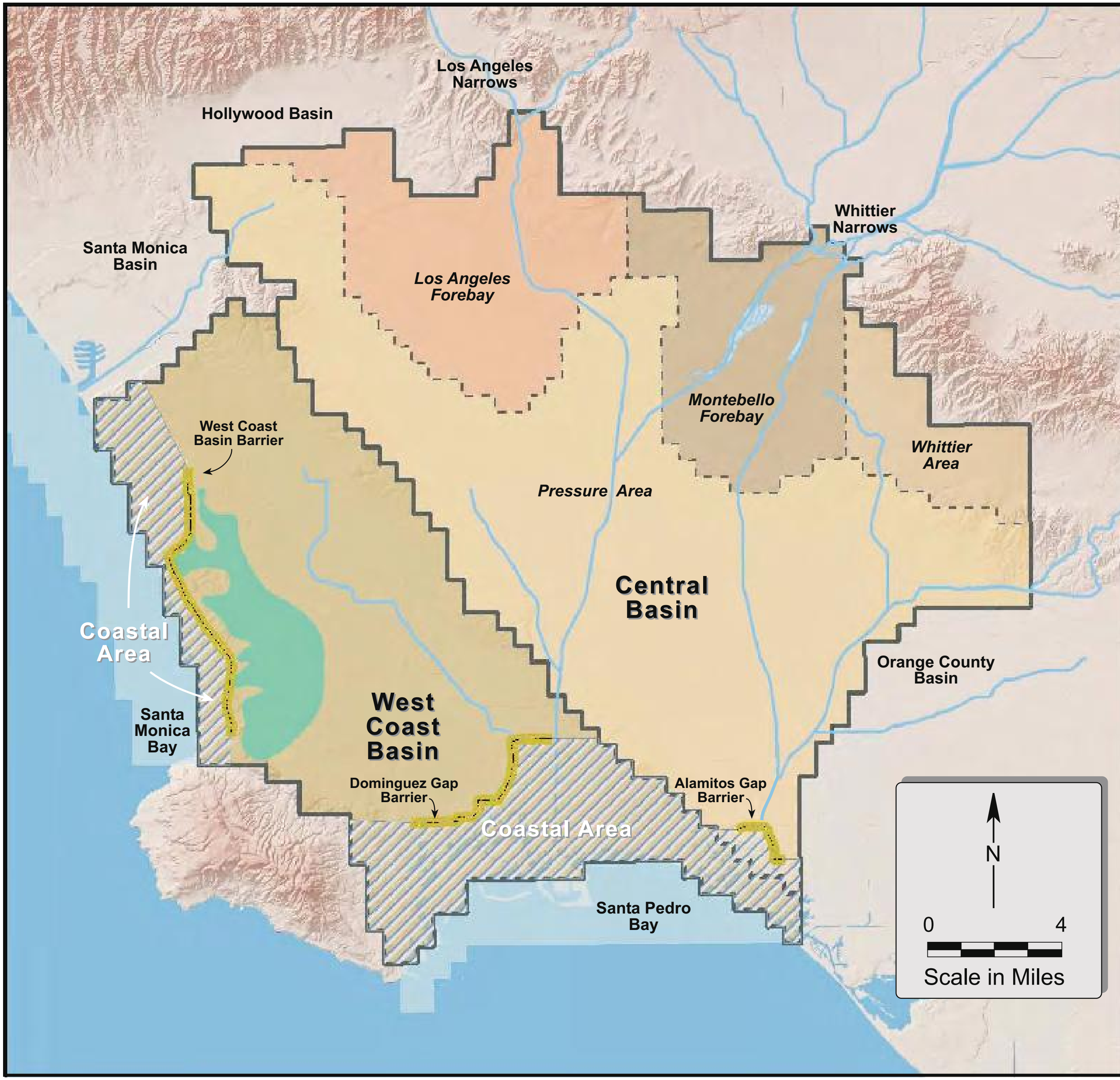


Figure 1
Physiographic Features and Groundwater Basins



Legend

Coastal Area
Stream
Seawater Intrusion Barrier
WCBB-Inland Saline Plume
Basin Subarea

Notes:

WCBB - West Coast Basin Barrier

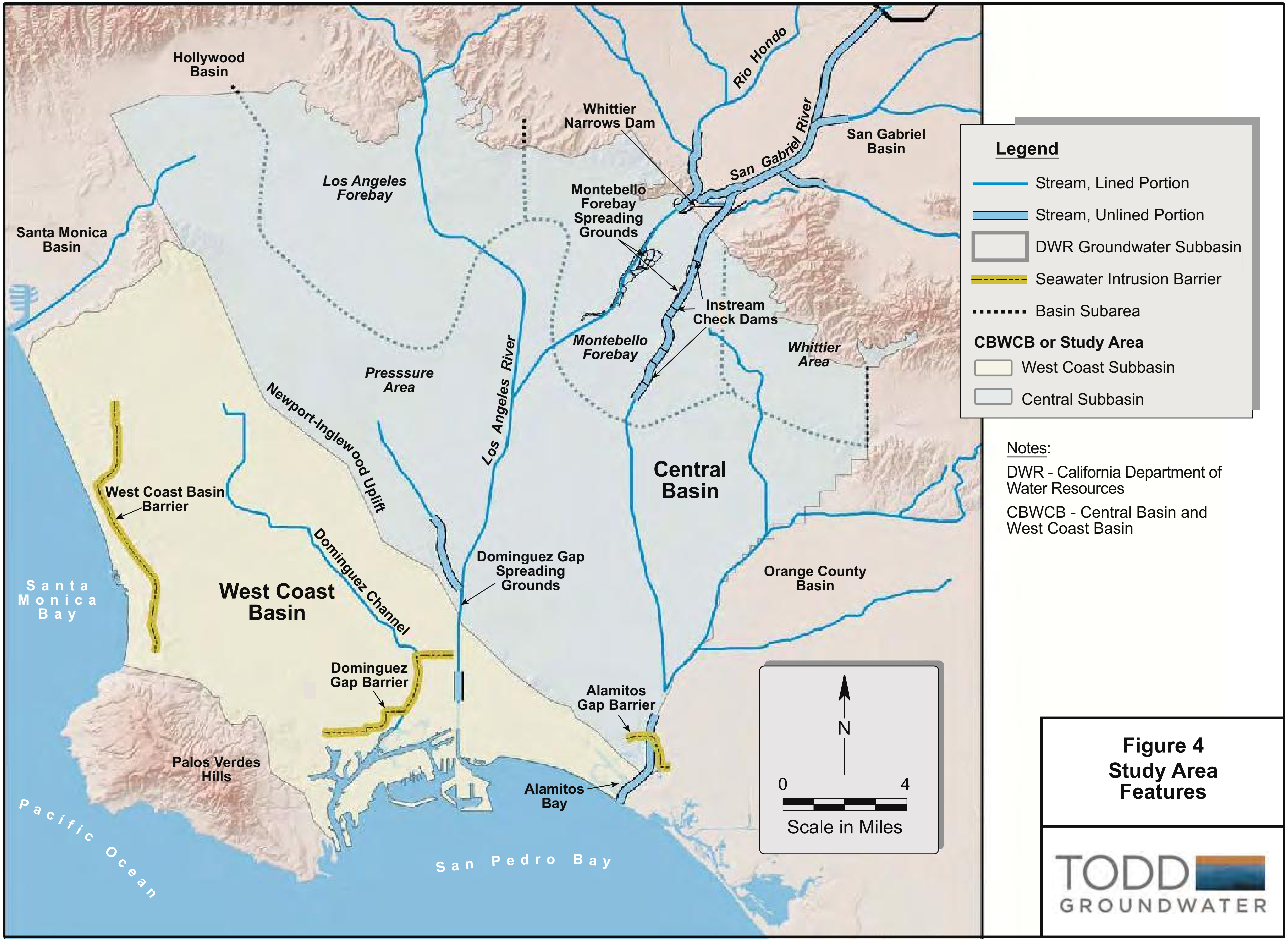
Figure 2
Model Subareas and Coastal Areas

TODD GROUNDWATER

Figure 2-15. Los Angeles Coastal Groundwater Basins.

Figure 3
De-Designated Coastal Areas

TODD GROUNDWATER



Notes:

DWR - California Department of Water Resources

CBWCB - Central Basin and West Coast Basin

Figure 4
Study Area Features

TODD GROUNDWATER

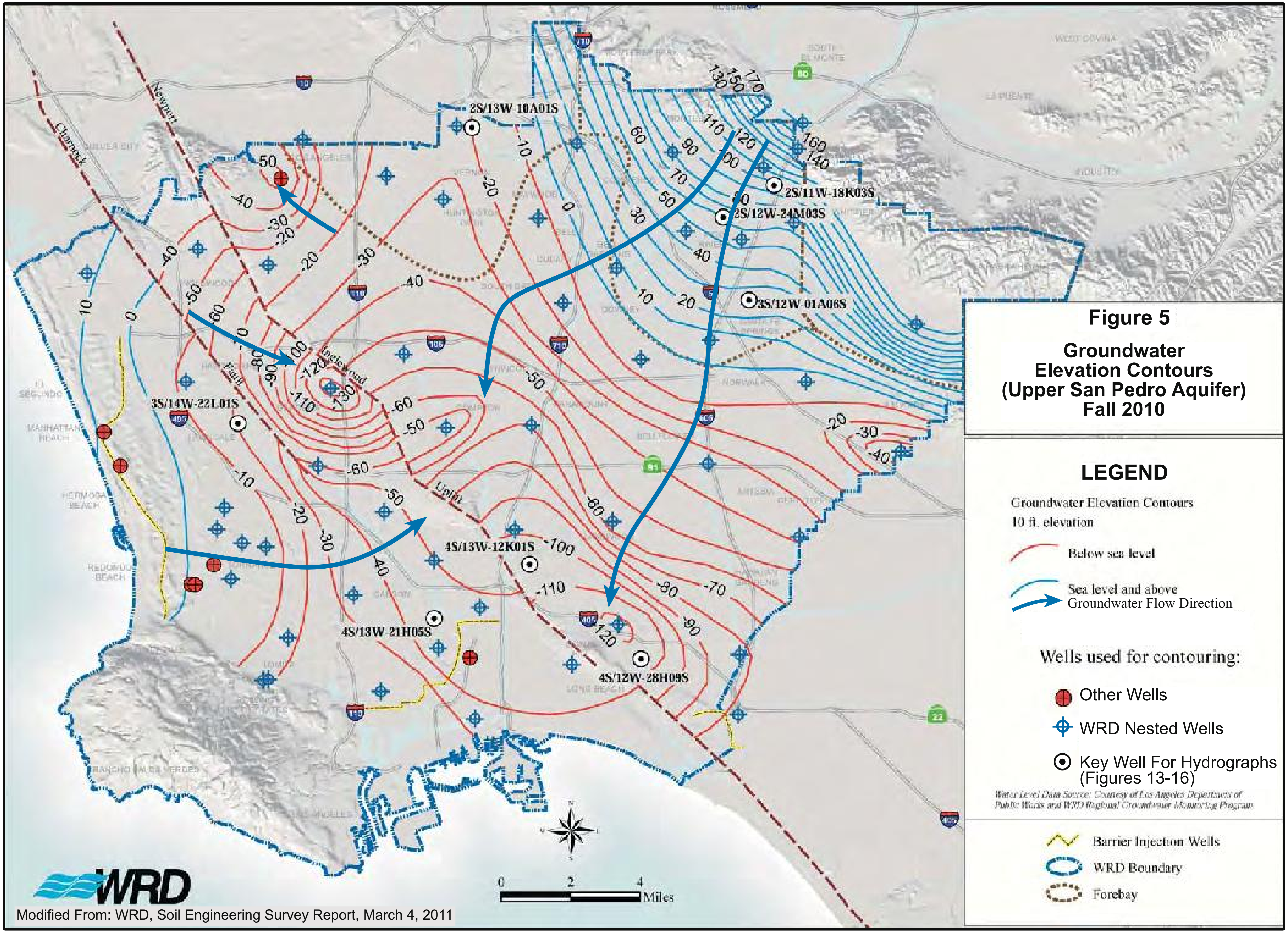
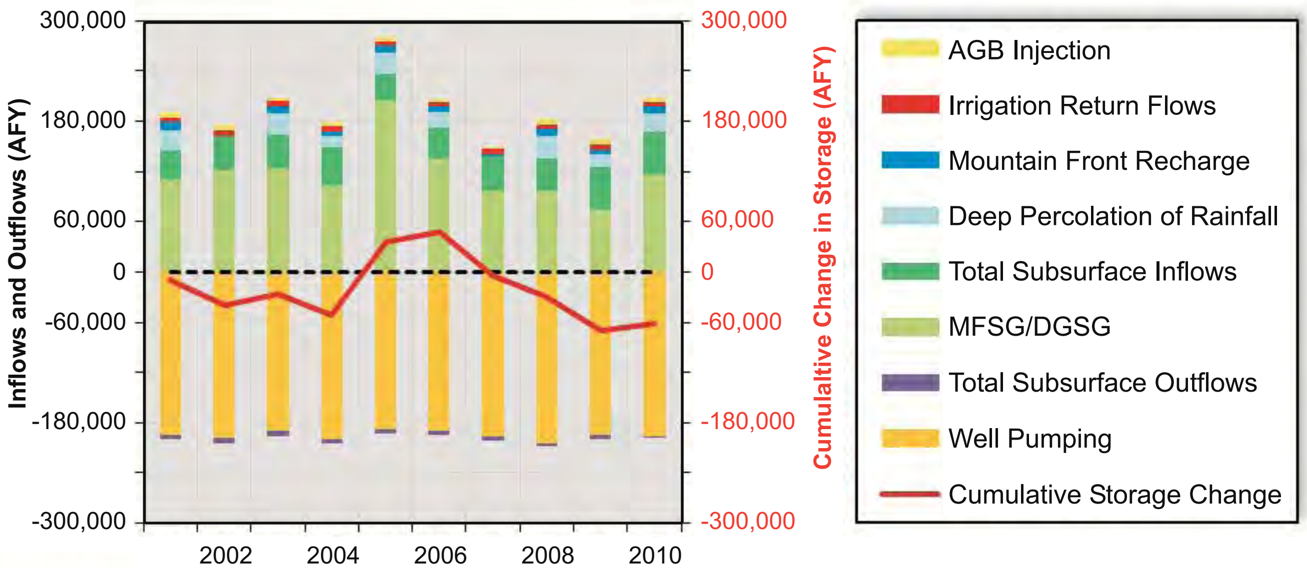
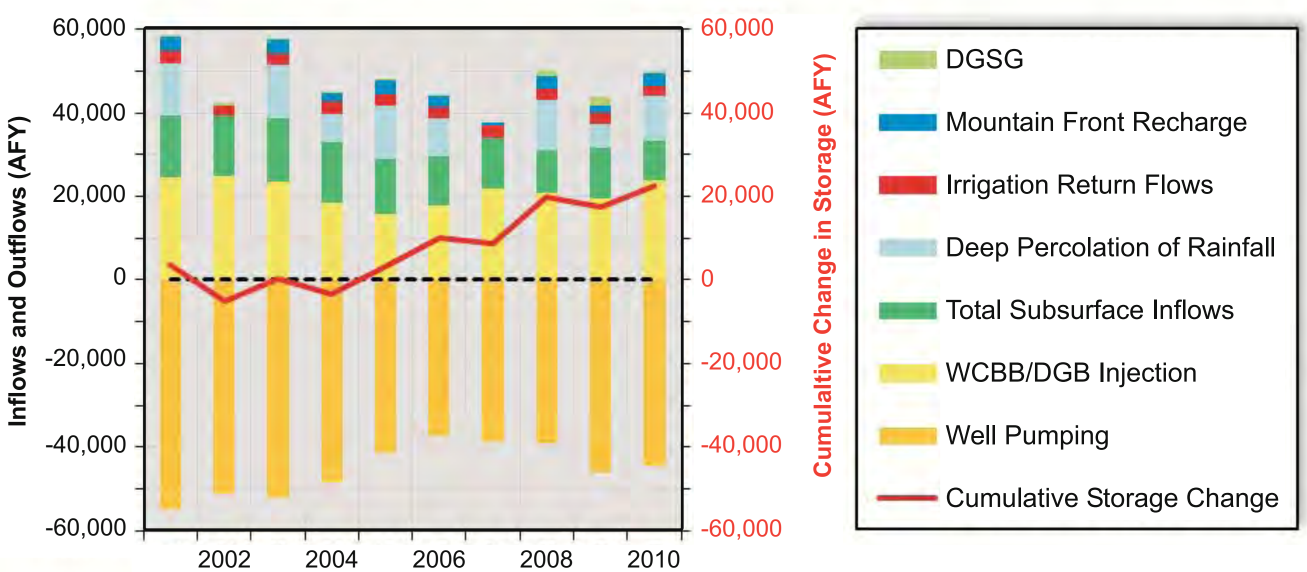


Figure 5
Groundwater
Elevation Contours
(Upper San Pedro Aquifer)
Fall 2010
LEGEND
Groundwater Elevation Contours
10 ft. elevation
Below sea level
Sea level and above
Groundwater Flow Direction
Wells used for contouring:
Other Wells
WRD Nested Wells
Key Well For Hydrographs
(Figures 13-16)
Barrier Injection Wells
WRD Boundary
Forebay
2S/13W-10A01S
2S/11W-18K03S
2S/12W-24M03S
3S/12W-01A06S
3S/14W-22L01S
4S/13W-12K01S
4S/13W-21H05S
4S/12W-28H09S
Newport
Inglewood
Fault
Uplift
Charnock
0
2
4
Miles
WRD
Modified From: WRD, Soil Engineering Survey Report, March 4, 2011

Central Basin - All Layers



West Coast Basin - All Layers



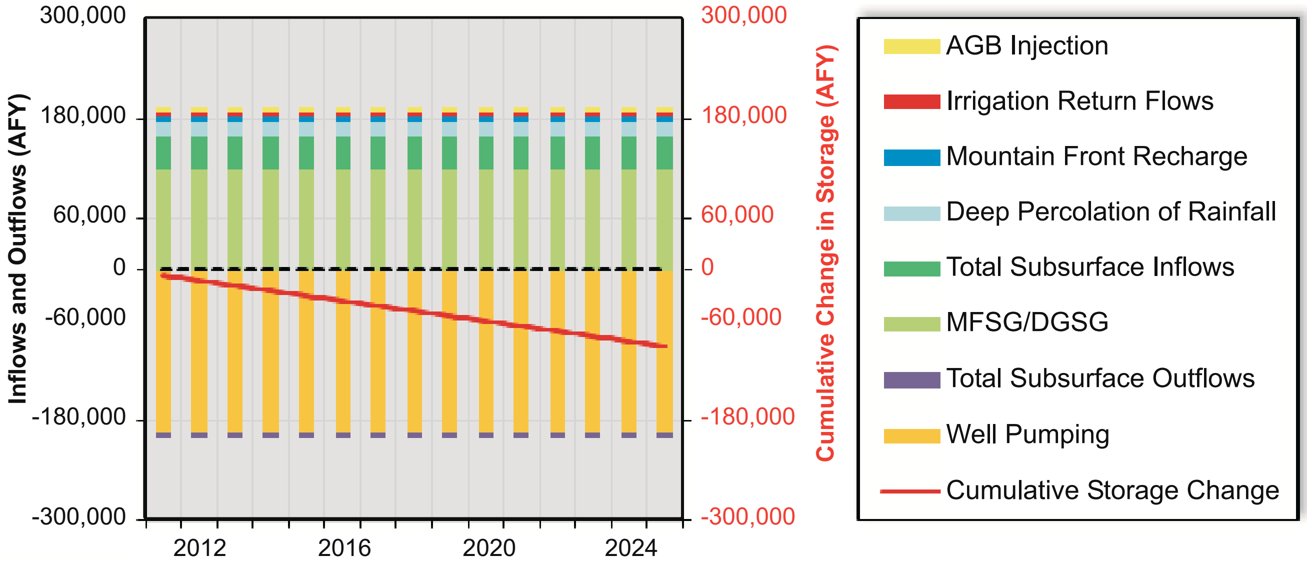
Notes:

DGSG - Dominguez Gap Spreading Grounds
MFSG - Montebello Forebay Spreading Grounds
AGB - Alamitos Gap Barrier
WCBB - West Coast Basin Barrier
DGB - Dominguez Gap Barrier
AFY - Acre-feet per Year

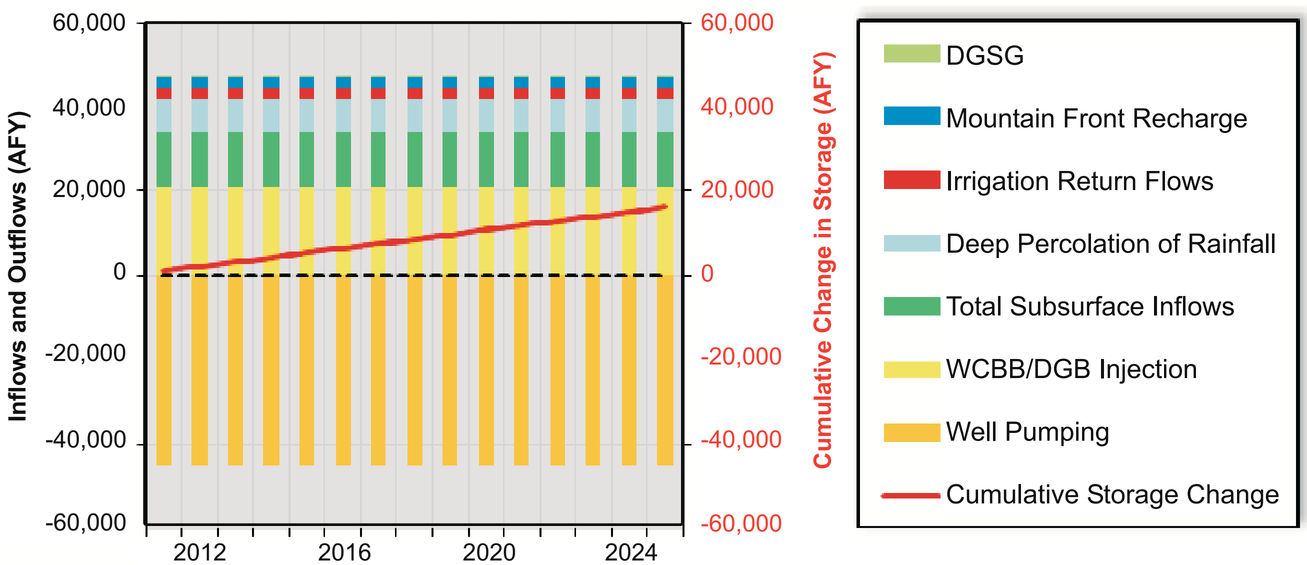
TODD GROUNDWATER

Figure 6
Baseline Period Water Balances

Central Basin - All Layers



West Coast Basin - All Layers



Notes:

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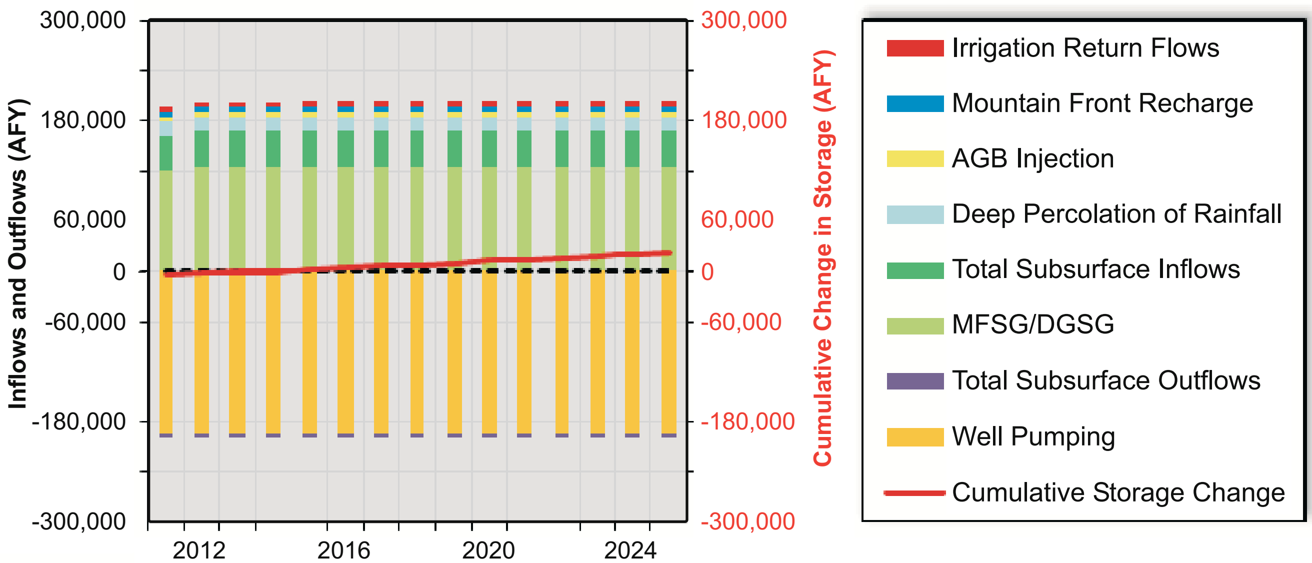
MFSG - Montebello Forebay Spreading Grounds
AGB - Alamitos Gap Barrier
WCBB - West Coast Basin Barrier
DGB - Dominguez Gap Barrier
AFY - Acre-feet per Year

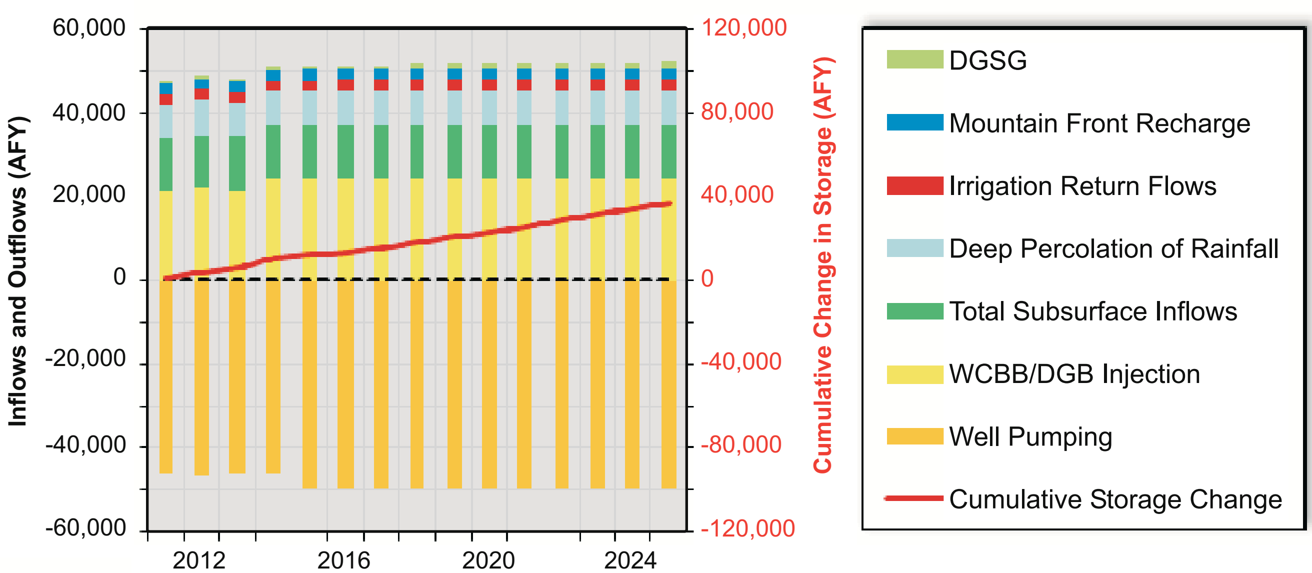
TODD GROUNDWATER

Figure 7
Future Planning Period No Future Projects Scenario Water Balances

Central Basin - All Layers



West Coast Basin - All Layers



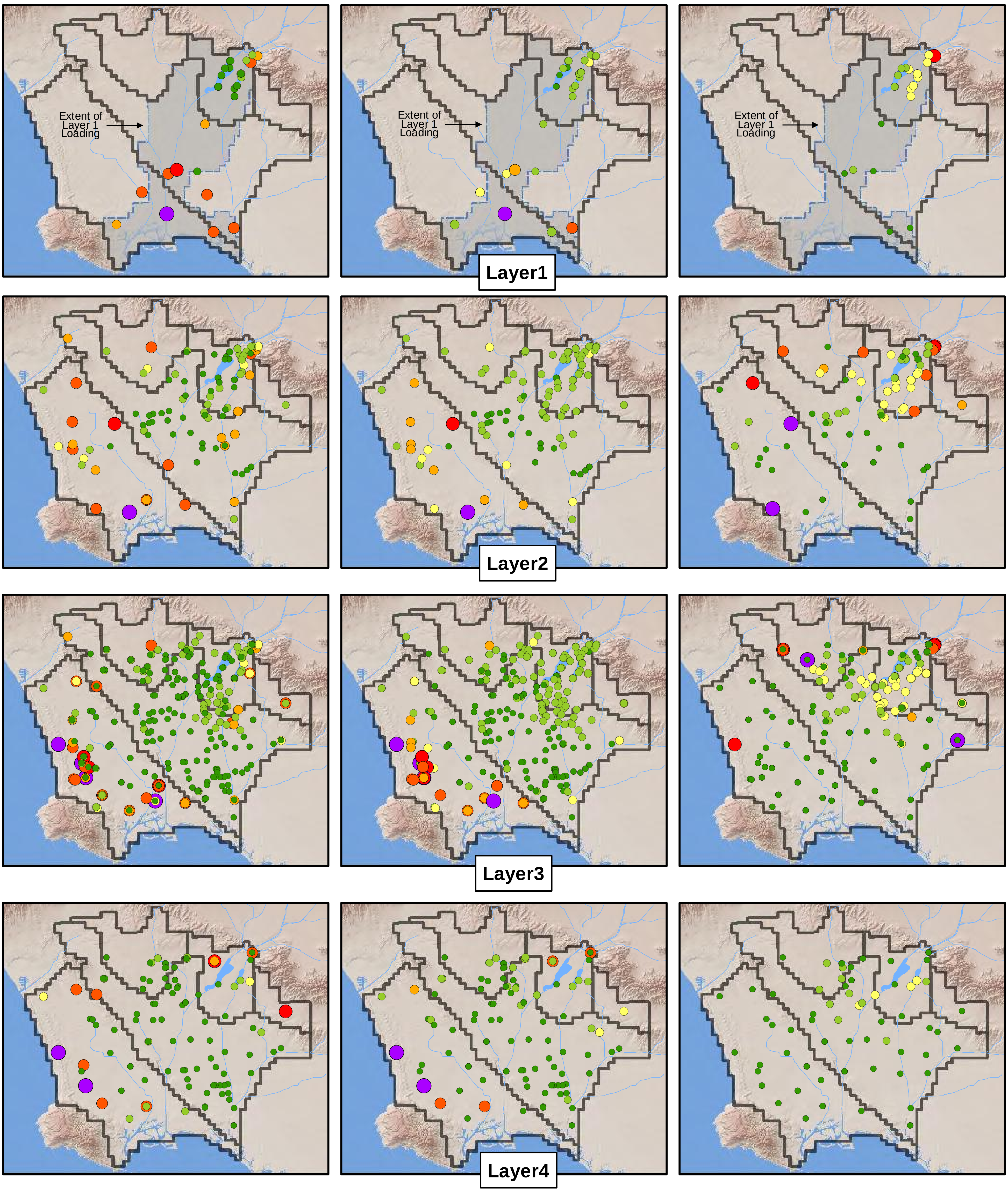
Notes:

DGSG - Dominguez Gap Spreading Grounds
MFSG - Montebello Forebay Spreading Grounds
AGB - Alamitos Gap Barrier
WCBB - West Coast Basin Barrier
DGB - Dominguez Gap Barrier
AFY - Acre-feet per Year

TODD GROUNDWATER

Figure 8
Future Planning Period
All Projects Scenario
Water Balances

TDS | CHLORIDE | NITRATE



Legend

Median TDS (mg/L)

- >4,000
- 2,001 to 4,000
- 1,001 to 2,000
- 801 to 1,000
- 701 to 800
- 501 to 700
- 500 or less

Legend

Median Chloride (mg/L)

- >2,000
- 1,001 to 2,000
- 501 to 1,000
- 251 to 500
- 151 to 250
- 51 to 150
- 50 or less

Legend

Median Nitrate - N (mg/L)

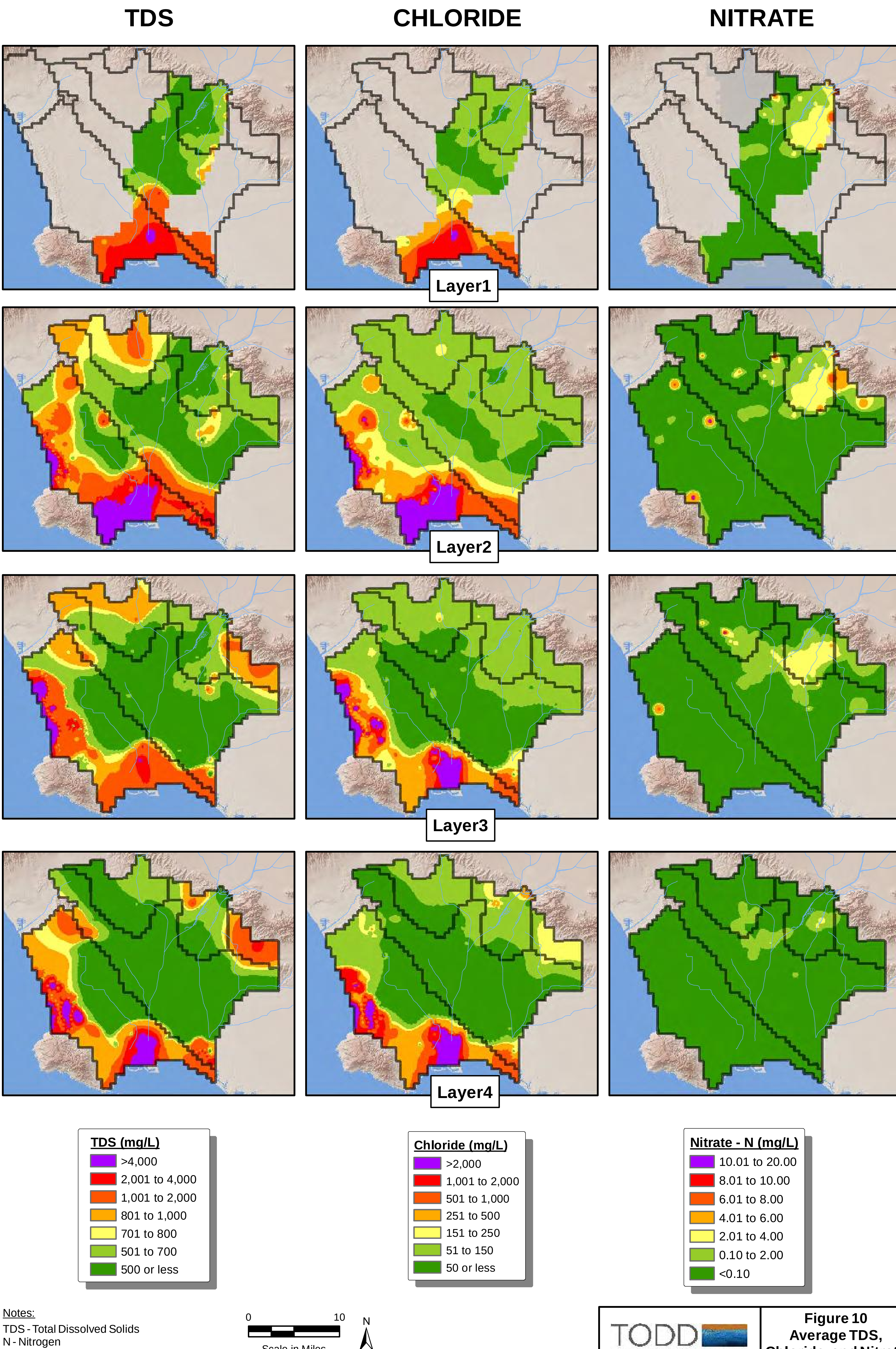
- 10.01 to 20.00
- 8.01 to 10.00
- 6.01 to 8.00
- 4.01 to 6.00
- 2.01 to 4.00
- 0.10 to 2.00
- <0.10

Notes:
TDS - Total Dissolved Solids
N - Nitrogen
mg/L - milligrams per Liter

0 10
Scale in Miles
N

TODD GROUNDWATER

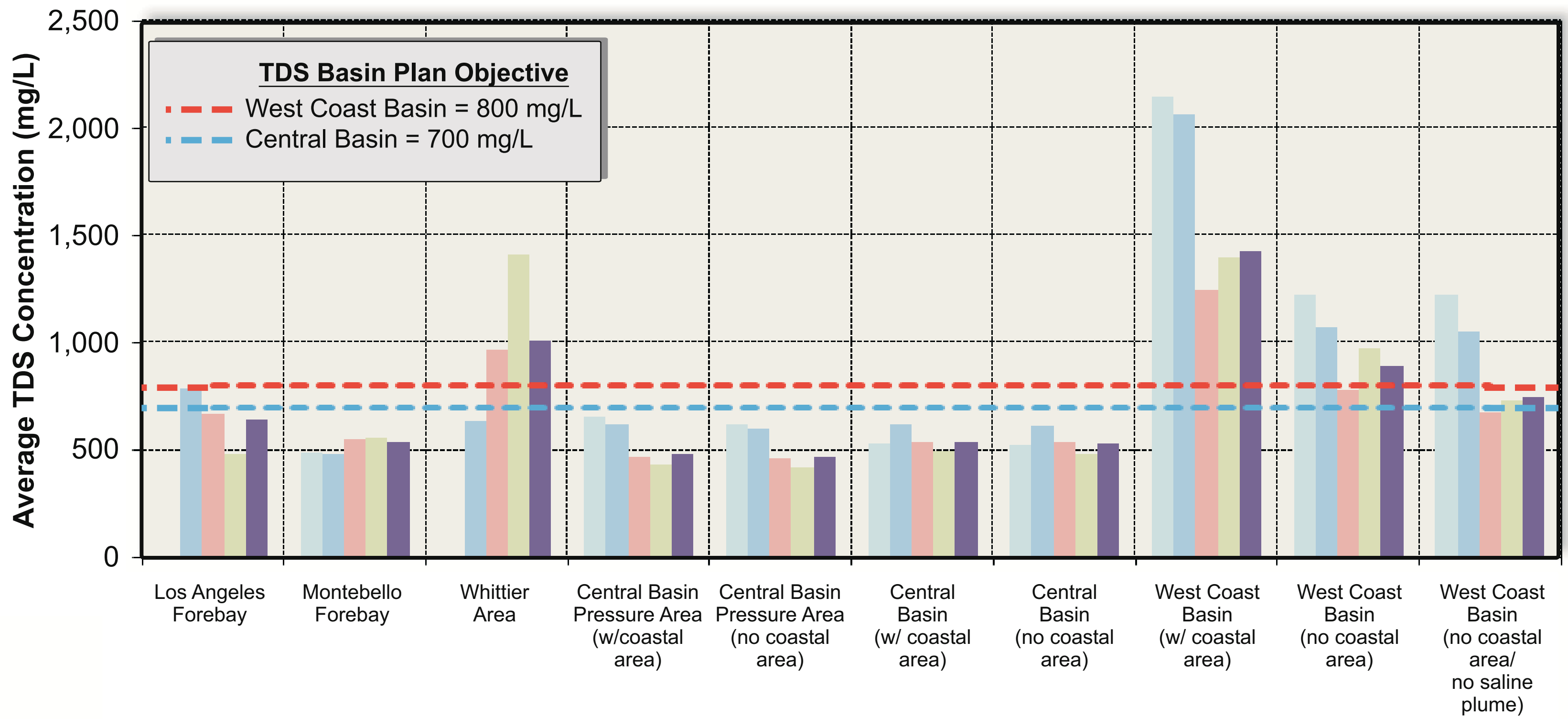
Figure 9
Median TDS, Chloride, and Nitrate Well Concentrations



Notes:
TDS - Total Dissolved Solids
N - Nitrogen
mg/L - milligrams per Liter

TODD GROUNDWATER

Figure 10
Average TDS, Chloride, and Nitrate Contours



LEGEND

- Layer 1
- Layer 2
- Layer 3
- Layer 4
- Layers 1-4

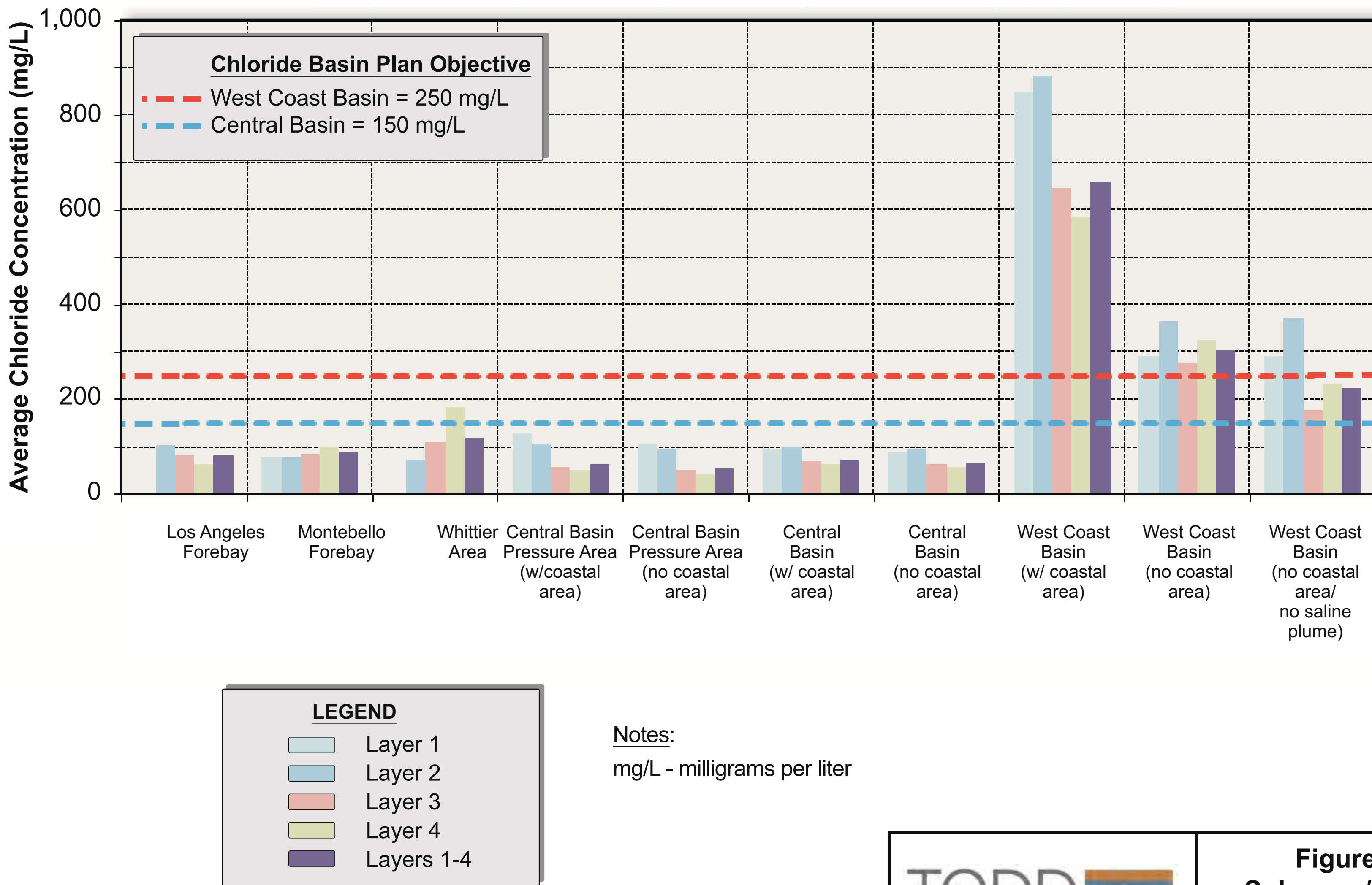
Notes:

TDS - Total Dissolved Solids

mg/L - milligrams per liter

TODD GROUNDWATER

Figure 11
Subareas/Layers/ Basins Average TDS Concentrations



Notes:

mg/L - milligrams per liter

TODD GROUNDWATER

Figure 12
Subareas/Layers/ Basins Average Chloride Concentrations

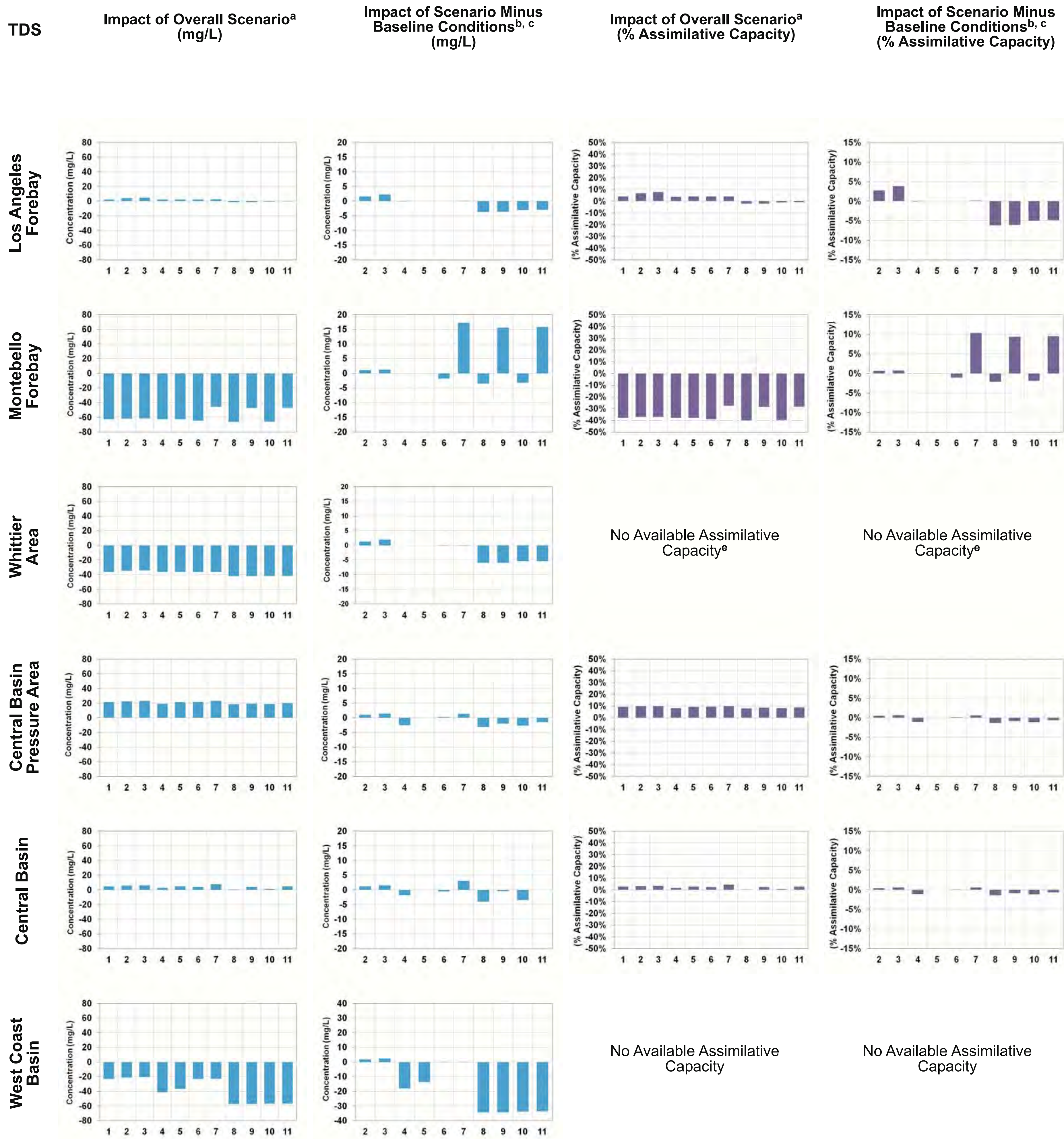
Notes:

N - Nitrogen

mg/L - milligrams per liter

TODD GROUNDWATER

Figure 13
Subareas/Layers/ Basins Average Nitrate-N Concentrations



Scenarios:

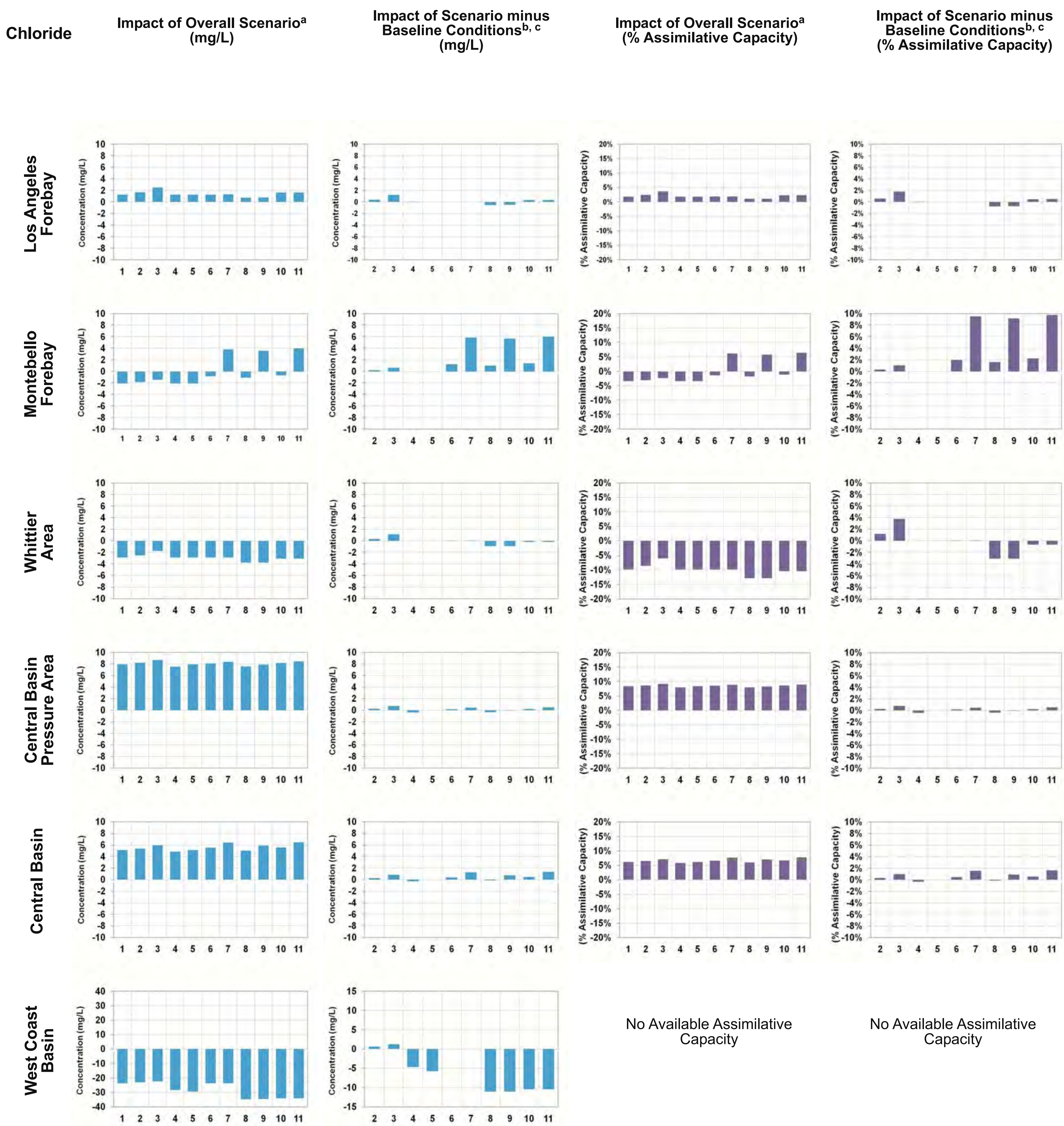
1. No Future Projects
2. Increased Recycled Water Irrigation (baseline average water quality)
3. Increased Recycled Water Irrigation (MCL/SMCL water quality)
4. Seawater Barriers (Increased Volume and AWT recycled water)
5. Increased Desalter Pumping and Treatment
6. GRIP A (10,000 AFY AWT and 11,000 AFY Tertiary-treated recycled water)
7. GRIP B (21,000 AFY [100%] Tertiary-treated recycled water)
8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)[d]
9. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)[d]
10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)[d]
11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)[d]

Notes:

TDS - total dissolved solids
MCL - maximum contaminant limit
SMCL - secondary maximum contaminant limit
AWT - advanced water treatment
AFY - acre-feet per year
mg/L - milligrams per liter
GRIP - Groundwater Reliability Improvement Program
a - "Overall Scenario" quantifies the impacts of the indicated future project in combination with existing projects in the CBWCB, i.e. including average baseline conditions (No Future Projects Scenario) continued through the future planning period
b - Quantifies impact of future project(s) minus impact of average baseline conditions (No Future Projects Scenario) continued through future planning horizon
c - Positive value indicates the scenario is increasing concentrations or using additional available assimilative capacity; negative value indicates the scenario is improving groundwater quality or increasing available assimilative capacity
d - Minor Future Changes included in Scenarios 8 through 11 include projected background changes including increased spreading at Dominguez Gap Spreading Grounds, reduced imported water for municipal supply in Central Basin, and increased imported water for supply in West Coast Basin
e - Elevated TDS in Whittier Area due to naturally occuring conditions

Figure 14
TDS Scenario Impacts on Groundwater Quality and Use of Assimilative Capacity

TODD GROUNDWATER



Scenarios:

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3. Increased Recycled Water Irrigation (MCL/SMCL water quality)
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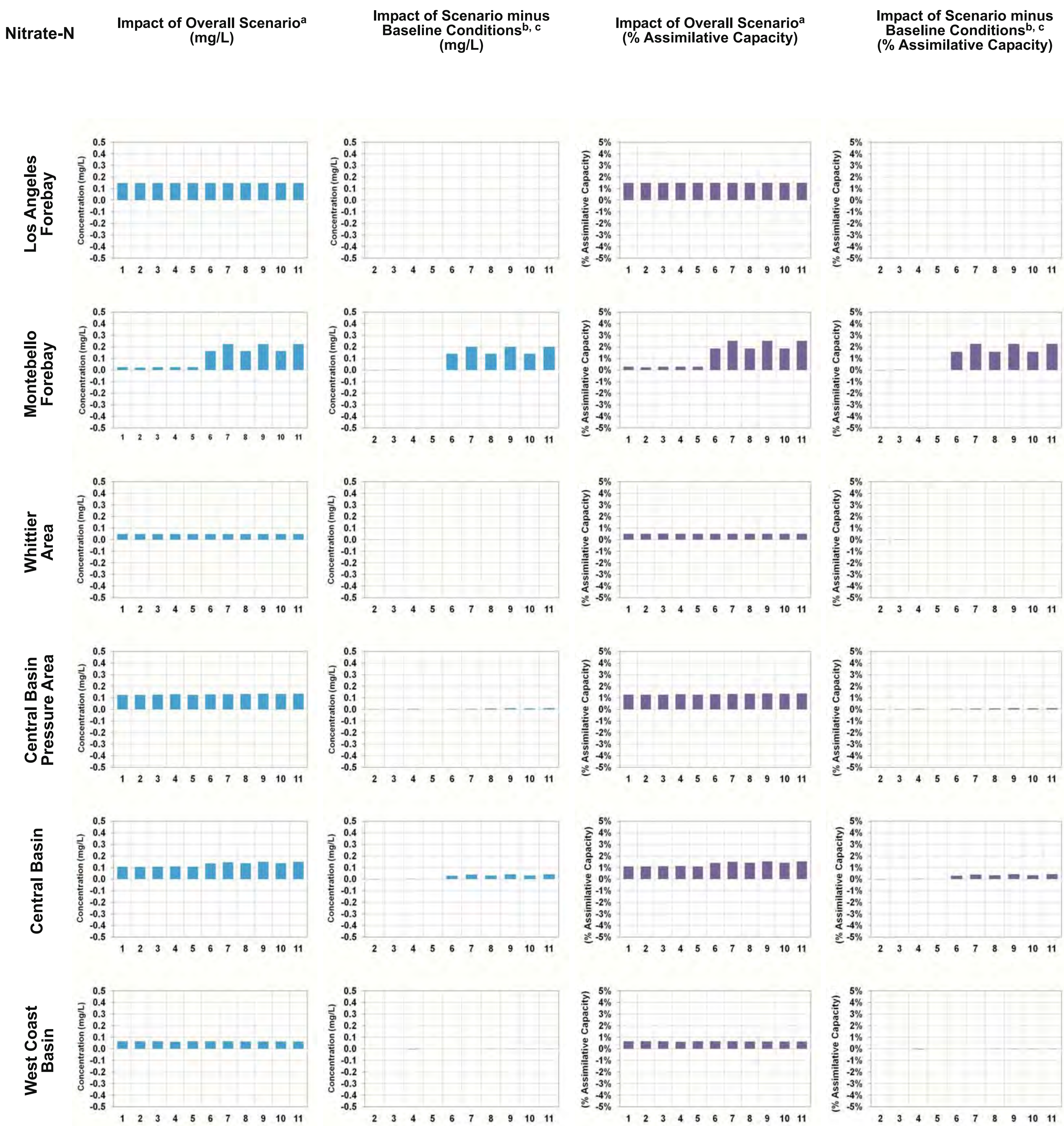
8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)[d]
8. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)[d]
8. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)[d]
8. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)[d]

Notes:

MCL - maximum contaminant limit
SMCL - secondary maximum contaminant limit
AWT - advanced water treatment
AFY - acre-feet per year
mg/L - milligrams per liter
GRIP - Groundwater Reliability Improvement Program
a - “Overall Scenario” quantifies the impacts of the indicated future project in combination with existing projects in the CBWCB, i.e. including average baseline conditions (No Future Projects Scenario) continued through the future planning period
b - Quantifies impact of future project(s) minus impact of average baseline conditions (No Future Projects Scenario) continued through future planning horizon
c - Positive value indicates the scenario is increasing concentrations or using additional available assimilative capacity; negative value indicates the scenario is improving groundwater quality or increasing available assimilative capacity
d - Minor Future Changes included in Scenarios 8 through 11 include projected background changes including increased spreading at Dominguez Gap Spreading Grounds, reduced imported water for municipal supply in Central Basin, and increased imported water for supply in West Coast Basin

Figure 15
Chloride Scenario Impacts on Groundwater Quality and Use of Assimilative Capacity

TODD GROUNDWATER



Scenarios:

1. No Future Projects
2. Increased Recycled Water Irrigation (baseline average water quality)
3. Increased Recycled Water Irrigation (MCL/SMCL water quality)
4. Seawater Barriers (Increased Volume and AWT recycled water)
5. Increased Desalter Pumping and Treatment
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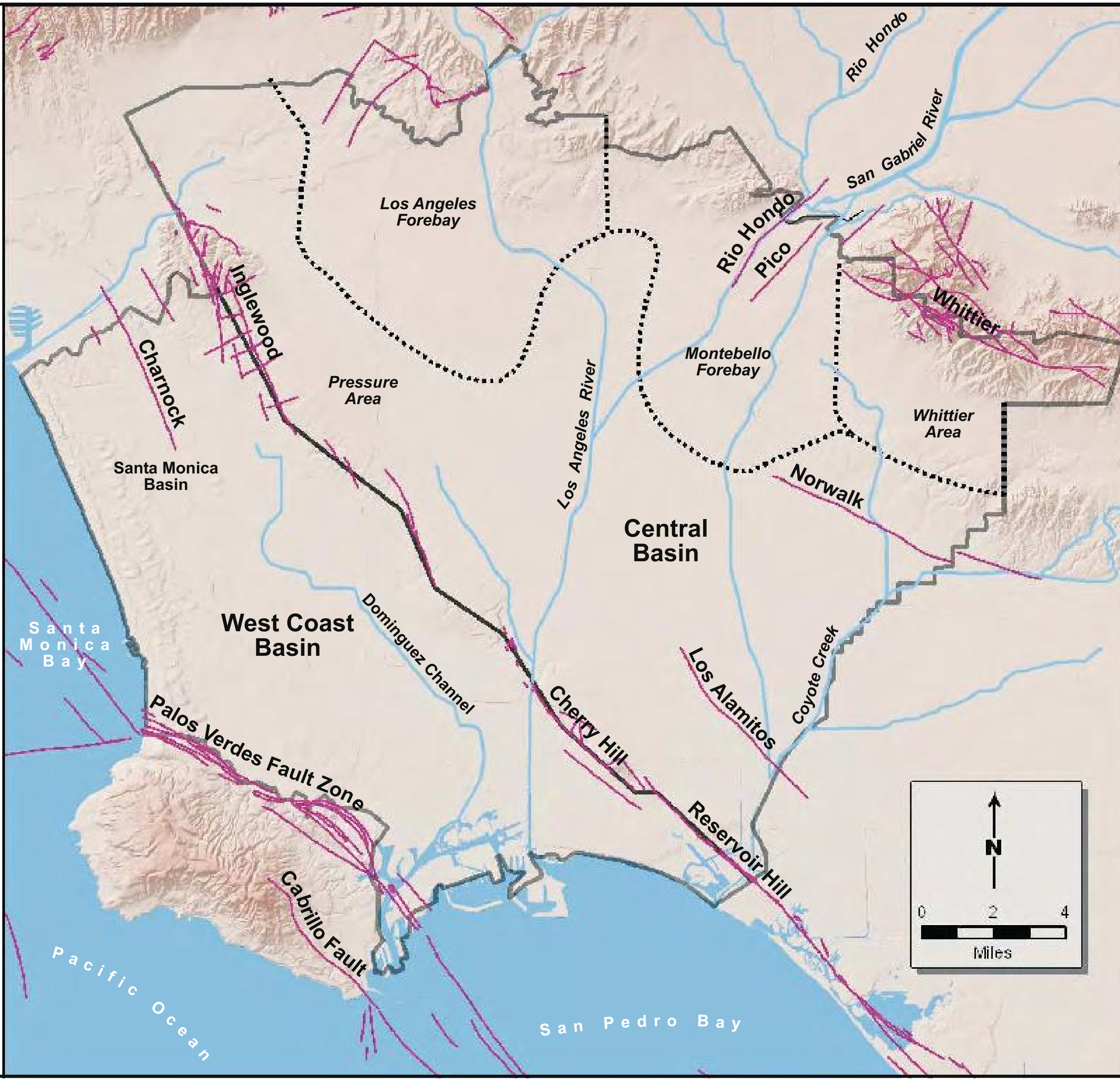
8. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)[d]
8. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)[d]

Notes:

Nitrate-N - nitrate as nitrogen
MCL - maximum contaminant limit
SMCL - secondary maximum contaminant limit
AWT - advanced water treatment
AFY - acre-feet per year
mg/L - milligrams per liter
GRIP - Groundwater Reliability Improvement Program
a - “Overall Scenario” quantifies the impacts of the indicated future project in combination with existing projects in the CBWCB, i.e. including average baseline conditions (No Future Projects Scenario) continued through the future planning period
b - Quantifies impact of future project(s) minus impact of average baseline conditions (No Future Projects Scenario) continued through future planning horizon
c - Positive value indicates the scenario is increasing concentrations or using additional available assimilative capacity; negative value indicates the scenario is improving groundwater quality or increasing available assimilative capacity
d - Minor Future Changes included in Scenarios 8 through 11 include projected background changes including increased spreading at Dominguez Gap Spreading Grounds, reduced imported water for municipal supply in Central Basin, and increased imported water for supply in West Coast Basin

Figure 16
Nitrate Scenario Impacts on Groundwater Quality and Use of Assimilative Capacity

TODD GROUNDWATER



Legend

Fault

Stream

Basin Subarea

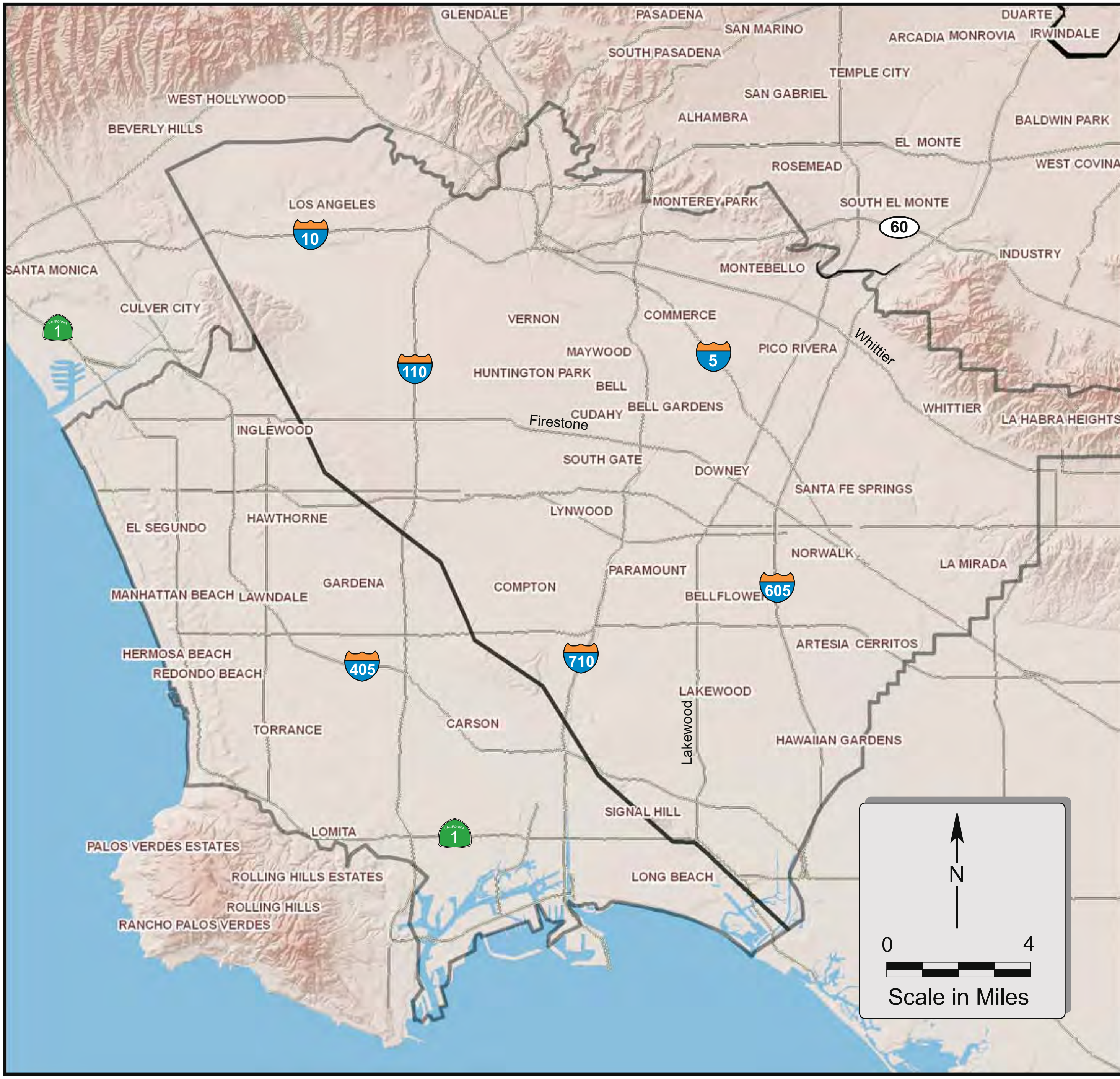
DWR Groundwater Basin

Notes:

DWR - California Department of Water Resources

Figure 17
Fault Systems

TODD GROUNDWATER



Legend

DWR Groundwater Basin

Notes:

DWR - California Department of Water Resources

CBWCB - Central Basin and West Coast Basin

Figure 18
Cities
in the CBWCB

TODD GROUNDWATER

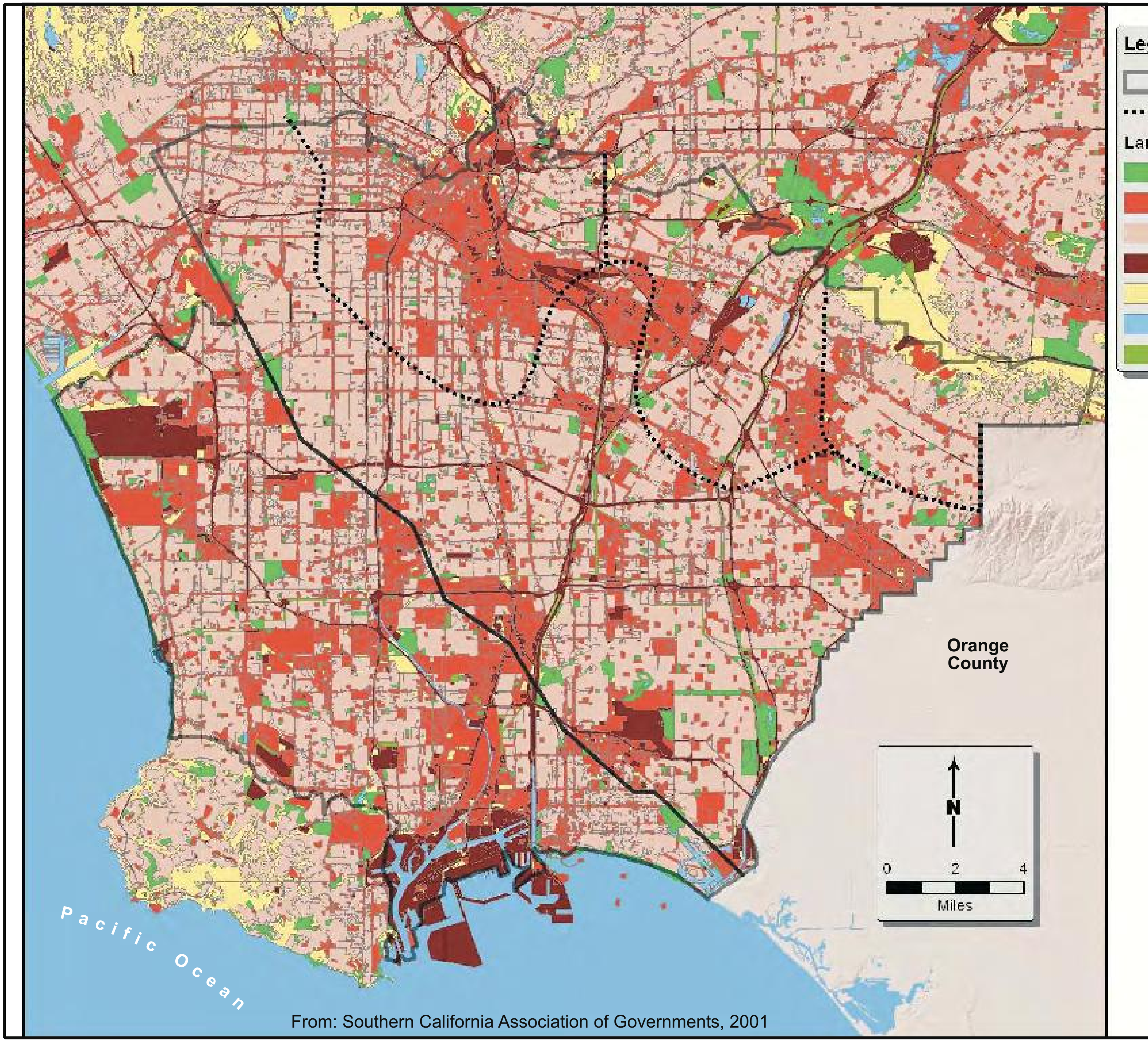


Figure 19
Land Use

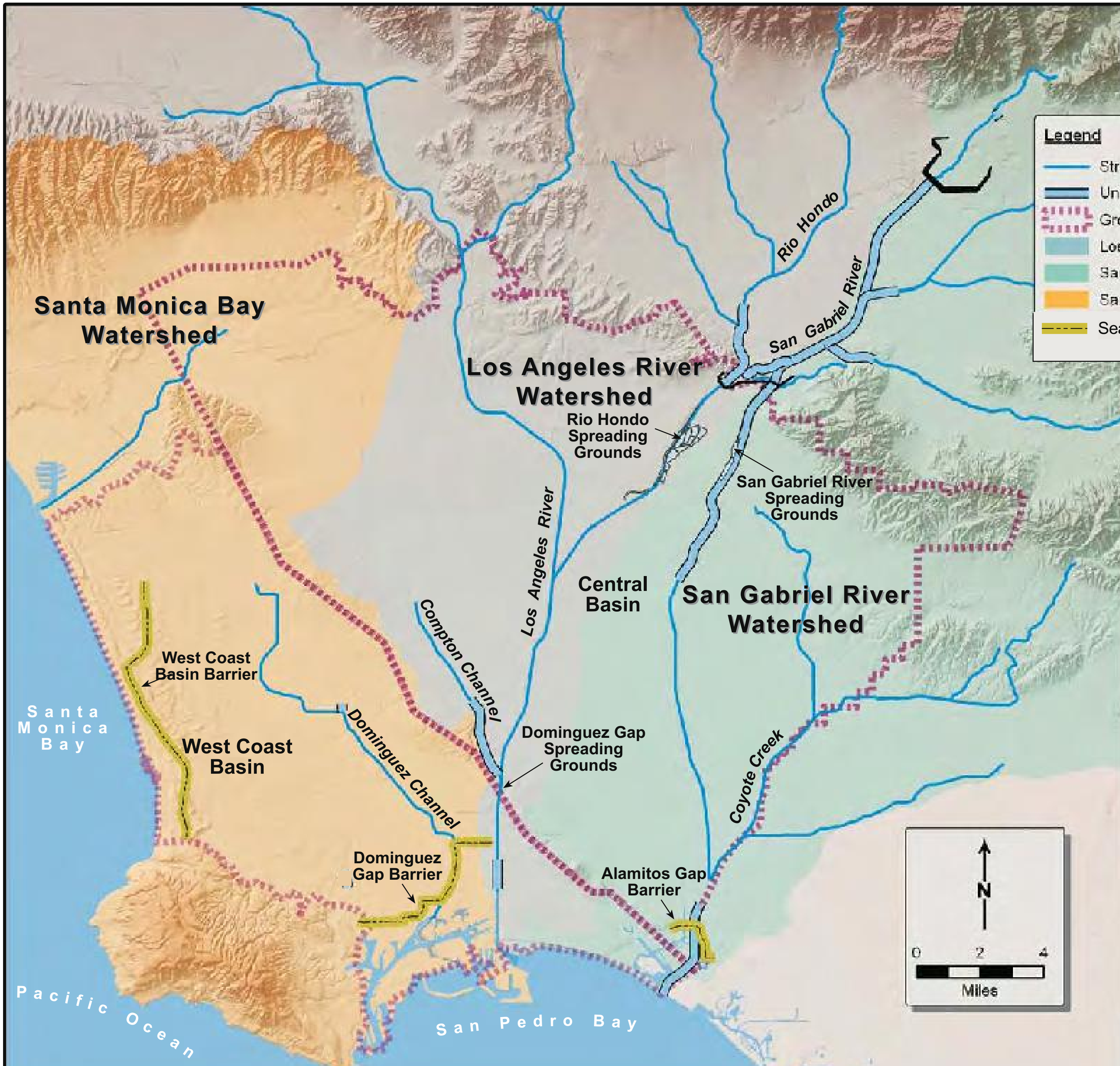
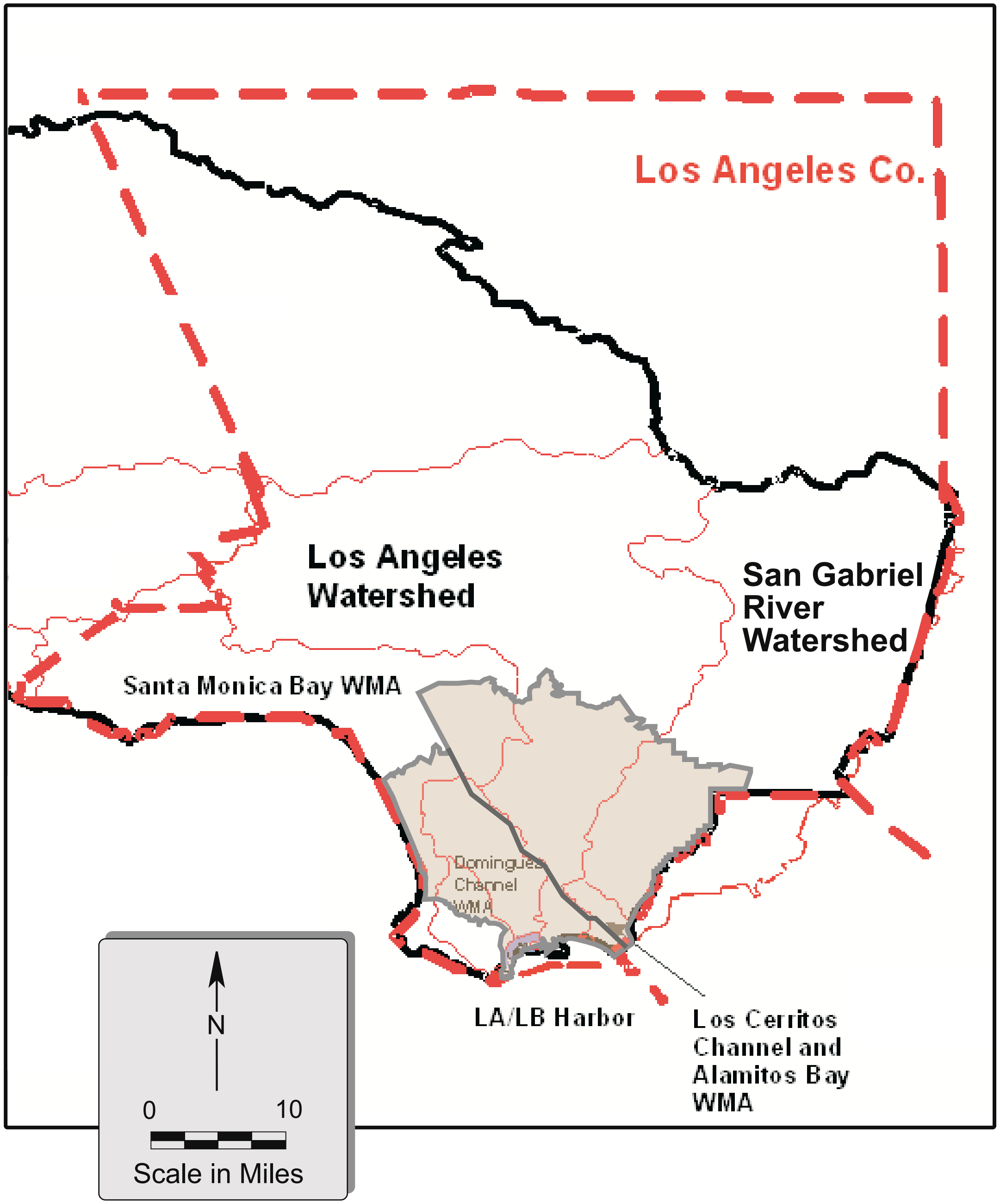


Figure 20
Watersheds

TODD GROUNDWATER



Legend

DWR Groundwater Basin or Subbasin

Notes:

WMA - Watershed Management Area

LA/LB - Los Angeles/Long Beach

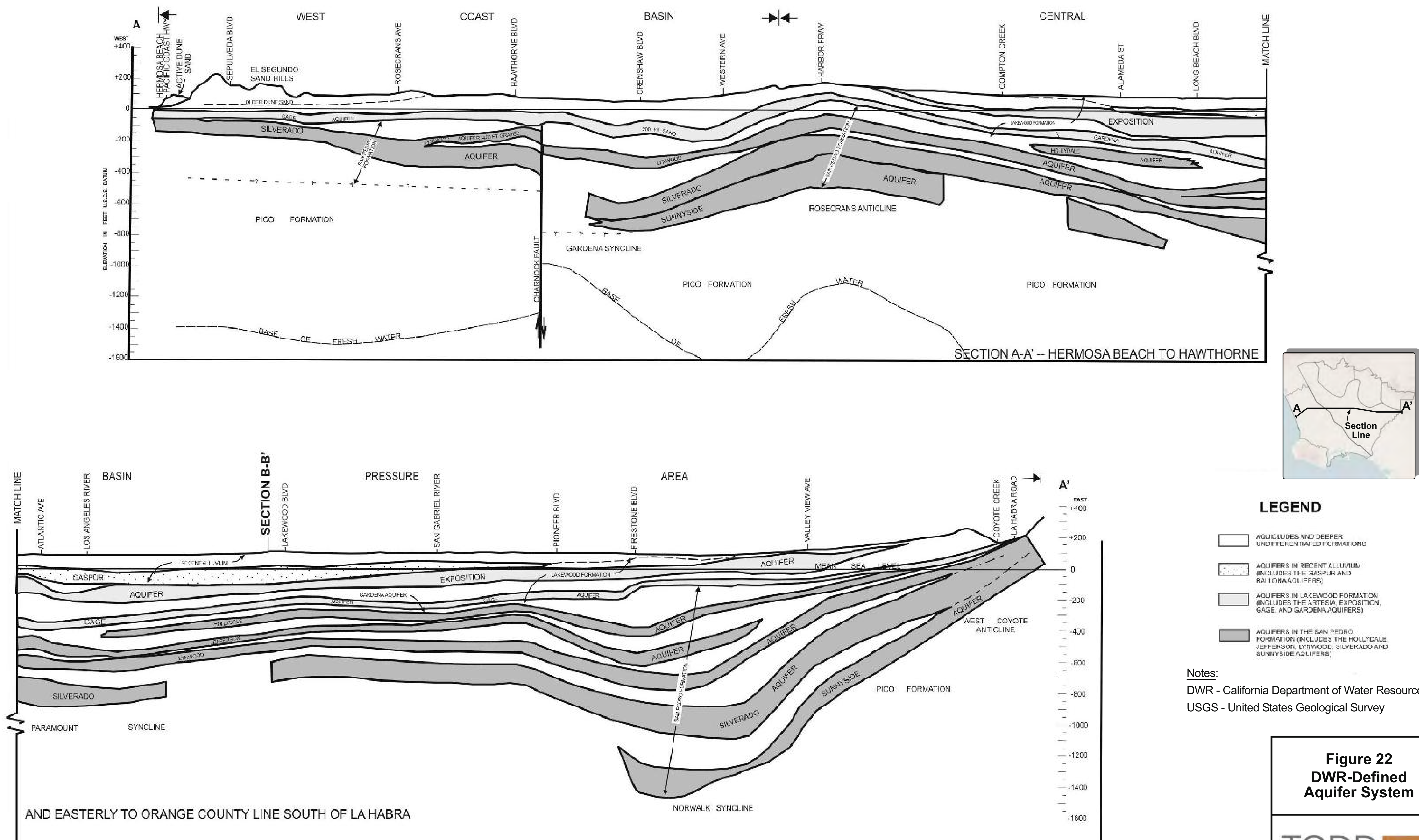
LARWQCB - Los Angeles Regional Water Quality Control Board

DWR - California Department of Water Resources

Modified from: Los Angeles Regional Water Quality Control Board, December 2007

Figure 21
LARWQCB Watershed Management Areas

TODD GROUNDWATER



Notes:

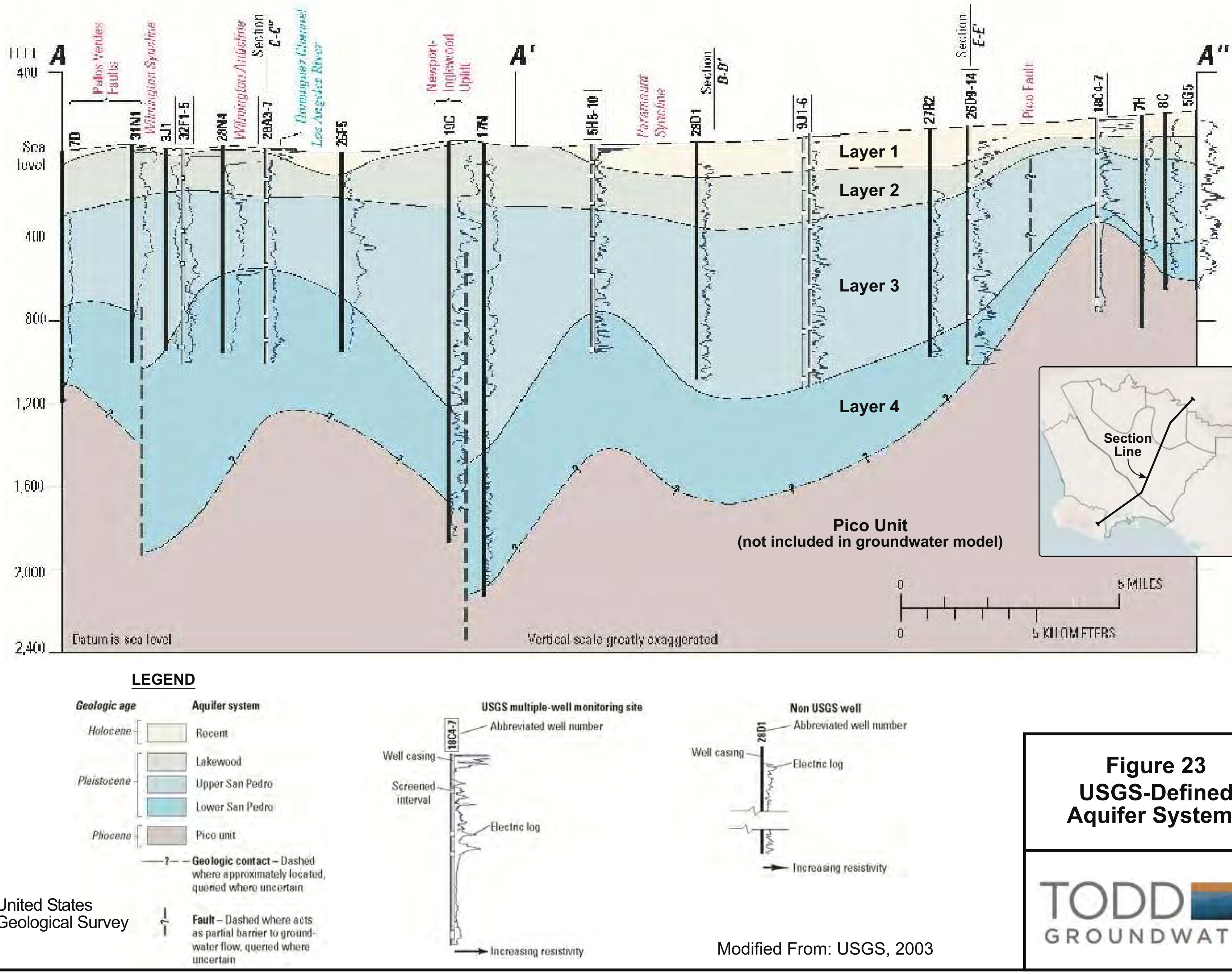
DWR - California Department of Water Resources

USGS - United States Geological Survey

Modified from: DWR, 1961, Bulletin 104, Appendix B

Figure 22
DWR-Defined Aquifer System

TODD GROUNDWATER



Notes:

USGS - United States Geological Survey

Modified From: USGS, 2003

Figure 23
USGS-Defined Aquifer Systems

TODD GROUNDWATER

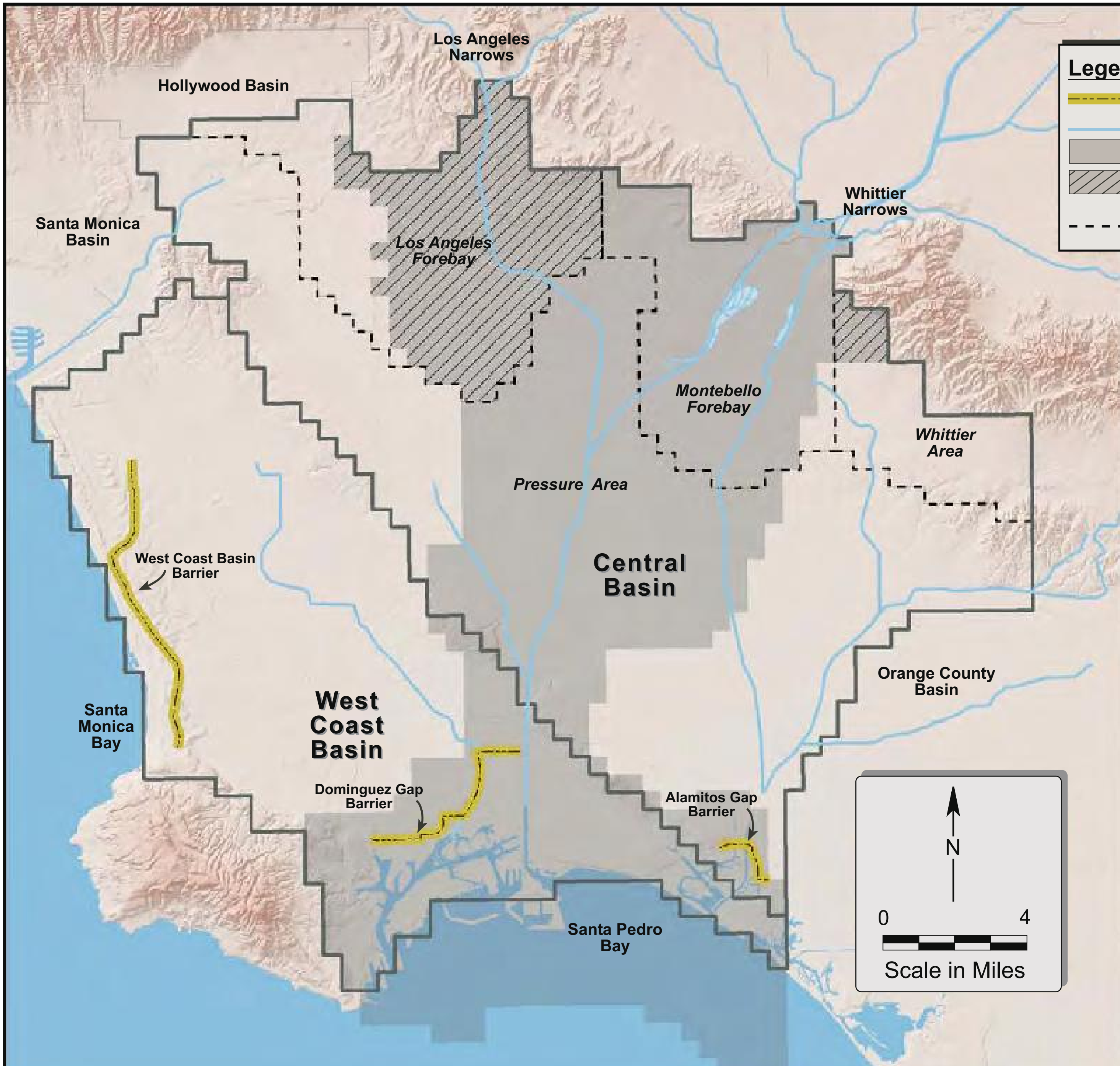
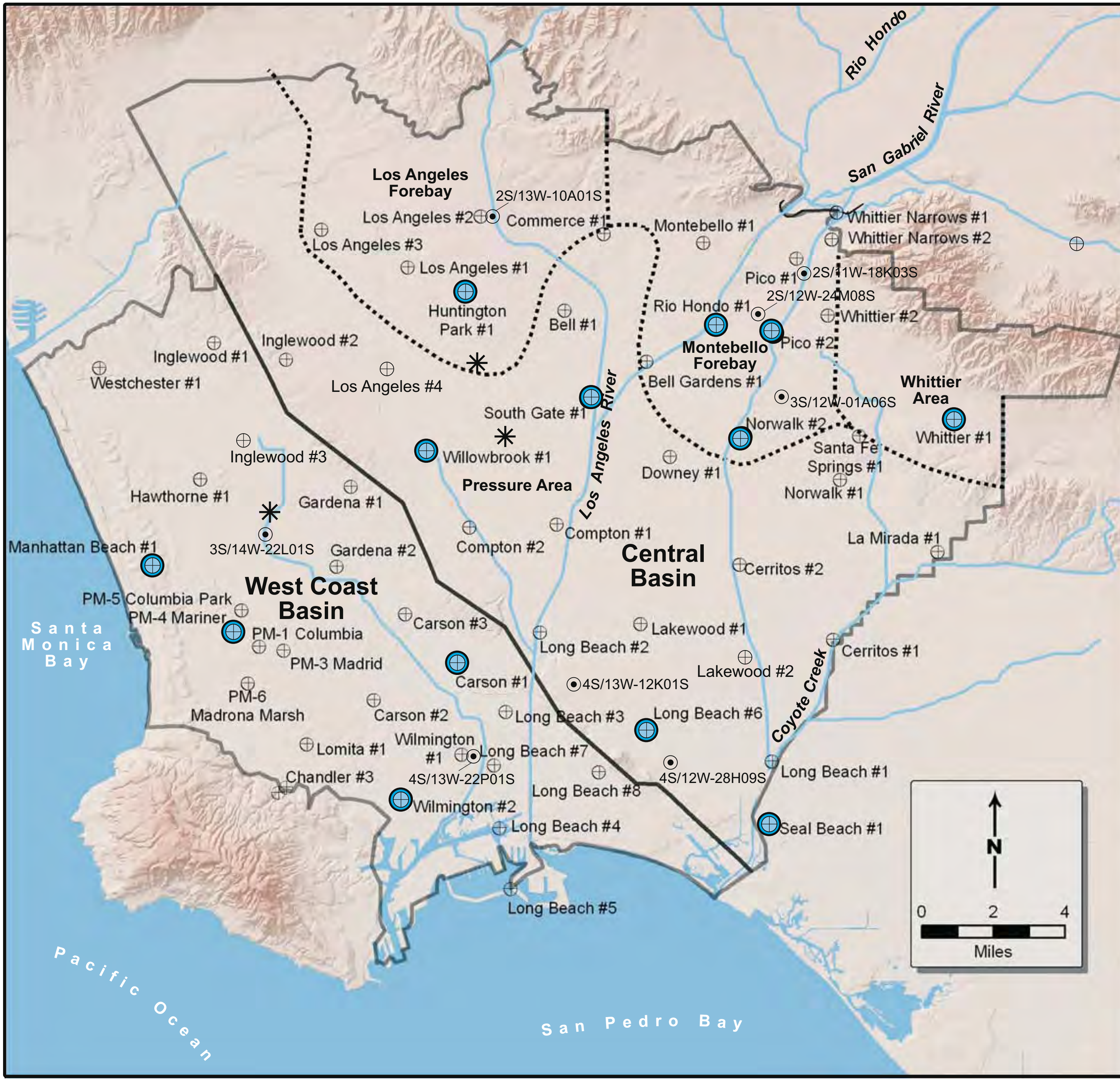


Figure 24
Extent of USGS Mapped Model Layer 1



Legend

- WRD Nested Monitoring Well
- Key Nested SNMP Monitoring Well
- Planned WRD Nested Monitoring Well
- Stream
- Basin Subarea
- DWR Groundwater Basin
- Current Key Water Level Monitoring Program Well

Notes:

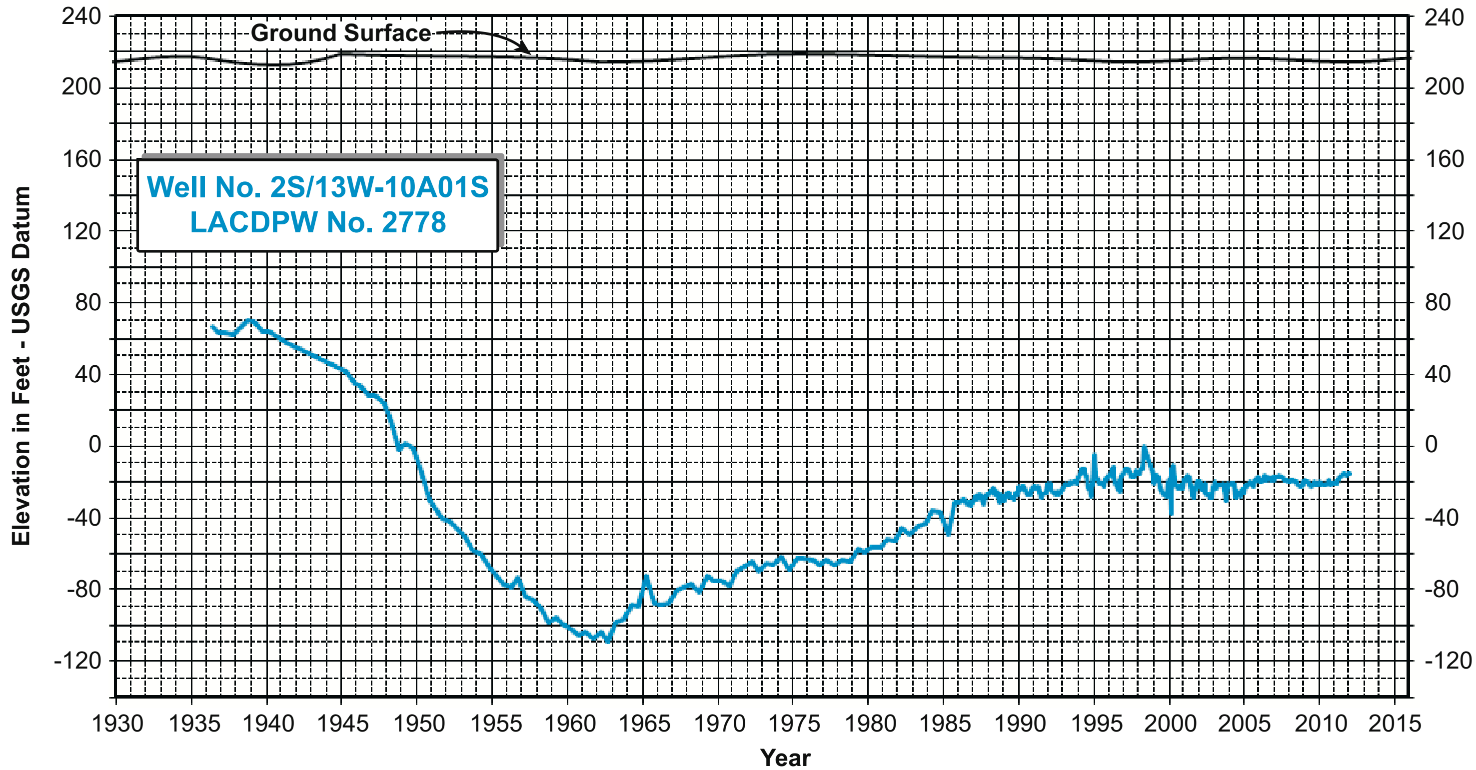
DWR - California Department of Water Resources

WRD - Water Replenishment District of California

SNMP - Salt and Nutrient Management Plan

Figure 25
Existing and Planned WRD Nested Groundwater Monitoring Wells

TODD GROUNDWATER



Notes: This is a key well designated in WRDs Engineering Survey and Report for long-term water level monitoring. Current key water level monitoring program wells shown on Figure 25.

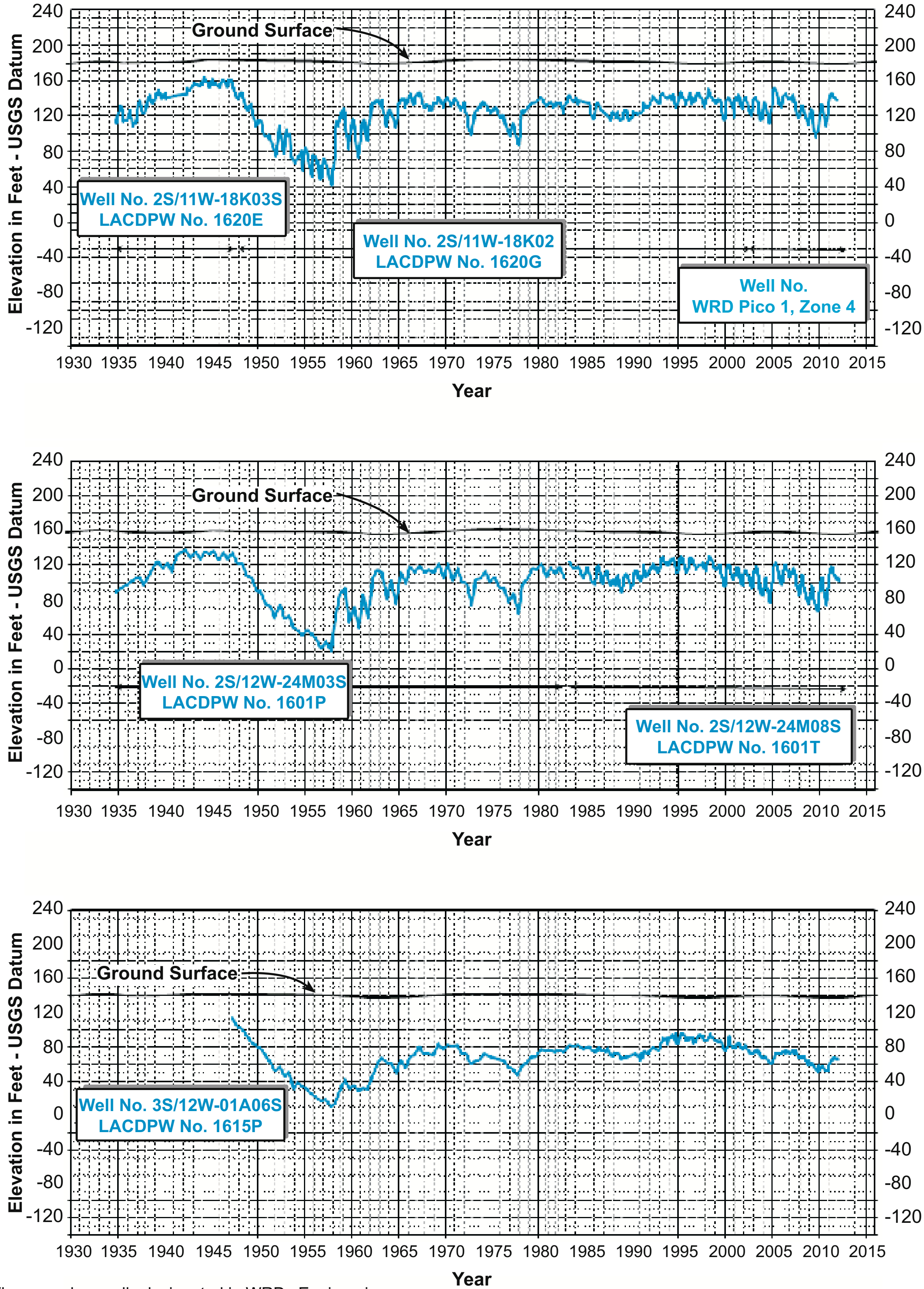
WRD - Water Replenishment District of California

LACDPW - Los Angeles County Department of Public Works

USGS - United States Geological Survey

Figure 26
Fluctuation of Water Levels in the Los Angeles Forebay

TODD GROUNDWATER



Notes: These are key wells designated in WRDs Engineering Survey and Report for long-term water level monitoring.

Current key water level monitoring program wells shown on Figure 25.

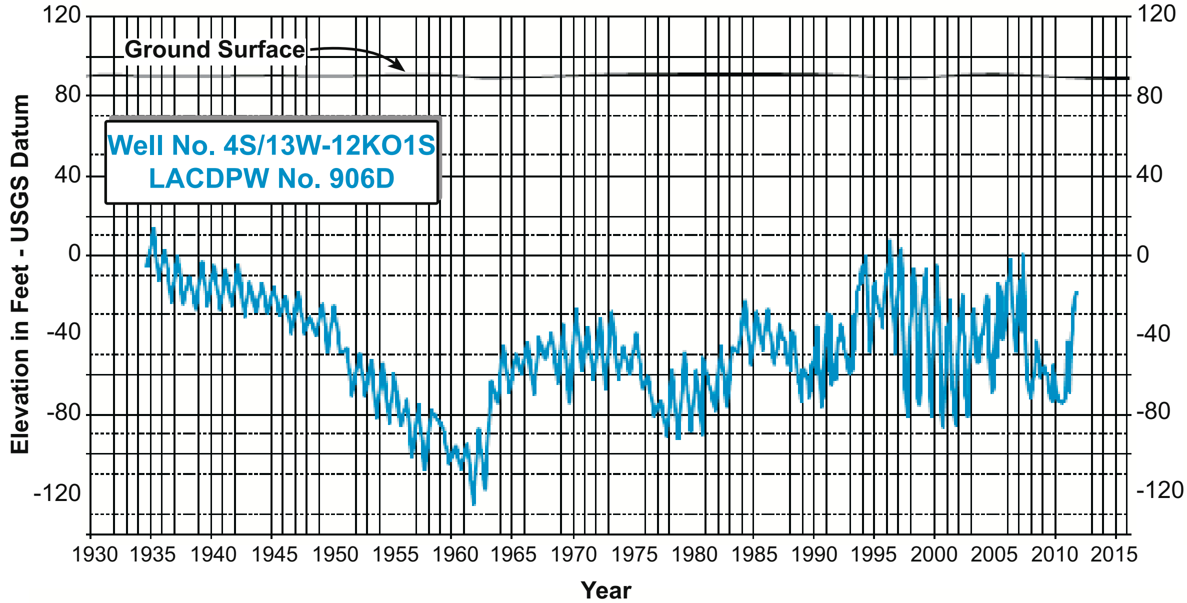
WRD - Water Replenishment District of California

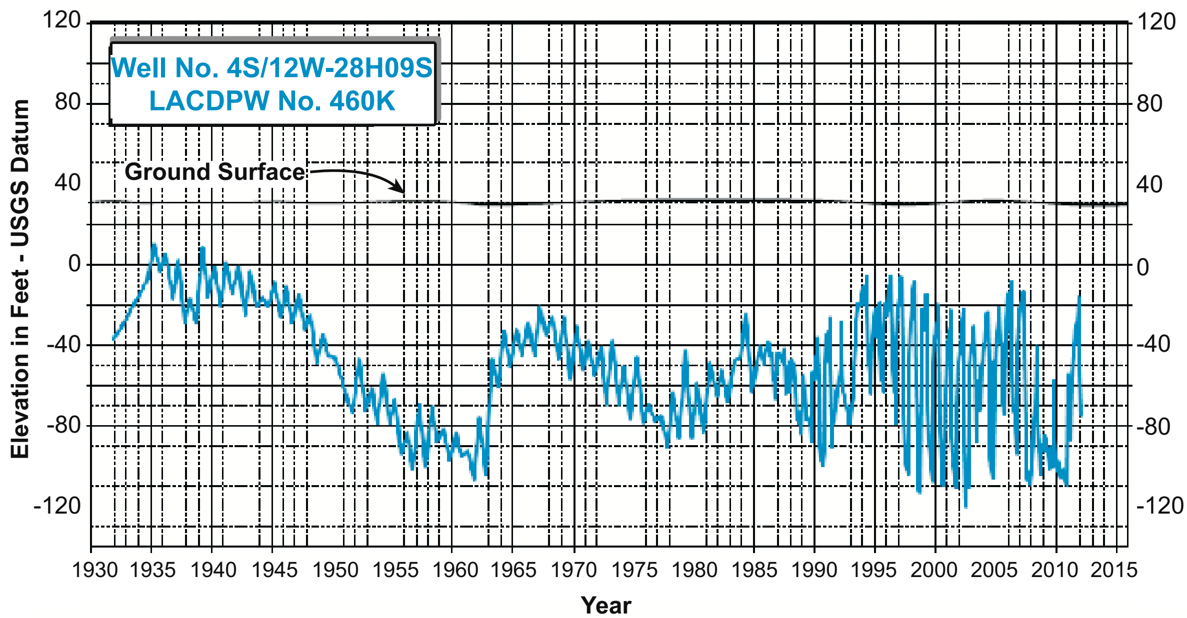
LACDPW - Los Angeles County Department of Public Works

USGS - United States Geological Survey

TODD GROUNDWATER

Figure 27
Fluctuation of Water Levels in the Montebello Forebay





Notes: These are key wells designated in WRDs Engineering Survey and Report for long-term water level monitoring.

Current key water level monitoring program wells shown on Figure 25.

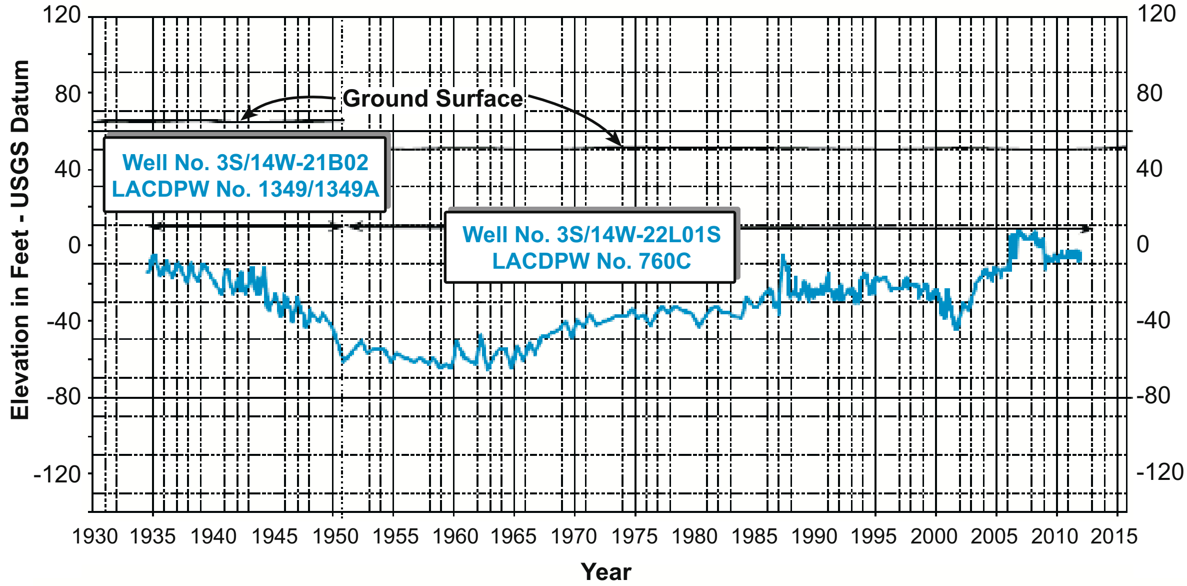
WRD - Water Replenishment District of California

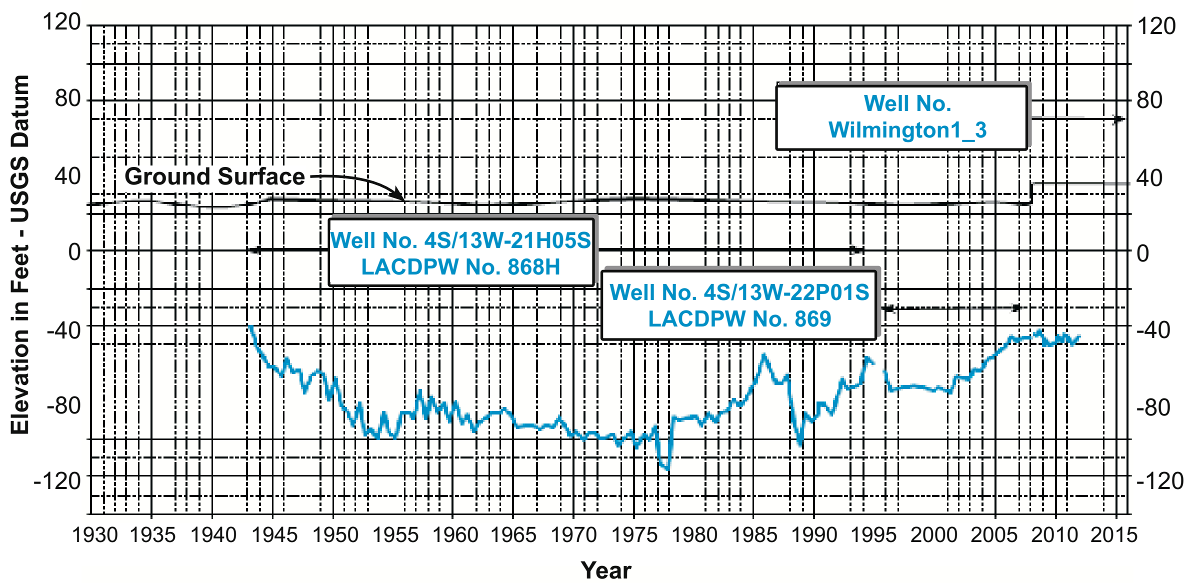
LACDPW - Los Angeles County Department of Public Works

USGS - United States Geological Survey

TODD GROUNDWATER

Figure 28
Fluctuation of Water Levels in the Central Basin Pressure Area





Notes: These are key wells designated in WRDs Engineering Survey and Report for long-term water level monitoring.

Current key water level monitoring program wells shown on Figure 25.

WRD - Water Replenishment District of California

LACDPW - Los Angeles County Department of Public Works

USGS - United States Geological Survey

TODD GROUNDWATER

Figure 29
Fluctuation of Water Levels in the West Coast Basin

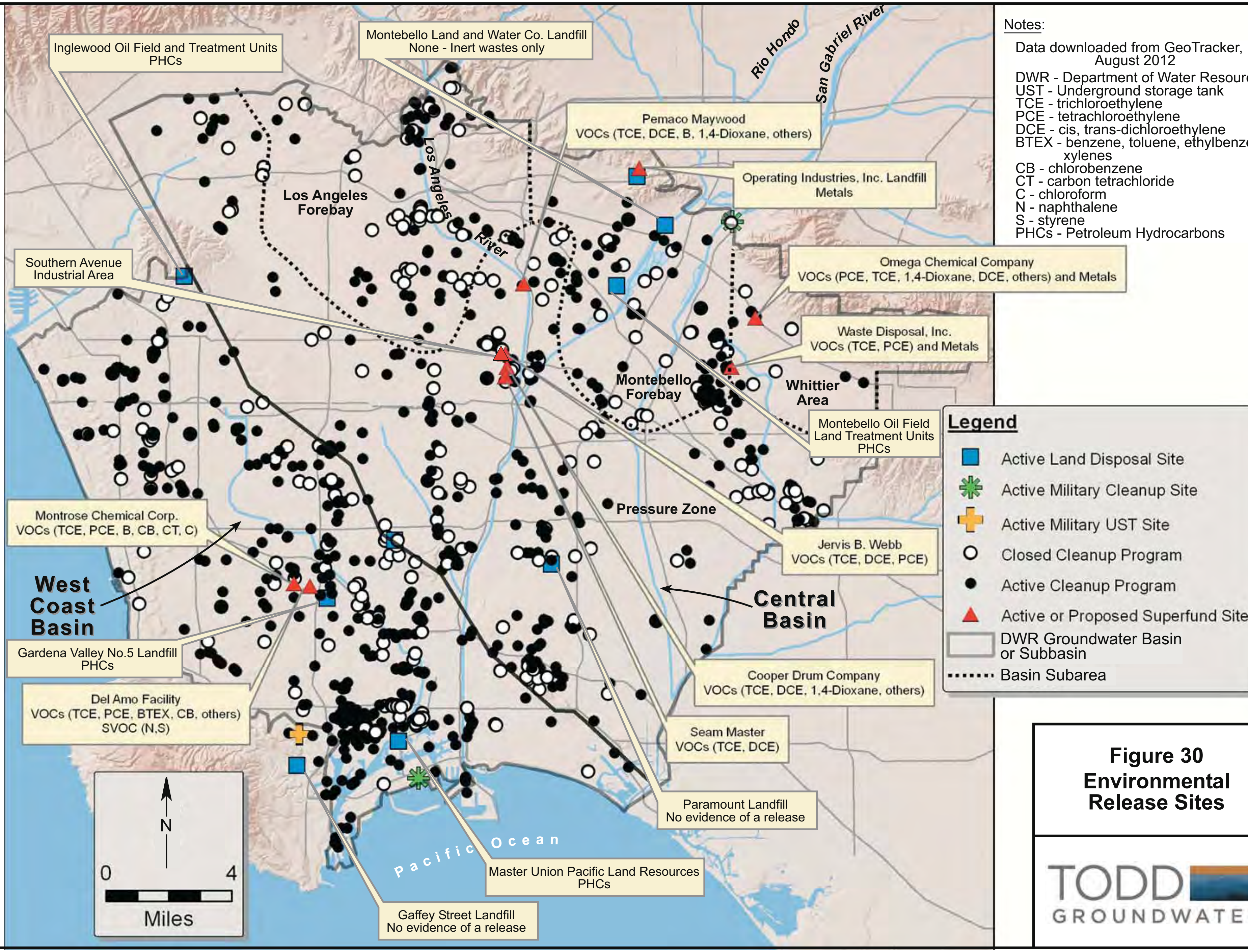
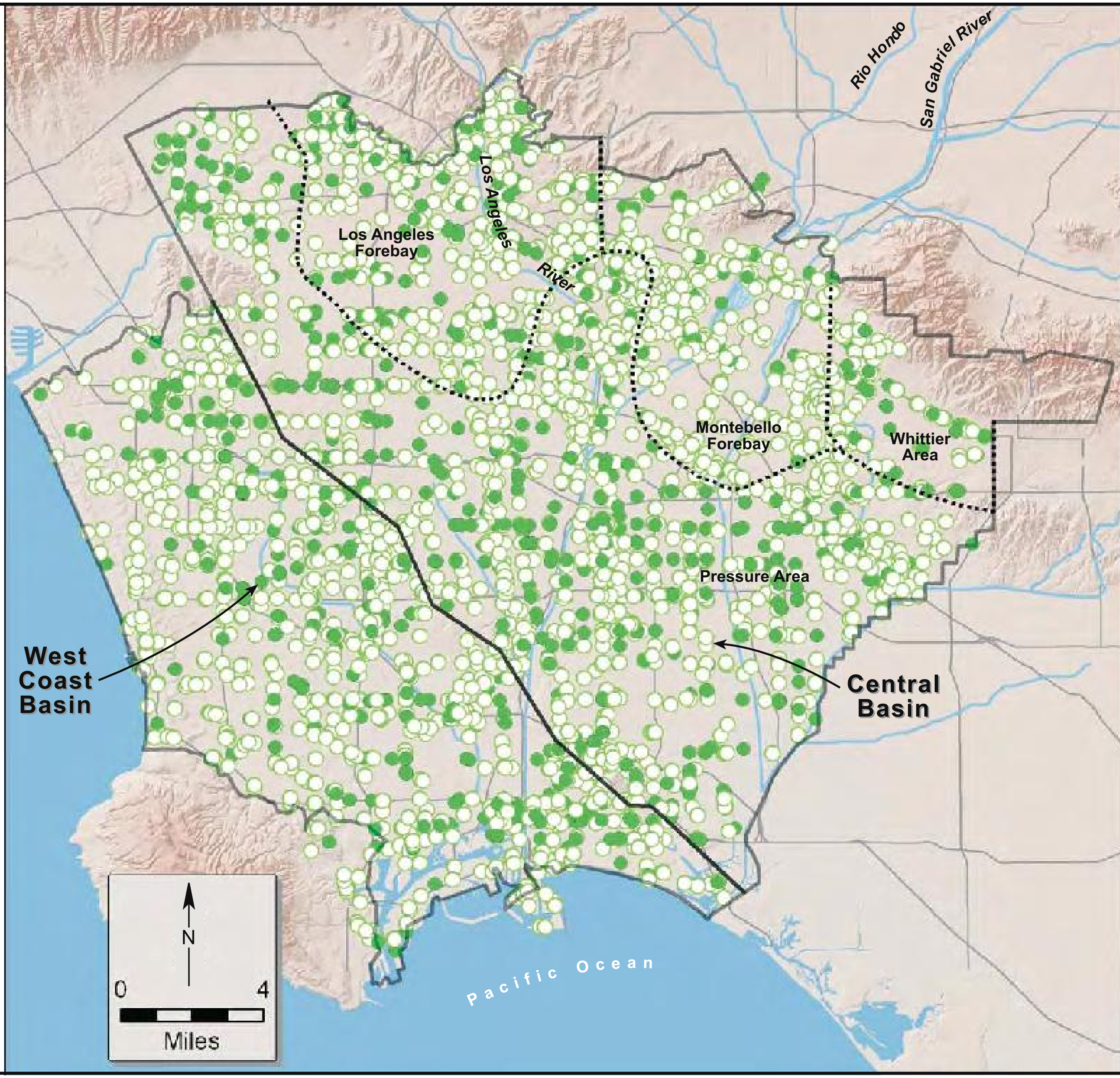


Figure 30
Environmental Release Sites

TODD GROUNDWATER



Legend

- Active LUST Sites
- Closed LUST Sites
- DWR Groundwater Basin or Subbasin
- Basin Subarea

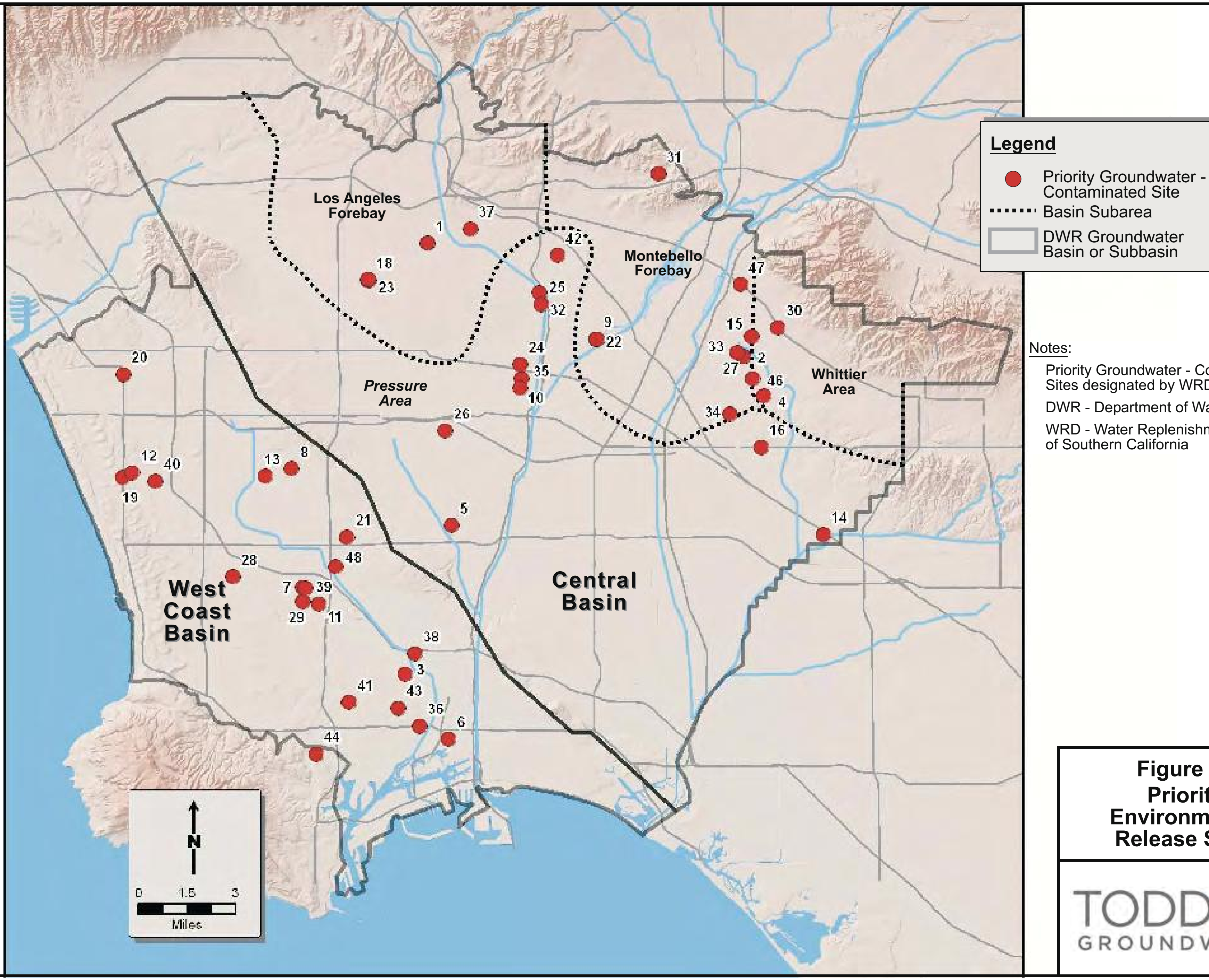
Notes:

Data downloaded from GeoTracker, August 2012

DWR - Department of Water Resources

Figure 31
Leaking Underground Storage Tank (LUST) Sites

TODD GROUNDWATER



Notes:

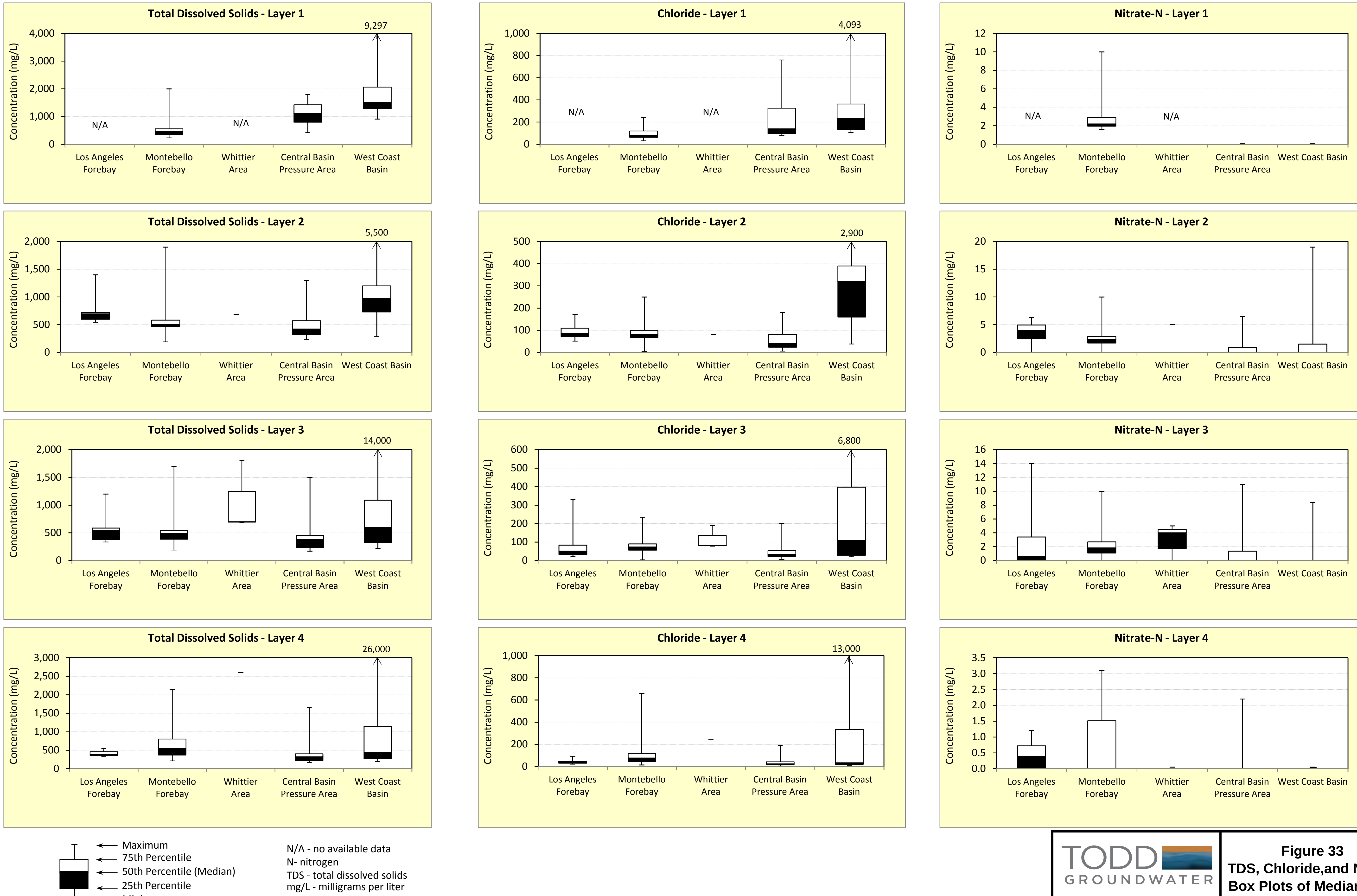
Priority Groundwater - Contaminated Sites designated by WRD in July 2012

DWR - Department of Water Resources

WRD - Water Replenishment District of Southern California

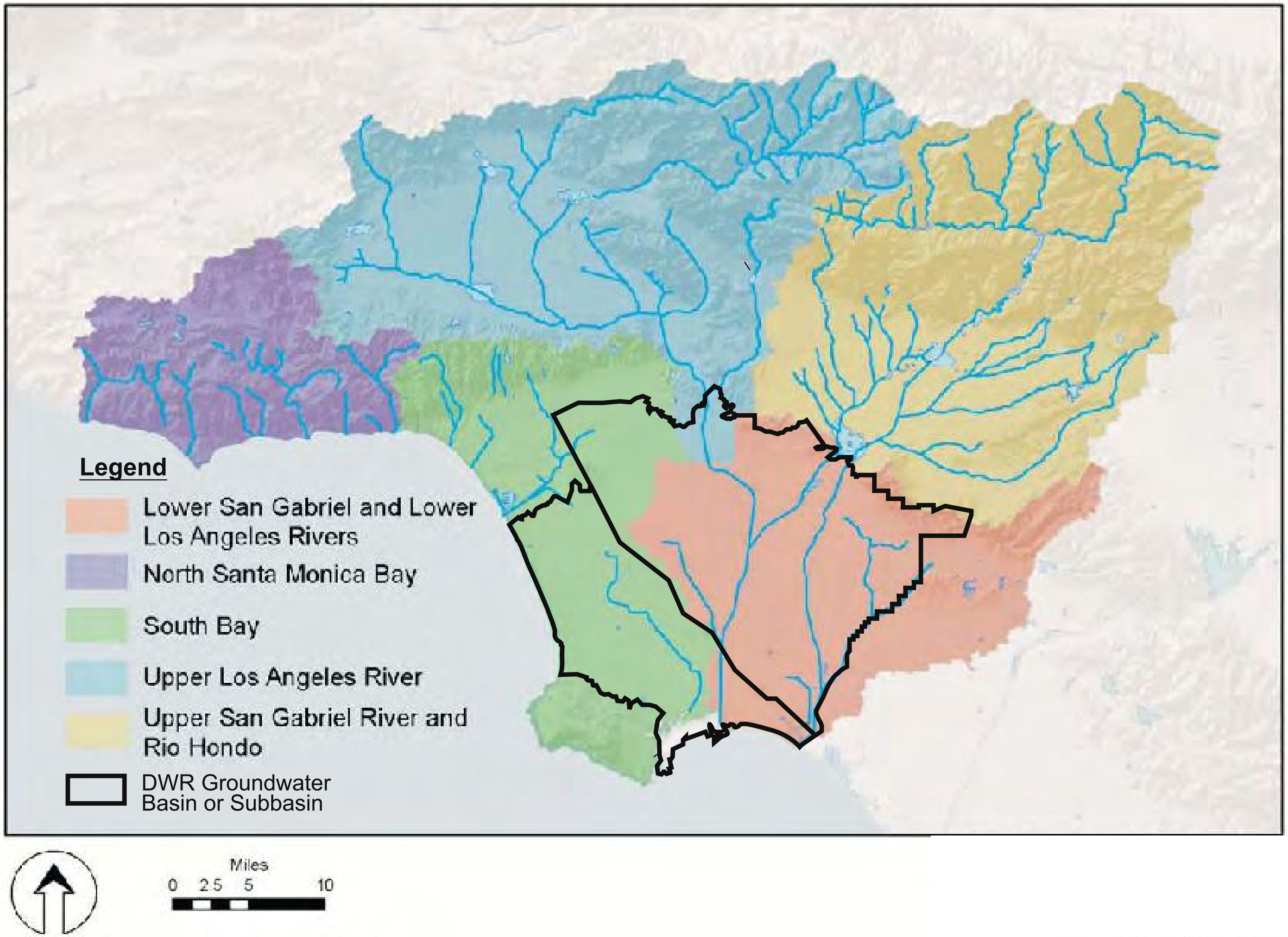
Figure 32
Priority Environmental Release Sites

TODD GROUNDWATER



TODD GROUNDWATER

Figure 33
TDS, Chloride,and Nitrate Box Plots of Median Data



Modified From: Cal-Atlas, Los Angeles County Department of Public Works and Department of Public Planning

Notes:

GLAC IRWMP - Greater Los Angeles County Intergrated Regional Water Management Plan

DWR - California Department of Water Resources

TODD GROUNDWATER

Figure 34
2012 GLAC IRWMP Region

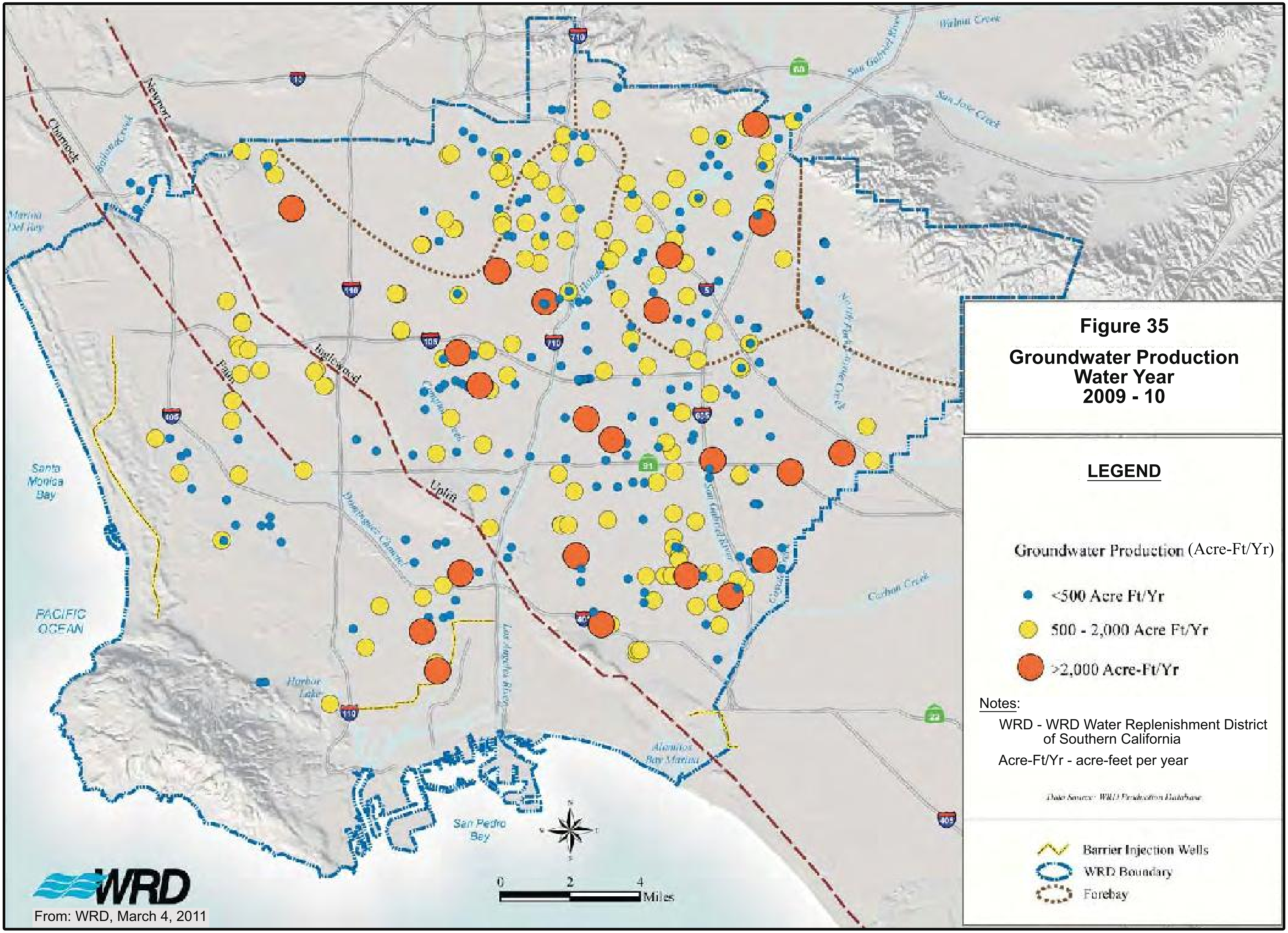


Figure 35
Groundwater Production
Water Year
2009 - 10
LEGEND
Groundwater Production (Acre-Ft/Yr)
<500 Acre Ft/Yr
500 - 2,000 Acre Ft/Yr
>2,000 Acre-Ft/Yr
Notes:
WRD - WRD Water Replenishment District of Southern California
Acre-Ft/Yr - acre-feet per year
Barrier Injection Wells
WRD Boundary
Forebay
Newport
Charnock
Inglewood
Fault
Uplift
Santa Monica Bay
PACIFIC OCEAN
San Pedro Bay
Walnut Creek
San Jose Creek
San Gabriel River
Carbon Creek
Harbor Lake
Alamitos Bay Marina
Dominguez Channel
Los Angeles River
0
2
4
Miles
WRD
From: WRD, March 4, 2011

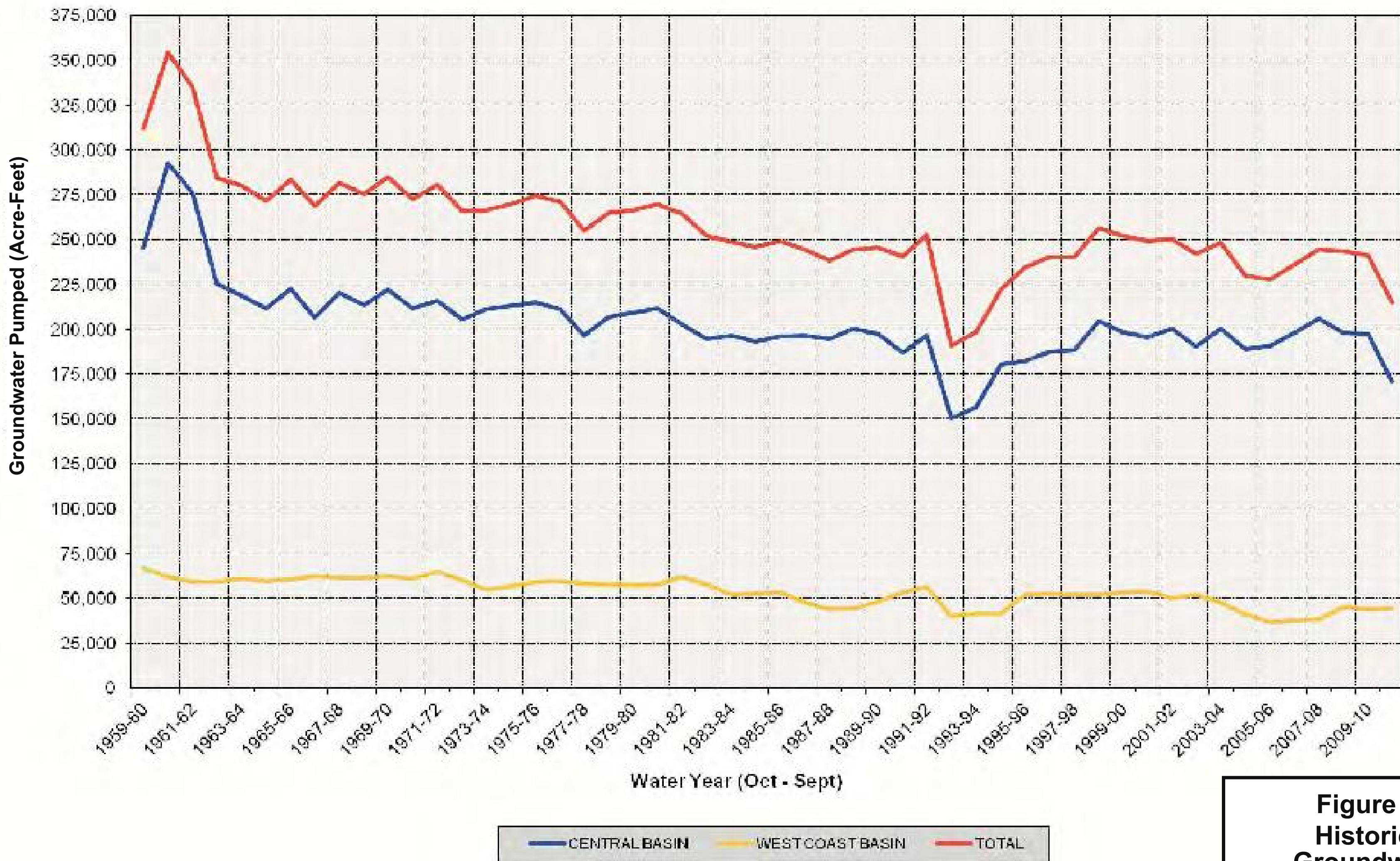


Figure 36
Historical Groundwater Production

TODD GROUNDWATER

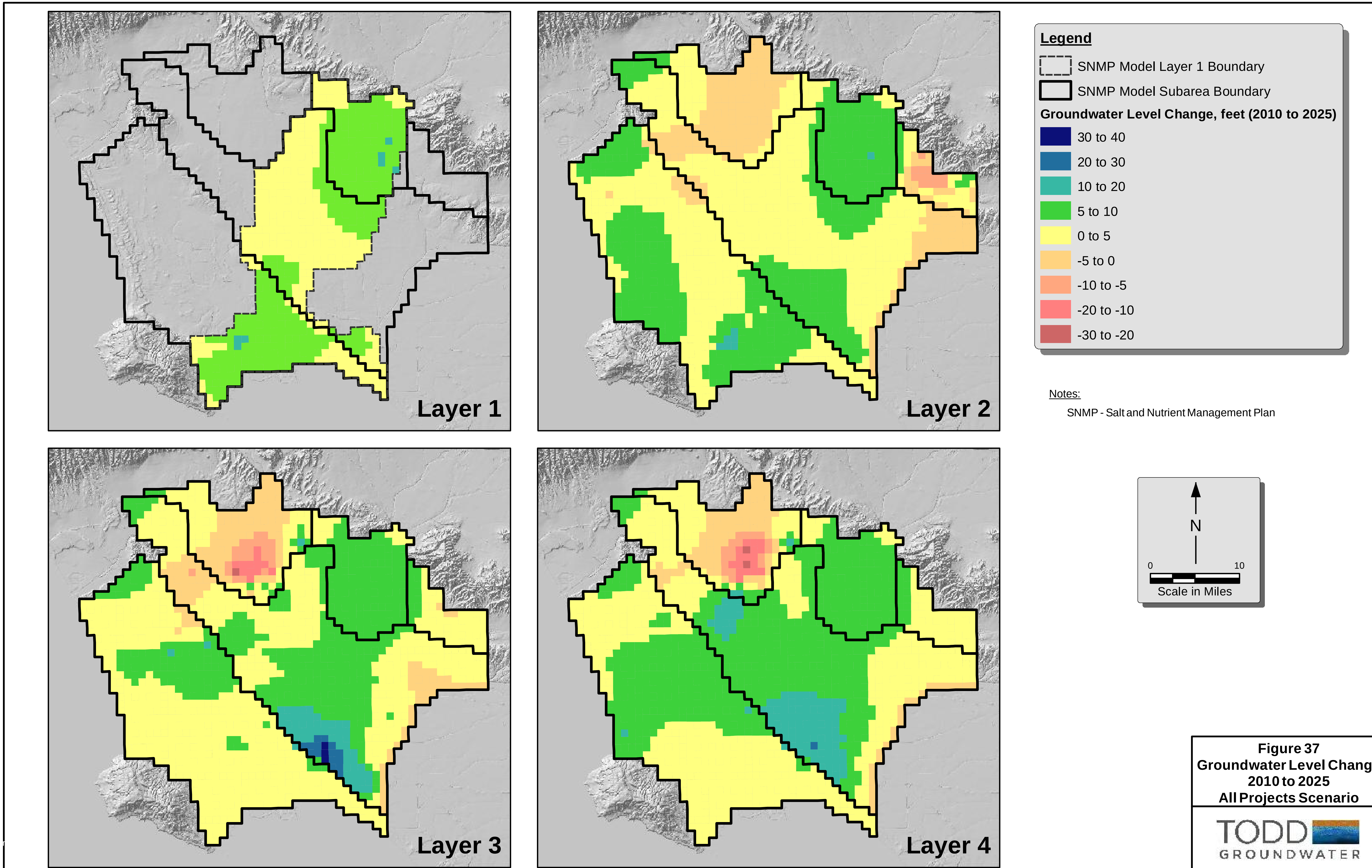


Figure 37
Groundwater Level Change
2010 to 2025
All Projects Scenario

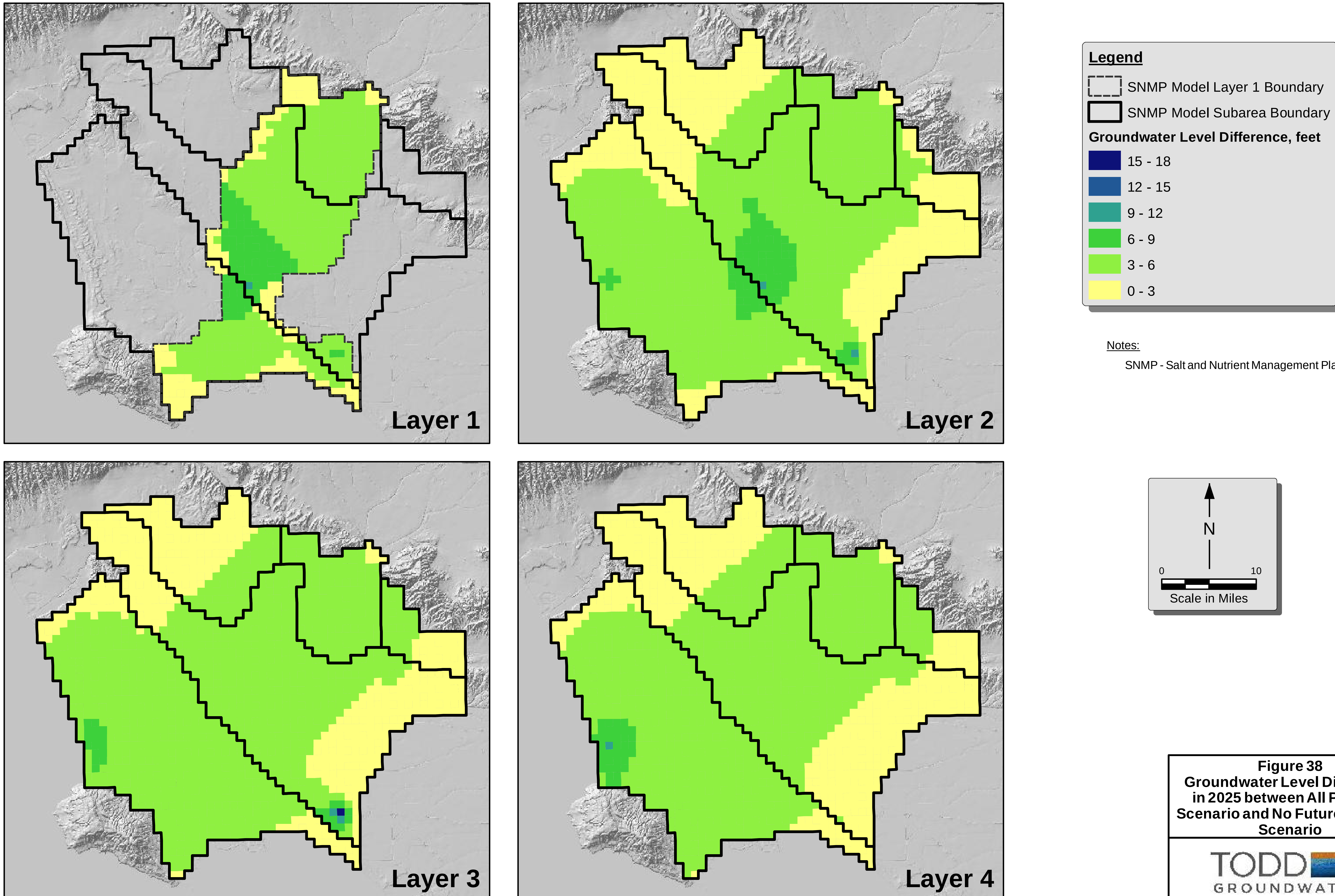
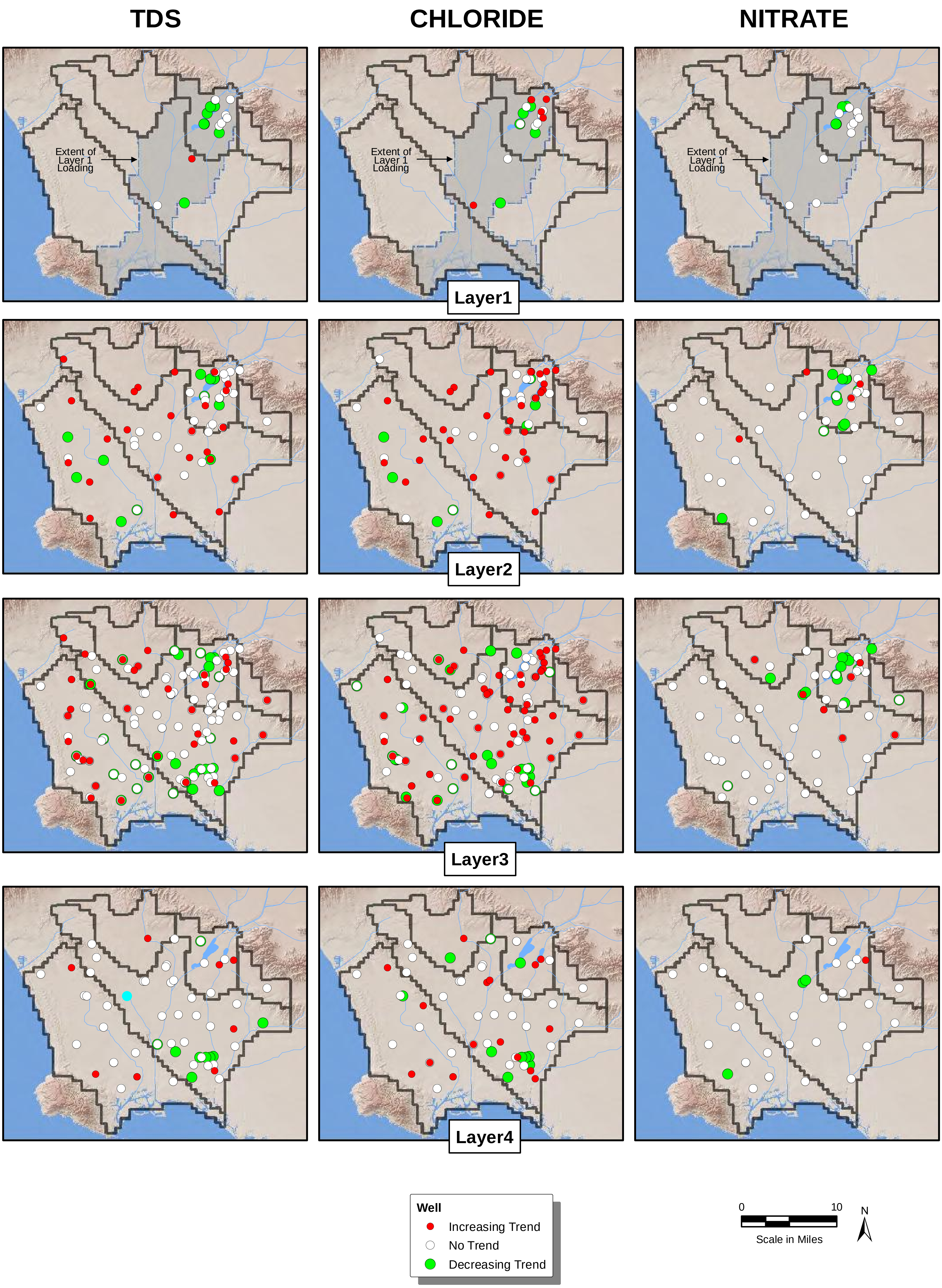


Figure 38
Groundwater Level Difference in 2025 between All Projects Scenario and No Future Projects Scenario

TODD GROUNDWATER



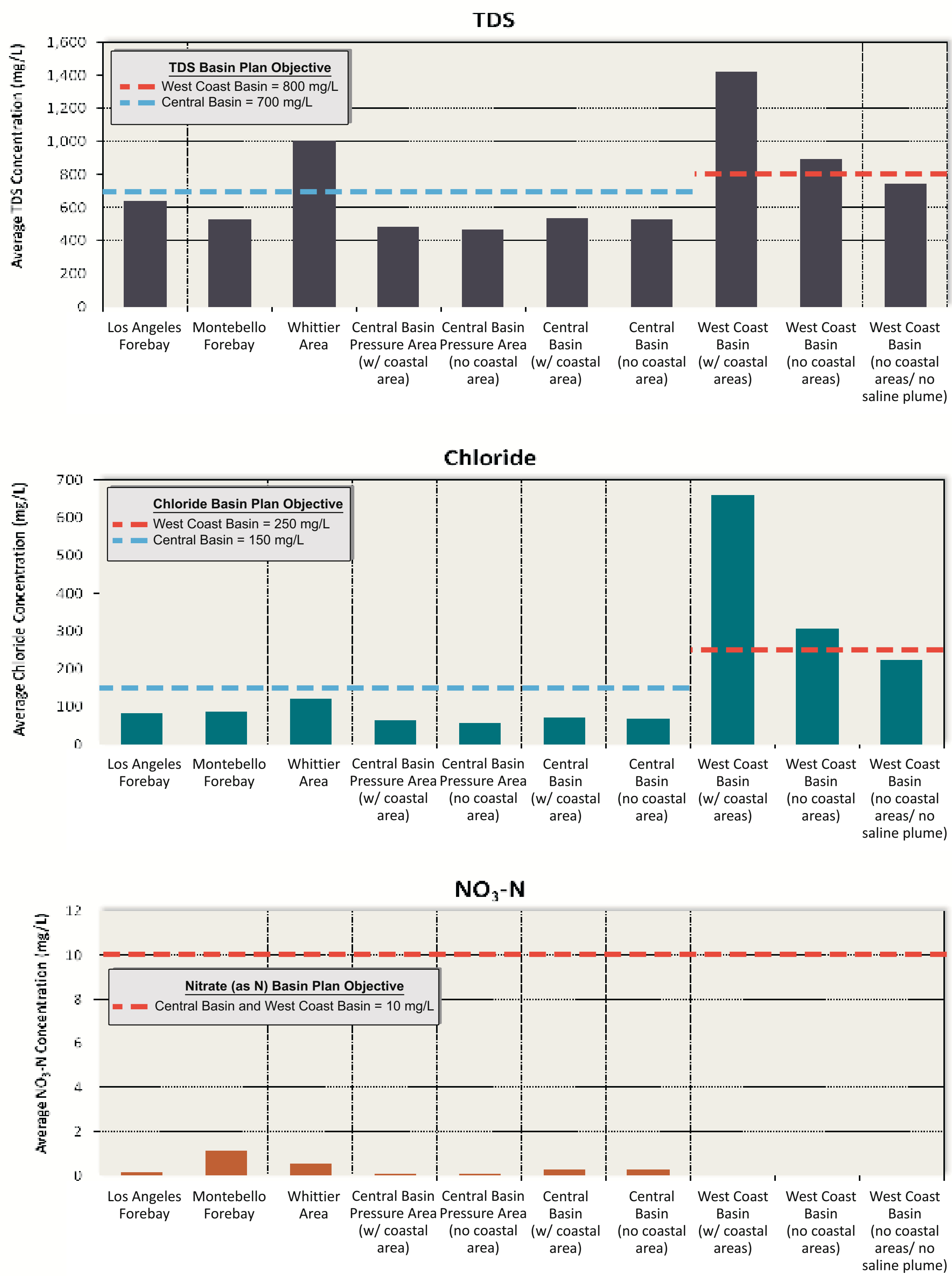
Notes:

Mann-Kendall trend analysis applied only to wells with 10 or greater sampling events using 95% confidence interval

TDS - Total Dissolved Solids

TODD GROUNDWATER

Figure 39
TDS, Chloride, and Nitrate Concentration Trends



Notes:

TDS - Total Dissolved Solids

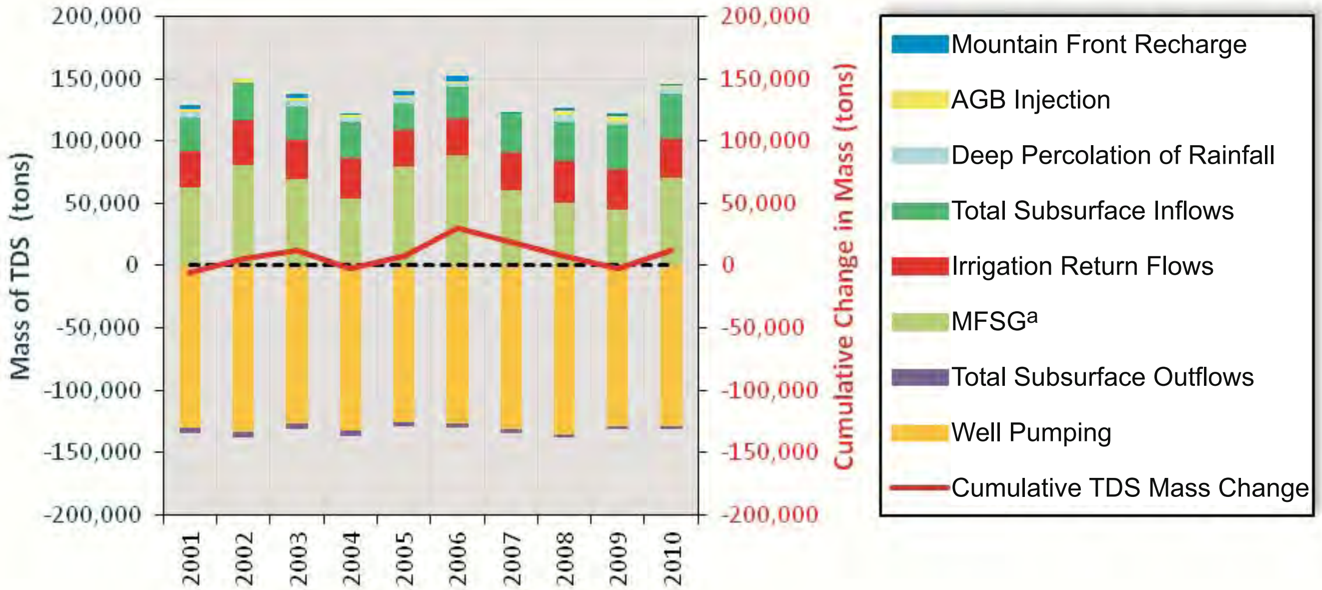
NO_3-N - Nitrate as Nitrogen

Mg/L - milligrams per Liter

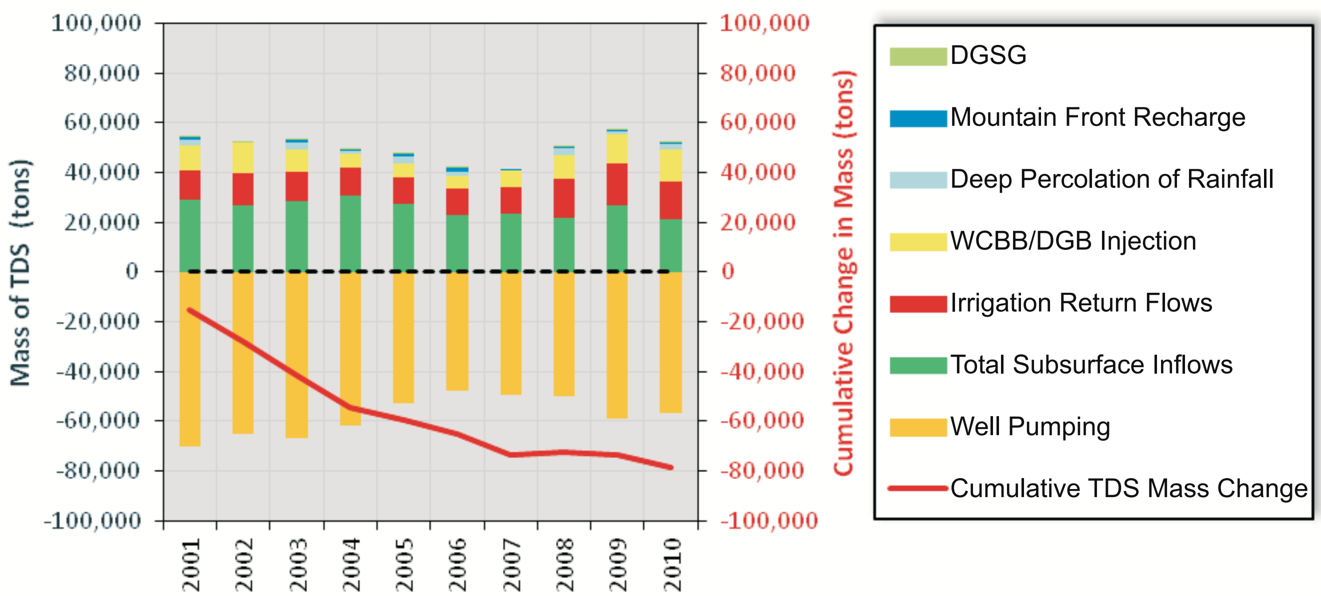
TODD GROUNDWATER

Figure 40
Subareas/Basin Average Existing TDS, Chloride, and Nitrate Concentrations

Central Basin TDS - All Layers



West Coast Basin TDS - All Layers



Notes:

DGSG - Dominguez Gap Spreading Grounds

MFSG - Montebello Forebay Spreading Grounds

AGB - Alamitos Gap Barrier

WCBB - West Coast Basin Barrier

DGB - Dominguez Gap Barrier

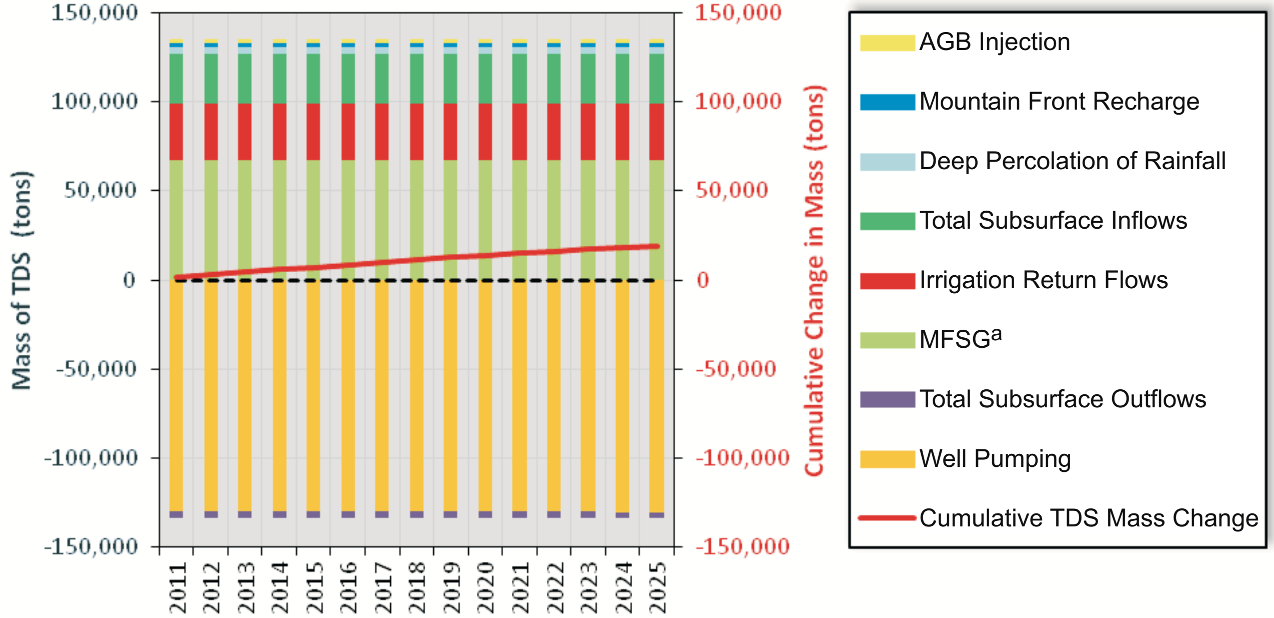
TDS - Total Dissolved Solids

[a] - May include minor loading from DGSG

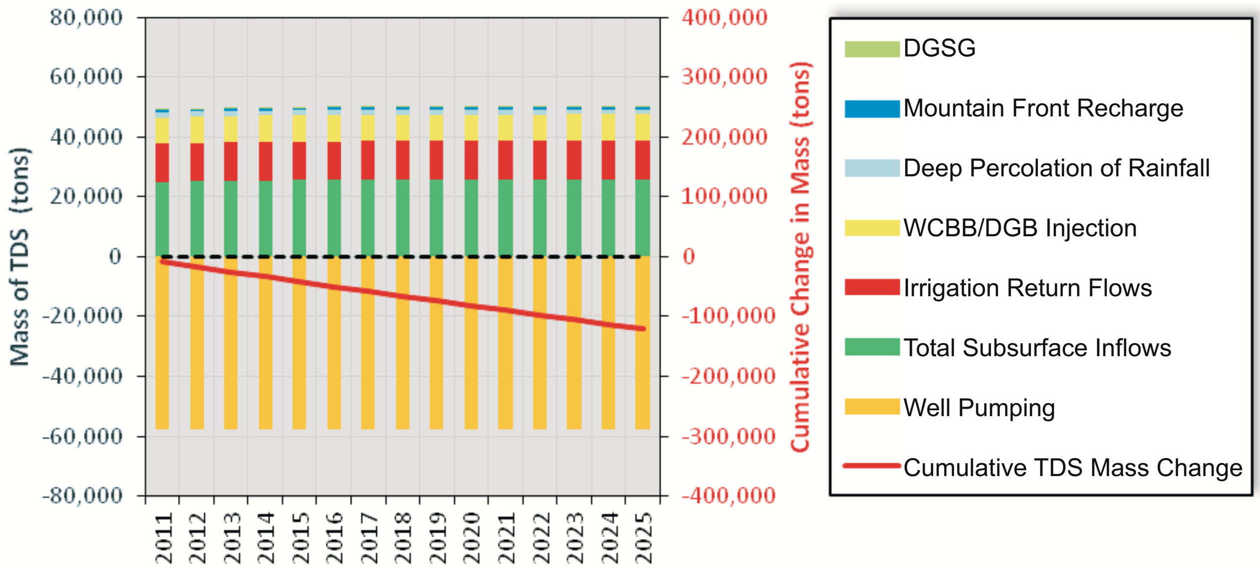
TODD GROUNDWATER

Figure 41
TDS
Mass Balances
Baseline Period

Central Basin TDS - All Layers



West Coast Basin TDS - All Layers

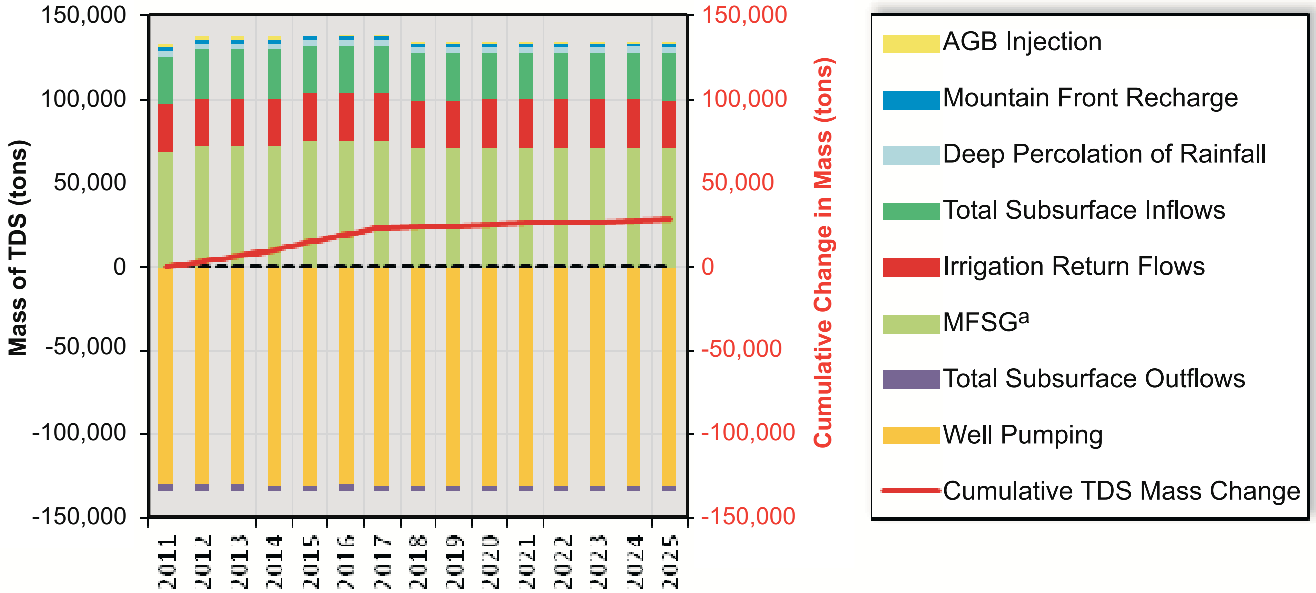


Notes:
DGSG - Dominguez Gap Spreading Grounds
MFSG - Montebello Forebay Spreading Grounds
AGB - Alamitos Gap Barrier
WCBB - West Coast Basin Barrier
DGB - Dominguez Gap Barrier
TDS - Total Dissolved Solids
[a] - May include minor loading from DGSG

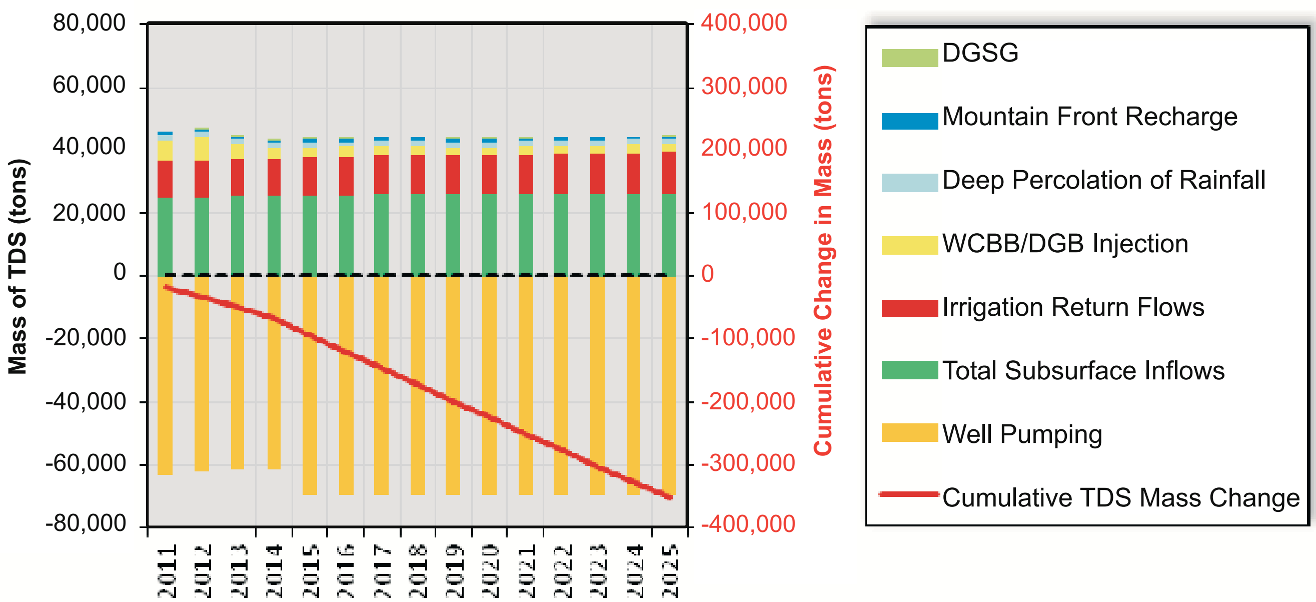
TODD GROUNDWATER

Figure 42
TDS Mass Balances
No Future Projects
Scenario 1
Future Planning Period

Central Basin TDS - All Layers



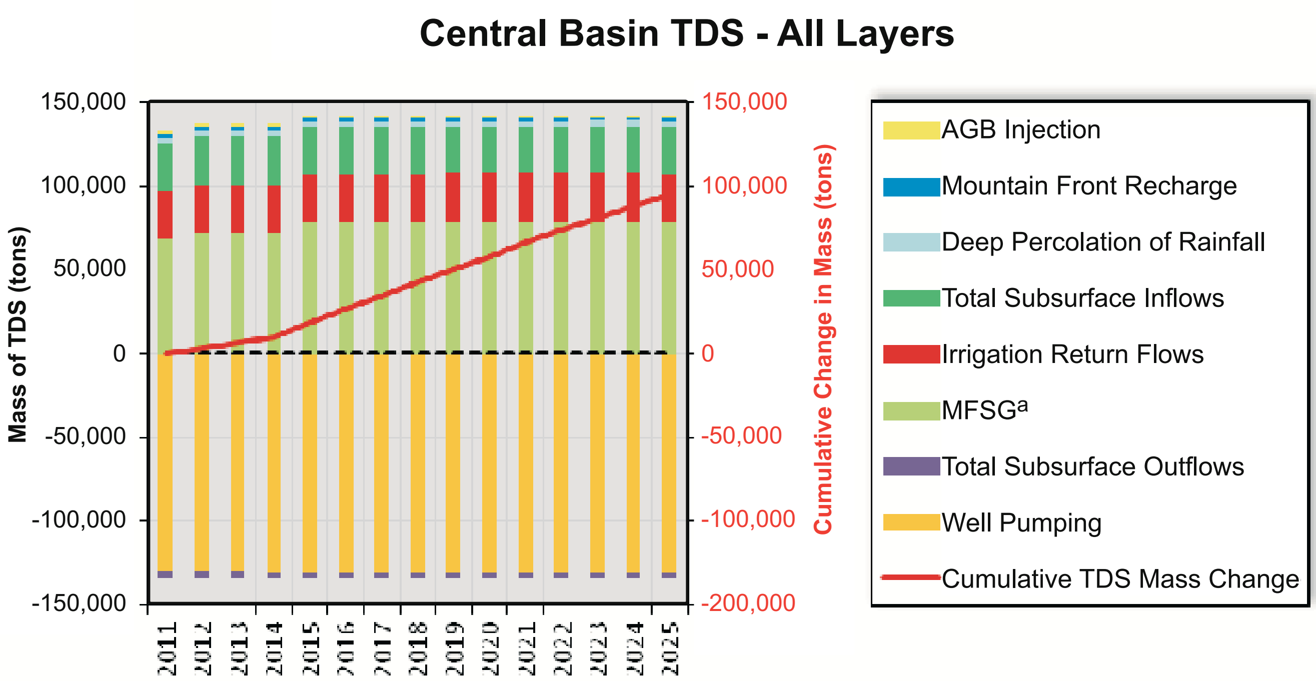
West Coast Basin TDS - All Layers

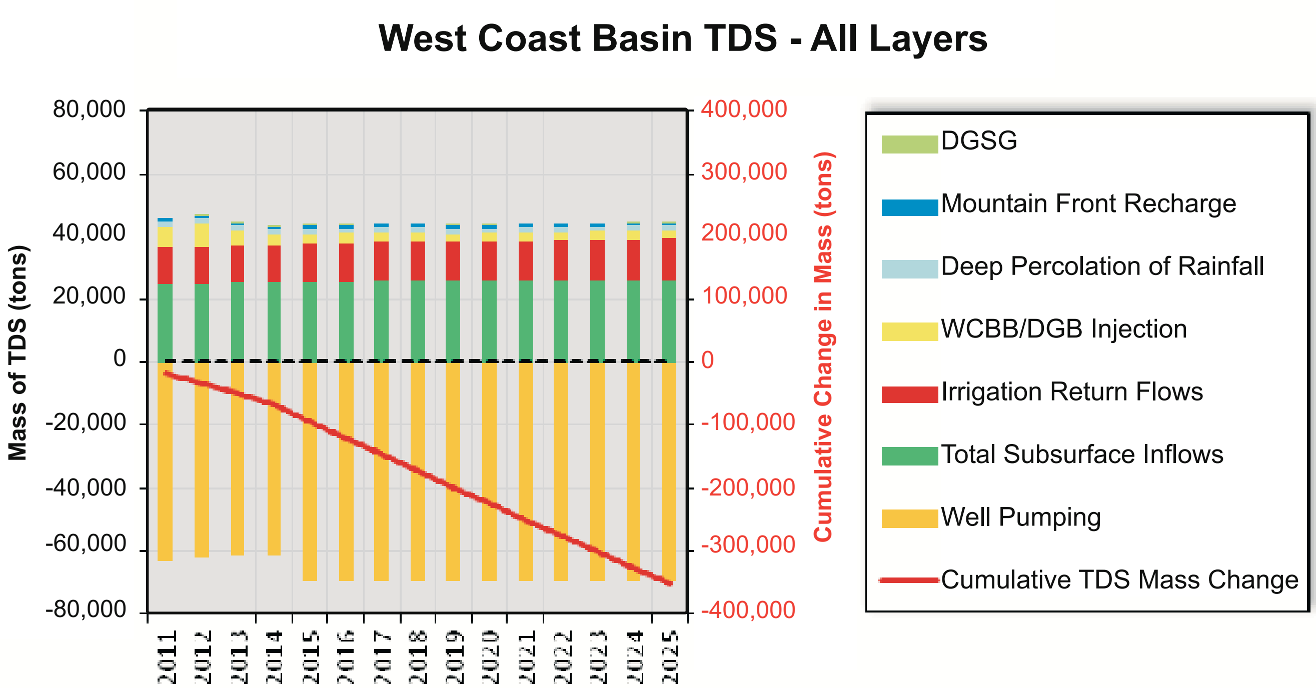


Notes:
DGSG - Dominguez Gap Spreading Grounds
MFSG - Montebello Forebay Spreading Grounds
AGB - Alamitos Gap Barrier
WCBB - West Coast Basin Barrier
DGB - Dominguez Gap Barrier
TDS - Total Dissolved Solids
[a] - May include minor loading from DGSG

TODD GROUNDWATER

Figure 43
TDS Mass Balances
Scenario 8
Future Planning Period





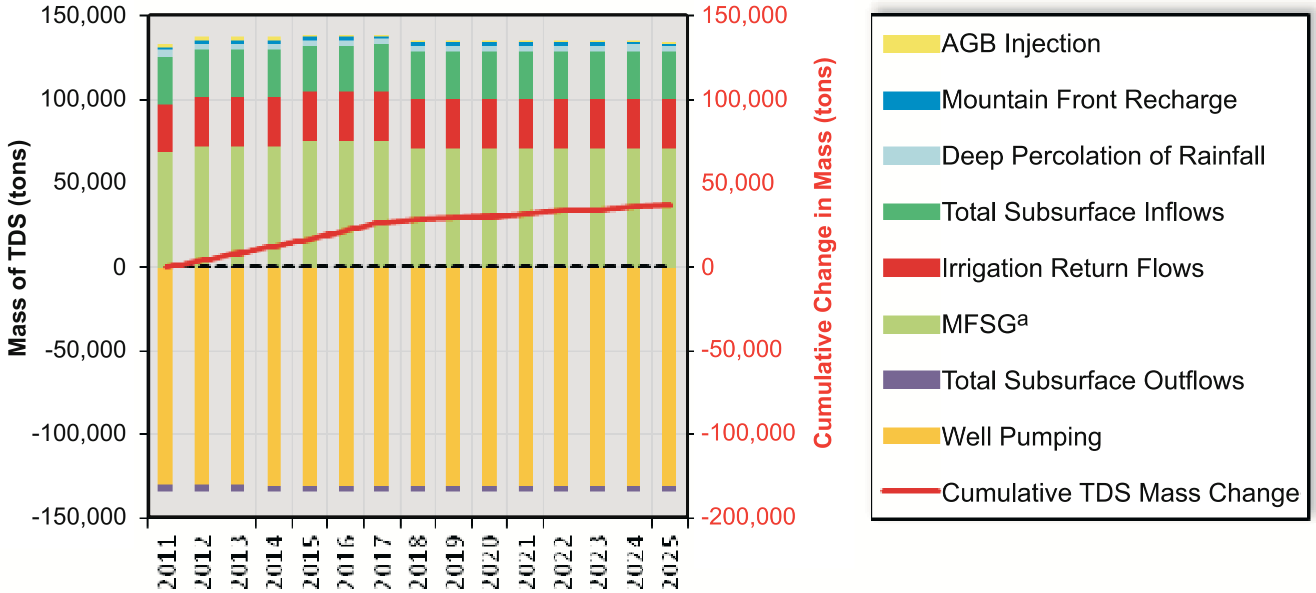
Notes:

DGSG - Dominguez Gap Spreading Grounds
MFSG - Montebello Forebay Spreading Grounds
AGB - Alamitos Gap Barrier
WCBB - West Coast Basin Barrier
DGB - Dominguez Gap Barrier
TDS - Total Dissolved Solids
[a] - May include minor loading from DGSG

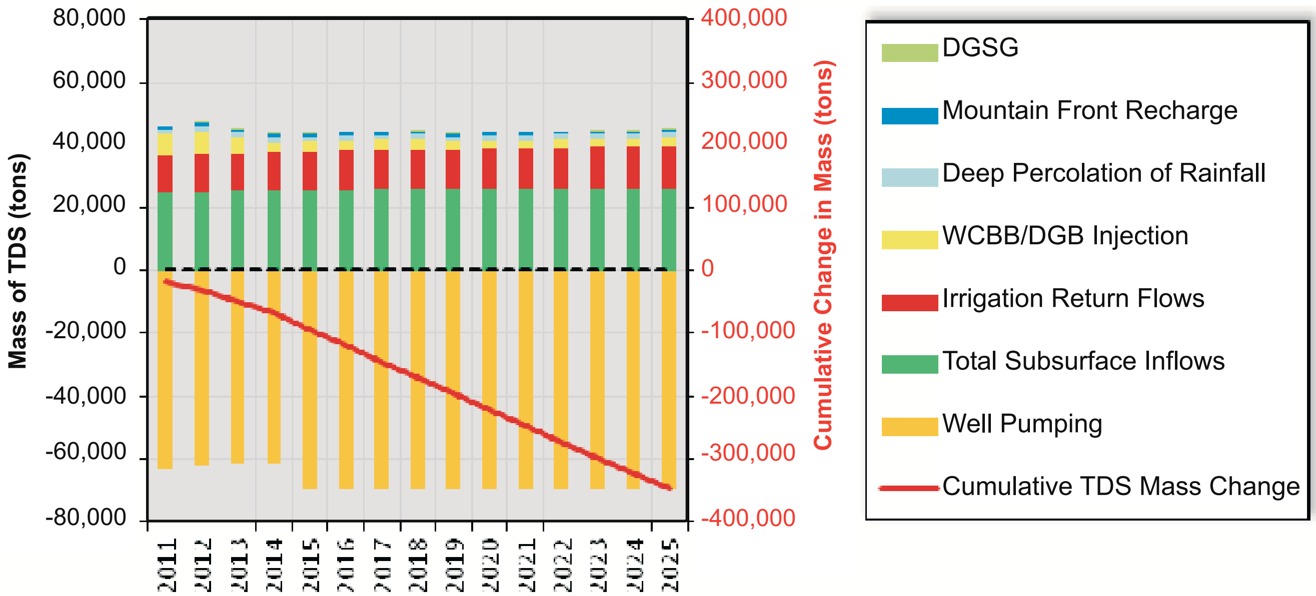
TODD GROUNDWATER

Figure 44
TDS Mass Balances
Scenario 9
Future Planning Period

Central Basin TDS - All Layers



West Coast Basin TDS - All Layers



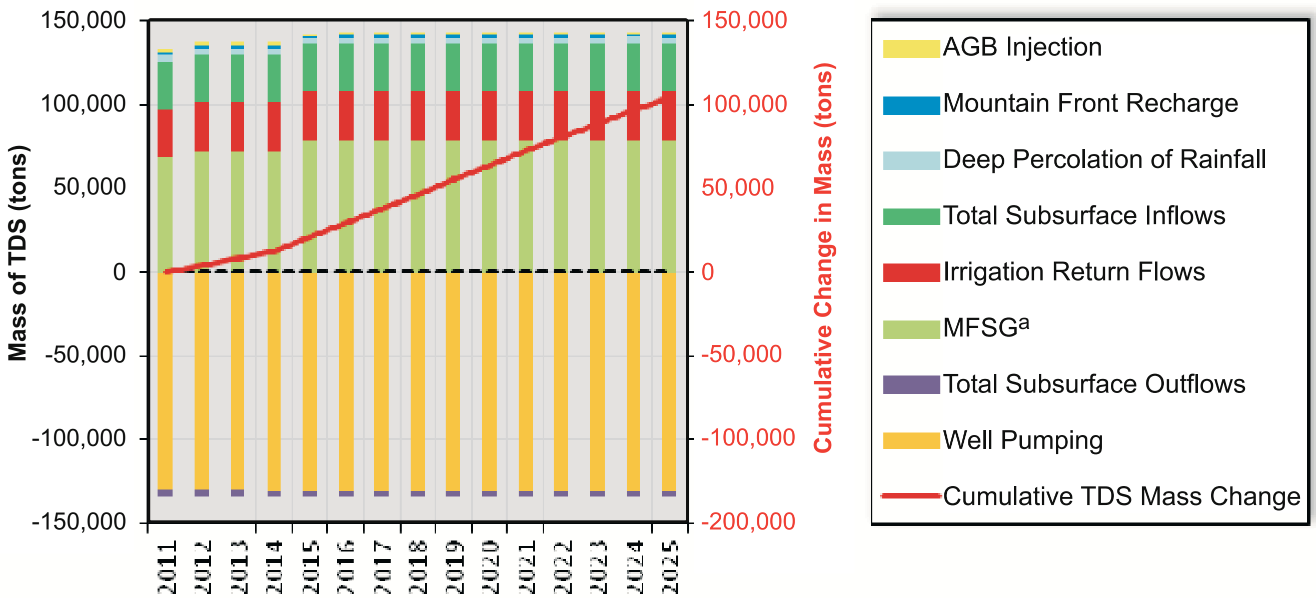
Notes:

DGSG - Dominguez Gap Spreading Grounds
MFSG - Montebello Forebay Spreading Grounds
AGB - Alamitos Gap Barrier
WCBB - West Coast Basin Barrier
DGB - Dominguez Gap Barrier
TDS - Total Dissolved Solids
[a] - May include minor loading from DGSG

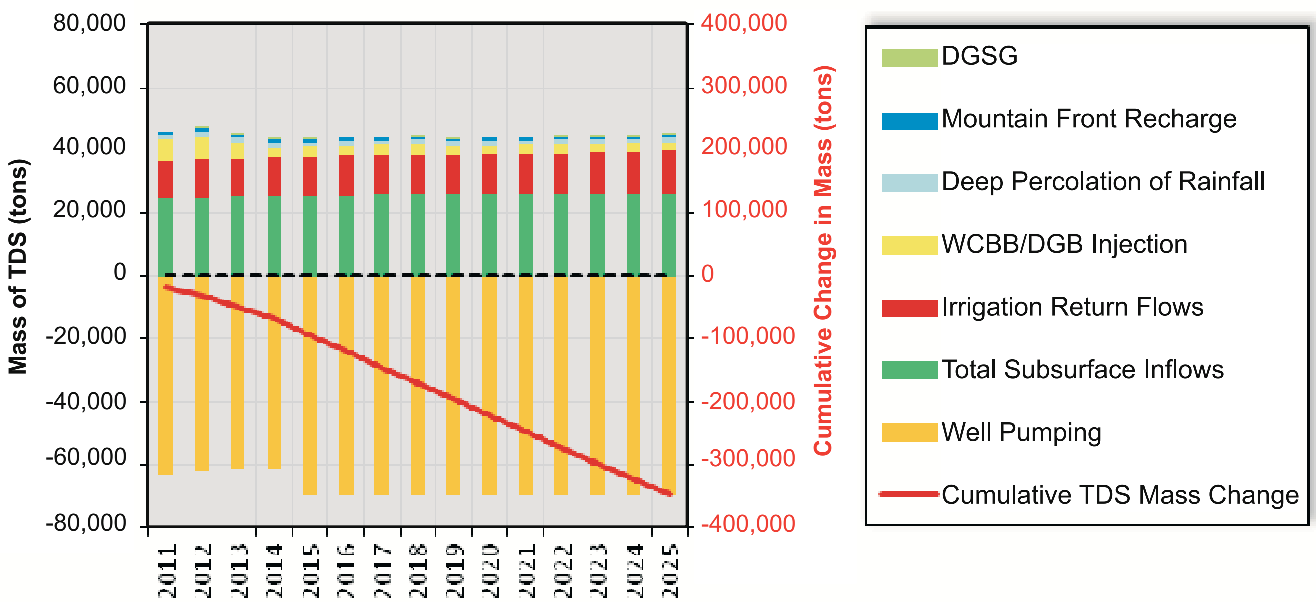
TODD GROUNDWATER

Figure 45
TDS Mass Balances
Scenario 10
Future Planning Period

Central Basin TDS - All Layers



West Coast Basin TDS - All Layers

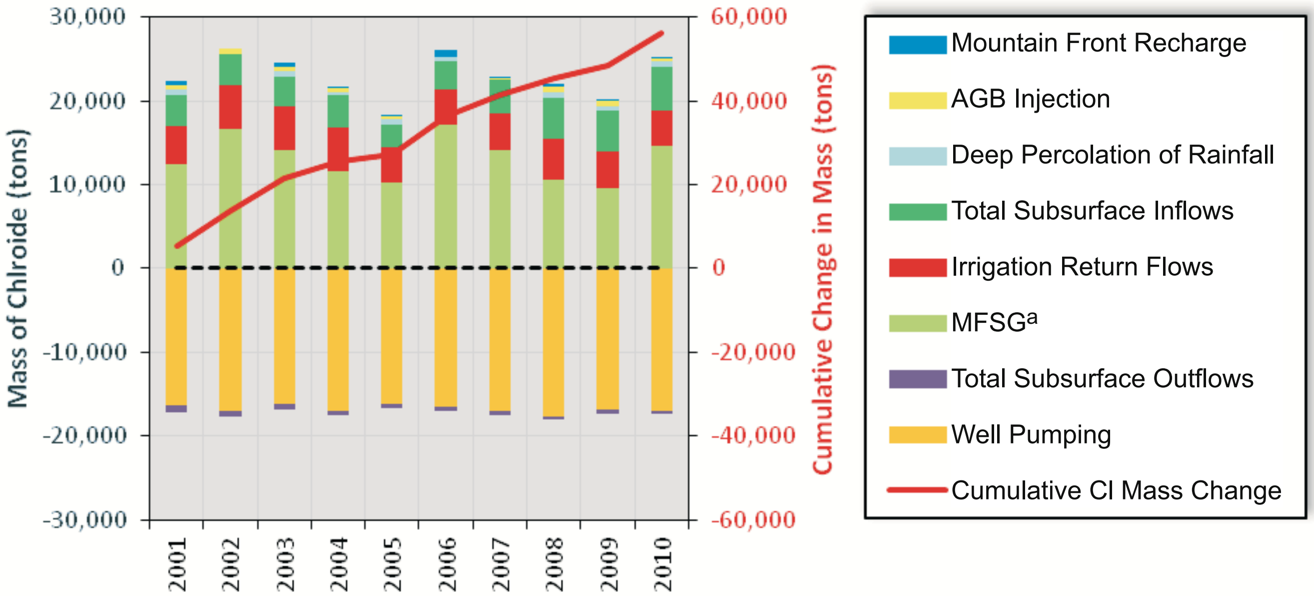


Notes:
DGSG - Dominguez Gap Spreading Grounds
MFSG - Montebello Forebay Spreading Grounds
AGB - Alamitos Gap Barrier
WCBB - West Coast Basin Barrier
DGB - Dominguez Gap Barrier
TDS - Total Dissolved Solids
[a] - May include minor loading from DGSG

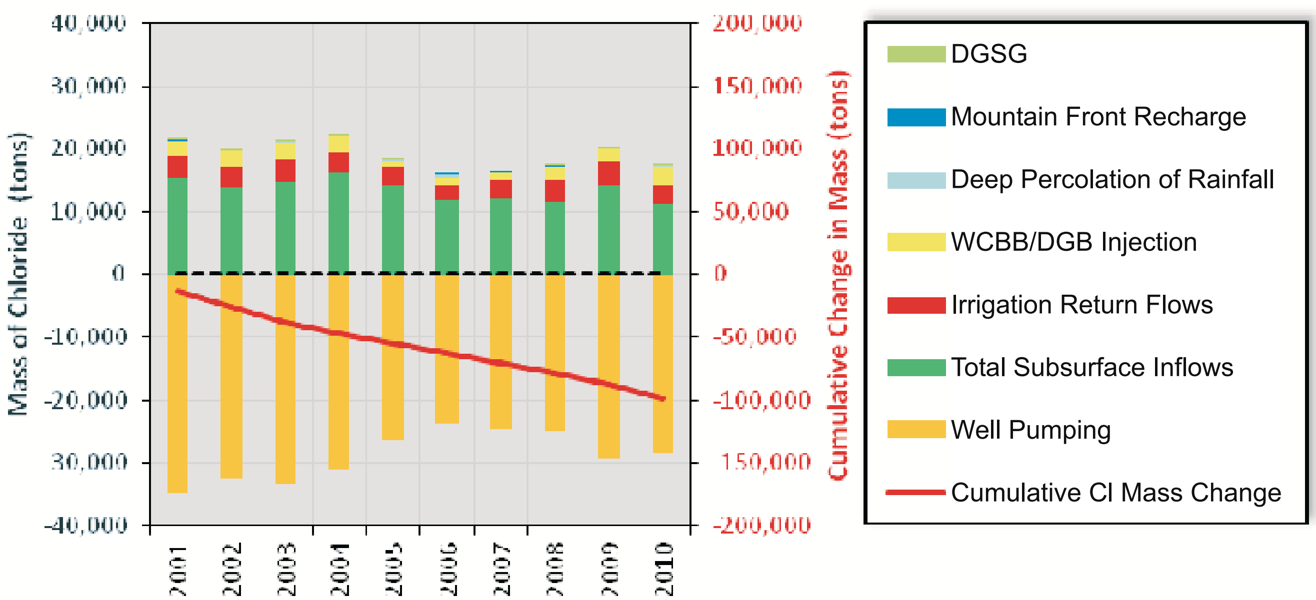
TODD GROUNDWATER

Figure 46
TDS Mass Balances
Scenario 11
Future Planning Period

Central Basin Chloride - All Layers



West Coast Basin Chloride - All Layers

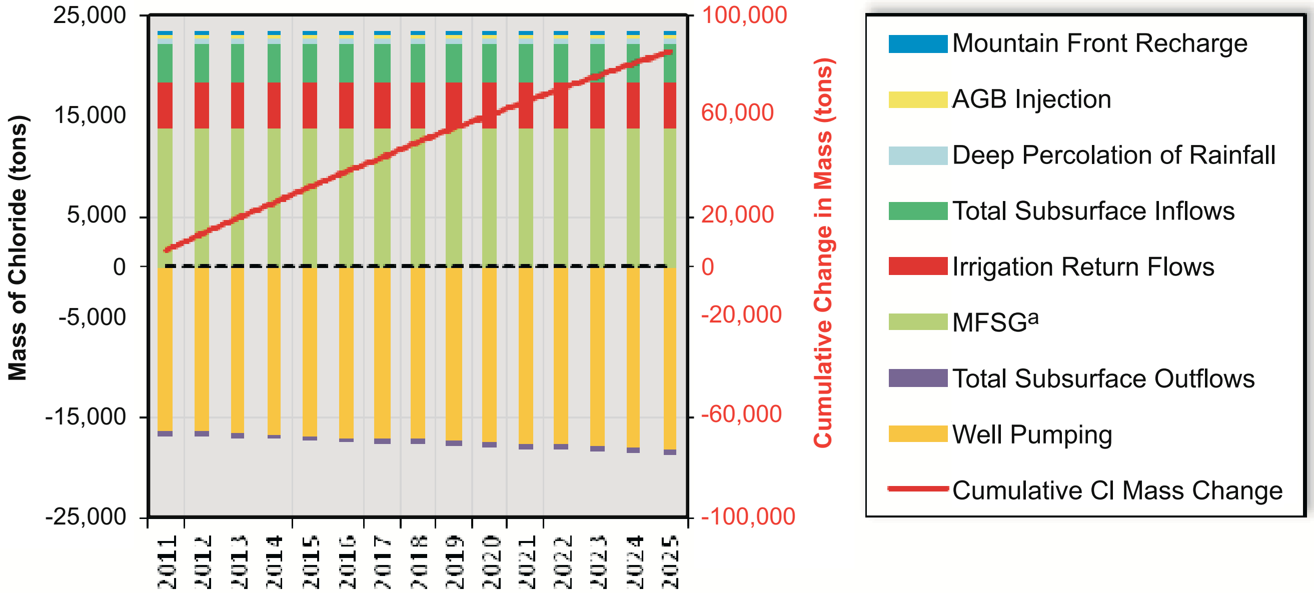


Notes:
DGSG - Dominguez Gap Spreading Grounds
MFSG - Montebello Forebay Spreading Grounds
AGB - Alamitos Gap Barrier
WCBB - West Coast Basin Barrier
DGB - Dominguez Gap Barrier
Cl - Chloride
[a] - May include minor loading from DGSG

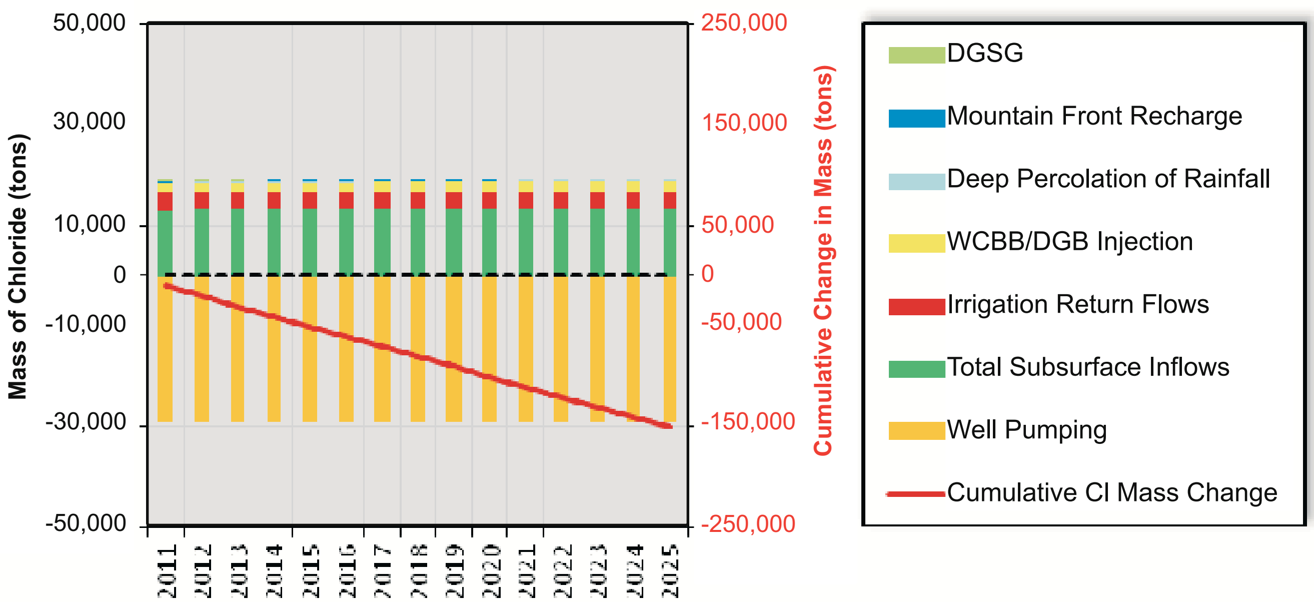
TODD GROUNDWATER

Figure 47
Chloride Mass Balances Baseline Period

Central Basin Chloride - All Layers



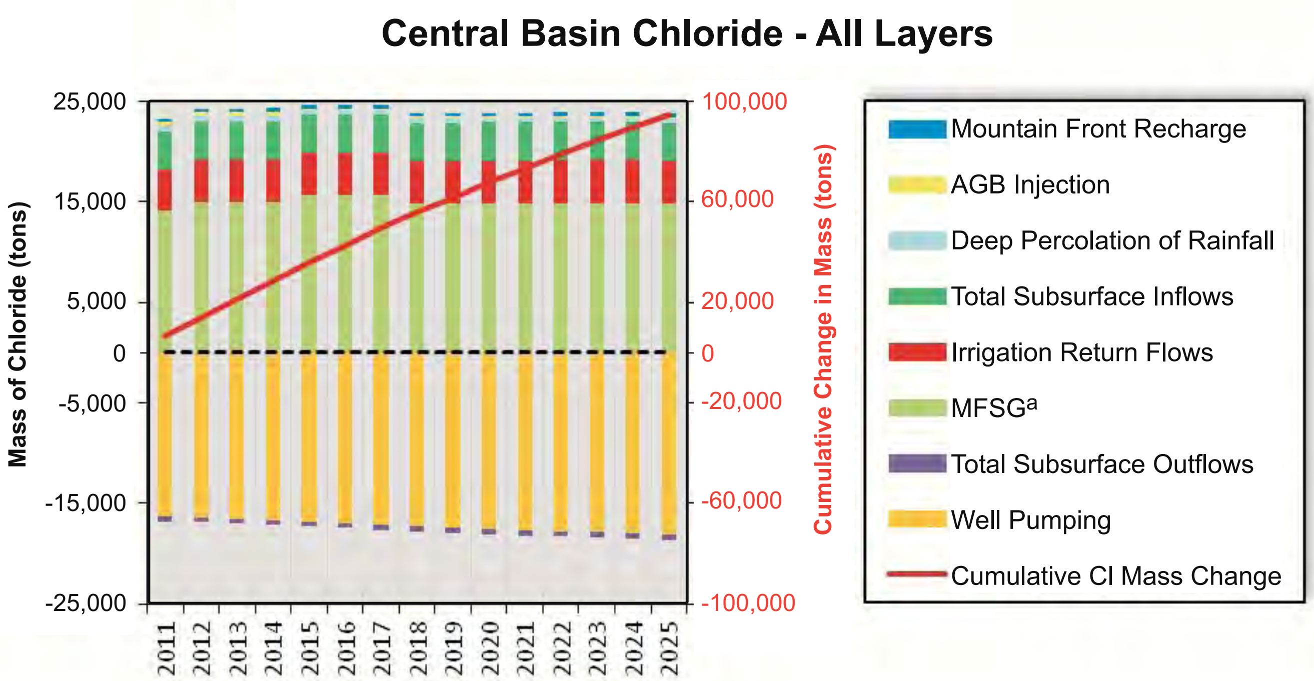
West Coast Basin Chloride - All Layers

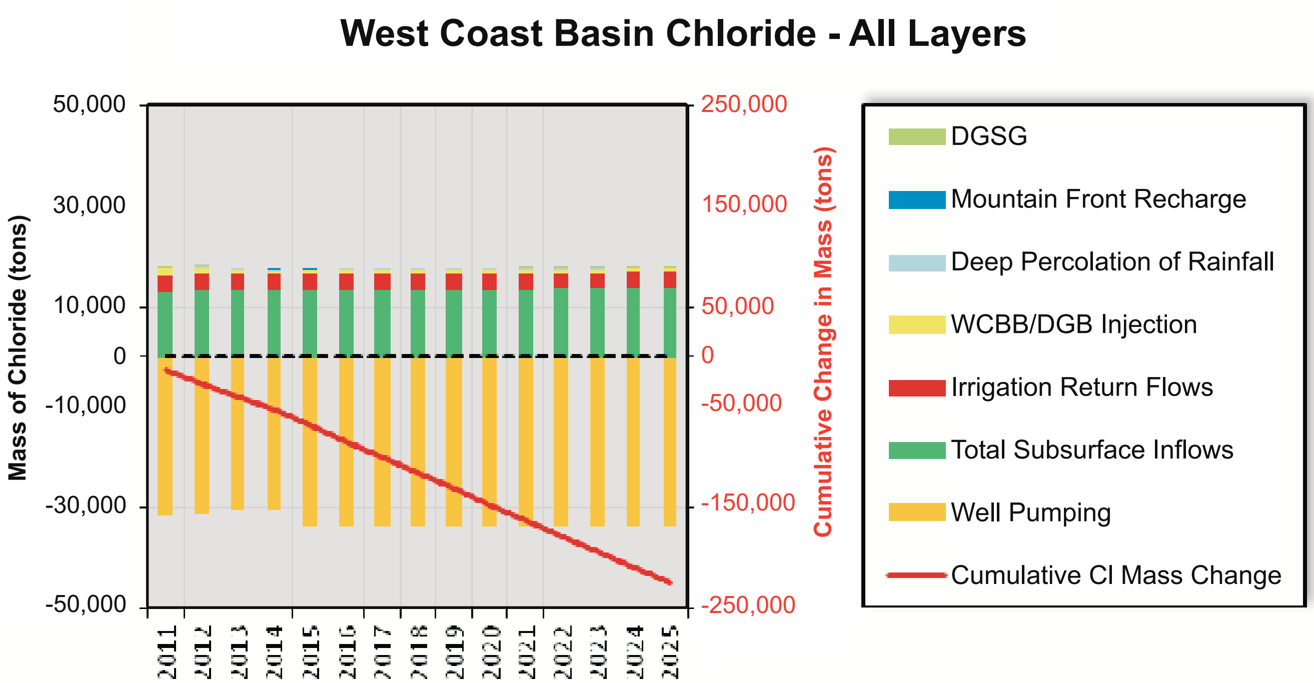


Notes:
DGSG - Dominguez Gap Spreading Grounds
MFSG - Montebello Forebay Spreading Grounds
AGB - Alamitos Gap Barrier
WCBB - West Coast Basin Barrier
DGB - Dominguez Gap Barrier
Cl - Chloride
[a] - May include minor loading from DGSG

TODD GROUNDWATER

Figure 48
Chloride Mass Balances
No Future Projects
Scenario 1
Future Planning Period





Notes:

DGSG - Dominguez Gap Spreading Grounds

MFSG - Montebello Forebay Spreading Grounds

AGB - Alamitos Gap Barrier

WCBB - West Coast Basin Barrier

DGB - Dominguez Gap Barrier

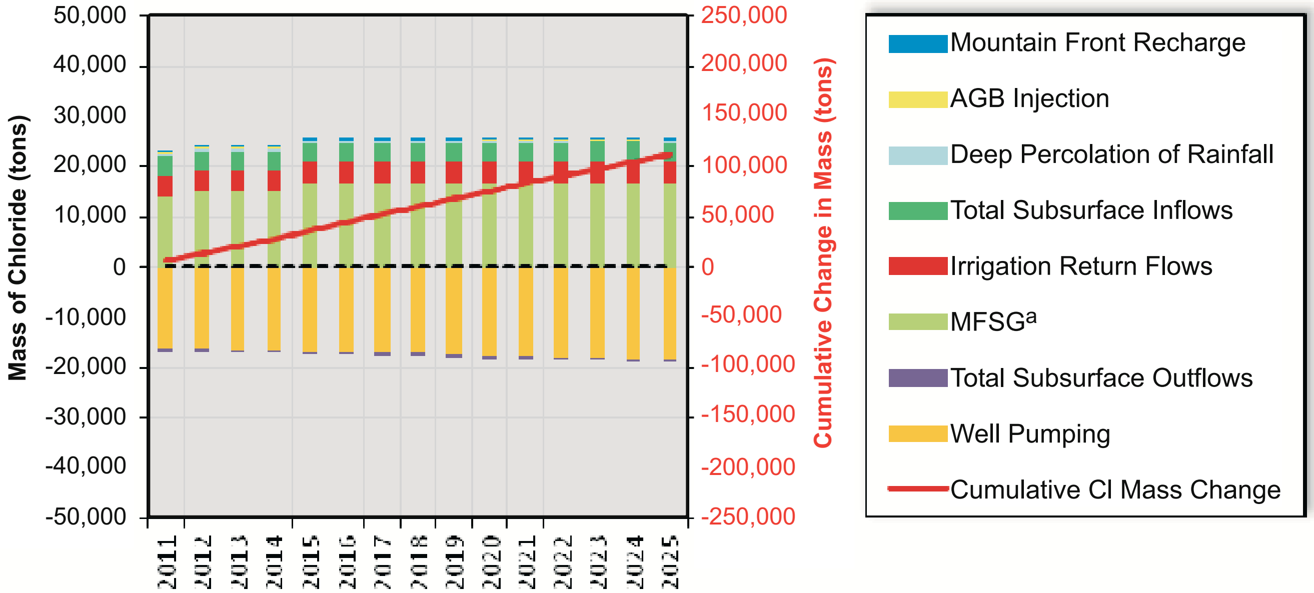
Cl - Chloride

[a] - May include minor loading from DGSG

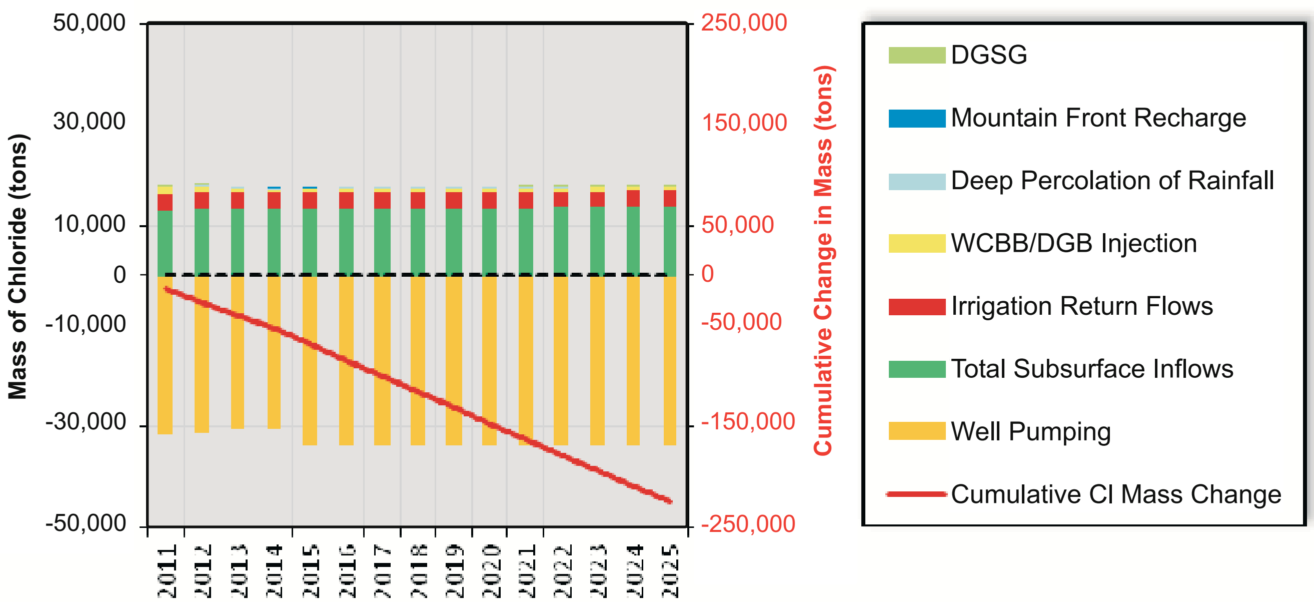
TODD GROUNDWATER

Figure 49
Chloride Mass Balances
Scenario 8
Future Planning Period

Central Basin Chloride - All Layers



West Coast Basin Chloride - All Layers

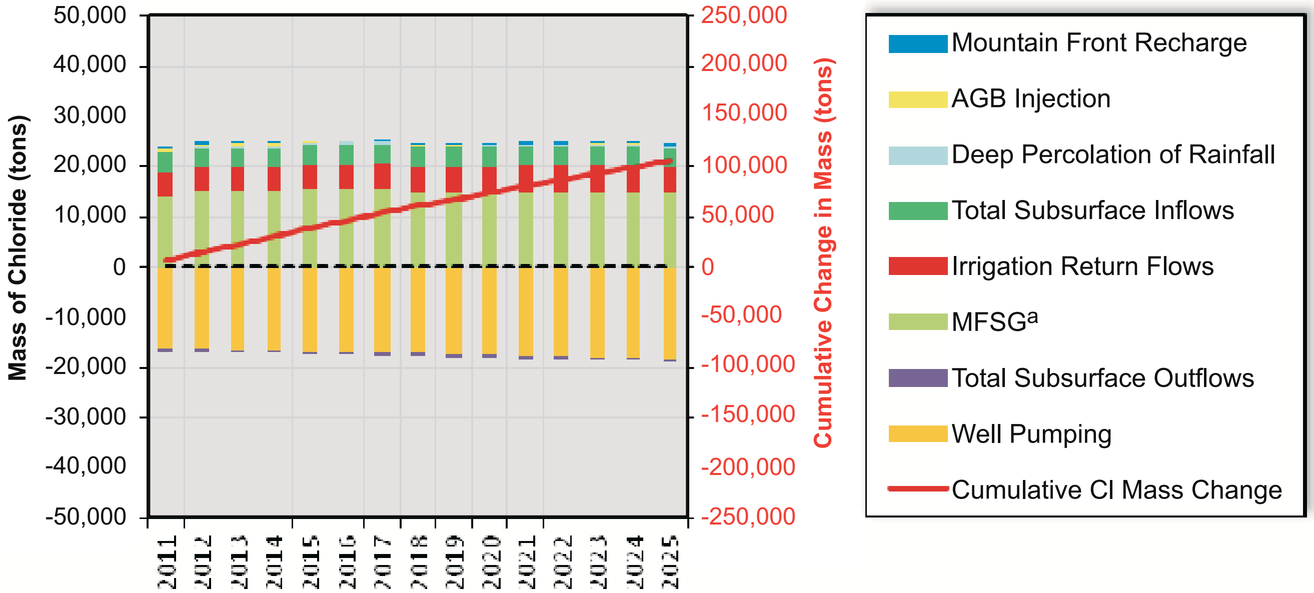


Notes:
DGSG - Dominguez Gap Spreading Grounds
MFSG - Montebello Forebay Spreading Grounds
AGB - Alamitos Gap Barrier
WCBB - West Coast Basin Barrier
DGB - Dominguez Gap Barrier
Cl - Chloride
[a] - May include minor loading from DGSG

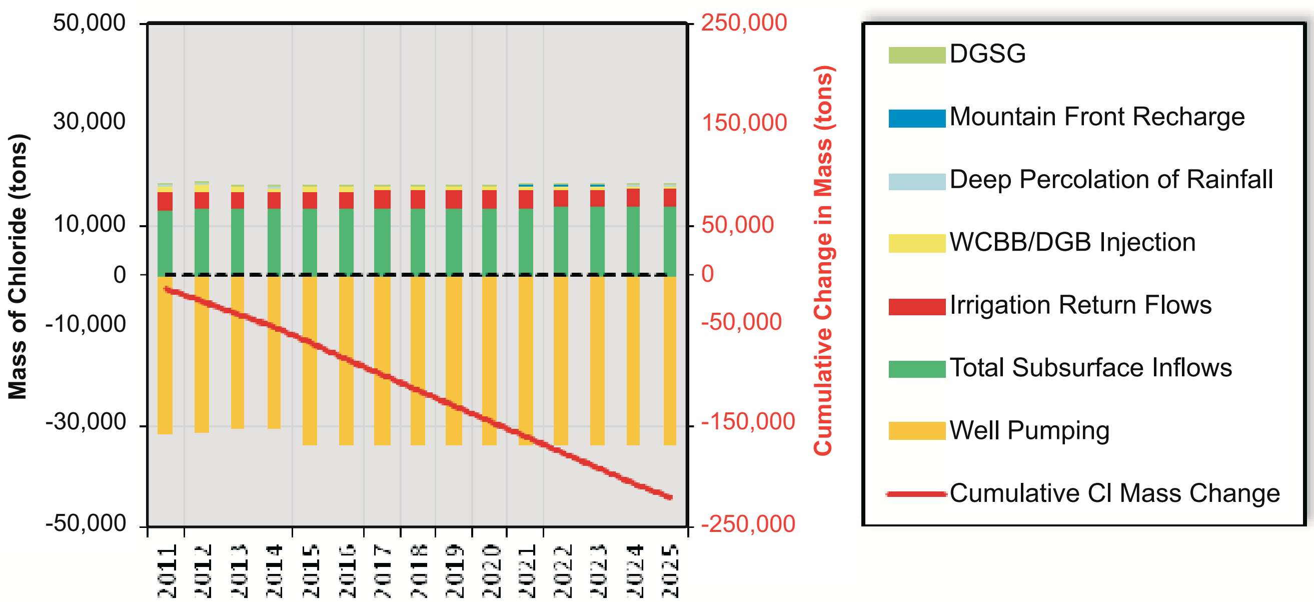
TODD GROUNDWATER

Figure 50
Chloride Mass Balances
Scenario 9
Future Planning Period

Central Basin Chloride - All Layers



West Coast Basin Chloride - All Layers

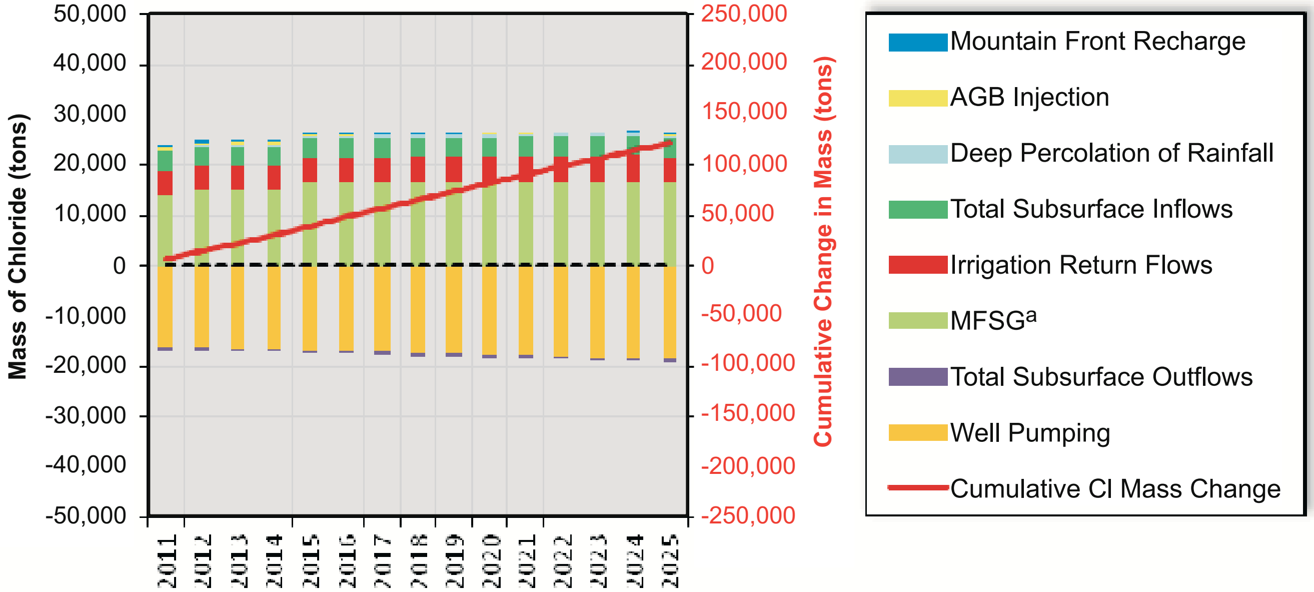


Notes:
DGSG - Dominguez Gap Spreading Grounds
MFSG - Montebello Forebay Spreading Grounds
AGB - Alamitos Gap Barrier
WCBB - West Coast Basin Barrier
DGB - Dominguez Gap Barrier
Cl - Chloride
[a] - May include minor loading from DGSG

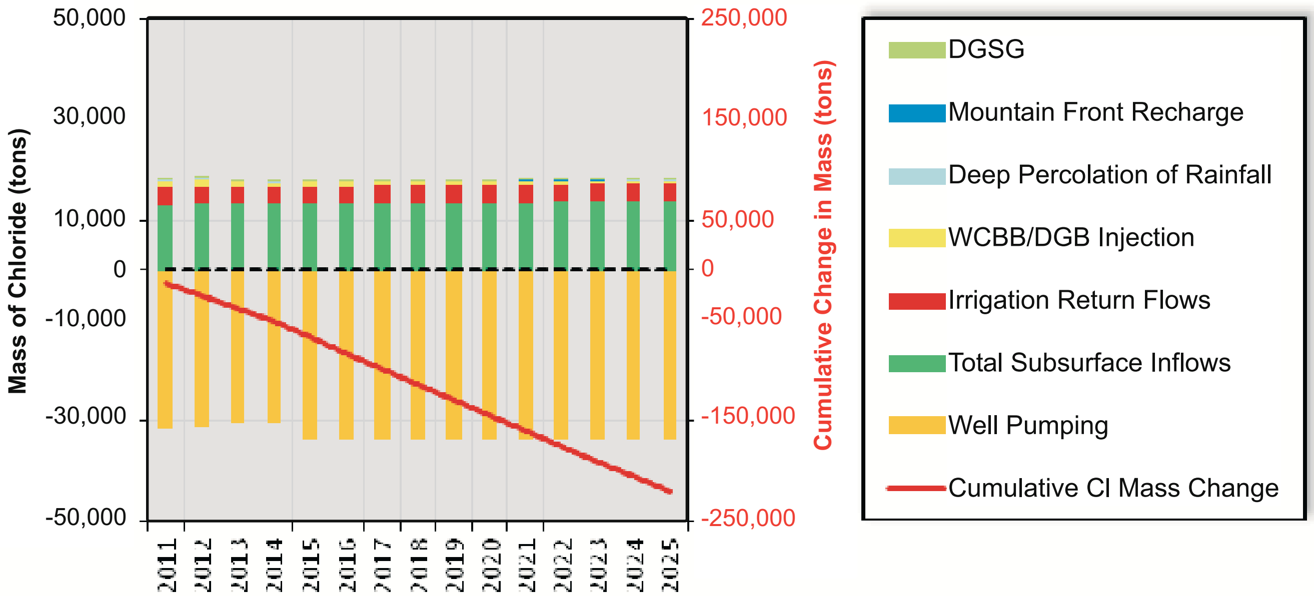
TODD GROUNDWATER

Figure 51
Chloride Mass Balances
Scenario 10
Future Planning Period

Central Basin Chloride - All Layers



West Coast Basin Chloride - All Layers

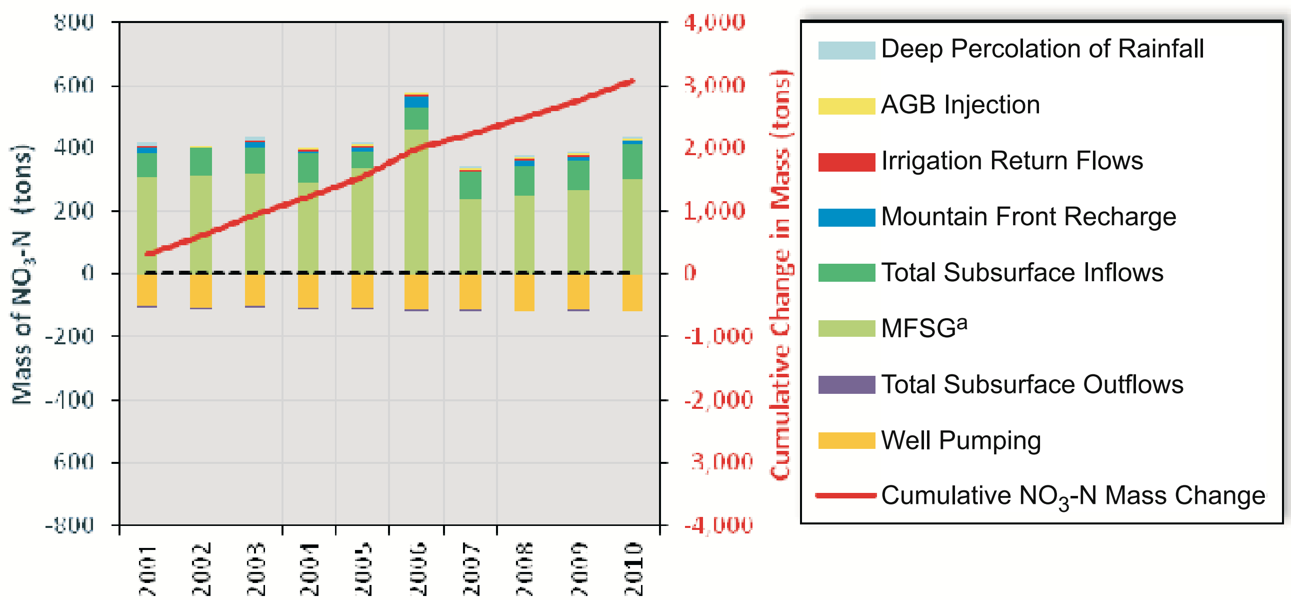


Notes:
DGSG - Dominguez Gap Spreading Grounds
MFSG - Montebello Forebay Spreading Grounds
AGB - Alamitos Gap Barrier
WCBB - West Coast Basin Barrier
DGB - Dominguez Gap Barrier
Cl - Chloride
[a] - May include minor loading from DGSG

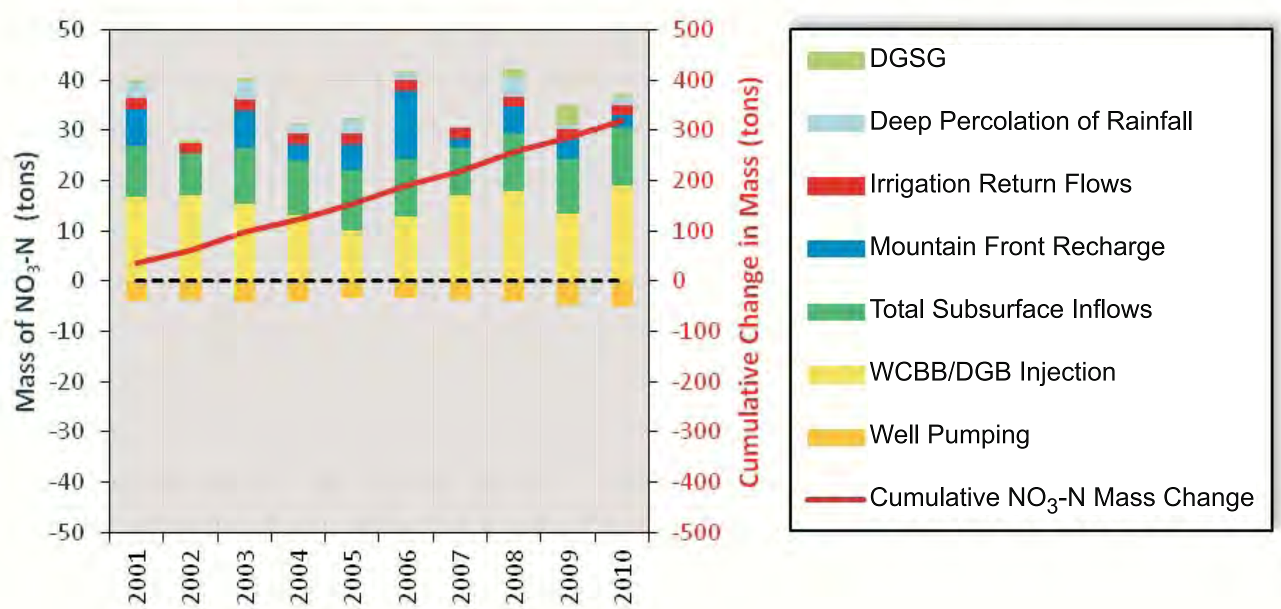
TODD GROUNDWATER

Figure 52
Chloride Mass Balances
Scenario 11
Future Planning Period

Central Basin NO_3-N - All Layers



West Coast Basin NO_3-N - All Layers



Notes:

DGSG - Dominguez Gap Spreading Grounds

MFSG - Montebello Forebay Spreading Grounds

AGB - Alamitos Gap Barrier

WCBB - West Coast Basin Barrier

DGB - Dominguez Gap Barrier

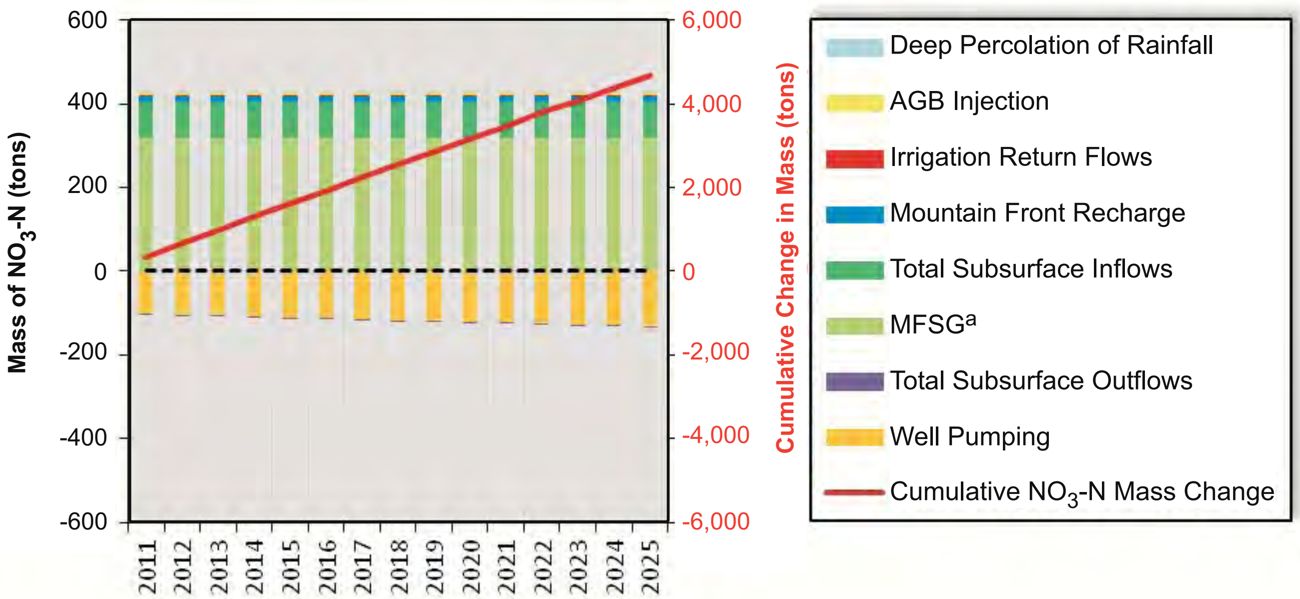
NO_3-N - Nitrate as nitrogen

[a] - May include minor loading from DGSG

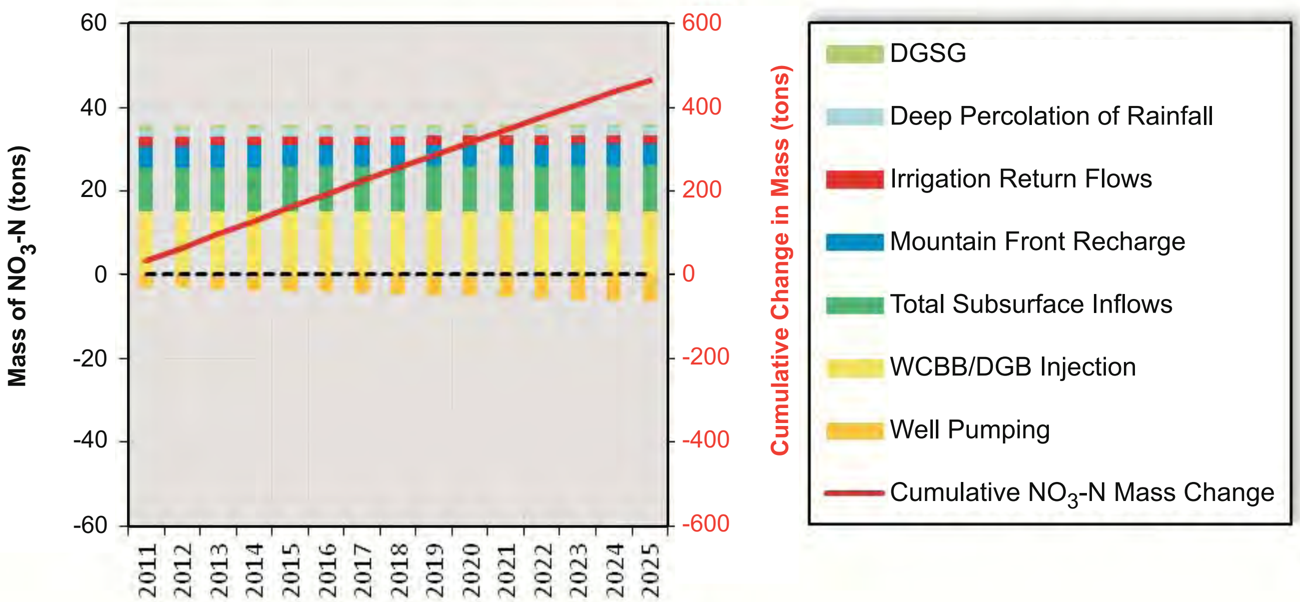
TODD GROUNDWATER

Figure 53
Nitrate Mass Balances Baseline Period

Central Basin NO_3-N - All Layers



West Coast Basin NO_3-N - All Layers



Notes:

DGSG - Dominguez Gap Spreading Grounds

MFSG - Montebello Forebay Spreading Grounds

AGB - Alamitos Gap Barrier

WCBB - West Coast Basin Barrier

DGB - Dominguez Gap Barrier

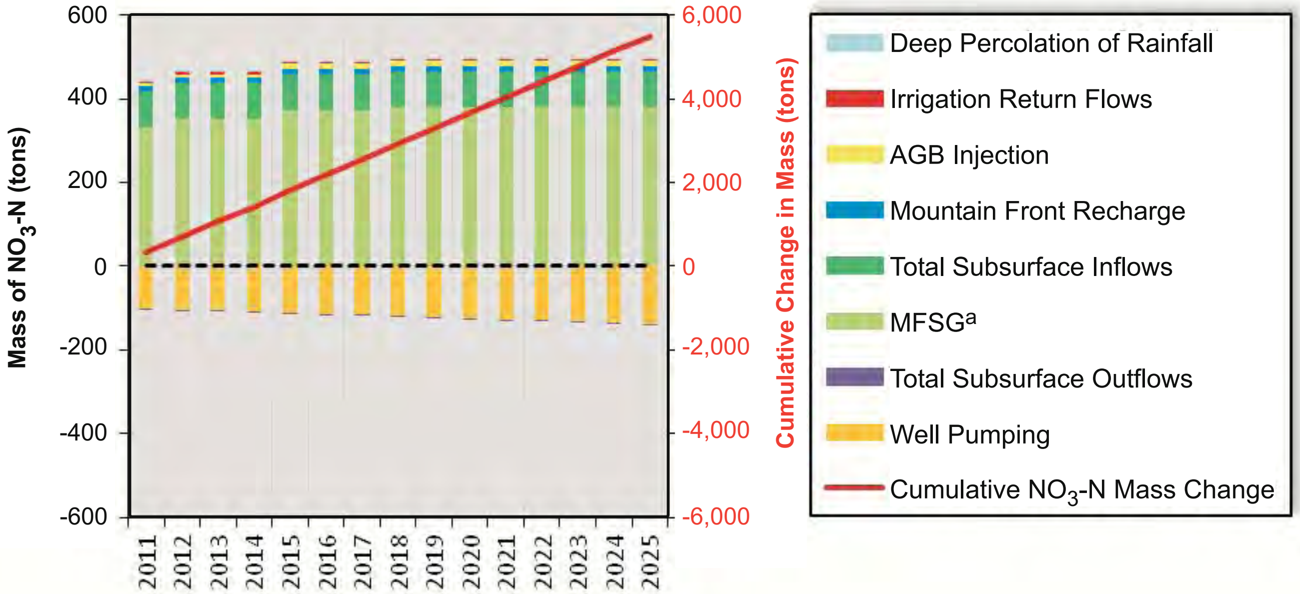
NO_3-N - Nitrate as nitrogen

[a] - May include minor loading from DGSG

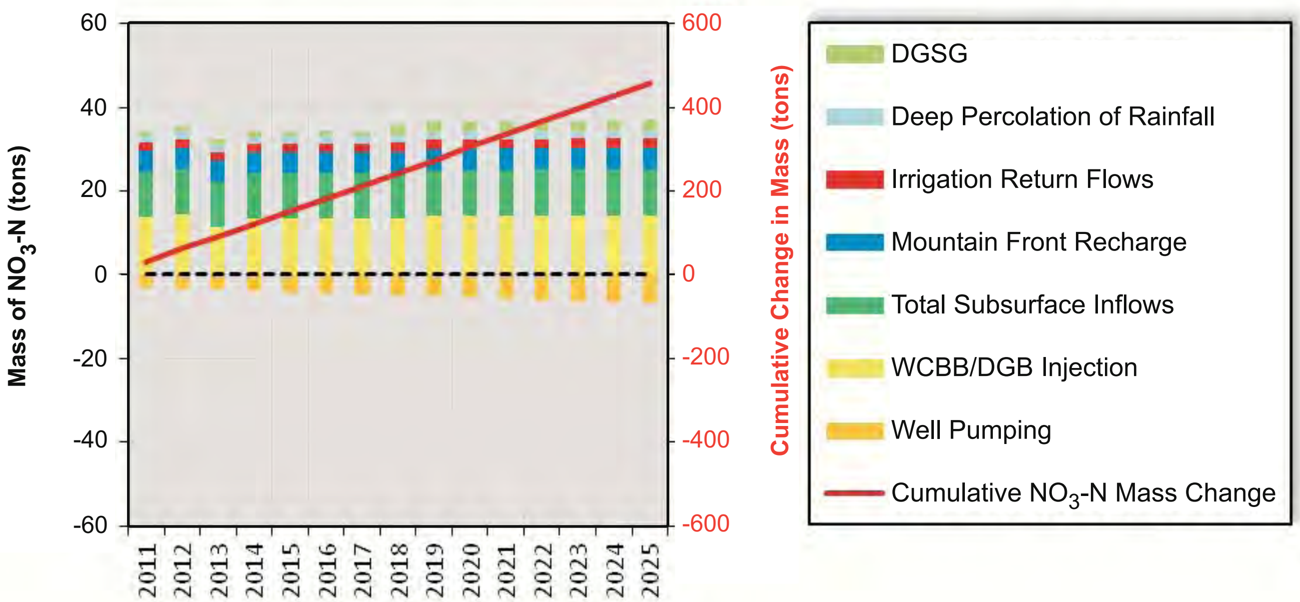
TODD GROUNDWATER

Figure 54
Nitrate Mass Balances
No Future Projects
Scenario 1
Future Planning Period

Central Basin NO_3-N - All Layers



West Coast Basin NO_3-N - All Layers



Notes:

DGSG - Dominguez Gap Spreading Grounds

MFSG - Montebello Forebay Spreading Grounds

AGB - Alamitos Gap Barrier

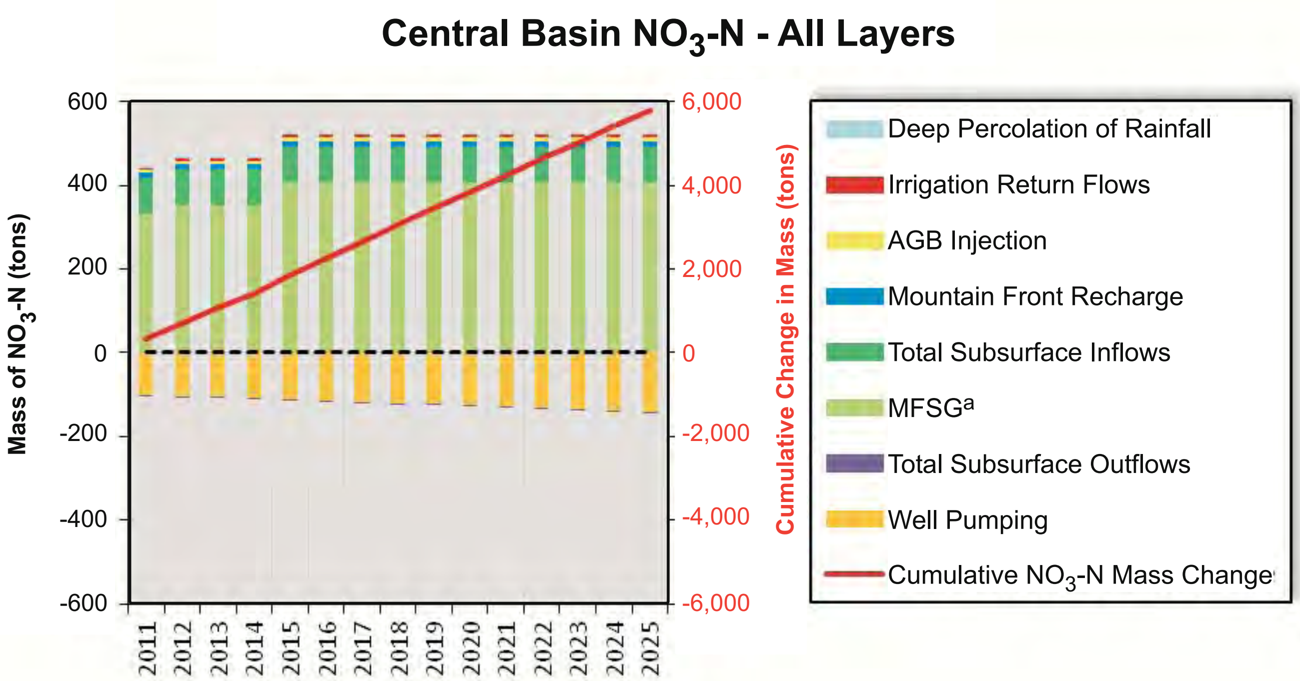
WCBB - West Coast Basin Barrier

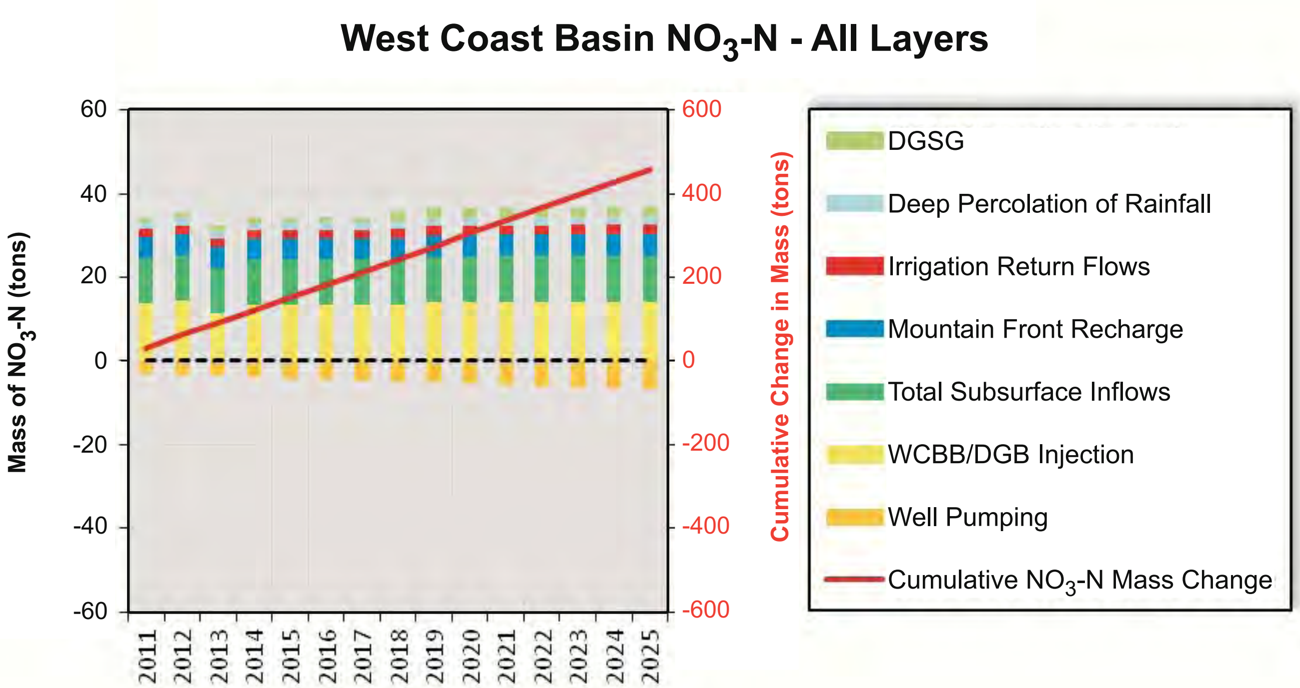
DGB - Dominguez Gap Barrier

NO_3-N - Nitrate as nitrogen

[a] - May include minor loading from DGSG

Figure 55
Nitrate Mass Balances
Scenario 8
Future Planning Period





Notes:

DGSG - Dominguez Gap Spreading Grounds

MFSG - Montebello Forebay Spreading Grounds

AGB - Alamitos Gap Barrier

WCBB - West Coast Basin Barrier

DGB - Dominguez Gap Barrier

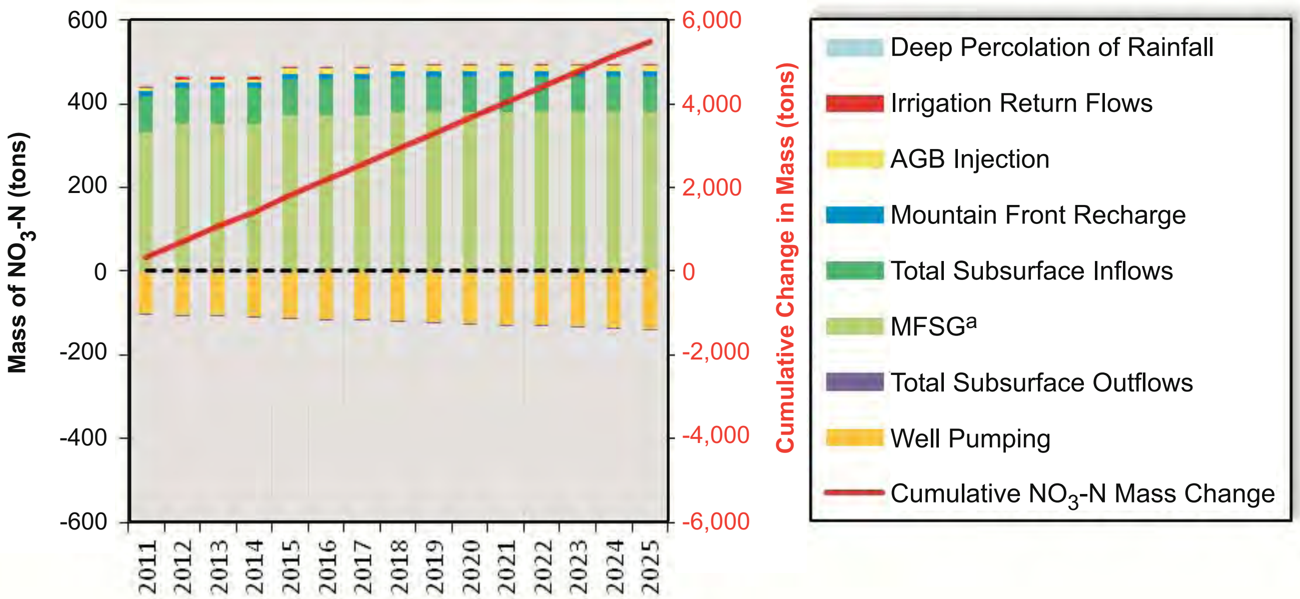
NO_3-N - Nitrate as nitrogen

[a] - May include minor loading from DGSG

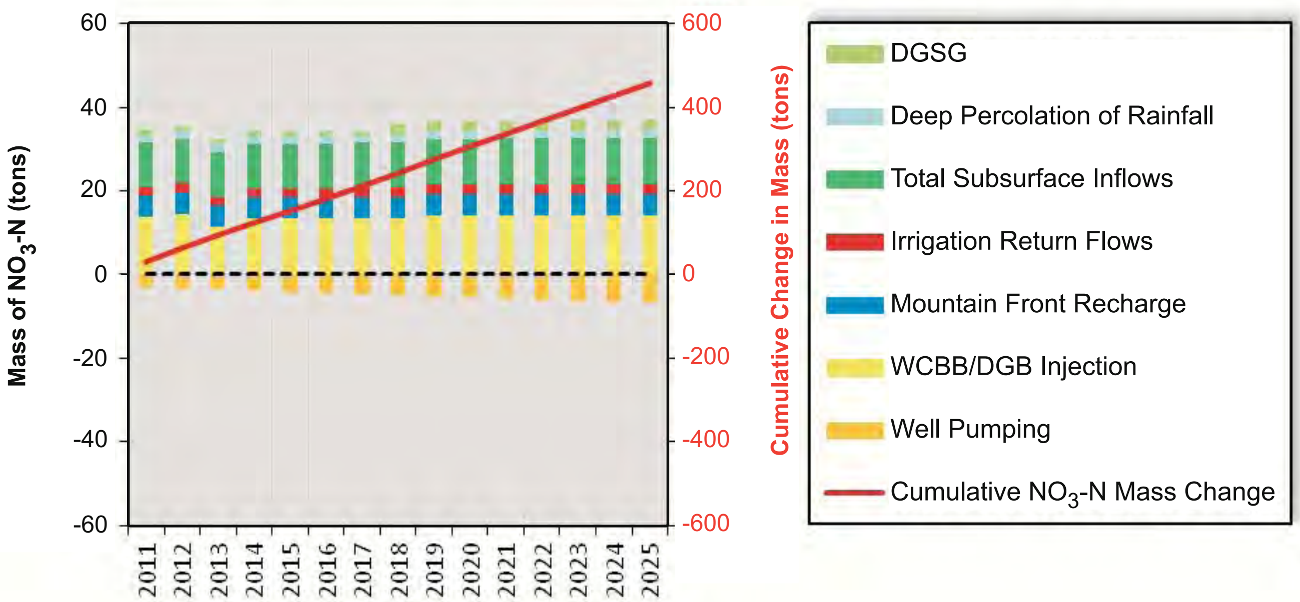
TODD GROUNDWATER

Figure 56
Nitrate Mass Balances
Scenario 9
Future Planning Period

Central Basin NO_3-N - All Layers



West Coast Basin NO_3-N - All Layers



Notes:

DGSG - Dominguez Gap Spreading Grounds

MFSG - Montebello Forebay Spreading Grounds

AGB - Alamitos Gap Barrier

WCBB - West Coast Basin Barrier

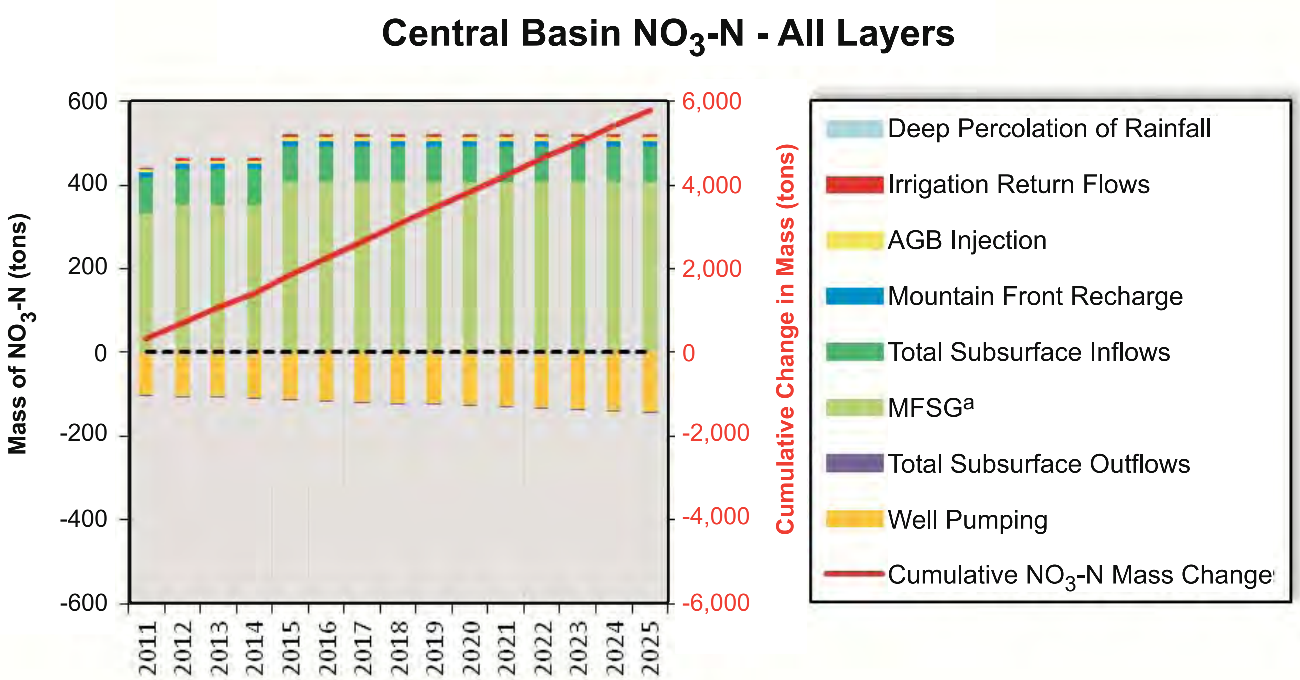
DGB - Dominguez Gap Barrier

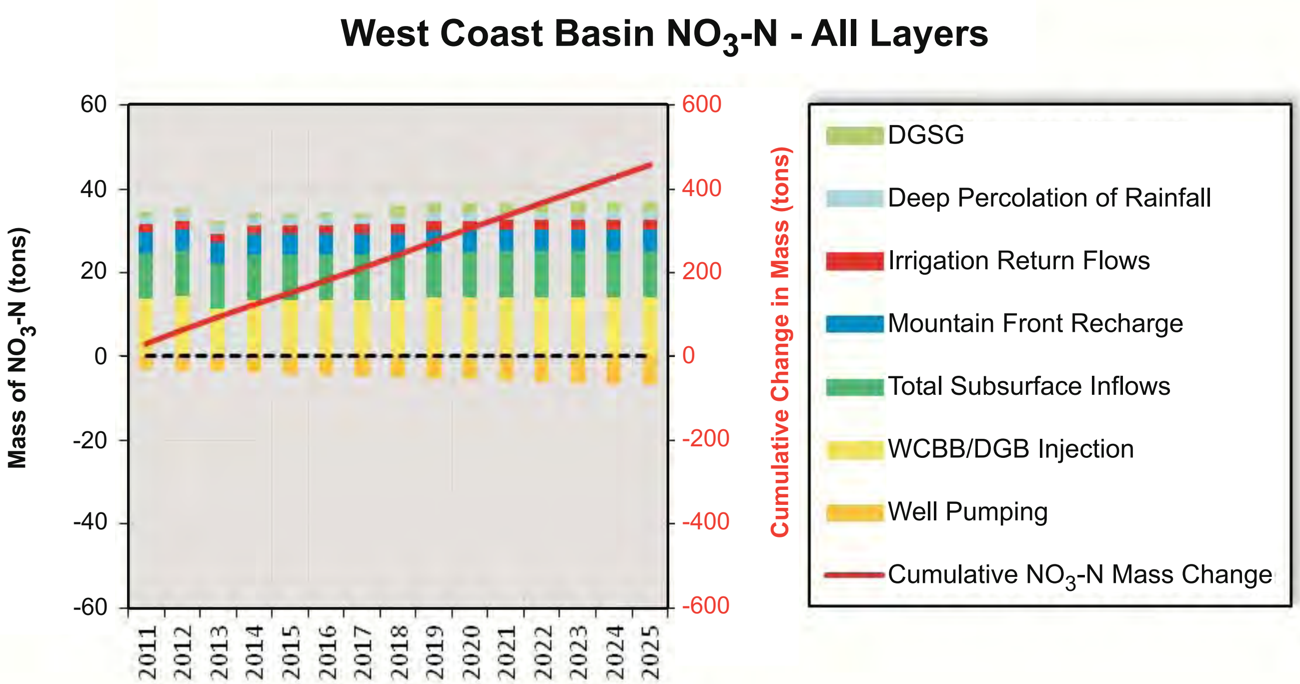
NO_3-N - Nitrate as nitrogen

[a] - May include minor loading from DGSG

TODD GROUNDWATER

Figure 57
Nitrate Mass Balances
Scenario 10
Future Planning Period

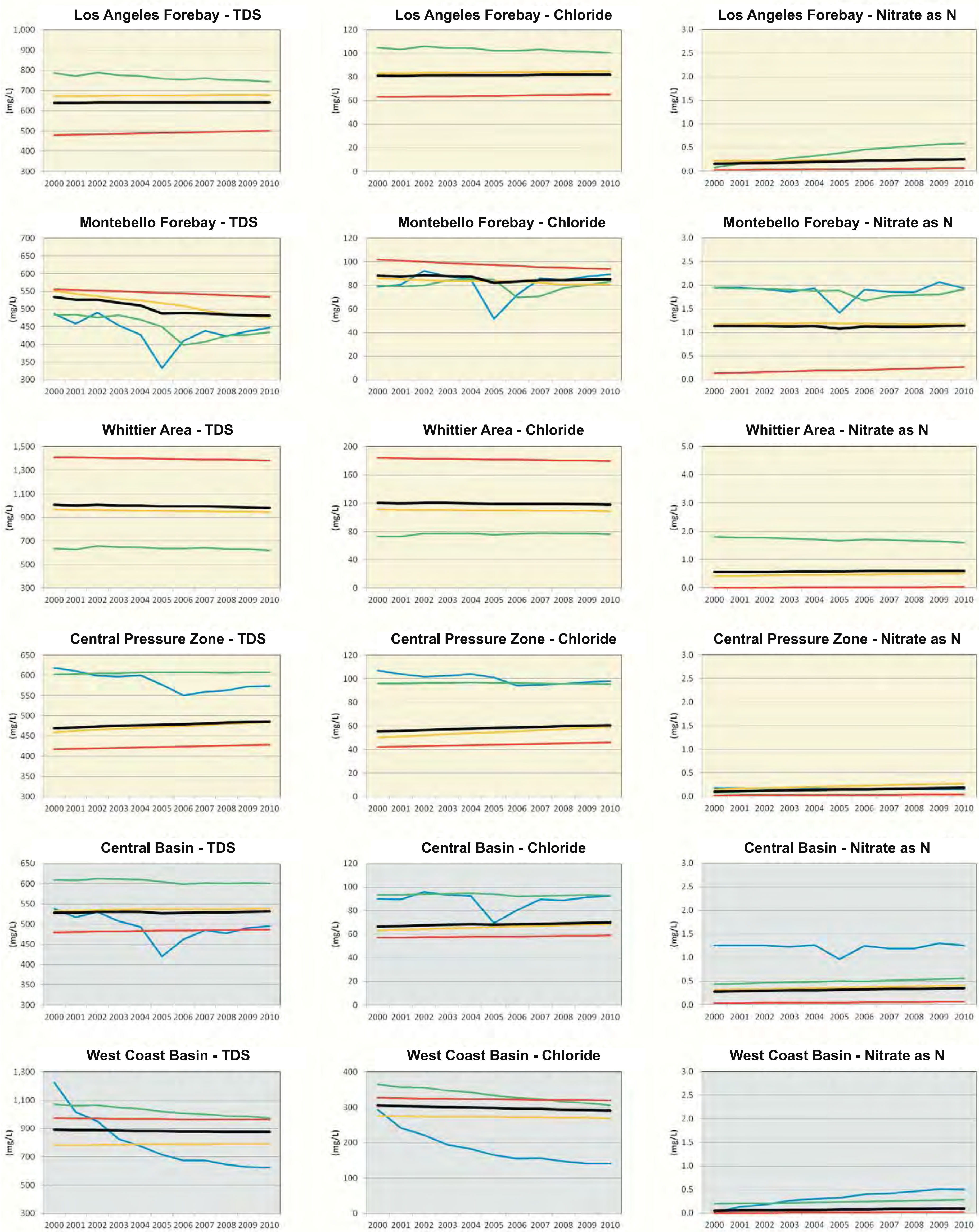




Notes:
DGSG - Dominguez Gap Spreading Grounds
MFSG - Montebello Forebay Spreading Grounds
AGB - Alamitos Gap Barrier
WCBB - West Coast Basin Barrier
DGB - Dominguez Gap Barrier
NO_3-N - Nitrate as nitrogen
[a] - May include minor loading from DGSG

TODD GROUNDWATER

Figure 58
Nitrate Mass Balances
Scenario 11
Future Planning Period



LEGEND

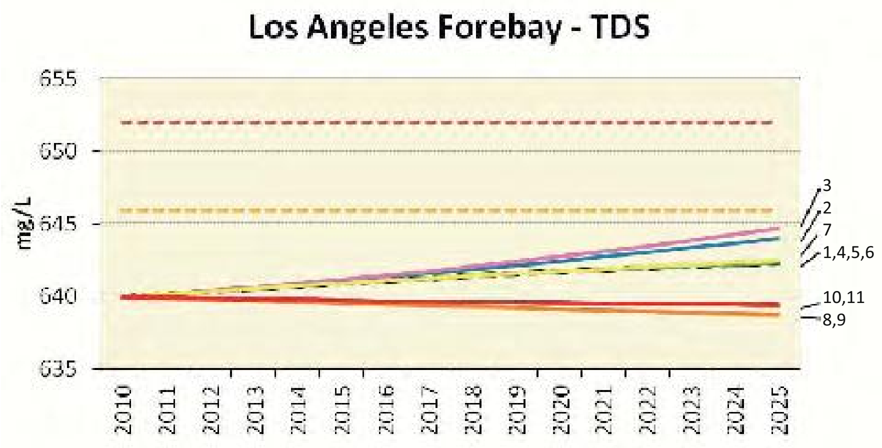
- Layer 1
- Layer 2
- Layer 3
- Layer 4
- All Layers

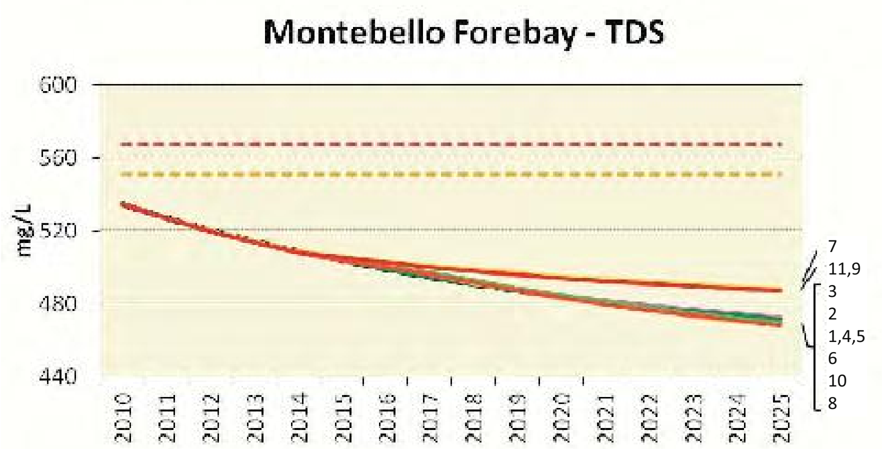
Notes:

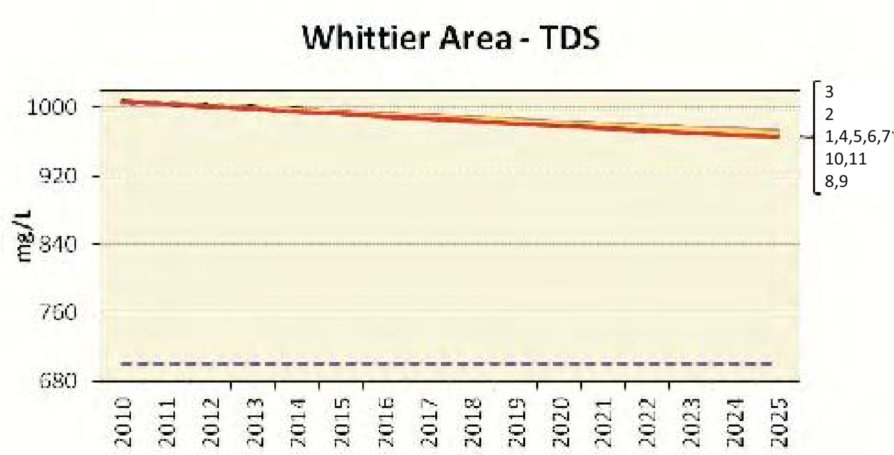
TDS - Total Dissolved Solids
N - Nitrogen
mg/L - milligrams per Liter

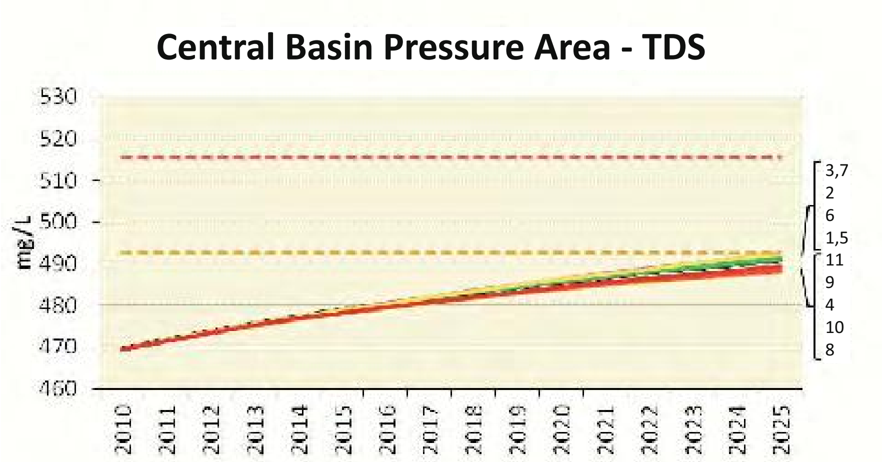
TODD GROUNDWATER

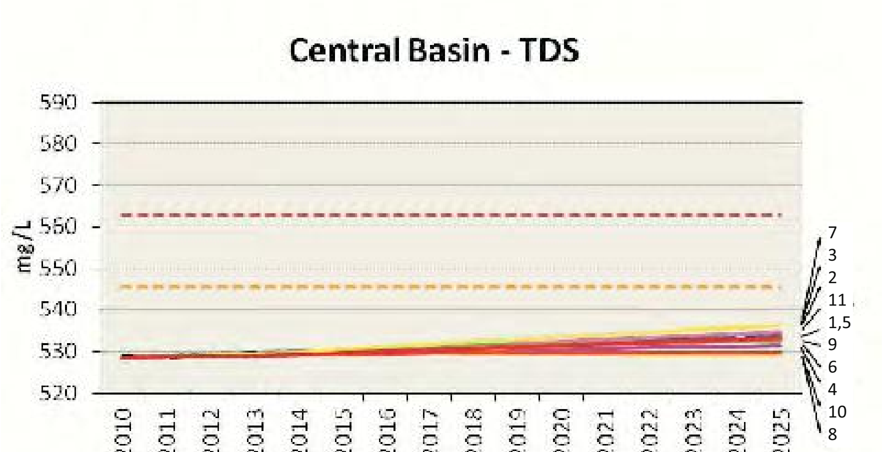
Figure 59
Simulated Calibrated Groundwater Concentrations Baseline Period

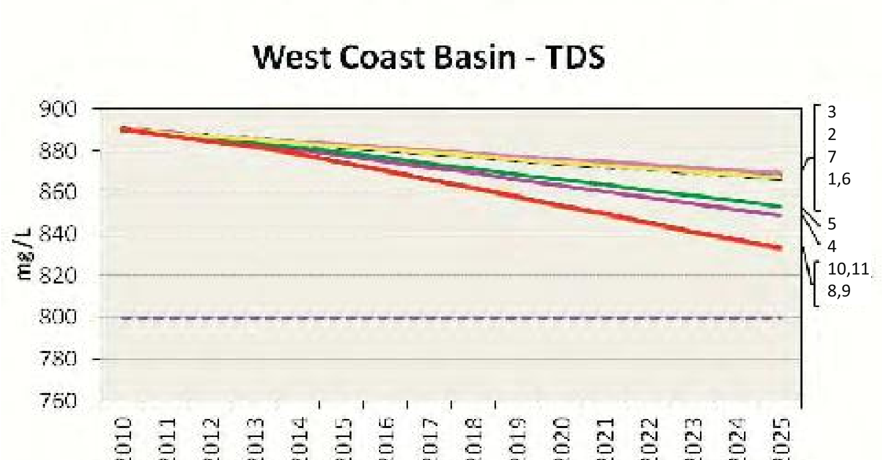












Legend

- BPO/BSBPO
- 20% Assimilative Capacity Threshold
- 10% Assimilative Capacity Threshold
- 1. No Future Projects
- 2. Increased Recycled Water Irrigation (baseline average)
- 3. Increased Recycled Water Irrigation (MCL or SMCL)
- 4. Seawater Barriers (Increased Injection Volume & AWT RW)
- 5. Increased Desalter Well Pumping and Treatment
- 6. GRIP A (10,000 AFY AWT and 11,000 AFY Tertiary-treated RW)
- 7. GRIP B (21,000 AFY [100%] Tertiary-treated RW)
- 8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)
- 9. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)
- 10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)
- 11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)

Notes:

In the West Coast Basin, where there is no available assimilative capacity for TDS and chloride due to historical seawater intrusion, the BPO/BSBPO is shown rather than the 10% and 20% assimilative capacity threshold.

Minor Future Changes included in Scenarios 8 through 11 include projected background changes including increased spreading at Dominguez Gap Spreading Grounds, reduced imported water for municipal supply in Central Basin, and increased imported water for supply in West Coast Basin

RW - Recycled Water

MCL - Maximum Contaminant Level

SMCL - Secondary MCL

GRIP - Groundwater Reliability Improvement Project

TDS - total dissolved solids

mg/L - milligrams per liter

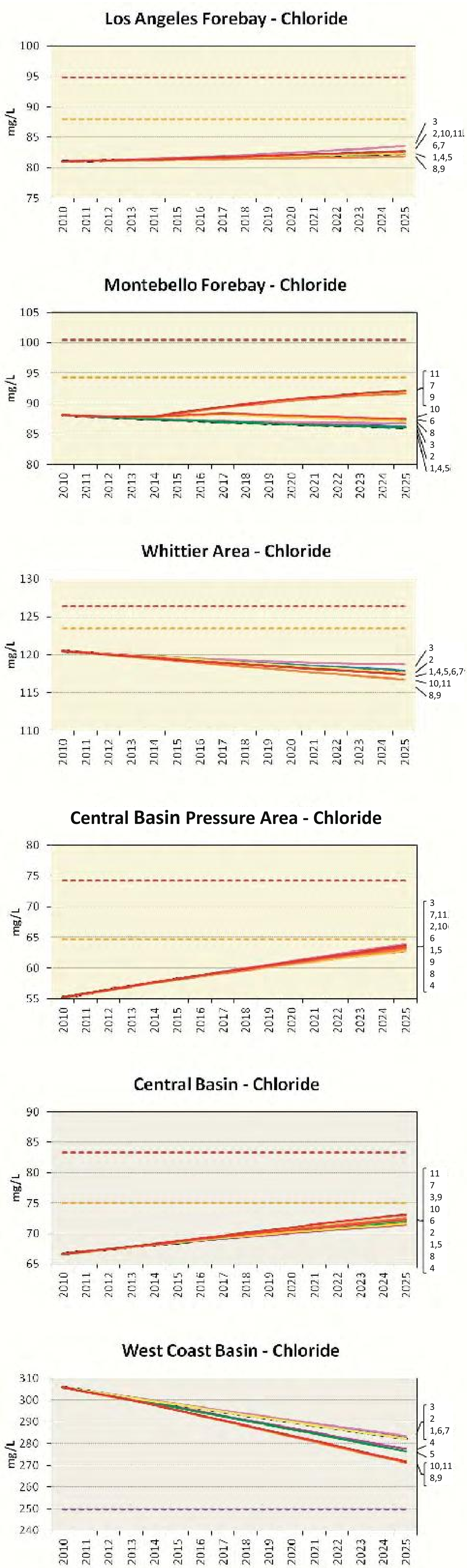
AFY - acre-feet per year

AWT - advanced water treatment

BPO/BSBPO - Basin Plan Objective/Basin-Specific Basin Plan Objective

Figure 60
Simulated Calibrated TDS Groundwater Concentrations for All Scenarios Future Planning Period

TODD GROUNDWATER



Legend

- BPO/BSBPO
- 20% Assimilative Capacity Threshold
- 10% Assimilative Capacity Threshold
- 1. No Future Projects
- 2. Increased Recycled Water Irrigation (baseline average)
- 3. Increased Recycled Water Irrigation (MCL or SMCL)
- 4. Seawater Barriers (Increased Injection Volume & AWT RW)
- 5. Increased Desalter Well Pumping and Treatment
- 6. GRIP A (10,000 AFY AWT and 11,000 AFY Tertiary-treated RW)
- 7. GRIP B (21,000 AFY [100%] Tertiary-treated RW)
- 8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)
- 9. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)
- 10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)
- 11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)

Notes:

In the West Coast Basin, where there is no available assimilative capacity for TDS and chloride due to historical seawater intrusion, the BPO/BSBPO is shown rather than the 10% and 20% assimilative capacity threshold.

Minor Future Changes included in Scenarios 8 through 11 include projected background changes including increased spreading at Dominguez Gap Spreading Grounds, reduced imported water for municipal supply in Central Basin, and increased imported water for supply in West Coast Basin

RW - Recycled Water

MCL - Maximum Contaminant Level

SMCL - Secondary MCL

GRIP - Groundwater Reliability Improvement Project

TDS - total dissolved solids

mg/L - milligrams per liter

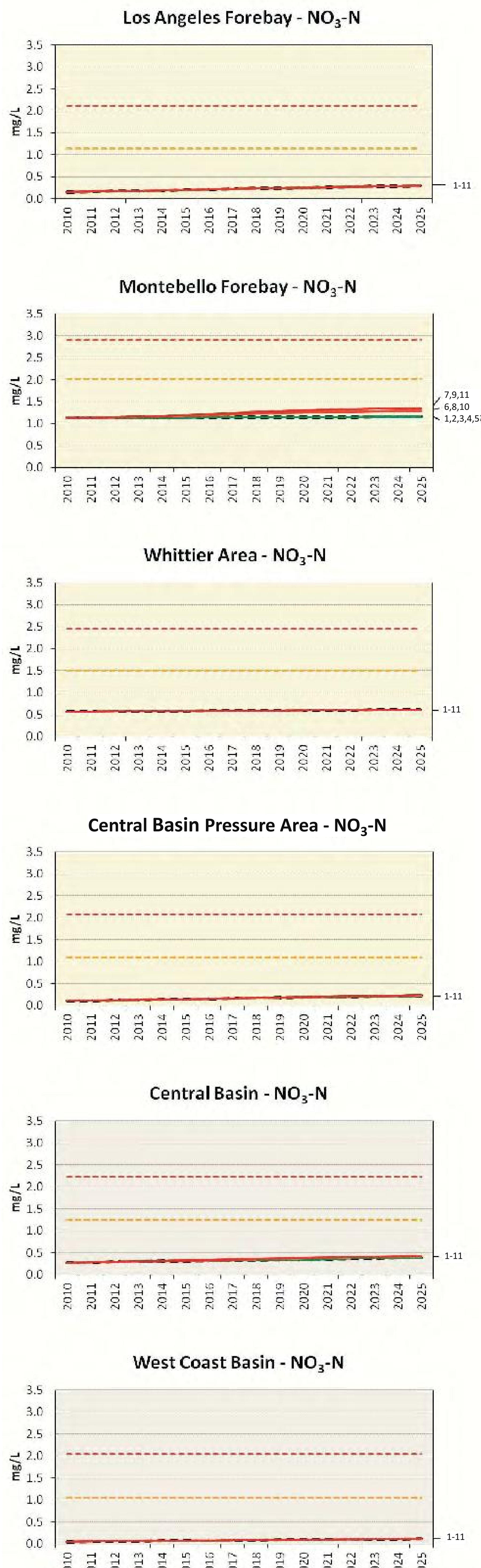
AFY - acre-feet per year

AWT - advanced water treatment

BPO/BSBPO - Basin Plan Objective/Basin-Specific Basin Plan Objective

Figure 61
Simulated Calibrated Chloride Groundwater Concentrations for All Scenarios Future Planning Period

TODD GROUNDWATER



Legend

- BPO/BSBPO
- 20% Assimilative Capacity Threshold
- 10% Assimilative Capacity Threshold
- 1. No Future Projects
- 2. Increased Recycled Water Irrigation (baseline average)
- 3. Increased Recycled Water Irrigation (MCL or SMCL)
- 4. Seawater Barriers (Increased Injection Volume & AWT RW)
- 5. Increased Desalter Well Pumping and Treatment
- 6. GRIP A (10,000 AFY AWT and 11,000 AFY Tertiary-treated RW)
- 7. GRIP B (21,000 AFY [100%] Tertiary-treated RW)
- 8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)
- 9. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)
- 10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)
- 11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)

Notes:

In the West Coast Basin, where there is no available assimilative capacity for TDS and chloride due to historical seawater intrusion, the BPO/BSBPO is shown rather than the 10% and 20% assimilative capacity threshold.

Minor Future Changes included in Scenarios 8 through 11 include projected background changes including increased spreading at Dominguez Gap Spreading Grounds, reduced imported water for municipal supply in Central Basin, and increased imported water for supply in West Coast Basin

RW - Recycled Water

MCL - Maximum Contaminant Level

SMCL - Secondary MCL

GRIP - Groundwater Reliability Improvement Project

TDS - total dissolved solids

mg/L - milligrams per liter

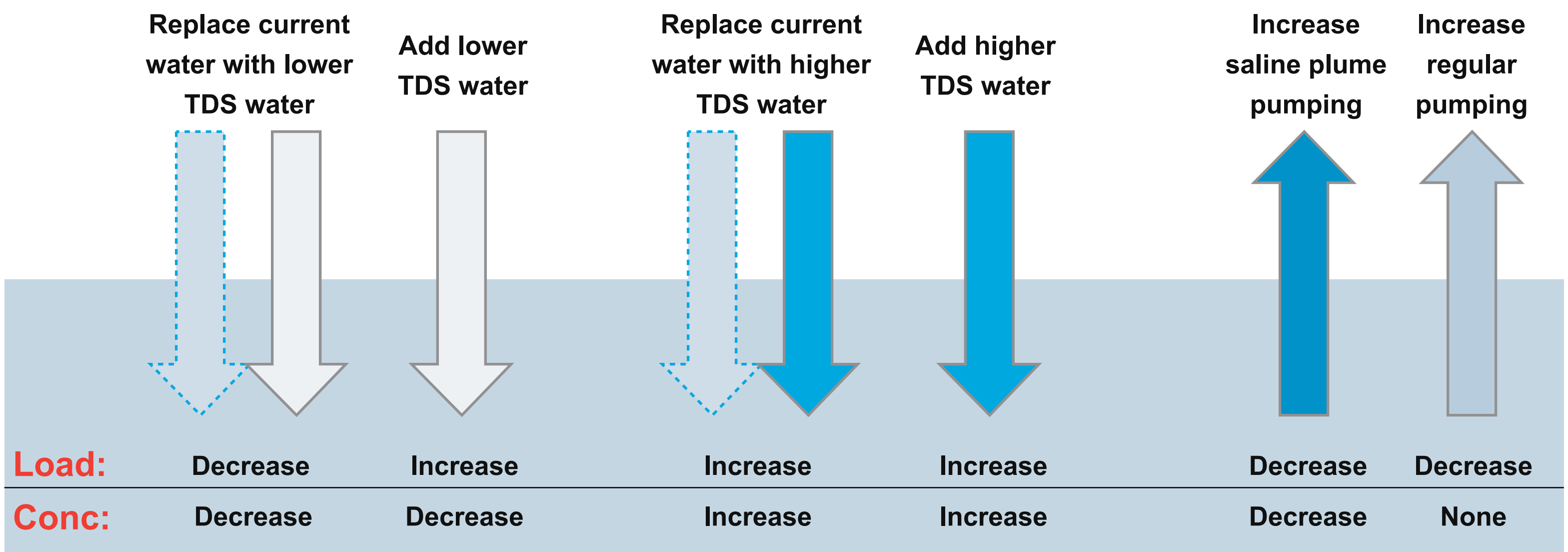
AFY - acre-feet per year

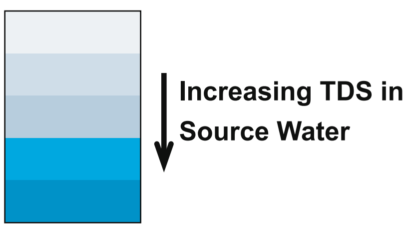
AWT - advanced water treatment

BPO/BSBPO - Basin Plan Objective/Basin-Specific Basin Plan Objective

Figure 62
Simulated Calibrated Nitrate Groundwater Concentrations for All Scenarios Future Planning Period

TODD GROUNDWATER





Notes:

The darker color represents a higher concentration of TDS and the dashed outline represents a source of water which was previously used and is currently being replaced by the source next to it.

TDS - Total Dissolved Solids
Conc - Concentration

Figure 63
Loading versus Concentration Schematic for TDS

TODD GROUNDWATER

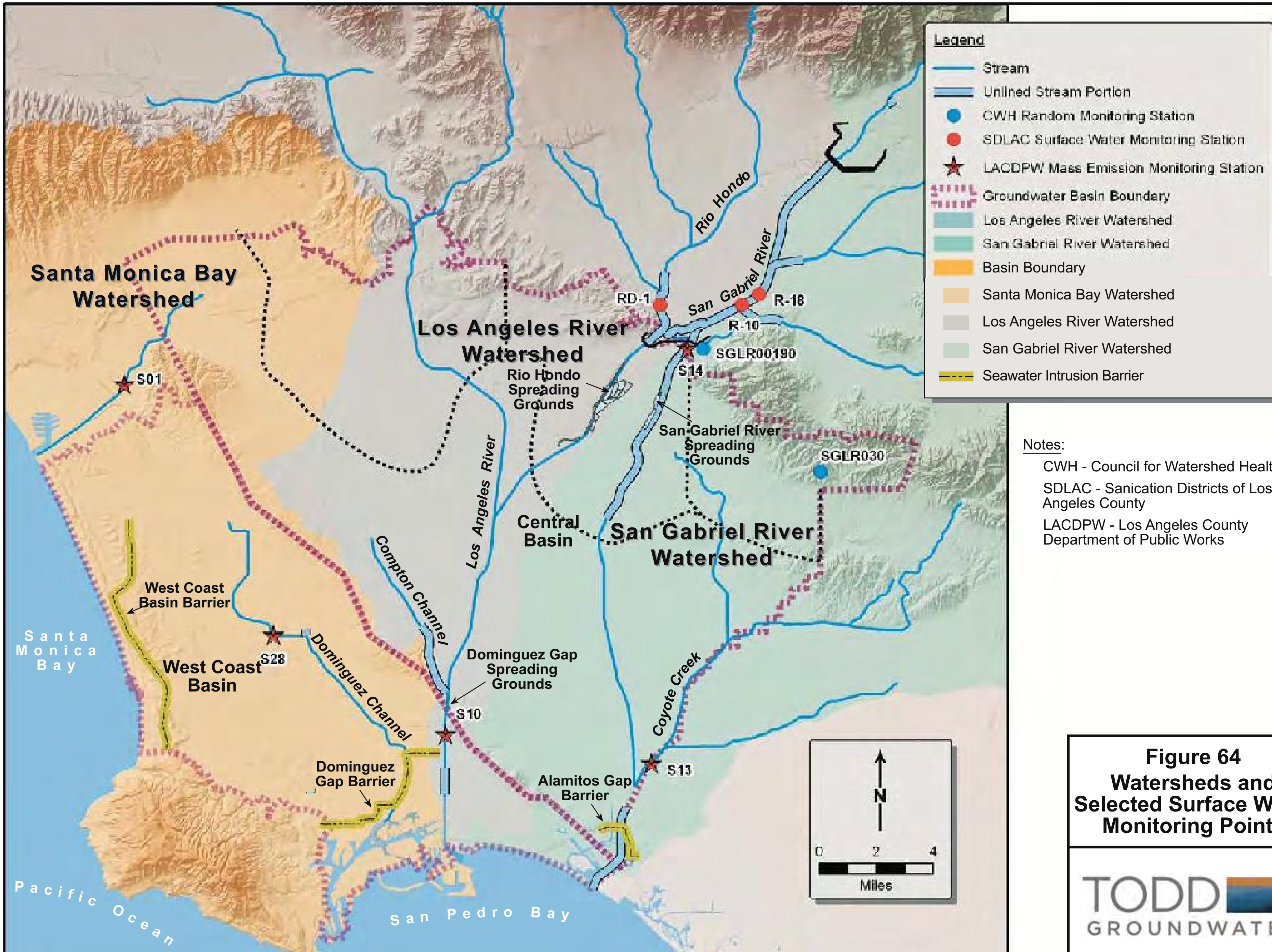


Figure 64
Watersheds and Selected Surface Water Monitoring Points

TODD GROUNDWATER

N

0 10

Scale in Miles

Notes:

LADWP - Los Angeles Department of Water and Power

MWD - Metropolitan Water District of Southern California

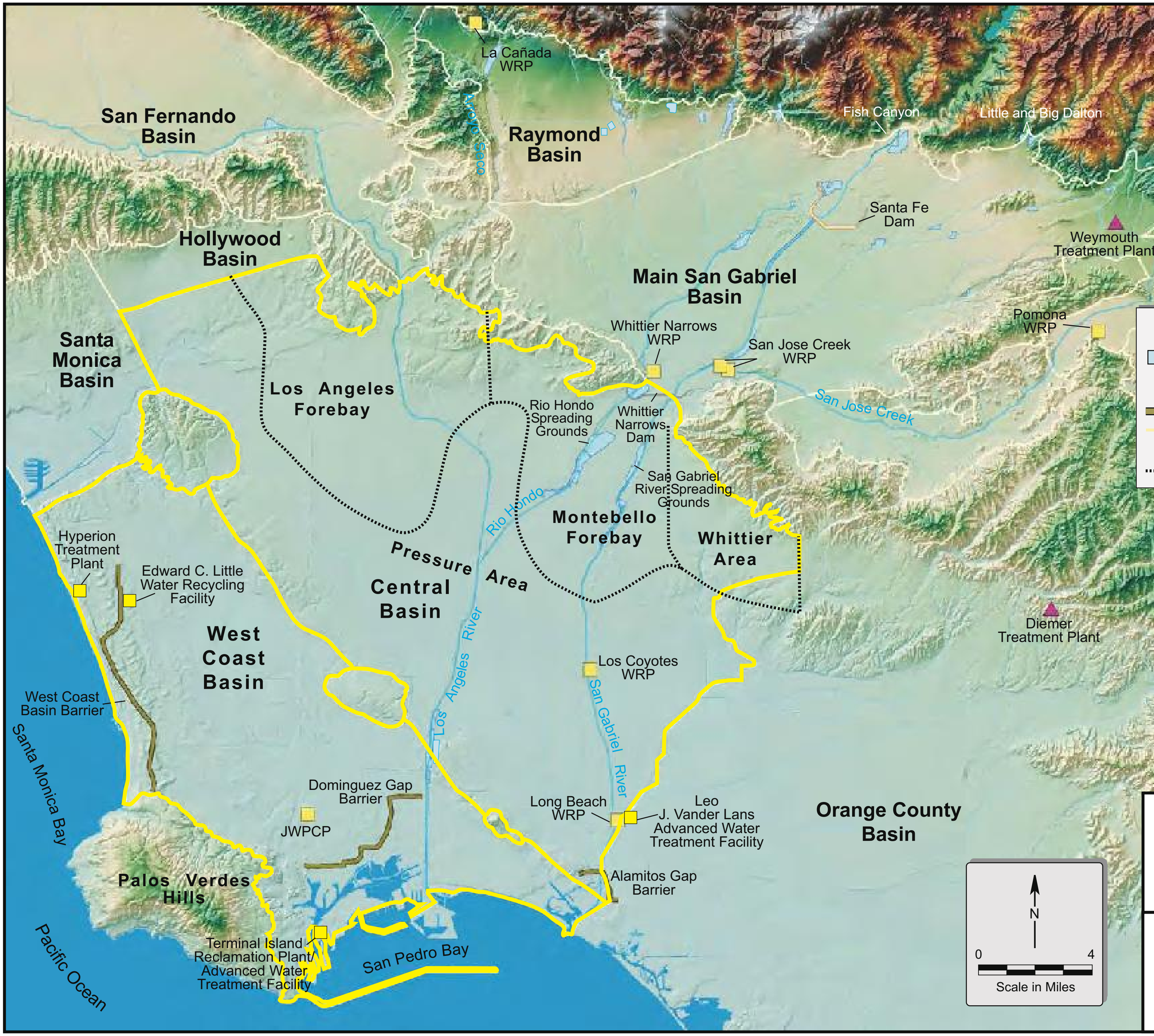
LEGEND

- Water Treatment Plant
- Power Plant

Modified from: Metropolitan Water District of Southern California, March 2011

Figure 65
MWD and LADWP Imported Water Facilities

TODD GROUNDWATER



Notes:

WRP - Water Reclamation Plant

JWPCP - Joint Water Pollution Control Plant

DWR - California Department of Water Resources

Figure 66
Location of Wastewater and Imported Water Treatment Facilities

TODD GROUNDWATER

Appendix A

State Water Resources Control Board, Policy for Water Quality Control for Recycled Water (Recycled Water Policy), Resolution No. 2013-0003, Revised January 22, 2013 and Effective April 25, 2013 (originally approved as Resolution No. 2009-0011 on May 14, 2009)

California
Water Boards
Protecting California's Water

State Water Resources Control Board

Policy for Water Quality Control for Recycled Water
(Recycled Water Policy)

Revised January 22, 2013
Effective April 25, 2013

State of California
Edmund G. Brown Jr., Governor

California Environmental Protection Agency
Matthew Rodriquez, Secretary

State Water Resources Control Board
P.O. Box100
Sacramento, CA 95812-0100

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 2013-0003

ADOPTION OF AN AMENDMENT TO THE POLICY FOR WATER QUALITY CONTROL FOR RECYCLED WATER CONCERNING MONITORING REQUIREMENTS FOR CONSTITUTENTS OF EMERGING CONCERN

WHEREAS:

1. Provisions of the Policy for Water Quality Control for Recycled Water (Recycled Water Policy), adopted under Resolution No. 2009-0011, directed the State Water Resources Control Board (State Water Board) to convene a "blue-ribbon" advisory panel (Panel) to provide guidance on future actions related to monitoring constituents of emerging concern (CECs) in recycled water.

2. In June 2010, the Panel submitted a report titled "Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water – Recommendations of a Science Advisory Panel" (Report), which presented recommendations for monitoring CECs in municipal recycled water used for groundwater recharge.

3. In December 2010, the State Water Board held a public hearing regarding the Panel's Report and received public comments.

4. In May 2012, staff circulated a draft amendment to the Recycled Water Policy that: (1) proposed, in accordance with the Panel's recommendations, monitoring requirements for CECs and surrogates in recycled water used for groundwater recharge; and (2) proposed a reduction of priority pollutant monitoring of recycled water used for landscape irrigation.

5. In July 2012, a scientific peer review of the draft amendment and the Panel's Report was conducted.

6. Staff reviewed comments received on the draft amendment from the public and peer reviewers and issued a revised draft amendment on September 14, 2012. Written comments were received on this draft prior to an October 9, 2012, due date.

7. The State Water Board held a public hearing on October 16, 2012, to consider adoption of the draft amendment. At the hearing, the adoption was postponed to refine the responses to comments and allow additional time for public review.

8. The Natural Resources Agency has approved the State Water Board's and the Regional Water Quality Control Boards' water quality control planning process as a "certified regulatory program" that adequately satisfies the California Environmental Quality Act requirements for preparing environmental documents. The amendment concerns monitoring requirements for priority pollutants and constituents of emerging concern. It is not a "project" as defined by title 14, California Code of Regulations chapter 3, Guidelines for Implementation of the California Environmental Quality Act. Hence, approval of an environmental document is not required to adopt the amendment.

THEREFORE BE IT RESOLVED THAT:

The State Water Board

1. Adopts the amendment to the Recycled Water Policy.

2. Directs State Water Board Staff to submit the amended Recycled Water Policy to the Office of Administrative Law (OAL) for final approval.

3. Directs the Executive Director or designee to make minor, non-substantive modifications to the language of the amendment, if OAL determines during its approval process that such changes are needed; and directs the Executive Director to inform the State Water Board of any such changes.

CERTIFICATION

The undersigned Clerk to the Board does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on January 22, 2013.

AYE:	Vice Chair Frances Spivy-Weber Board Member Tam M. Doduc Board Member Steven Moore
NAY:	None
ABSENT:	Chairman Charles R. Hoppin Board Member Felicia Marcus
ABSTAIN:	None

Jeanine Townsend
Clerk to the Board

Recycled Water Policy

Table of Contents

Recycled Water Policy

1. *Preamble*

California is facing an unprecedented water crisis.

The collapse of the Bay-Delta ecosystem, climate change, and continuing population growth have combined with a severe drought on the Colorado River and failing levees in the Delta to create a new reality that challenges California's ability to provide the clean water needed for a healthy environment, a healthy population and a healthy economy, both now and in the future.

These challenges also present an unparalleled opportunity for California to move aggressively towards a sustainable water future. The State Water Resources Control Board (State Water Board) declares that we will achieve our mission to "preserve, enhance and restore the quality of California's water resources to the benefit of present and future generations." To achieve that mission, we support and encourage every region in California to develop a salt/nutrient management plan by 2014 that is sustainable on a long-term basis and that provides California with clean, abundant water. These plans shall be consistent with the Department of Water Resources' Bulletin 160, as appropriate, and shall be locally developed, locally controlled and recognize the variability of California's water supplies and the diversity of its waterways. We strongly encourage local and regional water agencies to move toward clean, abundant, local water for California by emphasizing appropriate water recycling, water conservation, and maintenance of supply infrastructure and the use of stormwater (including dry-weather urban runoff) in these plans; these sources of supply are drought-proof, reliable, and minimize our carbon footprint and can be sustained over the long-term.

We declare our independence from relying on the vagaries of annual precipitation and move towards sustainable management of surface waters and groundwater, together with enhanced water conservation, water reuse and the use of stormwater. To this end, we adopt the following goals for California:

- Increase the use of recycled water over 2002 levels by at least one million acre-feet per year (afy) by 2020 and by at least two million afy by 2030.
- Increase the use of stormwater over use in 2007 by at least 500,000 afy by 2020 and by at least one million afy by 2030.
- Increase the amount of water conserved in urban and industrial uses by comparison to 2007 by at least 20 percent by 2020.
- Included in these goals is the substitution of as much recycled water for potable water as possible by 2030.

As modified by
State Water Board Resolution 2013-0003
(January 22, 2013)

The purpose of this Policy is to increase the use of recycled water from municipal wastewater sources that meets the definition in Water Code section 13050(n), in a manner that implements state and federal water quality laws. The State Water Board expects to develop additional policies to encourage the use of stormwater, encourage water conservation, encourage the conjunctive use of surface and groundwater, and improve the use of local water supplies.

When used in compliance with this Policy, Title 22 and all applicable state and federal water quality laws, the State Water Board finds that recycled water is safe for approved uses, and strongly supports recycled water as a safe alternative to potable water for such approved uses.

2. *Purpose of the Policy*

a. The purpose of this Policy is to provide direction to the Regional Water Quality Control Boards (Regional Water Boards), proponents of recycled water projects, and the public regarding the appropriate criteria to be used by the State Water Board and the Regional Water Boards in issuing permits for recycled water projects.

b. It is the intent of the State Water Board that all elements of this Policy are to be interpreted in a manner that fully implements state and federal water quality laws and regulations in order to enhance the environment and put the waters of the state to the fullest use of which they are capable.

c. This Policy describes permitting criteria that are intended to streamline the permitting of the vast majority of recycled water projects. The intent of this streamlined permit process is to expedite the implementation of recycled water projects in a manner that implements state and federal water quality laws while allowing the Regional Water Boards to focus their limited resources on projects that require substantial regulatory review due to unique site-specific conditions.

d. By prescribing permitting criteria that apply to the vast majority of recycled water projects, it is the State Water Board's intent to maximize consistency in the permitting of recycled water projects in California while also reserving to the Regional Water Boards sufficient authority and flexibility to address site-specific conditions.

e. The State Water Board will establish additional policies that are intended to assist the State of California in meeting the goals established in the preamble to this Policy for water conservation and the use of stormwater.

f. For purposes of this Policy, the term “permit” means an order adopted by a Regional Water Board or the State Water Board prescribing requirements for a recycled water project, including but not limited to water recycling requirements, master reclamation permits, and waste discharge requirements.

3. *Benefits of Recycled Water*

The State Water Board finds that the use of recycled water in accordance with this Policy, that is, which supports the sustainable use of groundwater and/or surface water, which is sufficiently treated so as not to adversely impact public health or the environment and which ideally substitutes for use of potable water, is presumed to have a beneficial impact. Other public agencies are encouraged to use this presumption in evaluating the impacts of recycled water projects on the environment as required by the California Environmental Quality Act (CEQA).

4. *Mandate for the Use of Recycled Water*

a. The State Water Board and Regional Water Boards will exercise the authority granted to them by the Legislature to the fullest extent possible to encourage the use of recycled water, consistent with state and federal water quality laws.

(1) The State Water Board hereby establishes a mandate to increase the use of recycled water in California by 200,000 afy by 2020 and by an additional 300,000 afy by 2030. These mandates shall be achieved through the cooperation and collaboration of the State Water Board, the Regional Water Boards, the environmental community, water purveyors and the operators of publicly owned treatment works. The State Water Board will evaluate progress toward these mandates biennially and review and revise as necessary the implementation provisions of this Policy in 2012 and 2016.

(2) Agencies producing recycled water that is available for reuse and not being put to beneficial use shall make that recycled water available to water purveyors for reuse on reasonable terms and conditions. Such terms and conditions may include payment by the water purveyor of a fair and reasonable share of the cost of the recycled water supply and facilities.

(3) The State Water Board hereby declares that, pursuant to Water Code sections 13550 *et seq*., it is a waste and unreasonable use of water for water agencies not to use recycled water when recycled water of adequate quality is available and is not being put to beneficial use, subject to the conditions established in sections 13550 *et seq*. The State Water Board shall exercise its authority pursuant to Water Code section 275 to the fullest extent possible to enforce the mandates of this subparagraph.

b. These mandates are contingent on the availability of sufficient capital funding for the construction of recycled water projects from private, local, state, and federal sources and assume that the Regional Water Boards will effectively implement regulatory streamlining in accordance with this Policy.

c. The water industry and the environmental community have agreed jointly to advocate for $1 billion in state and federal funds over the next five years to fund projects needed to meet the goals and mandates for the use of recycled water established in this Policy.

d. The State Water Board requests the California Department of Public Health (CDPH), the California Public Utilities Commission (CPUC), and the California Department of Water Resources (CDWR) to use their respective authorities to the fullest extent practicable to assist the State Water Board and the Regional Water Boards in increasing the use of recycled water in California.

5. *Roles of the State Water Board, Regional Water Boards, CDPH and CDWR*

The State Water Board recognizes that it shares jurisdiction over the use of recycled water with the Regional Water Boards and with CDPH. In addition, the State Water Board recognizes that CDWR and the CPUC have important roles to play in encouraging the use of recycled water. The State Water Board believes that it is important to clarify the respective roles of each of these agencies in connection with recycled water projects, as follows:

a. The State Water Board establishes general policies governing the permitting of recycled water projects consistent with its role of protecting water quality and sustaining water supplies. The State Water Board exercises general oversight over recycled water projects, including review of Regional Water Board permitting practices, and shall lead the effort to meet the recycled water use goals set forth in the Preamble to this Policy. The State Water Board is also charged by statute with developing a general permit for irrigation uses of recycled water.

b. The CDPH is charged with protection of public health and drinking water supplies and with the development of uniform water recycling criteria appropriate to particular uses of water. Regional Water Boards shall appropriately rely on the expertise of CDPH for the establishment of permit conditions needed to protect human health.

c. The Regional Water Boards are charged with protection of surface and groundwater resources and with the issuance of permits that implement CDPH recommendations, this Policy, and applicable law and will, pursuant to paragraph 4 of this Policy, use their authority to the fullest extent possible to encourage the use of recycled water.

d. CDWR is charged with reviewing and, every five years, updating the California Water Plan, including evaluating the quantity of recycled water presently being used and planning for the potential for future uses of recycled water. In undertaking these tasks, CDWR may appropriately rely on urban water management plans and may share the data from those plans with the State Water Board and the Regional Water Boards. CDWR also shares with the State Water Board the authority to allocate and distribute bond funding, which can provide incentives for the use of recycled water.

e. The CPUC is charged with approving rates and terms of service for the use of recycled water by investor-owned utilities.

6. *Salt/Nutrient Management Plans*

a. Introduction.

(1) Some groundwater basins in the state contain salts and nutrients that exceed or threaten to exceed water quality objectives established in the applicable Water Quality Control Plans (Basin Plans), and not all Basin Plans include adequate implementation procedures for achieving or ensuring compliance with the water quality objectives for salt or nutrients. These conditions can be caused by natural soils/conditions, discharges of waste, irrigation using surface water, groundwater or recycled water and water supply augmentation using surface or recycled water. Regulation of recycled water alone will not address these conditions.

(2) It is the intent of this Policy that salts and nutrients from all sources be managed on a basin-wide or watershed-wide basis in a manner that ensures attainment of water quality objectives and protection of beneficial uses. The State Water Board finds that the appropriate way to address salt and nutrient issues is through the development of regional or subregional salt and nutrient management plans

rather than through imposing requirements solely on individual recycled water projects.

b. Adoption of Salt/ Nutrient Management Plans.

(1) The State Water Board recognizes that, pursuant to the letter dated December 19, 2008 and attached to the Resolution adopting this Policy, the local water and wastewater entities, together with local salt/nutrient contributing stakeholders, will fund locally driven and controlled, collaborative processes open to all stakeholders that will prepare salt and nutrient management plans for each basin/sub-basin in California, including compliance with CEQA and participation by Regional Water Board staff.

(a) It is the intent of this Policy for every groundwater basin/sub-basin in California to have a consistent salt/nutrient management plan. The degree of specificity within these plans and the length of these plans will be dependent on a variety of site-specific factors, including but not limited to size and complexity of a basin, source water quality, stormwater recharge, hydrogeology, and aquifer water quality. It is also the intent of the State Water Board that because stormwater is typically lower in nutrients and salts and can augment local water supplies, inclusion of a significant stormwater use and recharge component within the salt/nutrient management plans is critical to the long-term sustainable use of water in California. Inclusion of stormwater recharge is consistent with State Water Board Resolution No. 2005-0006, which establishes sustainability as a core value for State Water Board programs and also assists in implementing Resolution No. 2008-0030, which requires sustainable water resources management and is consistent with Objective 3.2 of the State Water Board Strategic Plan Update dated September 2, 2008.

(b) Salt and nutrient plans shall be tailored to address the water quality concerns in each basin/sub-basin and may include constituents other than salt and nutrients that impact water quality in the basin/sub-basin. Such plans shall address and implement provisions, as appropriate, for all sources of salt and/or nutrients to groundwater basins, including recycled water irrigation projects and groundwater recharge reuse projects.

(c) Such plans may be developed or funded pursuant to the provisions of Water Code sections 10750 *et seq.* or other appropriate authority.

(d) Salt and nutrient plans shall be completed and proposed to the Regional Water Board within five years from the date of this Policy unless a Regional Water Board finds that the stakeholders are making substantial progress towards completion of a plan. In no case shall the period for the completion of a plan exceed seven years.

(e) The requirements of this paragraph shall not apply to areas that have already completed a Regional Water Board approved salt and nutrient plan for a basin, sub-basin, or other regional planning area that is functionally equivalent to paragraph 6(b)3.

(f) The plans may, depending upon the local situation, address constituents other than salt and nutrients that adversely affect groundwater quality.

(2) Within one year of the receipt of a proposed salt and nutrient management plan, the Regional Water Boards shall consider for adoption revised implementation plans, consistent with Water Code section 13242, for those groundwater basins within their regions where water quality objectives for salts or nutrients are being, or are threatening to be, exceeded. The implementation plans shall be based on the salt and nutrient plans required by this Policy.

(3) Each salt and nutrient management plan shall include the following components:

(a) A basin/sub-basin wide monitoring plan that includes an appropriate network of monitoring locations. The scale of the basin/sub-basin monitoring plan is dependent upon the site-specific conditions and shall be adequate to provide a reasonable, cost-effective means of determining whether the concentrations of salt, nutrients, and other constituents of concern as identified in the salt and nutrient plans are consistent with applicable water quality objectives. Salts, nutrients, and the constituents identified in paragraph 6(b)(1)(f) shall be monitored. The frequency of monitoring shall be determined in the salt/nutrient management plan and approved by the Regional Water Board pursuant to paragraph 6(b)(2).

(i) The monitoring plan must be designed to determine water quality in the basin. The plan must focus on basin water quality near water supply wells and areas proximate to large water recycling projects, particularly groundwater recharge projects. Also, monitoring locations shall, where appropriate, target groundwater and surface waters where groundwater has connectivity with adjacent surface waters.

(ii) The preferred approach to monitoring plan development is to collect samples from existing wells if feasible as long as the existing wells are located appropriately to determine water quality throughout the most critical areas of the basin.

(iii) The monitoring plan shall identify those stakeholders responsible for conducting, compiling, and reporting the monitoring data. The data shall be reported to the Regional Water Board at least every three years.

(b) A provision for annual monitoring of Constituents of Emerging Concern (e.g., endocrine disrupters, personal care products or pharmaceuticals) (CECs) consistent with recommendations by CDPH and consistent with any actions by the State Water Board taken pursuant to paragraph 10(b) of this Policy.

(c) Water recycling and stormwater recharge/use goals and objectives.

(d) Salt and nutrient source identification, basin/sub-basin assimilative capacity and loading estimates, together with fate and transport of salts and nutrients.

(e) Implementation measures to manage salt and nutrient loading in the basin on a sustainable basis.

(f) An antidegradation analysis demonstrating that the projects included within the plan will, collectively, satisfy the requirements of Resolution No. 68-16.

(4) Nothing in this Policy shall prevent stakeholders from developing a plan that is more protective of water quality than applicable standards in the Basin Plan. No Regional Water Board, however, shall seek to modify Basin Plan objectives without full compliance

with the process for such modification as established by existing law.

7. *Landscape Irrigation Projects*[1]

a. *Control of incidental runoff.* Incidental runoff is defined as unintended small amounts (volume) of runoff from recycled water use areas, such as unintended, minimal over-spray from sprinklers that escapes the recycled water use area. Water leaving a recycled water use area is not considered incidental if it is part of the facility design, if it is due to excessive application, if it is due to intentional overflow or application, or if it is due to negligence. Incidental runoff may be regulated by waste discharge requirements or, where necessary, waste discharge requirements that serve as a National Pollutant Discharge Elimination System (NPDES) permit, including municipal separate storm water system permits, but regardless of the regulatory instrument, the project shall include, but is not limited to, the following practices:

(1) Implementation of an operations and management plan that may apply to multiple sites and provides for detection of leaks, (for example, from broken sprinkler heads), and correction either within 72 hours of learning of the runoff, or prior to the release of 1,000 gallons, whichever occurs first,

(2) Proper design and aim of sprinkler heads,

(3) Refraining from application during precipitation events, and

(4) Management of any ponds containing recycled water such that no discharge occurs unless the discharge is a result of a 25-year, 24-hour storm event or greater, and there is notification of the appropriate Regional Water Board Executive Officer of the discharge.

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[1] Specified uses of recycled water considered "landscape irrigation" projects include any of the following:
i. Parks, greenbelts, and playgrounds;
ii. School yards;
iii. Athletic fields;
iv. Golf courses;
v. Cemeteries;
vi. Residential landscaping, common areas;
vii. Commercial landscaping, except eating areas;
viii. Industrial landscaping, except eating areas; and
ix. Freeway, highway, and street landscaping.

b. *Streamlined Permitting.*

(1) The Regional Water Boards shall, absent unusual circumstances (i.e., unique, site-specific conditions such as where recycled water is proposed to be used for irrigation over high transmissivity soils over a shallow (5' or less) high quality groundwater aquifer), permit recycled water projects that meet the criteria set forth in this Policy, consistent with the provisions of this paragraph.

(2) If the Regional Water Board determines that unusual circumstances apply, the Regional Water Board shall make a finding of unusual circumstances based on substantial evidence in the record, after public notice and hearing.

(3) Projects meeting the criteria set forth below and eligible for enrollment under requirements established in a general order shall be enrolled by the State or Regional Water Board within 60 days from the date on which an application is deemed complete by the State or Regional Water Board. For projects that are not enrolled in a general order, the Regional Water Board shall consider permit adoption within 120 days from the date on which the application is deemed complete by the Regional Water Board.

(4) Landscape irrigation projects that qualify for streamlined permitting shall not be required to include a project specific receiving water and groundwater monitoring component unless such project specific monitoring is required under the adopted salt/nutrient management plan. During the interim while the salt management plan is under development, a landscape irrigation project proponent can either perform project specific monitoring, or actively participate in the development and implementation of a salt/nutrient management plan, including basin/sub-basin monitoring. Permits or requirements for landscape irrigation projects shall include, in addition to any other appropriate recycled water monitoring requirements, monitoring for priority pollutants in the recycled water at the recycled water production facility once per year, except when the recycled water production facility has a design production flow for the entire water reuse system of one million gallons per day or less. For these smaller facilities, the recycled water shall be monitored for priority pollutants once every five years.

(5) It is the intent of the State Water Board that the general permit for landscape irrigation projects be consistent with the terms of this Policy.

c. *Criteria for streamlined permitting*. Irrigation projects using recycled water that meet the following criteria are eligible for streamlined permitting, and, if otherwise in compliance with applicable laws, shall be approved absent unusual circumstances:

(1) Compliance with the requirements for recycled water established in Title 22 of the California Code of Regulations, including the requirements for treatment and use area restrictions, together with any other recommendations by CDPH pursuant to Water Code section 13523.

(2) Application in amounts and at rates as needed for the landscape (i.e., at agronomic rates and not when the soil is saturated). Each irrigation project shall be subject to an operations and management plan, that may apply to multiple sites, provided to the Regional Water Board that specifies the agronomic rate(s) and describes a set of reasonably practicable measures to ensure compliance with this requirement, which may include the development of water budgets for use areas, site supervisor training, periodic inspections, tiered rate structures, the use of smart controllers, or other appropriate measures.

(3) Compliance with any applicable salt and nutrient management plan.

(4) Appropriate use of fertilizers that takes into account the nutrient levels in the recycled water. Recycled water producers shall monitor and communicate to the users the nutrient levels in their recycled water.

8. *Recycled Water Groundwater Recharge Projects*

a. The State Water Board acknowledges that all recycled water groundwater recharge projects must be reviewed and permitted on a site-specific basis, and so such projects will require project-by-project review.

b. Approved groundwater recharge projects will meet the following criteria:

(1) Compliance with regulations adopted by CDPH for groundwater recharge projects or, in the interim until such regulations are approved, CDPH's recommendations pursuant to Water Code section 13523 for the project (e.g., level of treatment, retention time, setback distance, source control, monitoring program, etc.).

(2) Implementation of a monitoring program for CECs that is consistent with Attachment A and any recommendations from CDPH.

Groundwater recharge projects shall include monitoring of recycled water for priority pollutants twice per year.

c. Nothing in this paragraph shall be construed to limit the authority of a Regional Water Board to protect designated beneficial uses, *provided* that any proposed limitations for the protection of public health may only be imposed following regular consultation by the Regional Water Board with CDPH, consistent with State Water Board Orders WQ 2005-0007 and 2006-0001.

d. Nothing in this Policy shall be construed to prevent a Regional Water Board from imposing additional requirements for a proposed recharge project that has a substantial adverse effect on the fate and transport of a contaminant plume or changes the geochemistry of an aquifer thereby causing the dissolution of constituents, such as arsenic, from the geologic formation into groundwater.

e. Projects that utilize surface spreading to recharge groundwater with recycled water treated by reverse osmosis shall be permitted by a Regional Water Board within one year of receipt of recommendations from CDPH. Furthermore, the Regional Water Board shall give a high priority to review and approval of such projects.

9. *Antidegradation*

a. The State Water Board adopted Resolution No. 68-16 as a policy statement to implement the Legislature's intent that waters of the state shall be regulated to achieve the highest water quality consistent with the maximum benefit to the people of the state.

b. Activities involving the disposal of waste that could impact high quality waters are required to implement best practicable treatment or control of the discharge necessary to ensure that pollution or nuisance will not occur, and the highest water quality consistent with the maximum benefit to the people of the state will be maintained.

c. Groundwater recharge with recycled water for later extraction and use in accordance with this Policy and state and federal water quality law is to the benefit of the people of the state of California. Nonetheless, the State Water Board finds that groundwater recharge projects using recycled water have the potential to lower water quality within a basin. The proponent of a groundwater recharge project must demonstrate compliance with Resolution No. 68-16. Until such time as a salt/nutrient management plan is in effect, such compliance may be demonstrated as follows:

(1) A project that utilizes less than 10 percent of the available assimilative capacity in a basin/sub-basin (or multiple projects utilizing less than 20 percent of the available assimilative capacity in a basin/sub-basin) need only conduct an antidegradation analysis verifying the use of the assimilative capacity. For those basins/sub-basins where the Regional Water Boards have not determined the baseline assimilative capacity, the baseline assimilative capacity shall be calculated by the initial project proponent, with review and approval by the Regional Water Board, until such time as the salt/nutrient plan is approved by the Regional Water Board and is in effect. For compliance with this subparagraph, the available assimilative capacity shall be calculated by comparing the mineral water quality objective with the average concentration of the basin/sub-basin, either over the most recent five years of data available or using a data set approved by the Regional Water Board Executive Officer. In determining whether the available assimilative capacity will be exceeded by the project or projects, the Regional Water Board shall calculate the impacts of the project or projects over at least a ten year time frame.

(2) In the event a project or multiple projects utilize more than the fraction of the assimilative capacity designated in subparagraph (1), then a Regional Water Board-deemed acceptable antidegradation analysis shall be performed to comply with Resolution No. 68-16. The project proponent shall provide sufficient information for the Regional Water Board to make this determination. An example of an approved method is the method used by the State Water Board in connection with Resolution No. 2004-0060 and the Regional Water Board in connection with Resolution No. R8-2004-0001. An integrated approach (using surface water, groundwater, recycled water, stormwater, pollution prevention, water conservation, etc.) to the implementation of Resolution No. 68-16 is encouraged.

d. Landscape irrigation with recycled water in accordance with this Policy is to the benefit of the people of the State of California. Nonetheless, the State Water Board finds that the use of water for irrigation may, regardless of its source, collectively affect groundwater quality over time. The State Water Board intends to address these impacts in part through the development of salt/nutrient management plans described in paragraph 6.

(1) A project that meets the criteria for a streamlined irrigation permit and is within a basin where a salt/nutrient management plan satisfying the provisions of paragraph 6(b) is in place may be

approved without further antidegradation analysis, provided that the project is consistent with that plan.

(2) A project that meets the criteria for a streamlined irrigation permit and is within a basin where a salt/nutrient management plan satisfying the provisions of paragraph 6(b) is being prepared may be approved by the Regional Water Board by demonstrating through a salt/nutrient mass balance or similar analysis that the project uses less than 10 percent of the available assimilative capacity as estimated by the project proponent in a basin/sub-basin (or multiple projects using less than 20 percent of the available assimilative capacity as estimated by the project proponent in a basin/sub-basin).

10. *Constituents of Emerging Concern*

a. General Provisions

(1) Regulatory requirements for recycled water shall be based on the best available peer-reviewed science. In addition, all uses of recycled water must meet conditions set by CDPH.

(2) Knowledge of risks will change over time and recycled water projects must meet legally applicable criteria. However, when standards change, projects should be allowed time to comply through a compliance schedule.

(3) The state of knowledge regarding CECs is incomplete. There needs to be additional research and development of analytical methods and surrogates to determine potential environmental and public health impacts. Agencies should minimize the likelihood of CECs impacting human health and the environment by means of source control and/or pollution prevention programs.

(4) Regulating most CECs will require significant work to develop test methods and more specific determinations as to how and at what level CECs impact public health or our environment.

b. Research Program

(1) The State Water Board, in consultation with CDPH, convened a “blue-ribbon” advisory panel to guide future actions relating to CECs.

(a) The panel was actively managed by the State Water Board and was composed of the following: one human health toxicologist, one environmental toxicologist, one epidemiologist, one biochemist, one civil engineer familiar with the design and construction of recycled water treatment facilities, and one chemist familiar with the design and operation of advanced laboratory methods for the detection of emerging constituents. Each of these panelists had extensive experience as a principal investigator in their respective areas of expertise.

(b) The panel reviewed the scientific literature and submitted a report to the State Water Board and CDPH that described the current state of scientific knowledge regarding the risks of CECs to public health and the environment. In December 2010, the State Water Board, in coordination with CDPH, held a public hearing to hear a presentation on the report and to receive comments from stakeholders.

(c) The State Water Board considered the panel report and the comments received and adopted an amendment to the Policy establishing monitoring requirements for CECs in recycled water. These monitoring requirements are prescribed in Attachment A.

(2) The panel or a similarly constituted panel shall update the report every five years. The next update is due in June 2015.

(a) Each updated report shall recommend actions that the State of California should take to improve our understanding of CECs and, as may be appropriate, to protect public health and the environment.

(b) The updated reports shall answer the following questions: What are the appropriate constituents to be monitored in recycled water, including analytical methods and method detection limits? What is the known toxicological information for the above constituents? Would the above lists change based on level of treatment and use? If so, how? What are possible indicators that represent a suite of CECs? What levels of CEC's should trigger enhanced monitoring of CEC's in recycled water, groundwater and/or surface waters?

(c) Within six months from receipt of an updated report, the State Water Board shall hold a hearing to consider recommendations from staff and shall endorse the recommendations, as appropriate, after making any necessary modifications.

c. Permit Provisions

Permits for recycled water projects shall be consistent with any CDPH recommendations to protect public health and the monitoring requirements prescribed in Attachment A.

11. *Incentives for the Use of Recycled Water*

a. Funding

The State Water Board will request CDWR to provide priority funding for projects that have major recycling components; particularly those that decrease demand on potable water supplies. The State Water Board will also request priority funding for stormwater recharge projects that augment local water supplies. The State Water Board shall promote the use of the State Revolving Fund (SRF) for water purveyor, stormwater agencies, and water recyclers to use for water reuse and stormwater use and recharge projects.

b. Stormwater

The State Water Board strongly encourages all water purveyors to provide financial incentives for water recycling and stormwater recharge and reuse projects. The State Water Board also encourages the Regional Water Boards to require less stringent monitoring and regulatory requirements for stormwater treatment and use projects than for projects involving untreated stormwater discharges.

c. TMDLs

Water recycling reduces mass loadings from municipal wastewater sources to impaired waters. As such, waste load allocations shall be assigned as appropriate by the Regional Water Boards in a manner that provides an incentive for greater water recycling.

ATTACHMENT A

Requirements for Monitoring Constituents of Emerging Concern in Recycled Water

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ATTACHMENT A

REQUIREMENTS FOR MONITORING CONSTITUENTS OF EMERGING CONCERN FOR RECYCLED WATER

The purpose of this attachment to the Recycled Water Policy (Policy) is to provide direction to the Regional Water Quality Control Boards (Regional Water Boards) on monitoring requirements for constituents of emerging concern[2] (CECs) in recycled municipal wastewater, herein referred to as "recycled water." The monitoring requirements and criteria for evaluating monitoring results in the Policy are based on recommendations from a Science Advisory Panel[3]. The monitoring requirements pertain to the production and use of recycled water for groundwater recharge reuse[4] by surface and subsurface application methods. The monitoring requirements apply to recycled water producers, including entities that further treat or enhance the quality of recycled water supplied by municipal wastewater treatment facilities, and groundwater recharge reuse facilities.

Groundwater recharge by surface application is the controlled application of water to a spreading area for infiltration resulting in the recharge of a groundwater basin. Subsurface application is the controlled application of water to a groundwater basin or aquifer by a means other than surface application, such as direct injection through a well.

The California Department of Public Health (CDPH) shall be consulted for any additional monitoring requirements for recycled water use found necessary by CDPH to protect human health.

[2] For this Policy, CECs are defined to be chemicals in personal care products, pharmaceuticals including antibiotics, antimicrobials; industrial, agricultural, and household chemicals; hormones; food additives; transformation products, inorganic constituents; and nanomaterials.
[3] The Science Advisory Panel was convened in accordance with provision 10.b. of the Policy. The panel's recommendations were presented in the report; *Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water – Recommendations of a Science Advisory Panel*, dated June 25, 2010.
[4] As used in this attachment, use of recycled water for groundwater recharge reuse has the same meaning as indirect potable reuse for groundwater recharge as defined in Water Code section 13561(c), where it is defined as the planned use of recycled water for replenishment of a groundwater basin or an aquifer that has been designated as a source of water supply for a public water system.

1. CECS AND SURROGATES

Within this Policy, CECs of toxicological relevance to human health are referred to as "health-based CECs."[5] CECs determined not to have human health relevance, but useful for monitoring treatment process effectiveness, are referred to as "performance indicator CECs." A performance indicator CEC is an individual CEC used for evaluating a family of CECs with similar physicochemical or biodegradable characteristics. The removal of a performance indicator CEC through a treatment process provides an indication of removal of CECs with similar properties. A health-based CEC may also serve as a performance indicator CEC.

A surrogate is a measurable physical or chemical property, such as chlorine residual or electrical conductivity, that can be used to measure the effectiveness of trace organic compound removal by treatment process and/or provide an indication of a treatment process failure. A reverse osmosis (RO) treatment process, for example, is expected to substantially reduce the electrical conductivity of the recycled water being treated. This reduction in the level of the surrogate also provides an indication that inorganic and organic compounds, including CECs, are being removed.

Recycled water monitoring programs used for groundwater recharge reuse shall include monitoring for: (1) human health-based CECs; (2) performance indicator CECs; and (3) surrogates. The purpose of monitoring performance indicator CECs and surrogates is to assess the effectiveness of unit processes to remove CECs. For this policy for groundwater recharge reuse, unit processes that remove CECs include RO, advanced oxidation processes (AOPs), and soil aquifer treatment.[6] AOPs are treatment processes involving the use of oxidizing agents, such as hydrogen peroxide and ozone, combined with ultraviolet light irradiation. Soil aquifer treatment is a natural treatment process that removes CECs as water passes through soil, the vadose zone, and within an aquifer.

This Policy provides CEC monitoring requirements for recycled water which undergoes additional treatment by soil aquifer treatment or by RO followed by AOPs. CEC monitoring requirements for groundwater recharge reuse projects implementing treatment processes that provide control of CECs by processes other than soil aquifer treatment or RO/AOPs shall be established on a case-by-case basis by the State Water Board in consultation with CDPH.

[5] Heath-based CECs were determined through a screening process that was developed and conducted by the CEC Science Advisory Panel; *Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water – Recommendations of a Science Advisory Panel*, dated June 25, 2010.

[6] For evaluating removal of CECs, the treatment zone for soil aquifer treatment is from the surface of the application area through the unsaturated zone to groundwater, including groundwater within a 30-day travel time distance through the aquifer downgradient of the surface application area.

Monitoring of health-based CECs or performance indicator CECs is not required for recycled water used for landscape irrigation due to the low risk for ingestion of the water.[7]

1.1. CECs for Monitoring Programs

This Policy provides requirements for monitoring CECs in recycled water used for groundwater recharge reuse. The Regional Water Boards shall not issue requirements for monitoring of additional CECs in recycled water beyond the requirements provided in this Policy except when recommended by CDPH or requested by the project proponent.

Table 1 provides the health-based CECs and performance indicator CECs to be monitored along with their respective reporting limits. All CECs listed for a recycled water application shall be monitored during an initial assessment monitoring phase, as described in Section 3.1. Based on monitoring results and findings, the list of performance indicator CECs required for monitoring may be refined for subsequent monitoring phases. The health-based CECs listed in Table 1 shall be monitored during the entirety of the initial assessment and baseline monitoring phases (Sections 3.1 and 3.2). Based on the results of the baseline monitoring phase and/or subsequent monitoring, the list of health-based CECs required for monitoring may be revised. The method for evaluation of monitoring results for health-based CECs is provided in Section 4.2.

Quality assurance and quality control measures shall be used for both collection of samples and laboratory analysis work. The project proponent shall develop a quality assurance project plan that includes the appropriate number of field blanks, laboratory blanks, replicate samples, and matrix spikes.

[7] "For monitoring programs to assess CEC threats for urban irrigation reuse, none of the chemicals for which measurement methods and exposure data are available exceeded the threshold for monitoring priority. This is largely attributable to higher Monitoring Trigger Levels (MTLs), because of reduced water ingestion in a landscape irrigation setting compared to drinking water." MTLs are health-based screening level values for CECs for a particular water reuse scenario. MTLs were established in, *Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water – Recommendations of a Science Advisory Panel*, dated June 25, 2010.

Table 1 – CECs to be Monitored

Constituent	Constituent Group	Relevance/Indicator Type	Reporting Limit (µg/L)
GROUNDWATER RECHARGE REUSE - SURFACE APPLICATION			
17β-estradiol	Steroid hormones	Health	0.001
Caffeine	Stimulant	Health & Performance	0.05
N-Nitrosodimethylamine (NDMA)	Disinfection byproduct	Health	0.002
Triclosan	Antimicrobial	Health	0.05
Gemfibrozil	Pharmaceutical	Performance	0.01
Iopromide	Pharmaceutical	Performance	0.05
N,N-Diethyl-meta-toluamide (DEET)	Personal care product	Performance	0.05
Sucralose	Food additive	Performance	0.1
GROUNDWATER RECHARGE REUSE - SUBSURFACE APPLICATION			
17β-estradiol	Steroid hormones	Health	0.001
Caffeine	Stimulant	Health & Performance	0.05
NDMA	Disinfection byproduct	Health & Performance	0.002
Triclosan	Antimicrobial	Health	0.05
DEET	Personal care product	Performance	0.05
Sucralose	Food additive	Performance	0.1

µg/L – Micrograms per liter

Analytical methods for laboratory analysis of CECs shall be selected to achieve the reporting limits presented in Table 1. The analytical methods shall be based on methods published by the United States Environmental Protection Agency, methods certified by CDPH, or peer reviewed and published methods that have been reviewed by CDPH, including those published by voluntary consensus standards bodies such as the Standards Methods Committee and the American Society for Testing and Materials International. Any modifications to the published or certified methods shall be reviewed by CDPH and subsequently submitted to the Regional Water Board in an updated quality assurance project plan.

1.2. Surrogates for Monitoring Programs

Table 2 presents a list of surrogates that shall be considered for monitoring treatment of recycled water used for groundwater recharge reuse. Other surrogates not listed in Table 2 may also be considered.

Table 2: Surrogates

GROUNDWATER RECHARGE REUSE - SURFACE APPLICATION
Ammonia
Total Organic Carbon (TOC)
Nitrate
Ultraviolet (UV) Light Absorption
GROUNDWATER RECHARGE REUSE - SUBSURFACE APPLICATION
Electrical Conductivity
TOC

The project proponent shall propose surrogates to monitor on a case-by-case basis appropriate for the treatment process or processes. The Regional Water Board shall review and approve the selected surrogates in consultation with CDPH.

Where applicable, surrogates may be measured using on-line or hand-held instruments provided that instrument calibration procedures are implemented in accordance with the manufacturer's specifications and that calibration is documented.

2. MONITORING LOCATIONS

Monitoring locations for CECs and surrogates are described in this section.

2.1. Health-Based CEC Monitoring Locations

2.1.1. Groundwater Recharge Reuse - Surface Application

For groundwater recharge reuse projects implementing surface application of recycled water, health-based CECs shall be monitored at these locations:

(1) Following tertiary treatment[8] prior to application to the surface spreading area; and

(2) At monitoring well locations designated in consultation with CDPH within the distance groundwater travels downgradient from the application site in 30 days.

Monitoring locations for health-based CECs for the phases of monitoring are presented in Tables 3 through 5.

2.1.2. Groundwater Recharge Reuse - Subsurface Application

For groundwater recharge reuse projects implementing subsurface application of recycled water, health-based CECs shall be monitored at a location following treatment prior to release into an aquifer.

2.2. Performance Indicator CEC and Surrogate Monitoring Locations

To allow evaluation of individual unit processes or a combination of unit processes that provide removal of CECs, performance indicator CECs and surrogates shall be monitored at the locations described below and presented in Tables 3 through 5.

2.2.1. Groundwater Recharge Reuse - Surface Application

For groundwater recharge reuse projects using surface application of recycled water, performance indicator CECs and surrogates shall be monitored at these locations:

(1) Following tertiary treatment prior to application to the surface spreading area; and

(2) At monitoring well locations designated in consultation with CDPH within the distance groundwater travels downgradient from the application site in 30 days.

Monitoring locations for performance indicator CECs and surrogates for the phases of monitoring are presented in Tables 3 through 5.

2.2.2. Groundwater Recharge Reuse - Subsurface Application

For groundwater recharge reuse projects using subsurface application of recycled water, performance indicator CECs shall be monitored in recycled water at these locations:

(1) Prior to treatment by RO; and

[8] Standards for disinfected tertiary recycled water presented in California Code of Regulations, Title 22, section 60301.230 and 60301.320.

(2) Following treatment prior to release to the aquifer.

If the project proponent can demonstrate that the RO unit will not substantially remove a CEC, the Regional Water Board may allow monitoring for that CEC prior to the AOPs, instead of prior to the RO unit.

For groundwater recharge reuse projects using subsurface application of recycled water, surrogates shall be monitored at locations proposed by the project proponent and approved by the Regional Water Board in consultation with CDPH.

3. PHASED MONITORING REQUIREMENTS

The Regional Water Board shall phase the monitoring requirements for CECs and surrogates for groundwater recharge reuse projects. The purpose of phased monitoring is to allow monitoring requirements for health-based CECs, performance indicator CECs and surrogates to be refined based on the monitoring results and findings of the previous phase. An initial assessment monitoring phase, followed by a baseline monitoring phase, shall be conducted to determine the project-specific monitoring requirements for standard operations. The initial assessment and baseline monitoring phases shall be conducted after CDPH approval for groundwater recharge reuse project operation.

3.1. Initial Assessment Monitoring Phase

The purposes of the initial assessment phase are to: (1) identify the occurrence of health-based CECs, performance indicator CECs, and surrogates in recycled water and groundwater;[9] (2) determine treatment effectiveness; (3) define the project-specific performance indicator CECs and surrogates to monitor during the baseline phase; and (4) specify the expected removal percentages for performance indicator CECs and surrogates. The monitoring requirements for the initial assessment monitoring phase shall apply to the start-up of new facilities, piloting of new unit processes at existing facilities, and existing facilities where CECs and surrogates have not been assessed equivalent to the requirements of this Policy. Data from prior assessment need not replicate the exact frequency and duration of the initial assessment phase requirements specified in Table 3, if the overall robustness and size of the data are sufficient to adequately characterize the CECs, surrogates, and treatment performance. The initial assessment monitoring phase shall be conducted for a period of one year.

During the initial assessment monitoring phase for the applicable recycled water application method, each of the health-based CECs and performance indicator CECs

[9] The identification of the occurrence of health-based CECs, performance indicator CECs, and surrogates in groundwater only applies to groundwater recharge reuse by surface application.

listed in Table 1 and appropriate surrogates (see Section 1.2) shall be monitored. Surrogates shall be selected to monitor individual unit processes or combinations of unit processes that remove CECs. Performance indicator CEC and surrogate monitoring results that demonstrate measurable removal for a given unit process shall be candidates for use in the monitoring programs for the baseline and standard operation phases. Monitoring requirements for the initial assessment phase are summarized in Table 3.

For existing groundwater recharge reuse projects, historic monitoring data may be used to assess the occurrence and removal of CECs and surrogates. Existing projects demonstrating prior assessment of CECs and surrogates equivalent to the initial assessment phase requirements of this Policy may skip the initial monitoring phase and initiate the baseline monitoring phase requirements in Section 3.2.
Monitoring results shall be evaluated following each sampling event to allow timely implementation of any response actions. If evaluation of monitoring results indicates a concern, such as finding a concentration of a health-based CEC above the thresholds described in Table 7, more frequent monitoring may be required to further evaluate the effectiveness of the treatment process. Additional actions may also be warranted, which may include, but not be limited to, resampling to confirm a result, additional monitoring, implementation of a source identification program, toxicological studies, engineering removal studies, and/or modification of facility operations. If additional monitoring is required, the Regional Water Board shall consult with CDPH and revise the Monitoring and Reporting Program as appropriate. Evaluation of monitoring results and determination of appropriate response actions based on the monitoring results are presented in Section 4.

Following completion of the initial assessment monitoring phase, monitoring requirements shall be re-evaluated and subsequent requirements for the baseline monitoring phase shall be determined on a project-specific basis.

3.2. Baseline Monitoring Phase

Based on the findings of the initial assessment monitoring phase, project-specific performance indicator CECs and surrogates shall be selected for monitoring during the baseline monitoring phase. The purpose of the baseline monitoring phase is to assess and refine which health-based CECs, performance indicator CECs and surrogates are appropriate to monitor the removal of CECs and treatment system performance for the standard operation of a facility. Performance indicator CECs and surrogates that exhibited reduction by unit processes and/or provided an indication of operational performance shall be selected for monitoring during the baseline monitoring phase. Surrogates not reduced through a unit process are not good indicators of the unit's intended performance. For example, soil aquifer treatment may not effectively lower electrical conductivity. Therefore, electrical conductivity may not be a good surrogate for soil aquifer treatment. The baseline monitoring phase shall be conducted for a period of three years following the initial assessment monitoring phase. Monitoring requirements for the baseline phase are summarized in Table 4. If a performance indicator CEC listed in Table 1 is found not to be a good indicator, the project proponent shall propose an alternative performance indicator CEC representative of the constituent group to monitor. This performance indicator CEC shall be subject to approval by the Regional Water Board in consultation with CDPH.

For existing groundwater recharge reuse projects, historic monitoring data may be used to assess removal of health-based CECs, performance indicator CECs and surrogates. Existing projects that can demonstrate prior assessment of CECs and surrogates equivalent to the initial assessment phase and baseline phase requirements of this Policy may be eligible for the standard operation monitoring requirements.

Monitoring results shall be evaluated following each sampling event to allow timely implementation of any response actions. If evaluation of monitoring results indicates a concern, such as finding a concentration of a health-based CEC above the thresholds described in Table 7, more frequent monitoring may be required to further evaluate the effectiveness of the treatment process. Additional actions may also be warranted, which may include, but not be limited to, resampling to confirm a result, additional monitoring, implementation of a source identification program, toxicological studies, engineering removal studies, and/or modification of facility operation. If additional monitoring is required, the Regional Water Board shall consult with CDPH and revise the Monitoring and Reporting Program as appropriate. Evaluation of monitoring results and determination of appropriate response actions based on the monitoring results are presented in Section 4.

Following the baseline operation monitoring phase, monitoring requirements shall be re-evaluated and subsequent requirements for the standard operation of a project shall be determined on a project-specific basis.

Table 3: Initial Assessment Phase Monitoring Requirements

Recycled Water Use	Constituent	Frequency	Monitoring Point
Groundwater Recharge Reuse- Surface Application	Health-Based CECs and Performance Indicator CECs: All listed in Table 1.	Quarterly[1]	- Following tertiary treatment prior to application to surface spreading area. - At monitoring well locations designated in consultation with CDPH.[2]
	Surrogates: To be selected on a project-specific basis.[5]	1st 3 months: To be determined on a project-specific basis.[3]	- Following tertiary treatment prior to application to the surface spreading area. - At monitoring well locations designated in consultation with CDPH.[2]
		3-12 months: To be determined on a project-specific basis.[3]	- Following tertiary treatment prior to application to the surface spreading area. - At monitoring well locations designated in consultation with CDPH.[2]
Groundwater Recharge Reuse -Subsurface Application	Health-Based CECs: All listed in Table 1.	Quarterly[1]	Following treatment prior to release to the aquifer.
	Performance Indicator CECs: All listed in Table 1.	Quarterly[1]	- Prior to RO treatment.[4] - Following treatment prior to release to the aquifer.
	Surrogates: To be selected on a project-specific basis.[5]	To be determined on a project-specific basis.	- At locations approved by the Regional Water Board.[6]

1 – This is the initial monitoring frequency for the monitoring and reporting program. The Regional Water Board may require additional monitoring to respond to a concern as stated in Section 3.1.
2 – Groundwater within the distance groundwater travels downgradient from the application site in 30-days.
3 – The monitoring frequency shall be determined by the Regional Water Board in consultation with CDPH. The intent is to have an increased monitoring frequency during the first three months and a decreased monitoring frequency after three months.
4 – If the project proponent can demonstrate that the RO unit will not substantially remove a CEC, the Regional Water Board may allow monitoring for that CEC prior to the AOP, instead of prior to the RO unit.
5 – See Section 1.2 for guidance on selection of surrogates.
6 – See Section 2.2.2 for information on surrogate monitoring locations for subsurface application.

Table 4: Baseline Phase Monitoring Requirements

Recycled Water Use	Constituent	Frequency	Monitoring Point
Groundwater Recharge Reuse – Surface Application	Health-Based CECs: All listed in Table 1. Performance Indicator CECs: Selected based on the findings of the initial assessment phase.	Semi-Annually[1]	- Following tertiary treatment prior to application to the surface spreading area. - At monitoring well locations designated in consultation with CDPH.[2]
	Surrogates: Selected based on the findings of the initial assessment phase.	Based on findings of the initial assessment phase. .	- Following tertiary treatment prior to application to the surface spreading area. - At monitoring well locations designated in consultation with CDPH.[2]
Groundwater Recharge Reuse – Subsurface Application	Health-Based CECs: All listed in Table 1.	Semi-Annually[1]	Following treatment prior to release to the aquifer.
	Performance Indicator CECs: Selected based on the findings of the initial assessment phase.	Semi-Annually[1]	- Prior to RO treatment.[3] - Following treatment prior to release to the aquifer.
	Surrogates: Selected based on the findings of the initial assessment phase.	Based on findings of the initial assessment phase.	- At locations approved by the Regional Water Board.[4]

1 – More frequent monitoring may be required to respond to a concern as stated in Section 3.2.
2 – Groundwater within the distance groundwater travels downgradient from the application site in 30-days.
3 – If the project proponent can demonstrate that the RO unit will not substantially remove a CEC, the Regional Water Board may allow monitoring for that CEC prior to the AOP, instead of prior to the RO unit.
4 – See Section 2.2.2 for information on surrogate monitoring locations for subsurface application.

3.3. Standard Operation Monitoring

Based on the findings of the baseline monitoring phase, monitoring requirements for health-based CECs, performance indicator CECs and surrogates may be refined to establish project-specific requirements for monitoring the standard operating conditions of a groundwater recharge reuse project. Monitoring requirements for the standard operation phase are summarized in Table 5. The list of health-based CECs may be revised to remove a health-based CEC from the list if monitoring results meet the conditions of the minimum threshold level presented in Table 7. Performance indicator CECs and surrogates that exhibited reduction by a unit process and/or provided an indication of operational performance shall be selected for monitoring of standard operations. If a performance indicator CEC is found to be a poor indicator, the project proponent shall propose an alternative performance indicator CEC representative of the constituent group to monitor. This performance indicator CEC shall be subject to approval by the Regional Water Board in consultation with CDPH.

Monitoring locations for the standard operation phase shall be the same as the locations used for the baseline monitoring phase.

Monitoring for health-based CECs and performance indicator CECs shall be conducted on a semi-annual basis, unless the project demonstrates consistency in treatment effectiveness in removal of CECs, treatment operational performance, and appropriate recycled water quality. These projects may be monitored for CECs on an annual basis. Monitoring frequencies for CECs and surrogates for standard operation monitoring are presented in Table 5.

Monitoring results shall be evaluated following each sampling event to allow timely implementation of any response actions. If evaluation of monitoring results indicates a concern, such as finding a health-based CEC above the thresholds described in Table 7 or a decline in removal of a performance indicator CEC from the performance levels established during the initial and baseline monitoring phases, more frequent monitoring may be required to further evaluate the effectiveness of the treatment process. Additional actions may also be warranted, which may include, but not be limited to, resampling to confirm a result, additional monitoring, implementation of a source identification program, toxicological studies, engineering removal studies, and/or modification of facility operation. If additional monitoring is required, the Regional Water Board shall consult with CDPH and revise the Monitoring and Reporting Program as appropriate. Evaluation of monitoring results and determination of appropriate response actions based on the monitoring results are presented in Section 4.

Table 5: Standard Operation Monitoring Requirement

Recycled Water Use	Constituent	Frequency	Monitoring Point
Groundwater Recharge Reuse - Surface Application	Health-Based CECs: Selected based on the findings of the baseline phase.	Semi-Annually or Annually[1]	- Following tertiary treatment prior to application to the surface spreading area. - At monitoring well locations designated in consultation with CDPH.[2]
	Performance Indicator CECs: Selected based on the findings of the baseline phase.		
	Surrogates: Selected based on the findings of the baseline phase.	Based on findings of the baseline assessment phase.	- Following tertiary treatment prior to application to the surface spreading area. - At monitoring well locations designated in consultation with CDPH.[2]
Groundwater Recharge Reuse - Subsurface Application	Health-Based CECs: Selected based on the findings of the baseline phase	Semi-Annually or Annually[1]	-Following ~~RO/AOPs~~ treatment prior to release to the aquifer.
	Performance Indicator CECs: Selected based on the findings of the baseline phase.	Semi-Annually or Annually[1]	- Prior to RO treatment.[3] - Following treatment prior to release to the aquifer.
	Surrogates: Selected based on the findings of the baseline phase,	Based on findings of the baseline assessment phase.	At locations approved by the Regional Water Board.[4]

1 – More frequent monitoring may be required to respond to a concern as stated in Section 3.3.
2 – Groundwater within the distance groundwater travels downgradient from the application site in 30-days.
3 – If the project proponent can demonstrate that the RO unit will not substantially remove a CEC, the Regional Water Board may allow monitoring for that CEC prior to the AOP, instead of prior to the RO unit.
4 – See Section 2.2.2 for information on surrogate monitoring locations for subsurface application.

4. EVALUATION OF CEC AND SURROGATE MONITORING RESULTS

This section presents the approaches for evaluating treatment process performance and health-based CEC monitoring results. Monitoring results for performance indicator CECs and surrogates shall be used to evaluate the operational performance of a treatment process and the effectiveness of a treatment process in removing CECs. For evaluation of health-based CEC monitoring results, a multi-tiered approach of thresholds and corresponding response actions is presented in Section 4.2. The evaluation of monitoring results shall be included in monitoring reports submitted to the Regional Water Board and CDPH.

4.1 Evaluation of Performance Indicator CEC and Surrogate Results

The effectiveness of a treatment process to remove CECs shall be evaluated by determining the removal percentages for performance indicator CECs and surrogates. The removal percentage is the difference in the concentration of a compound in recycled water prior to and after a treatment process (e.g., soil aquifer treatment or RO followed by AOPs), divided by the concentration prior to the treatment process and multiplied by 100.

$$\text{Removal Percentage} = ([X_{in} - X_{out}]/X_{in})\ (100)$$

X_{in} - Concentration in recycled water prior to a treatment process
X_{out} - Concentration in recycled water after a treatment process

During the initial assessment, the recycled water project proponent shall monitor performance to determine removal percentages for performance indicator CECs and surrogates. The removal percentages shall be confirmed during the baseline monitoring phase. One example of removal percentages from Drews et. al. (2008) for each application scenario and their associated processes (i.e. soil aquifer treatment or RO/AOPs) is presented in Table 6. The established removal percentages for each project shall be used to evaluate treatment effectiveness and operational performance.

4.1.1. Groundwater Recharge Reuse – Surface Application

For groundwater recharge reuse by surface application, the removal percentage shall be determined by comparing the quality of the recycled water applied to a surface spreading area to the quality of groundwater at monitoring wells. The distance between the application site and the monitoring wells shall be no more than the distance the groundwater travels in 30 days downgradient from the application site. The location of the monitoring wells shall be designated in consultation with CDPH. The removal percentage shall be adjusted to account for dilution from potable water applied to the application site, storm water applied to the application site, and native groundwater.

The removal percentage shall also be adjusted to account for CECs in these waters. The project proponent shall submit a proposal to the Regional Water Board and CDPH as part of its operation plan on how it will perform this accounting.

4.1.2. Groundwater Recharge Reuse – Subsurface Application

For groundwater recharge reuse using subsurface application, the removal percentage shall be determined by comparing recycled water quality before treatment by RO/AOPs and after treatment prior to release to the aquifer.

Table 6: Monitoring Trigger Levels and Removal Percentages

Constituent/ Parameter	Relevance/Indicator Type/Surrogate	Monitoring Trigger Level (micrograms/liter)[1]	Removal Percentages (%)[2]
GROUNDWATER RECHARGE REUSE - SURFACE APPLICATION[3]			
17β-estradiol	Health	0.0009	--[4]
Caffeine	Health & Performance	0.35	>90
NDMA	Health	0.01	--
Triclosan	Health	0.35	--
Gemfibrozil	Performance	--	>90
Iopromide	Performance	--	>90
DEET	Performance	--	>90
Sucralose	Performance	--	<25[5]
Ammonia	Surrogate	--	>90
TOC	Surrogate	--	>30
Nitrate	Surrogate	--	>30
UV Absorption	Surrogate	--	>30
GROUNDWATER RECHARGE REUSE - SUBSURFACE APPLICATION[6]			
17β-estradiol	Health	0.0009	--
Caffeine	Health & Performance	0.35	>90
NDMA	Health & Performance	0.01	25-50, >80[7]
Triclosan	Health	0.35	--
DEET	Performance	--	>90
Sucralose	Performance	--	>90
Electrical Conductivity	Surrogate	--	>90
TOC	Surrogate	--	>90

1 – Monitoring trigger levels for groundwater recharge reuse and landscape irrigation applications were established in *Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water – Recommendations of a Science Advisory Panel*, dated June 25, 2010.
2 –The removal percentages presented in this table are from work by Drewes et.al. (2008) and provide an example of performance for that specific research. Project specific removal percentages will be developed for each groundwater recharge reuse project during the initial and baseline monitoring phases.
3 – Treatment process: Soil aquifer treatment. The stated removal percentages are examples and need to be finalized during the initial and baseline monitoring phases for a given site.
4 – Not applicable
5 – Sucralose degrades poorly during soil aquifer treatment. It is included here mainly as a tracer.
6 – Treatment process: Reverse osmosis and advanced oxidation process.
7 – For treatment using reverse osmosis, removal percentage is between 25 and 50 percent. For treatment using reverse osmosis and advanced oxidation processes, removal percentage is greater than 80 percent.

4.2. Evaluation of Health-Based CEC Results

The project proponent shall evaluate health-based CEC monitoring results. To determine the appropriate response actions, the project proponent shall compare measured environmental concentrations (MECs) to their respective monitoring trigger levels[10] (MTLs) listed in Table 6 to determine MEC/MTL ratios. The project proponent shall compare the calculated MEC/MTL ratios to the thresholds presented in Table 7 and shall implement the response actions corresponding to the threshold.

For surface application, the results shall be evaluated for groundwater collected from the monitoring wells. For subsurface application projects, results shall be evaluated for the recycled water released to the aquifer.

Table 7: MEC/MTL Thresholds and Response Actions

MC/MTL Threshold	Response Action
If greater than 75 percent of the MEC/MTL ratio results for a CEC are less than or equal to 0.1 during the baseline monitoring phase and/or subsequent monitoring -	A) After completion of the baseline monitoring phase, consider requesting removal of the CEC from the monitoring program.
If MEC/MTL ratio is greater than 0.1 and less than or equal to 1 -	B) Continue to monitor.
If MEC/MTL ratio is greater than 1 and less than or equal to 10 -	C) Check the data. Continue to monitor.
If MEC/MLT ratio is greater than 10 and less than or equal to 100 -	D) Resample immediately and analyze to confirm CEC result. Continue to monitor.
If MEC/MLT ratio is greater than 100 -	E) Resample immediately and analyze to confirm result. Continue to monitor. Contact the Regional Water Board and CDPH to discuss additional actions. (Additional actions may include, but are not limited to, additional monitoring, toxicological studies, engineering removal studies, modification of facility operation, implementation of a source identification program, and monitoring at additional locations.)

[10] Monitoring Trigger Level (MTL): Health-based screening level value for a CEC for a particular water reuse scenario. MTLs were established in, *Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water – Recommendations of a Science Advisory Panel*, dated June 25, 2010.

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Appendix B

Los Angeles Regional Water Quality Control Board Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties, June 13, 1994 (only Chapters 1 through 3 are provided herein)

WATER QUALITY CONTROL PLAN
Los Angeles Region

Basin Plan

for the

Coastal Watersheds of

Los Angeles and Ventura Counties

California Regional Water Quality Control Board

Los Angeles Region (4)

WATER QUALITY CONTROL PLAN

Los Angeles Region

Adopted by

California Regional Water Quality Control Board, Los Angeles Region on June 13, 1994.

Approved by

State Water Resources Control Board on November 17, 1994.

State Office of Administrative Law on February 23, 1995.

California Regional Water Quality Control Board, Los Angeles Region
101 Centre Plaza Drive
Monterey Park, CA 91754

Telephone (213) 266-7500
Fax (213) 266-7600

STATE OF CALIFORNIA

PETE WILSON, Governor
JAMES M. STROCK, Secretary, Environmental Protection Agency

State Water Resources Control Board

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Clark Drane	Water Quality
Elizabeth D. Rogers, Ph.D.	Water Quality
John A. Slezak	Recreation, Fish, and Wildlife
Larry Zarian	Municipal Government

Robert P. Ghirelli, D.Env., *Executive Officer*

This report was prepared under the direction of

Richard A. Harris, *Assistant Executive Officer*
Dennis Dasker, *Chief, Regional Programs*

by

Deborah J. Smith, *Chief, Planning Unit*
Wendy Phillips, *Associate Engineering Geologist*
Ana Corado, *Water Resources Control Engineer*
Heather Trim, *Engineering Geologist*
Manjunath Venkatanarayana, *Environmental Specialist II*
Gerhardt Hubner, *Engineering Geologist*
Toby Moore, *Intern*
Pamela Hicks, *Graduate Student Assistant*

Assistance provided by the following State Water Resources Control Board staff

John Ladd, *Chief, Basin Planning Unit*
Stephen Fagundes, *Associate Water Resource Control Engineer*
Jean Ladyman, *Associate Government Program Analyst*
Rene Bozzuto, *Office Technician*

Cover Art by

Alex Fu, *Sanitary Engineer Associate, CRWQCB-LA*

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Appendix One

1. INTRODUCTION

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The State and Regional Boards

Responsibility for the protection of water quality in California rests with the State Water Resources Control Board (hereinafter referred to as the State Board) and nine Regional Water Quality Control Boards. The State Board sets statewide policies and develops regulations for the implementation of water quality control programs mandated by state and federal water quality statutes and regulations. Regional Water Quality Control Boards develop and implement Water Quality Control Plans (Basin Plans) that consider regional beneficial uses, water quality characteristics, and water quality problems.

The California Regional Water Quality Control Board, Los Angeles Region (hereinafter referred to as the Los Angeles Regional Board or Regional Board) has jurisdiction over the coastal drainages between Rincon Point (on the coast of western Ventura County) and the eastern Los Angeles County line (Figure 1-1). The Regional Board is governed by nine members, all of whom are appointed by the Governor and confirmed by the State Senate. Regional Board members represent certain categories related to the control of water quality and must reside in, or have a principal place of business within, the Region. Members of the Regional Board hold regular meetings at different sites throughout the Region. The staff at the Regional Board implement Regional Board policies under the direction of the Executive Officer who is appointed by the Regional Board. The public may address the Regional Board regarding any matter within the Regional Board's jurisdiction during the public forum period at any regular Regional Board meeting. Copies of the Regional Board meeting agendas are available for examination at the office of the Regional Board during regular working hours.

Function of the Basin Plan

The Los Angeles Regional Board's Basin Plan is designed to preserve and enhance water quality and protect the beneficial uses of all regional waters. Specifically, the Basin Plan (i) designates beneficial uses for surface and ground waters, (ii) sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to the state's antidegradation policy, and (iii) describes implementation programs to protect all waters in the Region. In addition, the Basin Plan incorporates (by reference) all applicable State and Regional Board plans and policies and other pertinent water quality policies and regulations. Major State and Regional Board plans and policies are summarized in Chapter 5. Those of other agencies are referenced in appropriate sections throughout the Basin Plan.

The Basin Plan is a resource for the Regional Board and others who use water and/or discharge wastewater in the Los Angeles Region. Other agencies and organizations involved in environmental permitting and resource management activities also use the Basin Plan. Finally, the Basin Plan provides valuable information to the public about local water quality issues.

The Basin Plan is reviewed and updated as necessary. Following adoption by the Regional Board, the Basin Plan and subsequent amendments are subject to approval by the State Board, the

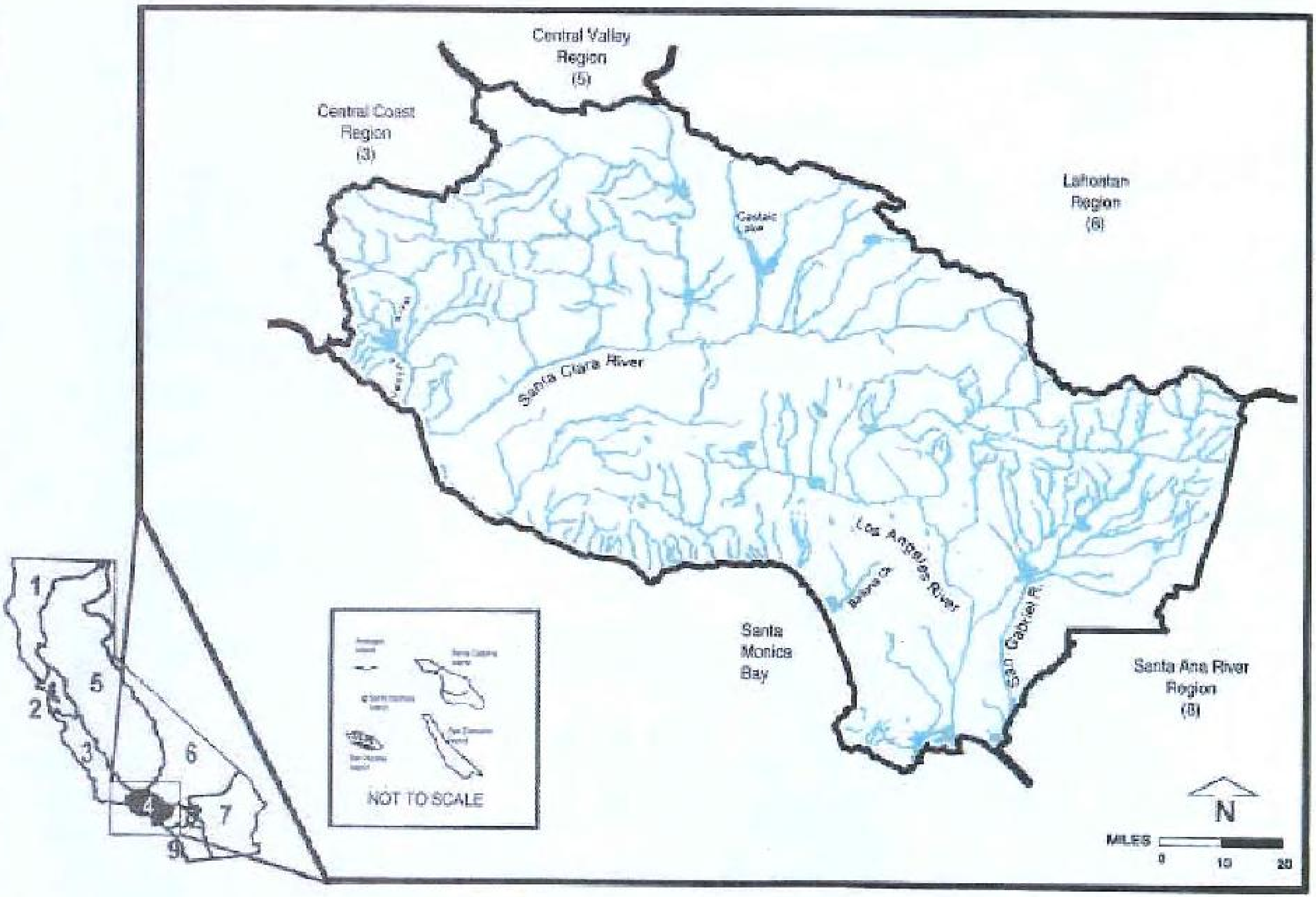


Figure 1-1. Regional Map: Regional Water Quality Control Board, Los Angeles Region.

State Office of Administrative Law (OAL), and the United States Environmental Protection Agency (USEPA).

Legal Basis and Authority

The Basin Plan implements a number of state and federal laws, the most important of which are the California Porter-Cologne Water Quality Control Act (California Water Code, Division 1, Chapter 2, Article 3, et seq., plus others) and the Clean Water Act (PL 92-500, as amended). Other pertinent state laws include: the Hazardous Substances Cleanup Bond Act of 1984 (Health & Safety Code, §25385 et seq.), the Toxic Pits Cleanup Act (Health & Safety Code, §25208 et seq.), and the Toxic Injection Well Control Act (Health & Safety Code, §25159.10 et seq.). Pertinent federal laws include: the Safe Drinking Water Act (42 U.S.C.A., §300F et seq.), the Toxic Substances Control Act (15 U.S.C.A., §2601 et seq.), the Resource Conservation and Recovery Act (RCRA, 42 U.S.C.A., §6 901 et seq.), and the Endangered Species Act (16 U.S.C.A., §1531 et seq.).

The Porter-Cologne Water Quality Control Act (herein after referred to as California Water Code), enacted by the State of California in 1969 and effective January 1, 1970, is considered landmark water quality legislation and has served as a model for subsequent legislation by the federal government and other state governments. This legislation authorizes the State Board to adopt, review, and revise policies for all waters of the state (including both surface and ground waters) and directs the Regional Boards to develop regional Basin Plans. The California Water Code (§13170) also authorizes the State Board to adopt water quality control plans on its own initiative. In the event of inconsistencies among various State and Regional Board plans, the more stringent provisions apply.

The Clean Water Act (CWA), enacted by the federal government in 1972, was designed to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. One of the national goals states that wherever attainable water quality should provide for the protection and propagation of fish, shellfish, and wildlife, and provide for recreation in and on the water (i.e., fishable, swimmable). The CWA (§303[c]) directs states to establish water quality standards for all "waters of the United States" and to review and update such standards on a triennial basis. Other provisions of the CWA related to basin planning include Section 208, which authorizes the preparation of waste treatment management plans, and Section 319 (added by 1987 amendments) which mandates specific actions for the control of pollution from nonpoint sources. The 1987 amendments to the CWA (§307[a]) also mandate that states adopt numerical standards for all priority pollutants.

The USEPA has delegated responsibility for implementation of portions of the CWA to the State and Regional Boards, including water quality planning and control programs such as the National Pollutant Discharge Elimination System (NPDES). The Code of Federal Regulations (Title 40, CFR) and USEPA guidance documents provide direction for implementation of the CWA.

Besides state and federal laws, several court decisions provide guidance for basin planning. For example, the 1983 Mono Lake Decision (National Audubon Society v. Superior Court [1993]) reaffirmed the public trust doctrine, holding that the public trust is "an affirmation of the duty of the state to protect the people's common heritage in streams, lakes, marshlands, and tidelands, surrendering that right of protection only in rare cases when the abandonment of that right is consistent with the purposes of the trust." Public trust encompasses uses of water for commerce, navigation, fisheries, and recreation. In California Trout, Inc. v. State Water Resources Control Board (1989), the courts found that the public trust doctrine also applies to activities that could harm the fisheries in a non-navigable water.

History of Basin Planning in the Los Angeles Region

The Dickey Act, enacted by the State of California in 1949, established nine Regional Water Pollution Control Boards in California. Regional Water Pollution Control Boards were directed to establish water quality objectives in order to protect the quality of receiving waters from adverse impacts of wastewater discharges. During the first few years, the Los Angeles Regional Water Pollution Control Board only established narrative objectives for discharges. By 1952, the Los Angeles Regional Water Pollution Control Board began including numerical limits in requirements for discharges and adopting water quality objectives for receiving waters.

With the enactment of the Porter-Cologne Water Quality Act in 1969, the names of the Regional Water Pollution Control Boards were changed to Regional Water Quality Control Boards, and their authorities were broadened. At this time, the Regional Water Quality Control Boards initiated development of comprehensive regional Basin Plans.

In 1971, the Los Angeles Regional Board adopted an *Interim Water Quality Control Plan* that compiled all of the existing objectives and policies into one document and rescinded all individually-adopted objectives and policies. A more comprehensive planning effort was undertaken when the State Board engaged Daniel, Mann, Johnson, and Mendenhall, Inc., and Koebig and Koebig, Inc. to develop Basin Plans for the Santa Clara River Basin and the Los Angeles River Basin, respectively. This major planning effort culminated in 1975 with the *Water Quality Control Plan for the Santa Clara River Basin (4A)* and the *Water Quality Control Plan for the Los Angeles River Basin (4B)*. These two documents, which together comprised the Basin Plans for the Los Angeles Region, were amended in 1978, 1990, and 1991. These two Basin Plans and amendments are superseded by this single Basin Plan which, for planning purposes, divides the Region into major surface watersheds and groundwater basins.

Since 1975, progress has been made toward the control of a number of water quality problems identified in the 1975 Basin Plans, including the control of point source discharges and the development of new programs to address nonpoint source pollution issues in the Region. At the same time, many new issues and areas of concern have arisen as health scientists have identified increasingly lower concentrations of toxic substances as health risks. Furthermore, advancing analytical technology enables detection of contaminants at increasingly lower concentrations. The State and Regional Board's Continuing Planning Process, based on the latest scientific information, addresses both "old" and "new" water quality issues.

Continuing Planning Process

As part of the State's Continuing Planning Process, components of the Basin Plan are reviewed as new data and information become available or as specific needs arise. Comprehensive updates of the Basin Plan occur in response to state and federal legislative requirements and as funding becomes available. State Board and other governmental entities' (federal, state and local) plans, that can affect water quality, are incorporated into the planning process. In addition, the Basin Plan provides consistent long-term standards and program guidance for the Region.

Triennial Review Process

The California Water Code, (§13240), directs the State and Regional Boards to periodically review and update Basin Plans. Furthermore, the CWA (§303 [c]) directs states to review water quality standards every three years (triennial review) and, as appropriate, modify and adopt new standards.

In the Triennial Review Process, basin planning issues are formally identified and ranked during the public hearing process. These and other modifications to the Basin Plan are implemented through Basin Plan amendments as described below. In addition, the Regional Board can amend the Basin Plan as needed. Such amendments need not coincide with the Triennial Review Process.

Basin Plan Amendments

Amending the Basin Plan involves the preparation of an amendment, an environmental checklist, and a staff report. Public workshops can be held to inform the public about planning issues before formal action is scheduled on the amendments. Following a public review period of at least 30 days, the Regional Board responds to public comments. Subsequently, the Regional Board can take action on the draft amendments at a public hearing.

The California Environmental Quality Act (as codified in the California Public Resources Code, §21080.5[d][2][i]) provides that the Secretary of Resources can exempt regulatory programs of state agencies from the requirements of preparing environmental impact reports, negative declarations, and initial studies should such programs be certified as "functionally equivalent." The Basin Planning process has been so certified. Accordingly, this amendment for the Basin Plan update (and accompanying documentation) is functionally equivalent to an environmental impact report or negative declaration.

Following adoption by the Regional Board, Basin Plan amendments and supporting documents are submitted to the State Board for review and approval. All Basin Plan amendments approved by the State Board after June 1, 1992 must also be reviewed and approved by the State Office of Administrative Law (OAL). All amendments take effect upon approval by the OAL. In addition, the USEPA must review and approve those Basin Plan amendments that involve changes in state standards to ensure such changes do not conflict with federal regulations.

The Region

Regional Setting

The Los Angeles Region (Figure 1-1) encompasses all coastal drainages flowing to the Pacific Ocean between Rincon Point (on the coast of western Ventura County) and the eastern Los Angeles County line, as well as the drainages of five coastal islands (Anacapa, San Nicolas, Santa Barbara, Santa Catalina, and San Clemente). In addition, the Region includes all coastal waters within three miles of the continental and island coastlines.

For planning purposes, the Regional Board uses the classification system developed by the California Department of Water Resources, which divides surface waters into hydrologic units, areas, and subareas (Figure 1-2) and ground waters into major groundwater basins (see ground water section). Figures 1-3 and 1-4 illustrate the major streams and lakes within the Region. As the eastern boundary, formed by the Los Angeles County line, departs somewhat from the hydrologic divide, the Los Angeles and Santa Ana Regions share jurisdiction over watersheds along their common border. The Regional Board is moving towards the use of Watershed Management Areas. Surface water watershed boundaries are illustrated on Figure 1-5.

Descriptions of the major hydrologic units follow:

- Pitas Point Hydrologic Unit, located in western Ventura County, extends from Rincon Point to the Ventura River. Numerous small canyons drain the southern slopes of the coastal hills in this area, which totals about 22 square miles. Limited supplies of ground water are present in alluvium along the bottoms of the canyons.

- Ventura River Hydrologic Unit includes parts of western Ventura County and a small part of eastern Santa Barbara County. The Ventura River drains the northern slopes of Sulphur Mountain and portions of the southern slopes of the Santa Ynez Mountains. The drainage area totals about 300 square miles and, except in coastal areas, land use is predominantly rural and open space. Small alluvial basins along the surface drainage system contain supplies of ground water.

- Santa Clara-Calleguas Hydrologic Unit covers most of Ventura County, part of northern Los Angeles County, and small parts of Santa Barbara and Kern Counties. With a drainage area of 1,760 square miles, it is the largest hydrologic unit in the Region. Most of the upland area is within the Angeles and Los Padres National Forests. While land use in the lower portion of the drainage area – in particular the Oxnard Plain – is predominantly agricultural, urban (primarily residential) land uses are encroaching upon and rapidly replacing these agricultural lands. The Santa Clara River and Calleguas Creek are the major streams in this area, draining the San Gabriel Mountains, Santa Susana Mountains, Oak Ridge, South Mountain, Simi Hills, Sawmill, Liebre and Frazier Mountains. Large reserves of ground water exist in alluvial aquifers underlying the Oxnard Plain and along the valleys of the Santa Clara River and its tributaries.

- Malibu Hydrologic Unit drains the southern slopes of the Santa Monica Mountains in western Los Angeles County and a small area of southeastern Ventura County. The drainage area totals 242 square miles and, except for the coastal area where land use is residential and commercial, most of the area is open space. No one stream dominates this drainage area rather, it is comprised of several small streams, including Topanga Canyon Creek, Malibu Creek, Dume Creek (Zuma Canyon Creek) and Big Sycamore Canyon Creek, which flow southward into the Pacific Ocean. Ground water is present in limited amounts in alluvium along the bottom of canyons and valleys and in fractured volcanic rocks.

- Los Angeles-San Gabriel Hydrologic Unit covers most of Los Angeles County and small areas of southeastern Ventura County. This drainage area totals 1,608 square miles. With most of

Regional Hydrologic Units, Areas and Subareas

401.00	PITAS POINT HYDROLOGIC UNIT
402.00	VENTURA RIVER HYDROLOGIC UNIT
402.10	Lower Ventura River HA
402.20	Upper Ventura River HA
402.30	Ojai HA
2.31	Upper Ojai HSA
2.32	Ojai Valley HSA
403.00	SANTA CLARA-CALLEGUAS HYDROLOGIC UNIT
403.10	Oxnard Plain HA
3.11	Oxnard HSA
3.12	Pleasant Valley HSA
403.20	Santa Paula HA
3.21	Sulfur Springs HSA
3.22	Sisar HSA
403.30	Sespe HA
3.31	Fillmore HSA
3.32	Topa Topa HSA
403.40	Piru HA
3.41	Santa Felicia HSA
3.42	Upper Piru HSA
3.43	Hungry Valley HSA
3.44	Stauffer HSA
403.50	Upper Santa Clara River HA
3.51	Eastern HSA
3.52	Bouquet HSA
3.53	Mint Canyon HSA
3.54	Sierra Pelona HSA
3.55	Acton HSA
403.60	Calleguas-Conejo HA
	SANTA CLARA-CALLEGUAS HU (Continued)
3.61	West Las Posas HSA
3.62	East Las Posas HSA
3.63	Arroyo Santa Rosa HSA
3.64	Conejo Valley HSA
3.65	Tierra Rejada Valley HSA
3.66	Gillibrand HSA
3.67	Simi Valley HSA
3.68	Thousand Oaks HSA
404.00	MALIBU HYDROLOGIC UNIT
404.10	Topanga HA
4.11	Topanga Canyon HSA
4.12	Tuna Canyon HSA
4.13	Pena Canyon HSA
4.14	Piedra Gorda Canyon HSA
4.15	Las Flores Canyon HSA
4.16	Carbon Canyon HSA
404.20	Malibu Creek HA
4.21	Monte Nido HSA
4.22	Las Virgenes Canyon HSA
4.23	Lindero Canyon HSA
4.24	Triunfo Canyon HSA
4.25	Russell Valley HSA
4.26	Sherwood HSA
404.30	Point Dume HA
4.31	Corral Canyon HSA
4.32	Solstice Canyon HSA
4.33	Latigo Canyon HSA
4.34	Escondido Canyon HSA
4.35	Ramirez Canyon HSA
	MALIBU HU (Continued)
4.36	Zuma Canyon HSA
4.37	Trancas Canyon HSA
404.40	Camarillo HA
4.41	Encinal Canyon HSA
4.42	Los Alisos Canyon HSA
4.43	Nicolas Canyon HSA
4.44	Arroyo Sequit HSA
4.45	Little Sycamore HSA
4.46	Deer Canyon HSA
4.47	Big Sycamore Canyon HSA
4.48	La Jolla Valley HSA
405.00	LOS ANGELES-SAN GABRIEL HYDROLOGIC UNIT
405.10	Coastal Plain HA
5.11	Palos Verdes HSA
5.12	West Coast HSA
5.13	Santa Monica HSA
5.14	Hollywood HSA
405.15	Central HSA Split
845.15	Central HSA Split
405.20	San Fernando HA
5.21	Bull Canyon HSA
5.22	Sylmar HSA
5.23	Tujunga HSA
5.24	Verdugo HSA
5.25	Eagle Rock HSA
405.30	Raymond HA
5.31	Pasadena HSA
5.32	Monk Hill HSA
	LOS ANGELES-SAN GABRIEL HU (Continued)
5.33	Santa Anita HSA
405.40	San Gabriel Valley HA
5.41	Main San Gabriel HSA
5.42	Lower Canyon HSA
5.43	Upper Canyon HSA
5.44	Foothill HSA
405.50	Spadra HA
5.51	San Jose HSA
5.52	Pomona HSA
5.53	Live Oak HSA
405.60	Anaheim HA
845.61	Buena Park HSA
405.62	La Habra HSA Split
845.62	La Habra HSA Split
405.63	Yorba Linda HSA Split
845.63	Yorba Linda HSA Split
406.00	SAN PEDRO CHANNEL ISLANDS HYDROLOGIC UNIT
406.10	Anacapa Island HA
406.20	San Nicolas Island HA
406.30	Santa Barbara Island HA
406.40	Santa Catalina Island HA
406.50	San Clemente Island HA
801.00	SANTA ANA RIVER HYDROLOGIC UNIT
801.20	Middle Santa Ana River HA Split
481.20	Chino HSA Split
481.22	Harrison HSA
481.23	Claremont Heights HSA Split

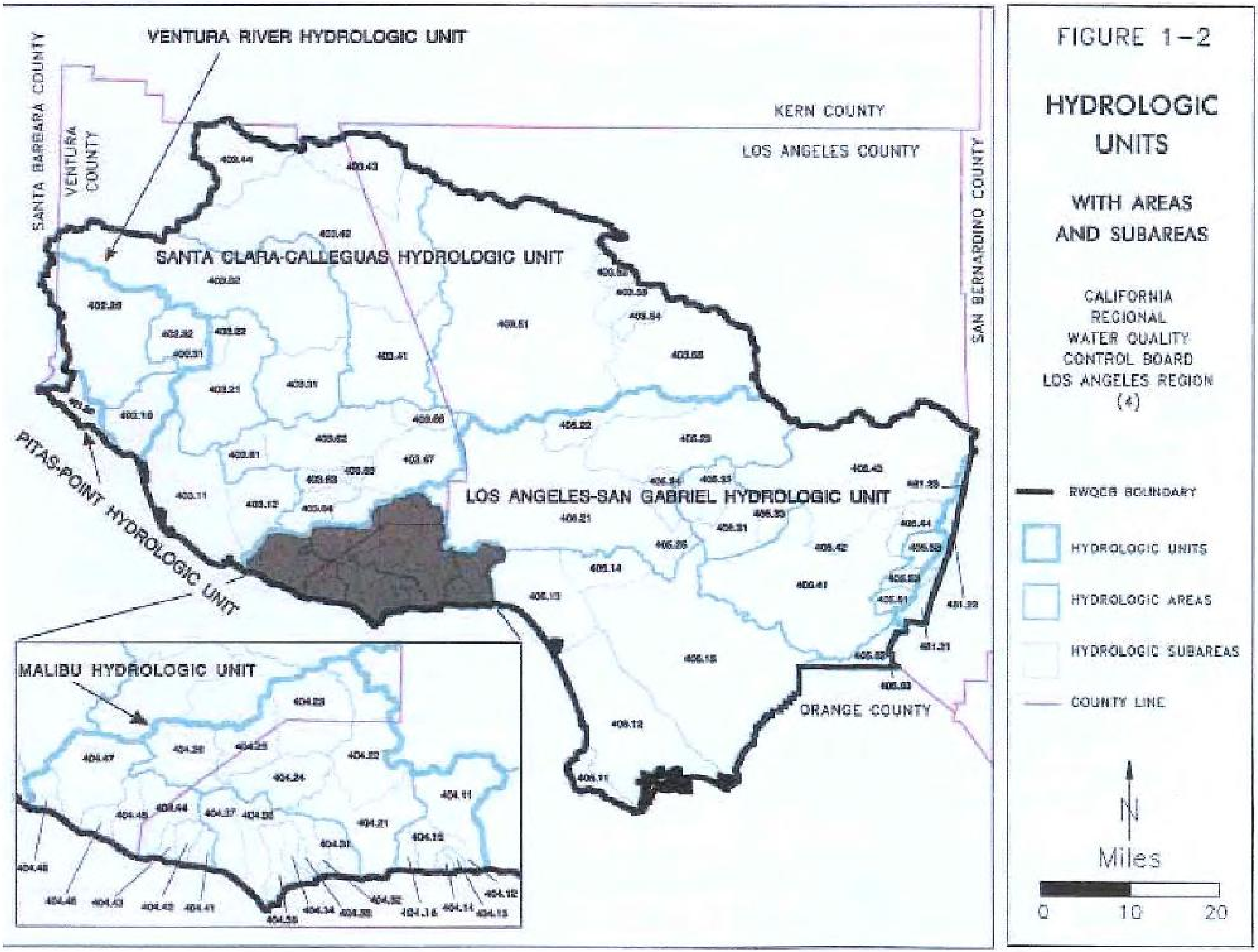


FIGURE 1-2

HYDROLOGIC UNITS

WITH AREAS AND SUBAREAS

FIGURE 1–4

MAJOR RESERVOIRS AND LAKES

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

RWQCB BOUNDARY

RESERVOIRS AND LAKES

STREAMS

N

Miles

0 10 20

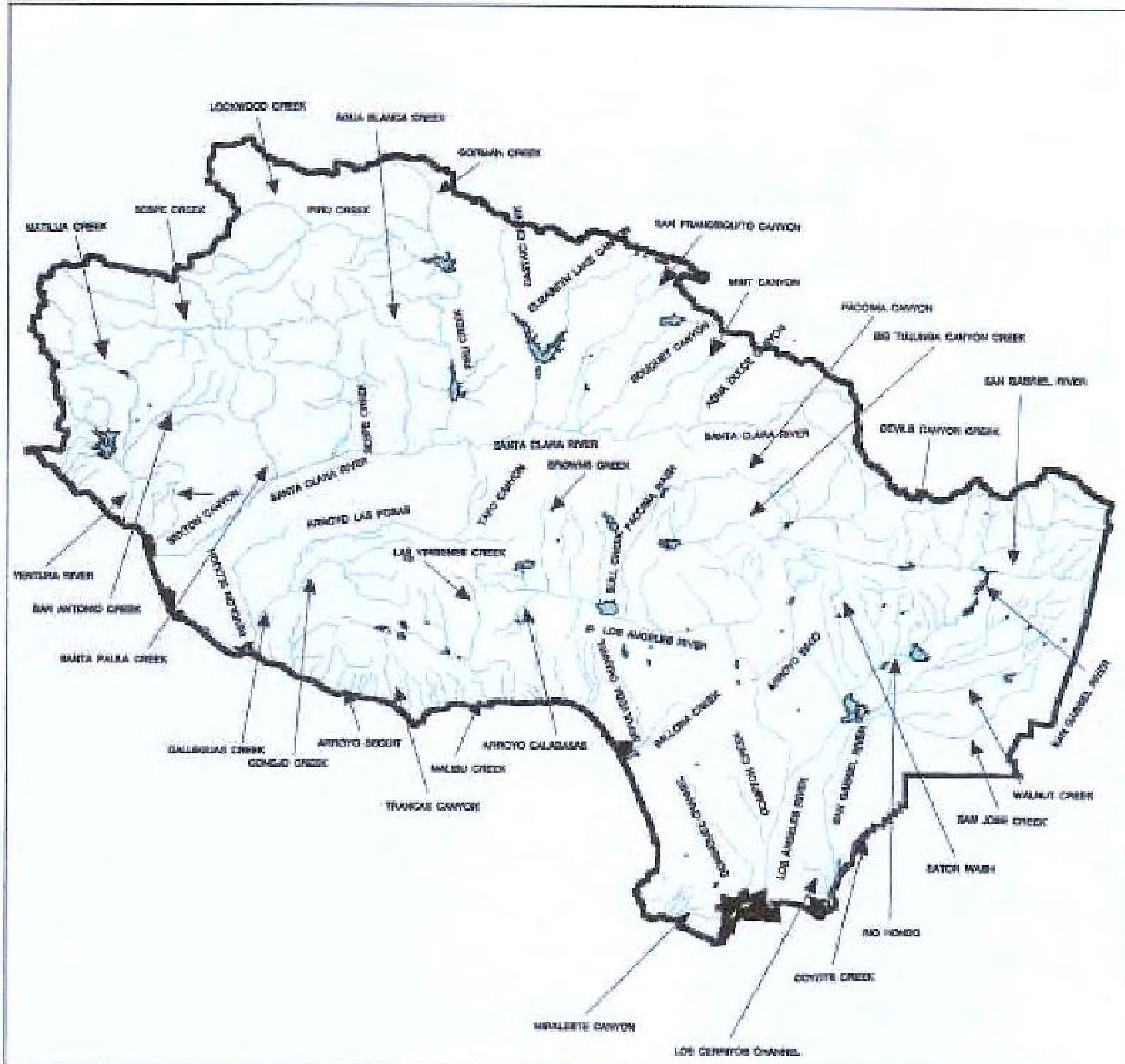


FIGURE 1-3

MAJOR RIVERS AND STREAMS

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD LOS ANGELES REGION (4)

REGIONAL BOUNDARY

STREAMS

LAKES

N

Miles

0 10 20

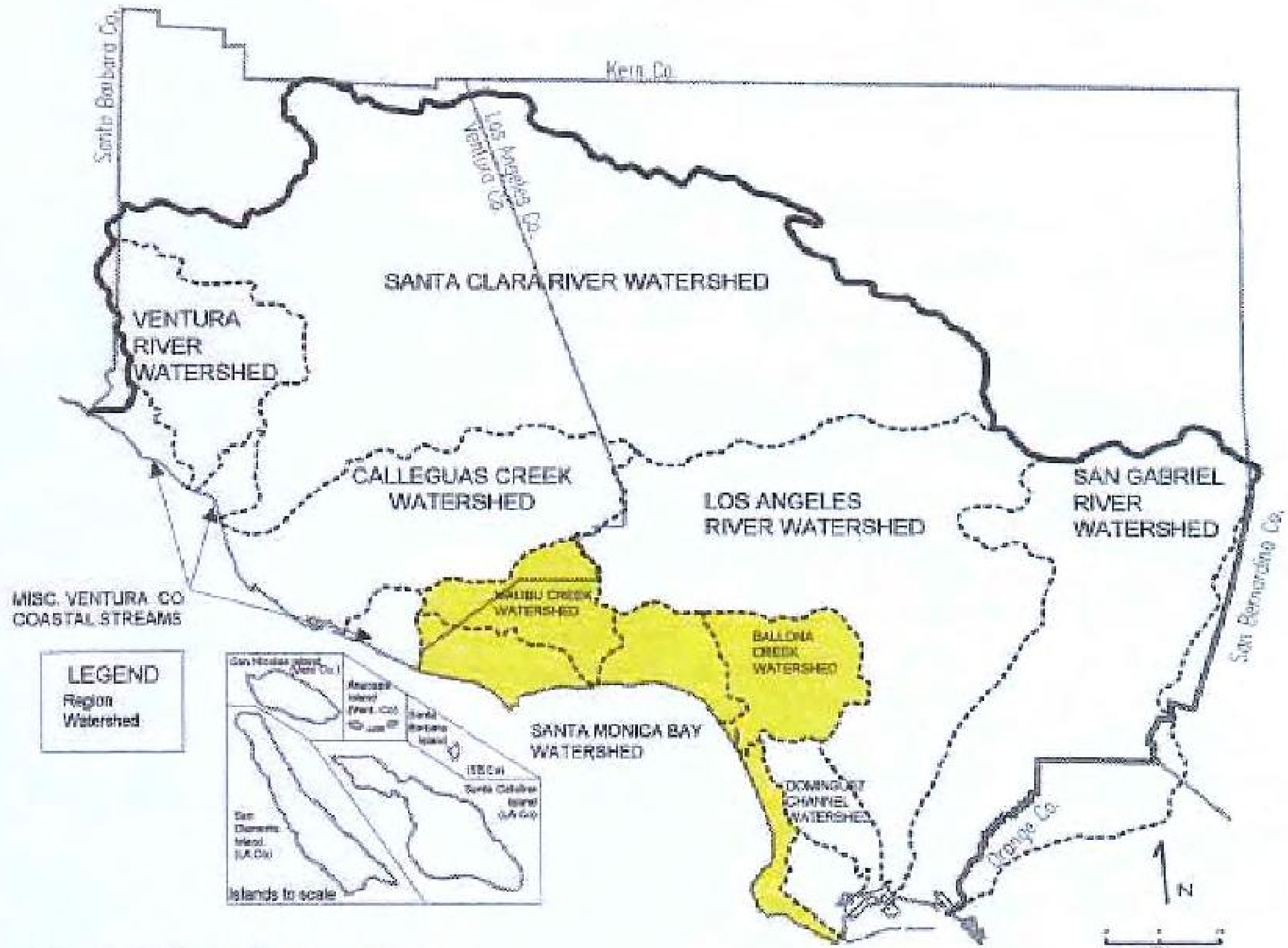


Figure 1-5. Watershed Managment Areas.

the population in the Region located in this hydrologic unit, land use is predominantly residential, commercial, and industrial; much of the area is covered with semi-permeable or non-permeable material (i.e., paved). The Los Angeles River, San Gabriel River, and Ballona Creek, which are the major drainage systems in this area, drain the coastal watersheds of the Transverse Ranges. These surface waters also recharge large reserves of ground water that exist in alluvial aquifers underlying the San Fernando and San Gabriel Valleys and the Los Angeles Coastal Plain.

- San Pedro Channel Islands Hydrologic Unit includes Santa Barbara, Santa Catalina, San Clemente, San Nicolas, and Anacapa Islands and Begg Rock. Except for limited development on Santa Catalina Island, land use of the Channel Islands is predominantly open space. Surface runoff on Santa Barbara Island does not flow in well-defined drainages; rather, surface runoff flows in sheets to the surrounding coastlines. Surface runoff on the other islands drains into intermittently-flowing creeks in small valleys and canyons. Reserves of ground water are limited on all of the islands.

Geology

Most of the Los Angeles Region lies within the western portion of the Transverse Ranges Geomorphic Province. The San Andreas transform fault system, forming the boundary between the North American and Pacific tectonic plates, cuts these western Transverse Ranges. This fault system, which extends northwesterly for over 700 miles from the Salton Sea in southern California to Cape Mendocino in northern California, bends in an east-west direction through the Transverse Ranges. Known as the "Big Bend," this portion of the San Andreas fault system formed from complex movements of the Pacific Plate against the North American Plate. Compression generated by such forces resulted in uplift of the Transverse Ranges, which have a conspicuous east-west trend (unlike other major ranges in the continental United States, which typically have a roughly north-south trend).

Major mountain ranges within the Los Angeles Region include: San Gabriel Mountains, Santa Monica Mountains, Santa Susana Mountains, Simi Hills, and Santa Ynez Mountains (Figure 1-6). The San Gabriel Mountains are the most prominent range in this group. The rock types exposed in the San Gabriel Mountains consist predominantly of Mesozoic granitic rocks (66 to 245 million years old), with minor exposures of Precambrian igneous and metamorphic rocks (prior to 570 million years old), and small stocks of Tertiary plutonic rocks (1.6 to 66 million years old). Cenozoic sedimentary beds (younger than 66 million years) are exposed only at the margins of the San Gabriel Mountains. Reflecting the recent and continuing uplift from plate tectonic activity, the San Gabriels are rugged mountains with deeply dissected canyons. Eroded sediments from these mountains have formed and are continuing to form prominent alluvial fans in the valleys along the flanks of the range.

During the Miocene Epoch (5 million to 23.5 million years ago), the sea advanced to the base of the San Gabriel Mountains, depositing fine-grained marine sediments. As the sea retreated, coarser-grained sediments, eroded from the Transverse Ranges, were deposited as alluvial fans in low-lying areas such as the San Fernando Valley, San Gabriel Valley, Oxnard Plain, and the Los Angeles Coastal Plain (Norris and Webb, 1991). These low-lying areas or basins are filled with layers of sediment. Many of these layers of sediment form aquifers that are important sources of ground water in the Region.

Climate

With prevailing winds from the west and northwest, moist air from the Pacific Ocean is carried inland in the Los Angeles Region until it is forced upward by the mountains. The resulting storms, common from November through March, are followed by dry periods during summer months. Differences in topography are responsible for large variations in temperature, humidity, precipitation, and cloud cover throughout the Region. The coastal plains and islands, with mild rainy winters and warm dry summers, are noted for their subtropical "mediterranean" climate. The inland slopes and basins of the Transverse Ranges, on the other hand, are characterized by more extreme temperatures and little precipitation.

Precipitation in the Region generally occurs as rainfall, although snowfall can occur at high elevations. Most precipitation occurs during just a few major storms. Annual rainfall in Ventura County averages 15.2 inches, although highs of almost 40 inches occur around Cobblestone Mountain and Pine Mountain, and lows of around 14 inches occur on the Oxnard Plain (Ventura County, 1993a).

Figure 1-6. Physiographic features of the Los Angeles Region.

Large variations also exist within Los Angeles County, as indicated by annual highs of around 42 inches at Mount Islip (along the crest of the Angeles National Forest) and annual lows of around 10 inches in the eastern Santa Clara River Valley. While an overall average is not available for Los Angeles County, annual rainfall at the Ducommun Street rain gauge in the City of Los Angeles averages 15.5 inches since measurements began in 1872 (Los Angeles County, 1993).

Land Use/Population

Land use within the Region varies considerably (Figure 1-7). In Ventura County, land uses are changing from agriculture and open space to urban residential and commercial. In southern Los Angeles County, the predominant land uses include urban residential, commercial and industrial. In northern Los Angeles County, open space is rapidly being transformed into residential communities.

The economy in Los Angeles County is primarily industrial, commercial, and service; while in Ventura County the economy is primarily agricultural, service, and commercial.

About 10 million people currently live in the Region. From 1950 to 1990 the population in the Region more than doubled. Figure 1-8 shows the increases in population in the Region since 1950, as well as projected population growth until the year 2015.

Natural Resources

Diversity in topography, soils, and microclimates of the Region supports a corresponding variety of plant and animal communities. Native vegetation in the Region can be categorized into several general plant communities: grasslands, sage-scrub, chaparral, oak woodland, riparian, pinyon-juniper, and timber-conifer. Within these general groups, many mixed subgroups and locally distinct vegetation types can be distinguished: mixed chaparral, semi-desert, and chamise chaparral, are a few examples.

Chaparral is the most common type of native vegetation in the Region. Large expanses of chaparral are found in the Santa Monica Mountains. Inland, coastal sagebrush occurs in the Simi Hills, Santa Susana Knolls, Verdugo Hills, and San Gabriel Mountains. Oak woodland, with the easily identifiable "Valley Oaks", sometimes reaching a height of 20 to 60 feet, is dominant in Thousand Oaks, Lake Casitas, Hidden Valley, Santa Clarita Valley, and elsewhere in the Transverse Mountain Ranges. Grasslands occur in Point Mugu State Park and on hillsides and valleys of northern Los Angeles County.

Riparian vegetation, found along most of the rivers and creeks, consists of sycamores, willows, cottonwoods, and alders. Extensive riparian corridors occur along Piru, Sespe, Santa Paula, Malibu, and Las Virgenes Creeks, Santa Clara, Ventura Rivers, and San Gabriel Rivers, as well as other rivers and creeks of the Los Padres and Angeles National Forests. The riparian vegetation provides essential habitat and transportation corridors for wildlife, supporting a great abundance and diversity of species.

The existence of "ecological islands" as a result of topography and climatic changes has led to the evolution of species, subspecies, and genetic strains of plants and animals in the Region. However, increasing urbanization and development have resulted in the loss of habitat and a decline in biological diversity. As a result, several native flora and fauna species have been listed as rare, endangered or threatened. Representative examples of endangered species include: California condor, American peregrine falcon, California least tern, tidewater goby, unarmored threespine stickleback, Mohave ground squirrel, conejo buckwheat, many-stemmed *Dudleya*, least Bell's vireo, and slender-horned spire flower.

Locally Unique Habitats

Habitats that support rare, threatened, endangered, or other sensitive plant or animal species are unique, not simply because they support these species, but because they are unique habitats in terms of their physical, geographical, and biological characteristics. Both Ventura and Los Angeles Counties have officially designated these unique areas as Significant Biological Resources or Significant Ecological Areas, respectively. These areas are described in detail in the counties' respective General Plans. The following two sections describe some of the more significant ecological areas recognized by Ventura and Los Angeles Counties as unique habitats.

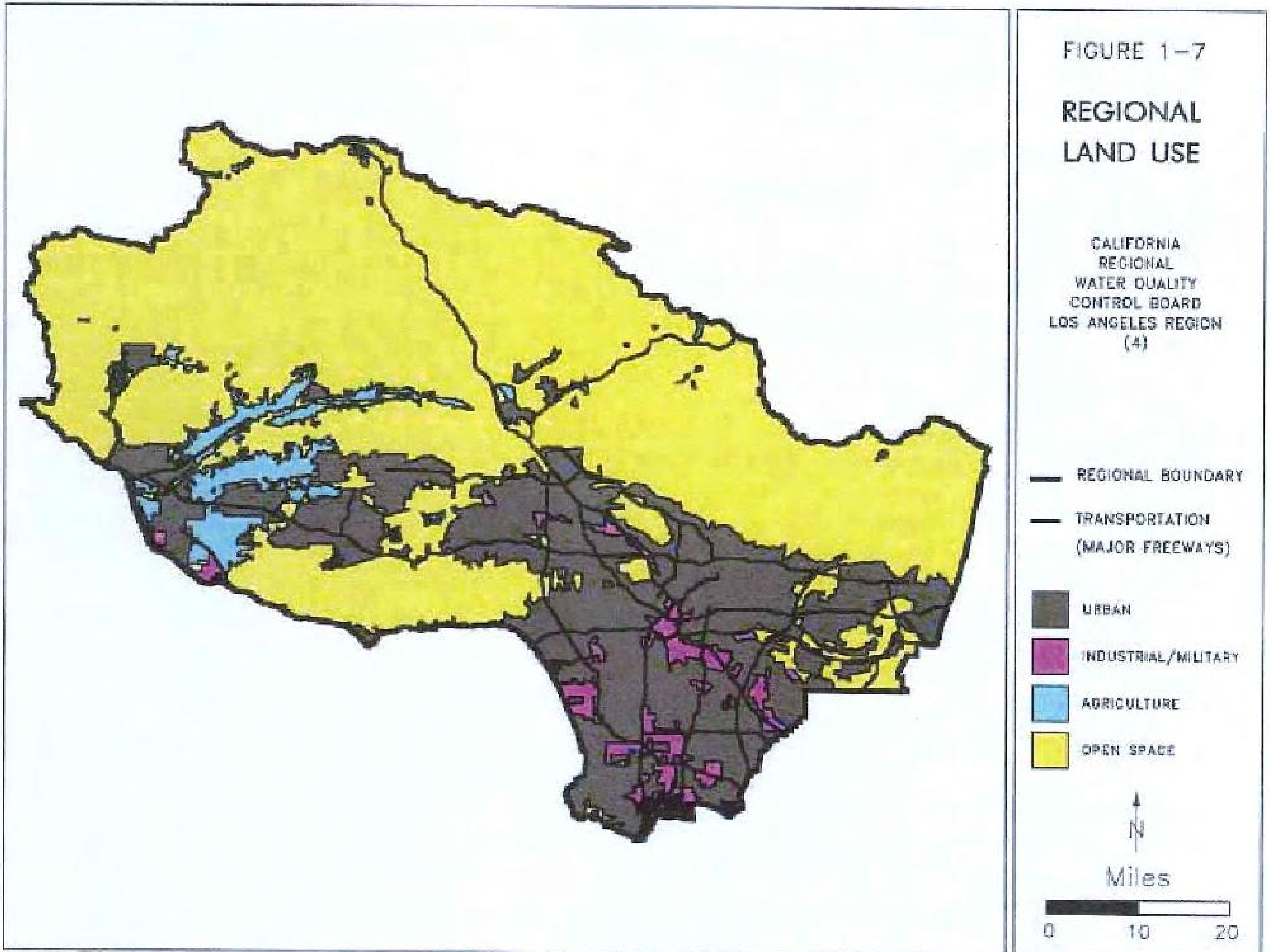
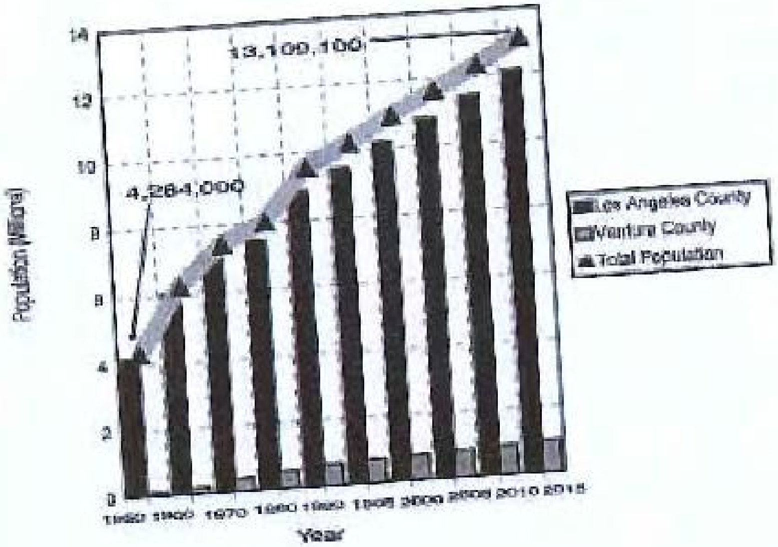


FIGURE 1-7

REGIONAL LAND USE



Year	Los Angeles County	Ventura County	Total
1950	4,168,400	115,600	4,284,000
1960	6,071,900	203,100	6,275,000
1970	7,055,800	381,400	7,437,200
1980	7,500,300	532,200	8,032,500
1990	8,897,500	671,000	9,569,100
1995	9,489,600[p]	725,700[p]	10,215,300[p]
2000	10,180,900[p]	782,700[p]	10,963,600[p]
2005	10,812,900[p]	834,500[p]	11,647,400[p]
2010	11,441,900[p]	905,600[p]	12,347,500[p]
2015	12,137,600[p]	971,500[p]	13,109,100[p]

p = Projected Population

Source: California Department of Finance, June 1994

Figure 1-8. Population Projections in Los Angeles and Ventura Counties.

Ventura County

Many unique habitats, including coastal wetlands and lagoons, are found along the southern coast of Ventura County. These areas provide habitats for many fish, birds, invertebrates, sea lions, and for other marine and estuarine species. Mugu Lagoon is the most extensive wetland in the Region and supports a rich diversity of fish and wildlife (that once inhabited much of southern California's coastal areas). Other wetlands include McGrath Lake, Ormond Beach, and the estuaries at the mouths of the Ventura and Santa Clara Rivers. The "Pothole" in the Devil's Potrero (on Agua Blanca Creek) is an inland freshwater marsh that supports several species of plants unique to freshwater marshes.

One of the largest of Santa Clara River's tributaries, Sespe Creek, contains most of the Santa Clara River's remnant, but restorable, run of the steelhead trout. Sespe Creek is designated as a "Wild Trout Stream" by the State of California and supports significant steelhead spawning and rearing habitat. The steelhead trout is an "anadromous" fish (migrating from the ocean into fresh water for spawning). The federal Los Padres Wilderness Act (1992) permanently set aside portions of Sespe Creek for steelhead trout protection and designated Sespe Creek as a "Wild and Scenic River." Piru and Santa Paula Creeks, two other tributaries of the Santa Clara River, also support good habitats for steelhead. The Pacific lamprey, another anadromous fish, also uses Sespe Creek and the Santa Clara River for spawning. The Santa Clara River also has populations of unarmored three-spine stickleback. In addition, the Santa Clara River serves as an important wildlife corridor.

The Sespe Condor Sanctuary was dedicated in 1947 and consists of 53,000 acres in northern Ventura County. Due to problems with the condor recovery efforts, condors are now being released in Santa Barbara County.

Local populations of steelhead and rainbow trout have nearly been eliminated along the Ventura River. A limited resident population of rainbow trout occurs above Robles Diversion Dam, in San Antonio Creek, and in the lower Ventura River. Migratory steelhead ascend upstream in the Ventura River as far as Robles Diversion Dam and into San Antonio Creek. The California Department of Fish and Game and others, however, have recognized the potential for the restoration of the estuary and enhancement of steelhead populations in the Ventura River (Ventura County, 1991).

Los Angeles County

The County of Los Angeles has designated sixty Significant Ecological Areas (SEAs; Table 1-1) within the County in their general plan (Los Angeles County, 1976). Selected SEAs are described below.

Malibu Lagoon supports two important plant communities, the coastal salt marsh and coastal strand, and is an important refuge for migrating birds (over 200 species of birds have been observed). As Malibu Canyon dissects the Santa Monica Mountains, species normally restricted to the drier interior valleys have extended their range down the canyon. Perennial streams in Malibu Canyon support outstanding oak and riparian woodlands. Malibu Creek is also the southernmost watercourse in California where steelhead trout continue to spawn (for more information about the Malibu Creek watershed see Chapter 4, page 4-54.

The Tujunga Canyon/Hansen Dam area possesses several important features. The floodplain behind the dam supports some of the last examples of the open coastal sage-scrub vegetation in the Los Angeles area. A spreading ground (basin used for groundwater recharge) southwest of the dam has created several freshwater marsh areas that are used by migratory waterfowl and shore birds. The area is also valuable as a wildlife corridor.

The San Gabriel River watershed, totalling more than 136,000 acres, has extensive areas of undisturbed riparian and woodland habitats. The United States Congress has set aside approximately 36,215 acres of the West Fork San Gabriel River watershed as the "San Gabriel Wilderness Area." In addition, about 31,680 acres of the East Fork San Gabriel River watershed have been set aside as the "Sheep Mountain Wilderness Area." This watershed is also valuable to sportsmen, hikers, and picnickers.

San Francisquito Canyon, a tributary of the Santa Clara River, supports populations of Unarmored Three-spine Stickleback, an endangered fish species.

Table 1- 1. Significant Ecological Areas (SEAs) in Los Angeles County.[1]

No.	Significant Ecological Area (SEA)	No.	Significant Ecological Area (SEA)
1	Malibu Coastline	33	Terminal Island
2	Point Dume	34	Palos Verdes Peninsula Coastline
3	Zuma Canyon	35	Harbor Lake Regional Park
4	Upper Sierra Canyon	36	Madrona Marsh
5	Malibu Canyon and Lagoon	37	Griffith Park
6	Las Virgenes	38	Baldwin Hills[2]
7	Hepatic Gulch	39	Encino Reservoir
8	Malibu Creek State Park Buffer Area	40	Verdugo Mountains
9	Cold Creek	41	Rio Hondo Spreading Grounds[2]
10	Tuna Canyon	42	Whittier Narrows Dam County Recreation Area
11	Temescal–Rustic–Sullivan Canyons	43	Rio Hondo College Wildlife Sanctuary
12	Palo Comado Canyon	44	Sycamore and Turnbull Canyons
13	Chatsworth Reservoir	45	*Dudleya densiflora* Population
14	Simi Hills	46	Tujunga Spreading Grounds[2]
15	Tonner Canyon/Chino Hills	47*	Edwards Air Force Base
16	Buzzard Peak/San Jose Hills	48*	Big Rock Wash
17	Powder Canyon/Puente Hills	49*	Little Rock Wash
18	Way Hill	50*	Rosamond Lake
19	San Francisquito Canyon	51*	Saddleback Butte State Park
20	Santa Susana Mountains	52*	Alpine Butte
21	Santa Susana Pass	53*	Lovejoy Butte
22	Santa Fe Dam Floodplain	54*	Piute Butte
23	Santa Clara River	55*	Desert-Montane Transect
24	Tujunga Valley/Hansen Dam	56*	Ritter Ridge
25	San Dimas Canyon	57*	Fairmont and Antelope Buttes
26	San Antonio Canyon Mouth	58*	Portal Ridge/Liebre Mountain
27	Portuguese Bend Landslide	59*	Tehachapi Foothills
28	El Segundo Dunes	60*	Joshua Tree Woodland Habitat
29	Ballona Creek	61*	Kentucky Springs[2]
30	Alamitos Bay	62*	Galium grande Population
31	Rolling Hills Canyons	63	Lyon Canyon
32	Agua Amarga Canyon	64	Oak Savannah

1 Descriptions of these areas can be found in the Los Angeles County General Plan (1976)
2 These are also designated as open spaces.
* Outside of the Los Angeles Region

Water Resources/Water Quality Issues

Surface and ground waters within the Los Angeles Region have proven insufficient to support the rapidly growing population in the Los Angeles Region. Water imported from other areas now meets about 50% of fresh water demands in the Region. Restrictions on imported water as well as drought conditions have necessitated water conservation measures which, at present, are voluntary. These conservation measures have slightly lessened the use of potable water in many areas of the Region. In addition, the demand for water is being partially fulfilled by the increasing use of reclaimed water for non-potable purposes such as greenbelt irrigation and industrial processing and servicing.

Surface Waters

Major surface waters of the Los Angeles Region flow from head waters in pristine mountain areas (largely in two National Forests and the Santa Monica Mountains), through urbanized foothill and valley areas, high density residential and industrial coastal areas, and terminate at highly utilized recreational beaches and harbors. Uncontrolled pollutants from nonpoint sources are believed to be the greatest threats to rivers and streams within the Region.

- *Ventura River Watershed:* The Ventura River is the northern-most river system in southern California (south of Point Conception) that supports a large number of sensitive aquatic species, several of which are currently, or proposed to be, endangered or threatened. Water quality in the upper reaches is good but quality in the lower reaches is impacted by a combination of municipal water discharges and agricultural, urban and oil industry nonpoint sources.

- *Santa Clara River Watershed:* The Santa Clara River is the largest river system in southern California that remains in a relatively natural state. Extensive patches of high quality riparian habitat are present along the length of the river and its tributaries. Stream flows are diverted, usually during high flow, for "out-of-stream" beneficial uses. Threats to water quality include increasing development in floodplain areas, necessitating flood control measures such as channelization that results in increased flows, erosion, and loss of habitat.

- *Calleguas Creek Watershed:* Calleguas Creek drains a predominantly agricultural area on the Oxnard Plain and empties into Mugu Lagoon, one of southern California's few remaining large wetlands. While natural flows in the past were intermittent, discharges of municipal, agricultural, and urban wastewaters have increased surface flow in the watershed resulting in increased sedimentation in the lagoon. The general instability of the streambanks, continual destruction of riparian vegetation, and other land use practices have accelerated erosion in this watershed. Erosion problems are intensified in areas where residential development is occurring on steeply sloping upland areas. Should sedimentation continue at the present rate, the lagoon is projected to fill with sediment in about 50 years. Additional problems are produced by irrigation return-flows which add nutrients, pesticides, and other dissolved constituents to the creek and its tributaries.

- *Malibu Creek Watershed:* This watershed has changed rapidly in the last 20 years from a predominantly rural area to a steadily developing area that has doubled in population to nearly 80,000 residents. Increased flows (from imported waters needed to support the growing population base) and channelization of several tributaries to Malibu Creek have caused an imbalance in the natural flow regime in the watershed. Pollutants of concern, many of which are discharged from nonpoint sources, include excess nutrients, sediment, and bacteria.

- *Ballona Creek Watershed:* Pollutants from industrial and municipal effluent as well as urban runoff degrade the quality of Ballona Creek. Specific pollutants include high levels of dissolved solids (chlorides, sulfates, heavy metals) and bacteria. Untreated sewage overflows discharged into Ballona Creek during the rainy season cause beach closures along Santa Monica Bay. In addition, high concentrations of DDT in sediments at the mouth of the creek and in Marina Del Rey provide evidence of past discharges that have resulted in long-term water quality problems.

- *Los Angeles River Watershed:* The Los Angeles River is highly modified, having been lined with concrete along most of its length by the U.S. Army Corps of Engineers from the

1930s to the 1960s. One seven-mile reach in the narrows area (in the middle portion of the river system), where ground water rises into the streambed, is mostly unlined along the stream bottom and provides natural habitat for fish and other wildlife in an otherwise concrete conveyance. The upper reaches of the river carry urban runoff and flood flows from the San Fernando Valley. Below the Sepulveda Basin, flows are dominated by tertiary-treated effluent from several municipal wastewater treatment plants. Because the watershed is highly urbanized, urban runoff and illegal dumping are major contributors to impaired water quality in the Los Angeles River and tributaries.

- *San Gabriel River Watershed:* While the upper San Gabriel River and its tributaries remain in a relatively pristine state, intensive recreational use of this area for picnicking, off road vehicle use, fishing, and hiking threaten water quality and aquatic and riparian habitats. Further problems in the upper San Gabriel River occur as vast amounts of naturally eroding sediment from the rugged San Gabriel Mountains settle into reservoirs behind flood control dams. Improper sediment sluicing operations from these reservoirs can impact aquatic habitats and groundwater recharge areas. In the San Gabriel Valley, the middle reaches of the river have been extensively modified in order to control flood and debris flows and to recharge ground water. Extensive sand and gravel operations are found along these stretches of the river. The lower San Gabriel River (i.e., those stretches flowing through the Los Angeles Coastal Plain) also has been extensively modified and is lined with concrete from approximately Firestone Boulevard to the estuary. Flow in these lower reaches is dominated by effluent from several municipal wastewater treatment facilities and urban runoff. Beneficial uses have been impaired in these lower reaches of the San Gabriel River, as evidenced by ambient toxicity and bioaccumulation of metals in fish tissue.

Other more generalized surface water problems in the Region include:

- Poor mineral quality in some areas due to a variety of reasons including geology, agricultural runoff, discharge of highly mineralized ground water, and poor quality of some imported waters
- Bioaccumulation of toxic compounds in fish and other aquatic life
- Impacts from increased development and recreational uses
- In-stream toxicity from point and nonpoint sources
- Diversion of flows necessary for the propagation of fish and wildlife populations
- Channelization, dredging, and other losses of habitat
- Impacts from transient camps located along creeks and lagoons
- Illegal dumping
- Introduction of non-native plants which are of little value to the biota and clog the streams
- Impacts from sand and gravel mining operations
- Natural oil seeps
- Eutrophication and the accumulation of toxic pollutants in lakes

Ground Waters

Ground water accounts for most of the Region's local (i.e., non-imported) supply of fresh water. Major groundwater basins in the Region are shown in Figure 1-9.

The general quality of ground water in the Region has degraded substantially from background levels. Much of the degradation reflects land uses. For example, fertilizers and pesticides, typically used on agricultural lands, can degrade ground water when irrigation-return waters containing such substances seep into the subsurface. In areas that are unsewered, nitrogen and pathogenic bacteria from overloaded or improperly sited septic tanks can seep into ground water and result in health risks to those who rely on ground water for domestic supply. In areas with industrial or commercial activities, aboveground and underground storage tanks contain vast quantities of hazardous substances. Thousands of these tanks in the Region have leaked or are leaking, discharging petroleum fuels, solvents, and other hazardous substances into the subsurface. These leaks as well as otherdischarges

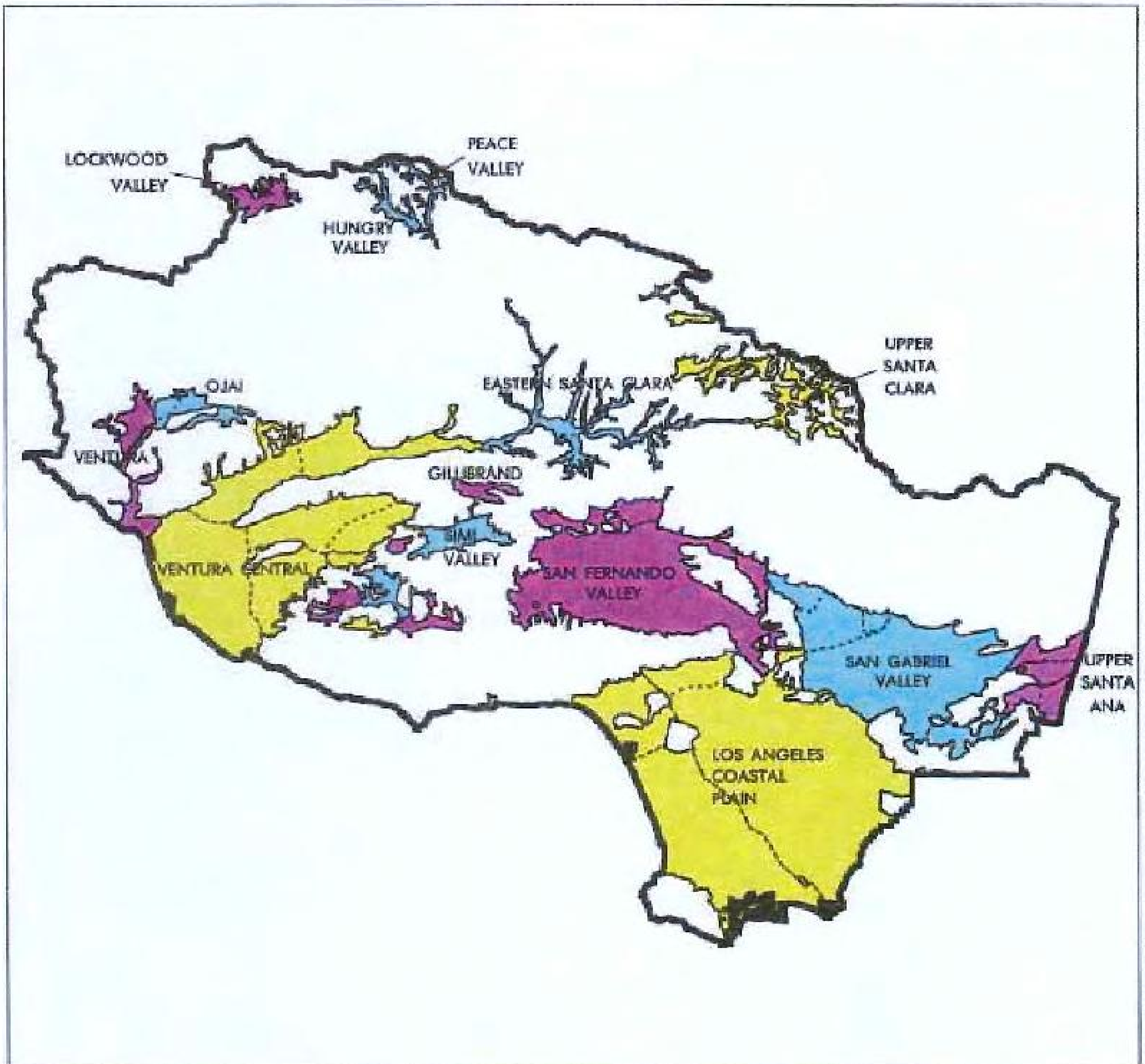


FIGURE 1–9

REGIONAL GROUNDWATER BASINS

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

REGIONAL BOUNDARY

NOTE: THIS FIGURE SHOWS ONLY MAJOR GROUNDWATER BASINS IN THE LOS ANGELES REGION. DESIGNATIONS OF BASINS CONFORM TO CA DEPARTMENT OF WATER RESOURCES DESIGNATIONS (1980)

N

Miles

0 10 20

to the subsurface that result from inadequate handling, storage, and disposal practices can seep into the subsurface and pollute ground water.

Compared to surface water pollution, investigations and remediation of polluted ground waters are often difficult, costly, and extremely slow.

Examples of specific groundwater quality problems include:

- San Gabriel Valley and San Fernando Valley Groundwater Basins: Volatile organic compounds from industry, and nitrates from subsurface sewage disposal and past agricultural activities, are the primary pollutants in much of the ground water throughout these basins. These deep alluvial basins do not have continuous effective confining layers above ground water and as a result pollutants have seeped through the upper sediments into the ground water. Approximately 20% of groundwater production capacity for municipal use in the San Gabriel Valley has been shut down due to this pollution.

  In light of the widespread pollution in both the San Gabriel Valley and San Fernando Valley Groundwater Basins, the California Department of Toxic Substances Control has designated large areas of these basins as high priority Hazardous Substances Cleanup sites. Furthermore, the USEPA has designated these areas as Superfund sites. The Regional Board and USEPA are overseeing investigations to further define the extent of pollution, identify the responsible parties, and begin remediation in these areas.

- Central and West Coast Groundwater Basins (Los Angeles Coastal Plain): Seawater intrusion that has occurred in these basins is now under control in most areas through an artificial recharge system consisting of spreading basins and injection wells that form fresh water barriers along the coast. Ground water in the lower aquifers of these basins is generally of good quality, but large plumes of saline water have been trapped behind the barrier of injection wells in the West Coast Basin, degrading significant volumes of ground water with high concentrations of chloride. Furthermore, the quality of ground water in parts of the upper aquifers of both basins is degraded by both organic and inorganic pollutants from a variety of sources, such as leaking tanks, leaking sewer lines, and illegal discharges. As the aquifers and confining layers in these alluvial basins are typically interfingered, the quality of ground water in the deeper production aquifers is threatened by migration of pollutants from the upper aquifers.

- Ventura Central Groundwater Basins: Despite efforts to artificially recharge ground water and to control levels of pumping, ground water in several of the Ventura Central basins has been, and continues to be, overdrafted (particularly in the Oxnard Plain and Pleasant Valley areas). Some of the aquifers in these basins are in hydraulic continuity with seawater; thus seawater is intruding further inland, degrading large volumes of ground water with high concentrations of chloride. In addition, nutrients and other dissolved constituents in irrigation return-flows are seeping into shallow aquifers and degrading ground water in these basins. Furthermore, degradation and cross-contamination are occurring as degraded or contaminated ground water travels between aquifers through abandoned and improperly sealed wells and corroded active wells.

  Unsewered areas of Ventura County, such as the El Rio area (to the northwest of Oxnard), represent another source of pollution to ground water in the Ventura Central Basins. In many wells in the El Rio area, nitrate is present in levels exceeding maximum contaminant levels (MCLs) established by the state and federal government (Ventura County, 1994).

- Acton Valley Groundwater Basin: Ground water is the source of most potable water in this unsewered area. However, increasing concentrations of nitrate are degrading the quality of this water. Investigations are underway to confirm septic tanks as the source of high levels of nitrate in this area.

Coastal Waters

Coastal waters in the Region include bays, harbors, estuaries, beaches, and open ocean. Santa Monica Bay dominates a large portion of the Region's open coastal waters. Deep-draft commercial harbors include the Los Angeles/Long Beach Harbor complex and Port Hueneme. Shallower, small craft harbors, such as Marina del Rey, King Harbor and Ventura Marina, occur at a number of locations.

Important estuaries are represented by coastal lagoons such as Mugu Lagoon and numerous small coastal wetlands such as Ballona Wetlands and Los Cerritos Wetlands. Recreational beaches occur along large stretches of the coastal waters.

These coastal waters are impacted by a variety of activities which include:

- Municipal and industrial wastewater discharges
- Cooling water discharges
- Nonpoint source runoff (urban and agricultural runoff in particular), including leaking septic systems, construction, and recreational activities
- Oil spills
- Vessel wastes
- Dredging
- Increased development and loss of habitat
- Offshore operations
- Illegal dumping
- Natural oil seeps

Imported Waters

Water from other areas has been imported into the Los Angeles Region since 1913, when the Los Angeles Aqueduct started delivering water from the Owens Valley. Since that time, southern California has developed complex systems of aqueducts to import water to support a rapidly growing population and economy. Water imported to the Region presently meets roughly half of the demand for potable water.

The principal systems (Figure 1-9) for importing water are summarized below:

- *The Los Angeles Aqueducts:* The City of Los Angeles, Department of Water and Power, diverts water from the Mono and Owens River Basins and transports this water via the 338-mile long Los Angeles Aqueducts to the City of Los Angeles. The original aqueduct was completed in 1913. A second aqueduct, which parallels the first, was completed in 1970.

Figure 1-10. Sources of Imported Water in the Los Angeles Region (after Los Angeles Department of Water and Power, 1991).

  Releases from the Haiwee Reservoir Complex, at the end of the Owens Valley Basin, supplied over 500,000 acre-feet per year to the City of Los Angeles during the first half of the 1980s. However, releases dropped to 127,012 acre-feet in 1990 as a result of the recent statewide drought, as well as legal restrictions on Mono Basin and Owens Valley water resources. Releases in 1992 totalled 173,945 acre-feet.

- *The California Aqueduct (The State Water Project):* The State of California, Department of Water Resources, transports about 2.4 million acre-feet per year of water, largely from the Feather and the Sacramento Rivers in northern California, to other parts of California via the California Aqueduct. In southern California, the aqueduct splits into east and west branches, terminating at Perris and Castaic Reservoirs, respectively. Approximately 1.4 million acre-feet per year of this water is delivered to four contractors for use within the Los Angeles Region: The Metropolitan Water District of Southern California (MWD), County of Ventura, Castaic Lake Water Agency, and San Gabriel Valley Municipal Water District.
- *The Colorado River Aqueduct:* The MWD imports water from Lake Havasu on the Colorado River through the 242-mile long Colorado River Aqueduct. This water is

transported to Lake Mathews, MWD's terminal reservoir, in Riverside County. While MWD held water rights for over 1.2 million acre-feet per year in the 1930s, MWD's dependable supply of Colorado River water has now been reduced to 450,000 acre-feet per year due to the exercise of water rights by other Colorado River water users. After blending with water delivered through the State Water Project, MWD delivers a portion of this water to its member agencies in the Los Angeles Region; the remaining water is delivered to other areas in southern California.

Water imported from the Owens Valley through the Los Angeles Aqueduct is usually treated for turbidity. Water from the Colorado River typically is harder than local supplies and other imported waters. This hardness is the result of dissolved constituents from soils and rocks in the Colorado River watershed. Water from northern California, while not as hard as Colorado River water, accumulates organic materials as it flows through the fertile Sacramento-San Joaquin Delta. These organic materials when combined with chlorine during typical disinfection treatment processes can result in by-products such as trihalomethanes (THMs). As THMs are linked to cancer, a 100 parts per billion standard has been established that mitigates the occurrence of THMs in drinking water while still allowing for adequate chlorine disinfection.

Water Supply and Drought Issues

During the most recent period of drought, water supplies from northern California often had higher than normal concentrations of chlorides which, in turn, often resulted in waste discharges that exceeded chloride limitations. To provide a measure of relief to dischargers who were unable to meet chloride limitations due to the drought and/or water conservation measures, the Regional Board adopted Resolution No. 90-04, entitled *Effects of Drought Induced Water Supply Changes and Water Conservation Measures on Compliance with Waste Discharge Requirements within the Los Angeles Region*. This policy, which was adopted on March 26, 1990, temporarily raised chloride limitations to match chloride increases in the water supply for a period of three years. Under this policy, chloride limitations were temporarily set at the lesser of (i) 250 mg/L or (ii) the supply concentration plus 85 mg/L.

Although the drought ended in 1993, water supplies in storage still contained higher than normal levels of chlorides. Accordingly, on June 14, 1993 the Regional Board extended these temporary chloride limitations for 18 months.

The Regional Board realizes that there may be a need for a longer term solution to these water supply issues, and will address these issues as part of the next Triennial Review.

Reclaimed Wastewaters

The State and Regional Boards recognize the shortage of fresh water in the Region and the need to conserve water for beneficial uses. Accordingly, reclaimed wastewaters are an increasingly important local resource. The State Board's *Policy with Respect to Water Reclamation in California* (State Board Resolution No. 77-1) is summarized and reprinted in Chapter 5. The importance of water reclamation is also recognized in Porter-Cologne. Sections 13575 to 13577, which were added in 1991 (during the fifth year of the last drought), set reclamation goals of 700,000 acre-feet per year and 1,000,000 acre-feet per year in the years 2000 and 2010, respectively.

The Regional Board supports reclamation projects (i.e., those projects that reuse treated wastewaters, thereby offsetting the use of fresh waters) through the Water Reclamation Requirements program. Under this program, discussed in detail in Chapter 4, treated wastewaters are reused for groundwater recharge, recreational impoundments, industrial processing and supply, and landscape irrigation.

In addition, the State and Regional Boards provide financial assistance to projects that are developing reclamation capabilities.

The Basin Plan

The following chapters designate beneficial uses of the Region's waters, water quality objectives for the protection of these beneficial uses, and a plan of implementation for enhancing or maintaining water quality. This information supersedes that in previously adopted Basin Plans and amendments.

Three overlays are located in appendix two of this Plan (hydrologic units, major freeways and USGS Quad Boundaries). These can be placed over any of the standard regional maps throughout this plan for orientation.

2. BENEFICIAL USES

Table of Contents

Introduction

Beneficial uses form the cornerstone of water quality protection under the Basin Plan. Once beneficial uses are designated, appropriate water quality objectives can be established and programs that maintain or enhance water quality can be implemented to ensure the protection of beneficial uses. The designated beneficial uses, together with water quality objectives (referred to as criteria in federal regulations), form water quality standards. Such standards are mandated for all waterbodies within the state under the California Water Code. In addition, the federal Clean Water Act mandates standards for all surface waters, including wetlands.

Twenty-four beneficial uses in the Region are identified in this Chapter. These beneficial uses and their definitions were developed by the State and Regional Boards for use in the Regional Board Basin Plans. Three beneficial uses were added since the original 1975 Basin Plans. These new beneficial uses are Aquaculture, Estuarine Habitat, and Wetlands Habitat.

Beneficial uses can be designated for a waterbody in a number of ways. Those beneficial uses that have been attained for a waterbody on, or after, November 28, 1975, must be designated as "existing" in the Basin Plans. Other uses can be designated, whether or not they have been attained on a waterbody, in order to implement either federal or state mandates and goals (such as fishable and swimmable) for regional waters. Beneficial uses of streams that have intermittent flows, as is typical of many streams in southern California, are designated as intermittent. During dry periods, however, shallow ground water or small pools of water can support some beneficial uses associated with intermittent streams; accordingly, such beneficial uses (e.g., wildlife habitat) must be protected throughout the year and are designated "existing." In addition, beneficial uses can be designated as "potential" for several reasons, including:

- implementation of the State Board's policy entitled "Sources of Drinking Water Policy" (State Board Resolution No. 88-63, described in Chapter 5),
- plans to put the water to such future use,
- potential to put the water to such future use,
- designation of a use by the Regional Board as a regional water quality goal, or
- public desire to put the water to such future use.

Beneficial Use Definitions

Beneficial uses for waterbodies in the Los Angeles Region are listed and defined below. The uses are listed in no preferential order.

Municipal and Domestic Supply (MUN)
Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

Agricultural Supply (AGR)
Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

Industrial Process Supply (PROC)
Uses of water for industrial activities that depend primarily on water quality.

Industrial Service Supply (IND)
Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.

Ground Water Recharge (GWR)
Uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.

Freshwater Replenishment (FRSH)
Uses of water for natural or artificial maintenance of

surface water quantity or quality (e.g., salinity).

Navigation (NAV)
Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

Hydropower Generation (POW)
Uses of water for hydropower generation.

Water Contact Recreation (REC-1)
Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

Limited Water Contact Recreation (LREC-1)
Uses of water for recreational activities involving body contact with water, where full REC-1 use is limited by physical conditions such as very shallow water depth and restricted access and, as a result, ingestion of water is incidental and infrequent.

Non-contact Water Recreation (REC-2)
Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

High Flow Suspension: The High Flow Suspension shall apply to water contact recreational activities associated with the swimmable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use, non-contact water recreation involving incidental water contact regulated under the REC-2 use, and the associated bacteriological objectives set to protect those activities. Water quality objectives set to protect (1) other recreational uses associated with the fishable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use and (2) other REC-2 uses (e.g., uses involving the aesthetic aspects of water) shall remain in effect at all times for waters where the (av) footnote appears in Table 2-1a. The High Flow Suspension shall apply on days with rainfall greater than or equal to ½ inch and the 24 hours following the end of the ½-inch or greater rain event, as measured at the nearest local rain gauge, using local Doppler radar, or using widely accepted rainfall estimation methods. The High Flow Suspension only applies to engineered channels, defined as inland, flowing surface water bodies with a box, V-shaped or trapezoidal configuration that have been lined on the sides and/or bottom with concrete. The water bodies to which the High Flow Suspension applies are identified in Table 2-1a in the column labeled "High Flow Suspension".

Commercial and Sport Fishing (COMM)
Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

Aquaculture (AQUA)
Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.

Warm Freshwater Habitat (WARM)
Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Cold Freshwater Habitat (COLD)
Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Inland Saline Water Habitat (SAL)
Uses of water that support inland saline water ecosystems including, but not limited to, preservation or enhancement of aquatic saline habitats, vegetation, fish, or wildlife, including invertebrates.

Estuarine Habitat (EST)
Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).

Wetland Habitat (WET)
Uses of water that support wetland ecosystems, including, but not limited to, preservation or enhancement of wetland habitats, vegetation, fish, shellfish, or wildlife, and other unique wetland functions which enhance water quality, such as providing flood and erosion control, stream bank stabilization, and filtration and purification of naturally

occurring contaminants.

Marine Habitat (MAR)
Uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).

Wildlife Habitat (WILD)
Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

Preservation of Biological Habitats (BIOL)
Uses of water that support designated areas or habitats, such as **Areas of Special Biological Significance (ASBS),** established refuges, parks, sanctuaries, ecological reserves, or other areas where the preservation or enhancement of natural resources requires special protection.

The following coastal waters have been designated as ASBS in the Los Angeles Region. For detailed descriptions of their boundaries see the Ocean Plan discussion in Chapter 5, Plans and Policies:

- San Nicolas Island and Begg Rock
- Santa Barbara Island and Anacapa Island
- San Clemente Island
- Mugu Lagoon to Latigo Point

- Santa Catalina Island, Subarea One, Isthmus Cove to Catalina Head
- Santa Catalina Island, Subarea Two, North End of Little Harbor to Ben Weston Point
- Santa Catalina Island, Subarea Three, Farnsworth Bank Ecological Reserve
- Santa Catalina Island, Subarea Four, Binnacle Rock to Jewfish Point

The following areas are designated Ecological Reserves or Refuges:

- Channel Islands National Marine Sanctuary
- Santa Barbara Island Ecological Reserve
- Anacapa Island Ecological Reserve
- Catalina Marine Science Center Marine Life
- Point Fermin Marine Life Refuge
- Farnsworth Bank Ecological Reserve
- Lowers Cove Reserve
- Abalone Cove Ecological Reserve
- Big Sycamore Canyon Ecological Reserve

Rare, Threatened, or Endangered Species (RARE)
Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.

Migration of Aquatic Organisms (MIGR)
Uses of water that support habitats necessary for migration, acclimatization between fresh and salt water, or other temporary activities by aquatic organisms, such as anadromous fish.

Spawning, Reproduction, and/or Early Development (SPWN)
Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

Shellfish Harvesting (SHELL)
Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sports purposes.

Beneficial Uses for Specific Waterbodies

Tables 2-1 through 2-4 list the major regional waterbodies and their designated beneficial uses. These tables are organized by waterbody type: (i) inland surface waters (rivers, streams, lakes, and inland wetlands), (ii) ground water, (iii) coastal waters (bays, estuaries, lagoons, harbors, beaches, and ocean waters), and (iv) coastal wetlands. Within Tables 2-1 and 2-1a waterbodies are organized by major watersheds. Twelve digit Hydrologic unit codes are noted in the surface water tables (2-1, 2-1a, 2-3, and 2-4) as a cross reference to the Watershed Boundary Dataset developed by the United States Geological Survey (2007). For those surface waterbodies that cross into other hydrologic units, such waterbodies appear more than once in a table. Furthermore, certain coastal waterbodies are duplicated in more than one table for completeness (e.g., many lagoons are listed both in inland surface waters and in coastal features tables). Major groundwater basins are classified in Table 2-2 according to the Department of Water Resources Bulletin No.119 – Update 2003. A series of maps (Figures 2-1 to 2-22) illustrates regional surface waters, ground waters, and major harbors.

The Regional Board contracted with the California Department of Water Resources for a study of beneficial uses and objectives for the upper Santa Clara River (DWR, 1989) and for another study of the beneficial uses and objectives the Piru, Sespe, and Santa Paula Hydrologic areas of the Santa Clara River (DWR, 1993). In addition, the Regional Board contracted with Dr. Prem Saint of California State University at Fullerton to survey and research beneficial uses of all waterbodies throughout the Region (Saint, et al., 1993a and 1993b). Information from these studies was used to update this Basin Plan.

State Board Resolution No. 88-63 (Sources of Drinking Water) followed by Regional Board Resolution No. 89-03 (Incorporation of Sources of Drinking Water Policy into the Water Quality Control Plans (Basin Plans)) states that " All surface and ground waters of the State are considered to be suitable, or potentially suitable, for municipal or domestic waters supply and should be so designated by the Regional Boards ... [with certain exceptions which must be adopted by the Regional Board]." In adherence with these policies, all inland surface and ground waters have been designated as MUN - presuming at least a potential suitability for such a designation.

These policies allow for Regional Boards to consider the allowance of certain exceptions according to criteria set forth in SB Resolution No. 88-63. While supporting the protection of all waters that may be used as a municipal water supply in the future, the Regional Board realizes that there may be exceptions to this policy.

In recognition of this fact, the Regional Board will soon implement a detailed review of criteria in the State Sources of Drinking Water policy and identify those waters in the Region that should be excepted from the MUN designation. Such exceptions will be proposed under a special Basin Plan Amendment and will apply exclusively to those waters designated as MUN under SB Res. No. 88-63 and RB Res. No. 89-03.

In the interim, no new effluent limitations will be placed in Waste Discharge Requirements as a result of these designations until the Regional Board adopts this amendment.

The following sections summarize general information regarding beneficial uses designated for the various waterbody types.

Inland Surface Waters

Inland surface waters consist of rivers, streams, lakes, reservoirs, and inland wetlands. Beneficial uses of these inland surface waters and their tributaries (which are graphically represented on Figures 2-1 to 2-10) are designated on Tables 2-1 and 2-1a.

Beneficial uses of inland surface waters generally include REC-1 (swimmable) and WARM, COLD, SAL, or COMM (fishable), reflecting the goals of the federal Clean Water Act. In addition, inland waters are usually designated as IND, PRO, REC-2, WILD, and are sometimes designated as BIOL and RARE. In a few cases, such as reservoirs used primarily for drinking water, REC-1 uses can be restricted or prohibited by the entities that manage these waters. Many of these reservoirs, however, are designated as potential for REC-1, again reflecting federal goals. Furthermore, many regional streams are primary sources of replenishment for major groundwater basins that supply water for drinking and other uses, and as such must be protected as GWR. Inland surface waters that meet the criteria mandated by the *Sources of Drinking Water Policy* (which became effective when the State Board adopted Resolution No. 88-63 in 1988) are designated MUN. (This policy is reprinted in Chapter 5, Plans and Policies).

Under federal law, all surface waters must have water quality standards designated in the Basin Plans. Most of the inland surface waters in the Region have beneficial uses specifically designated for them. Those waters not specifically listed (generally smaller tributaries) are designated with the same beneficial uses as the streams, lakes, or reservoirs to which they are tributary. This is commonly referred to as the "tributary rule."

Ground Waters

Beneficial uses for regional groundwater basins (Figure 1-9) are designated on Table 2-2. For reference, Figures 2-11 to 2-18 show enlargements of all of the major basins and sub-basins referred to in the ground water beneficial use table (Table 2-2) and the water quality objective table (Table 3-8) in Chapter 3.

Many groundwater basins are designated MUN, reflecting the importance of ground water as a source of drinking water in the Region and as required by the State Board's *Sources of Drinking Water Policy*. Other beneficial uses for ground water are generally IND, PROC, and AGR. Occasionally, ground water is used for other purposes (e.g., ground water pumped for use in aquaculture operations at the Fillmore Fish Hatchery).

Coastal Waters

Coastal waters in the Region include bays, estuaries, lagoons, harbors, beaches, and ocean waters. Beneficial uses for these coastal waters provide habitat for marine life and are used extensively for recreation, boating, shipping, and commercial and sport fishing, and are accordingly designated in Table 2-3. Figures 2-19 to 2-22 show specific sub-areas of some of these coastal waters.

Wetlands

Wetlands include freshwater, estuarine, and saltwater marshes, swamps, mudflats, and riparian areas. As the California Water Code (§13050[e]) defines "waters of the state" to be "any water, surface or underground, including saline waters, within the boundaries of the state," natural wetlands are therefore entitled to the same level of protection as other waters of the state.

Wetlands also are protected under the Clean Water Act, which was enacted to restore and maintain the physical, chemical, and biological integrity of the nation's waters, including wetlands. Regulations developed under the CWA specifically include wetlands "as waters of the United States" (40 CFR 116.3) and defines them as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Although the definition of wetlands differs widely among federal agencies, both the USEPA and the U.S. Army Corps of Engineers use this definition in administrating the 404 permit program.

Recently, both state and federal wetlands policies have been developed to protect these valuable waters. Executive Order W-59-93 (signed by Governor Pete Wilson on August 23, 1993) established state policy guidelines for wetlands conservation. The primary goal of this policy is to ensure no overall net loss and to achieve a long-term net gain in the quantity, quality, and permanence of wetland acreage in California. The federal wetlands policy, representing a significant advance in wetlands protection, was unveiled by nine federal agencies on August 24, 1993. This policy represents an agreement that is sensitive to the needs of landowners, more efficient, and provides flexibility in the permit process.

The USEPA has requested that states adopt water quality standards (beneficial uses and objectives) for wetlands as part of their overall effort to protect the nation's water resources. The 1975 Basin Plans identified a number of waters which are known to include wetlands; these wetlands, however, were not specifically identified as such. In this Basin Plan, a wetlands beneficial use category has been added to identify inland waters that support wetland habitat as well as a variety of other beneficial uses. The wetlands habitat definition recognizes the uniqueness of these areas and functions they serve in protecting water quality. Tables 2-1a and 2-4 identifies and designates beneficial uses for significant coastal wetlands in the Region. These waterbodies are also included on Tables 2-1 and 2-3. Beneficial uses of wetlands include many of the same uses designated for the rivers, lakes, and coastal waters to which they are adjacent, and include REC-1, REC-2, WARM, COLD, EST, MAR, WET, GWR, COMM, SHELL, MIGR, SPWN, WILD and often RARE or BIOL.

As some wetlands can not be easily identified in southern California because of the hydrologic regime, the Regional Board identifies wetlands using indicators such as hydrology, presence of hydrophytic plants (plants adapted for growth in water), and/or hydric soils (soils saturated for a period of time during the growing season). The Regional Board contracted with Dr. Prem Saint, et al. (1993a and 1993b), to inventory and describe major regional wetlands. Information from this study was used to update this Basin Plan.

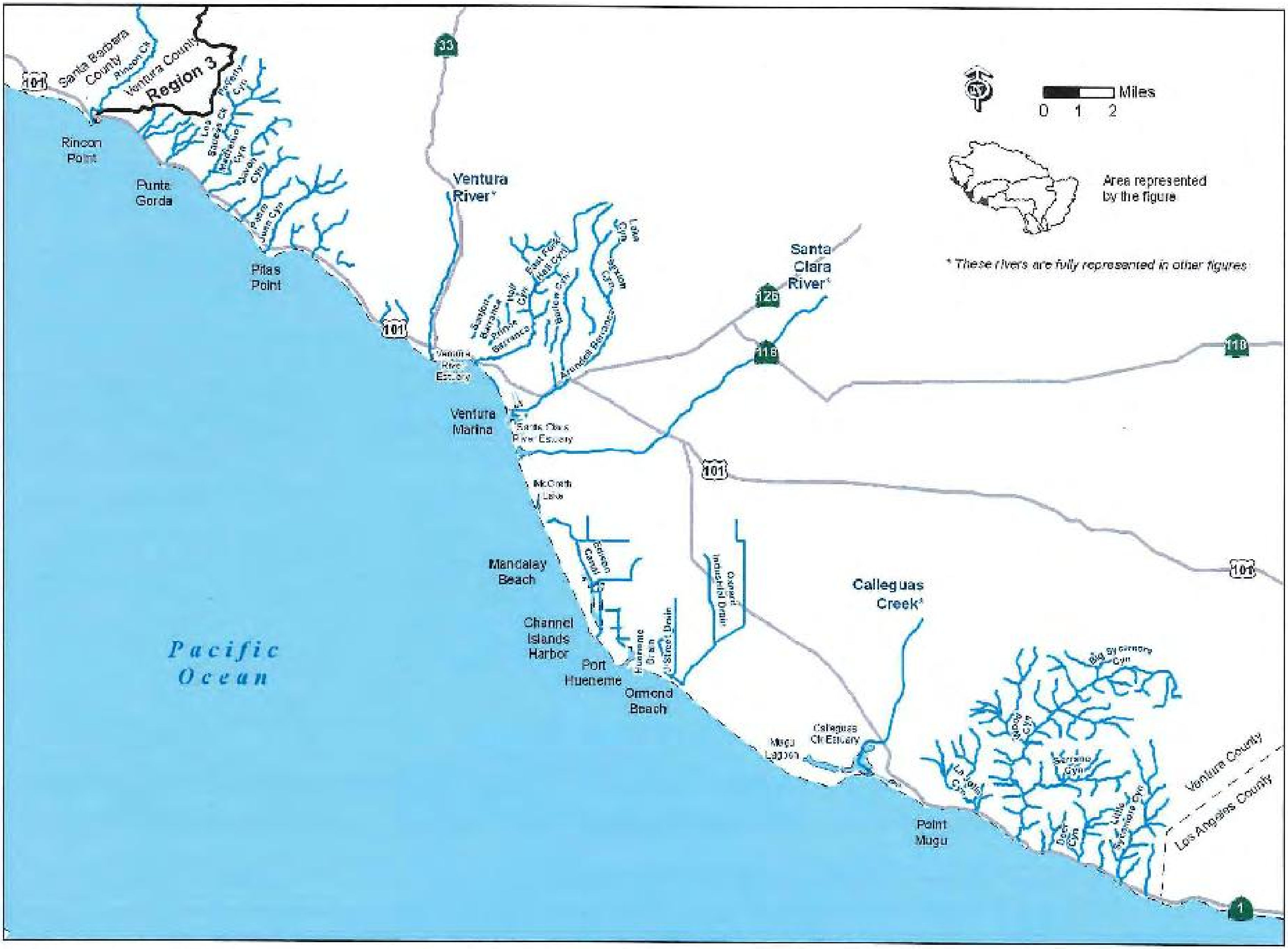


Figure 2-1. Miscellaneous streams and coastal features, Ventura County.

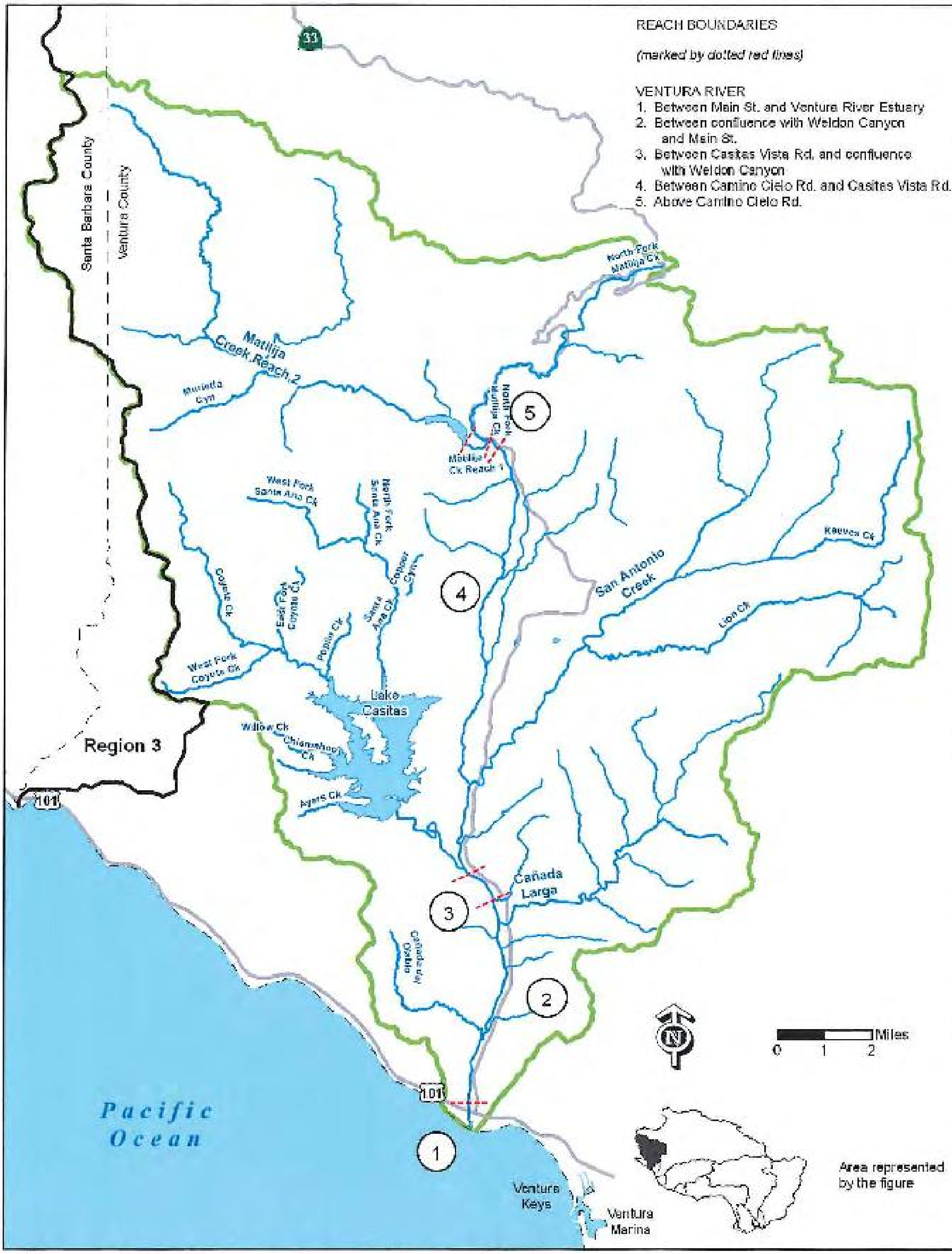


Figure 2-2. Major surface waters of the Ventura River watershed.

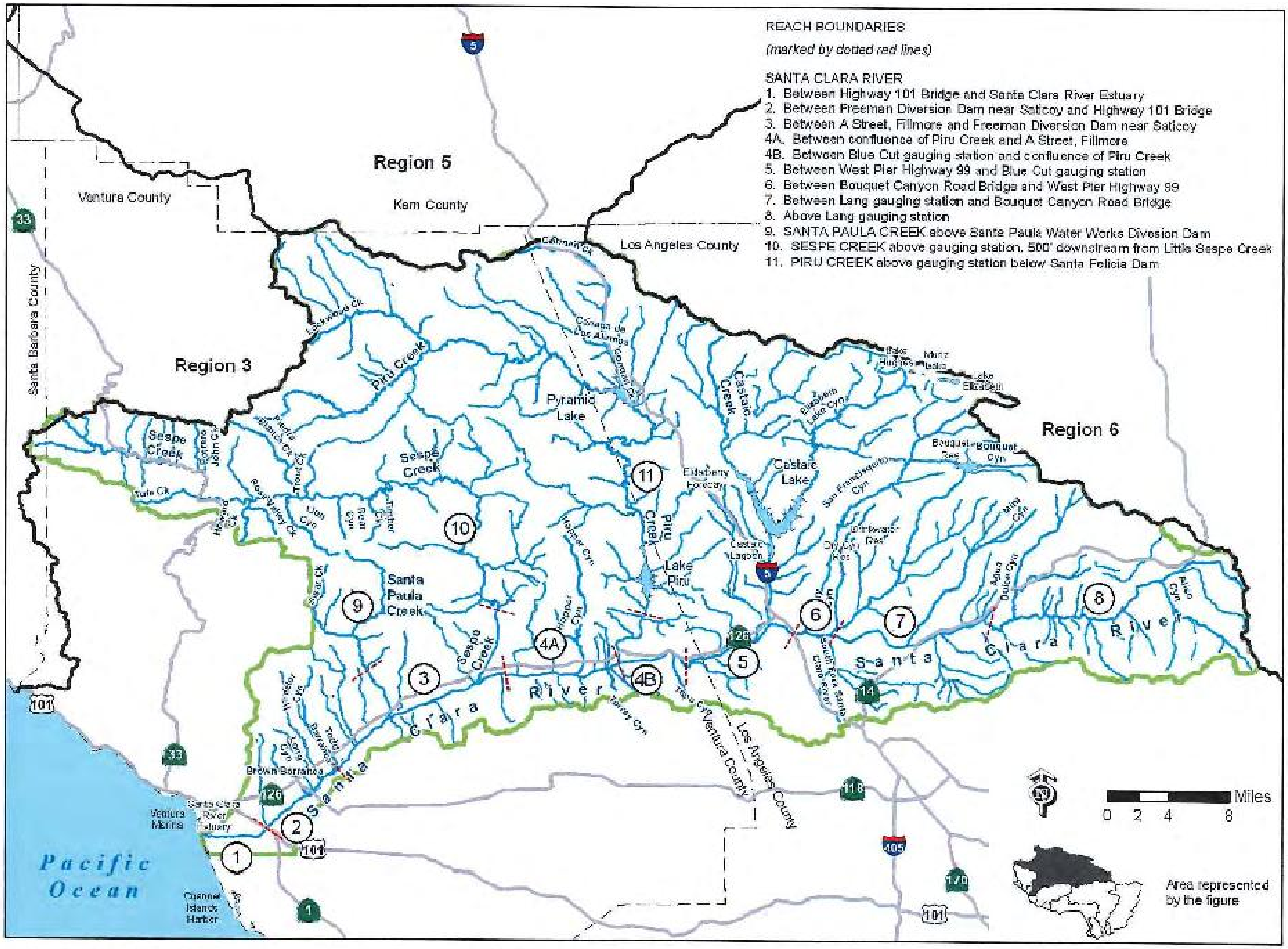


Figure 2-3. Major surface waters of the Santa Clara River watershed.

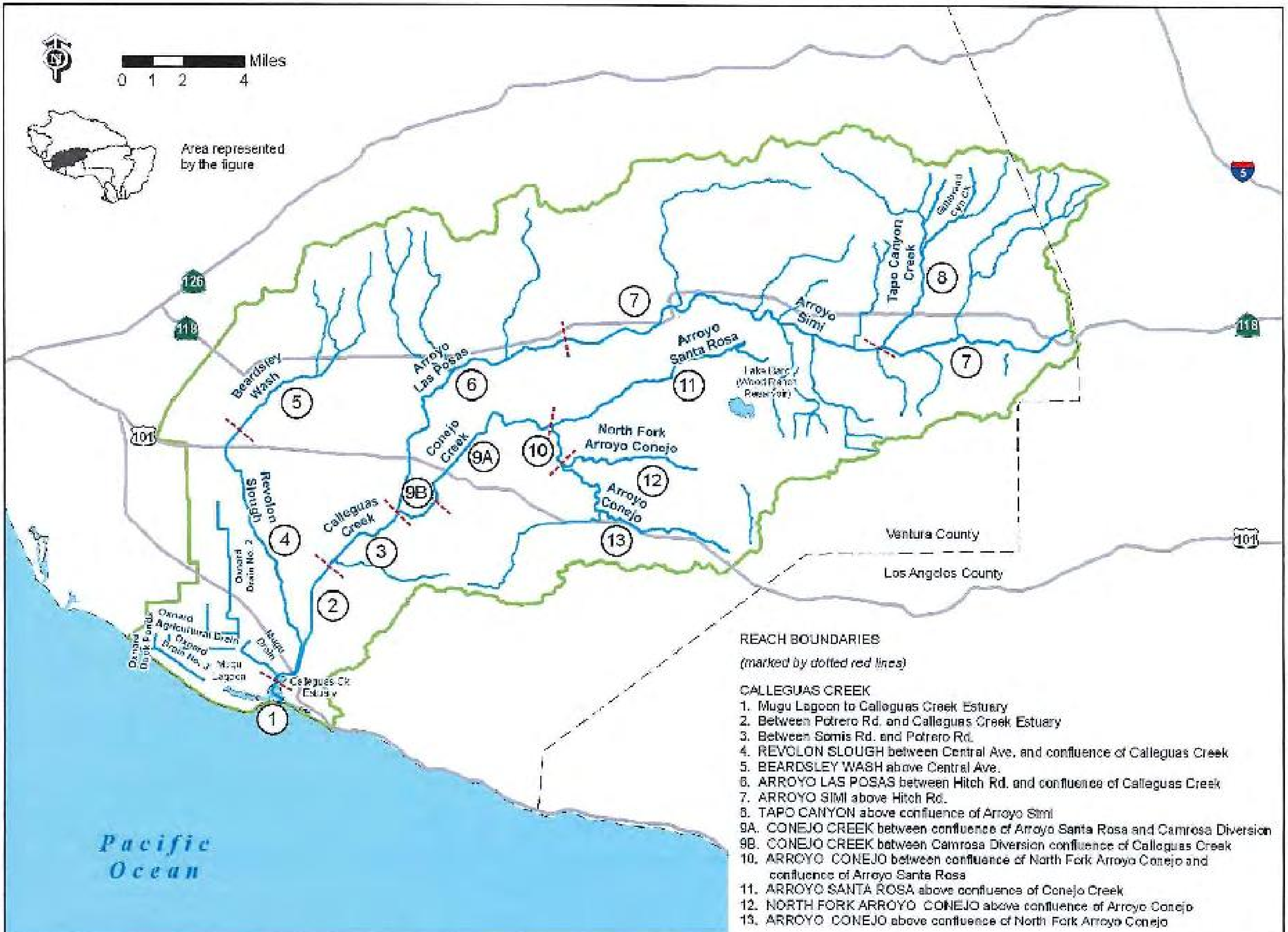


Figure 2-4. Major surface waters of the Calleguas-Conejo Creek watershed.

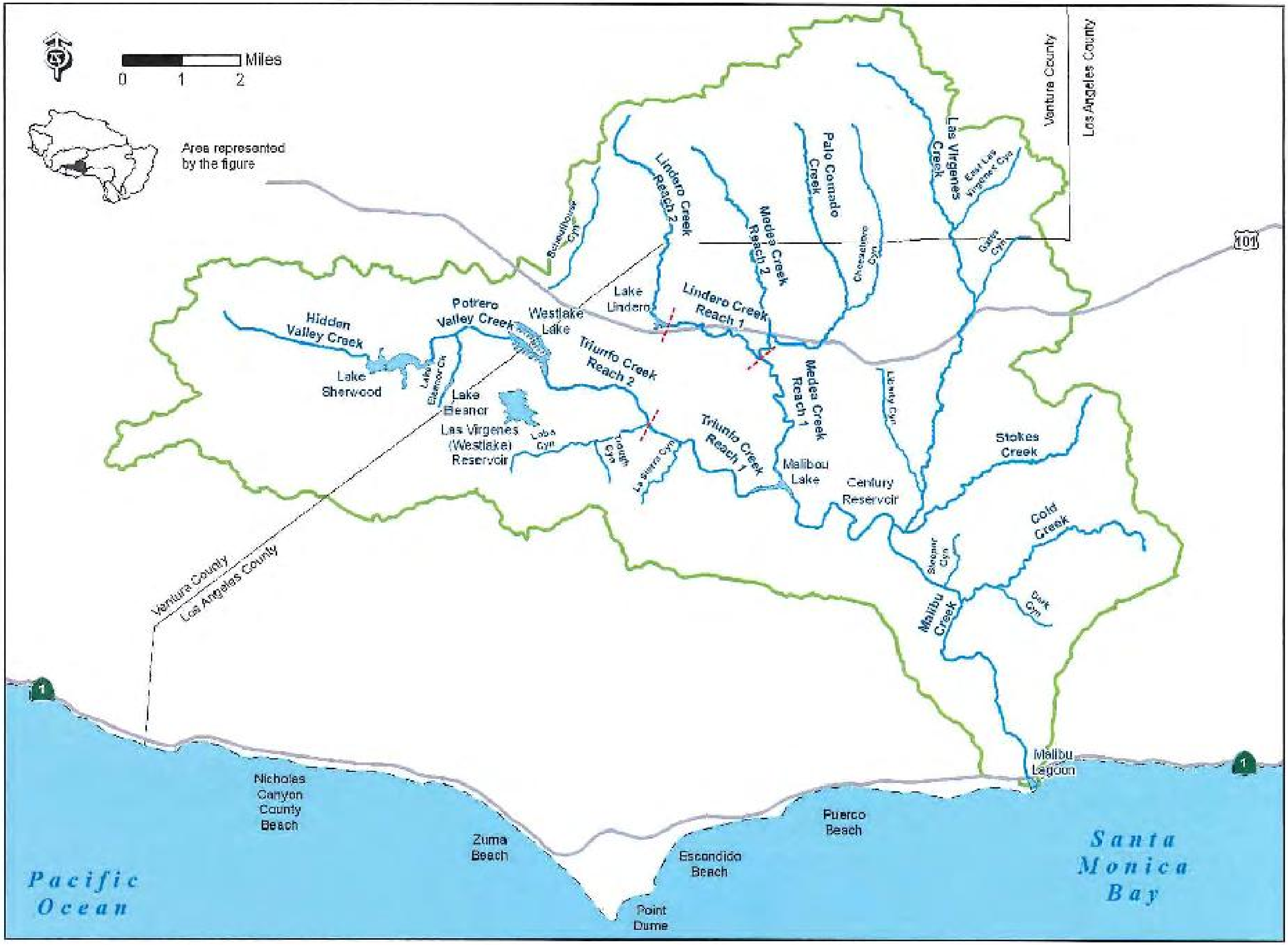


Figure 2-5. Major surface waters of the Malibu Creek watershed.

Figure 2-6. Major surface waters of the Ballona Creek watershed.

Figure 2-7. Major surface waters of the Dominguez Channel and Los Cerritos Channel watersheds.

Figure 2-8. Major surface waters of the Los Angeles River watershed.

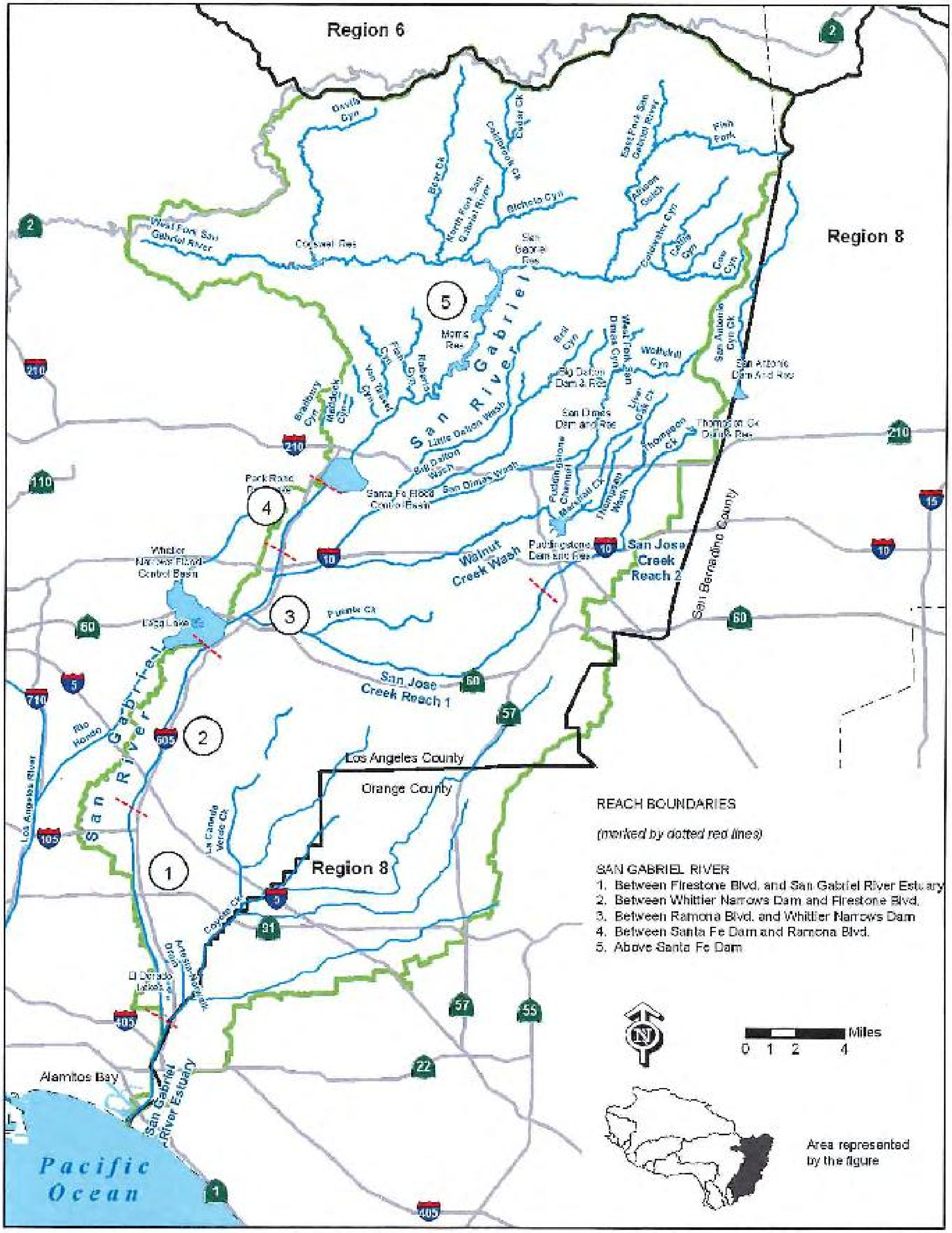


Figure 2-9. Major surface waters of the San Gabriel River watershed.

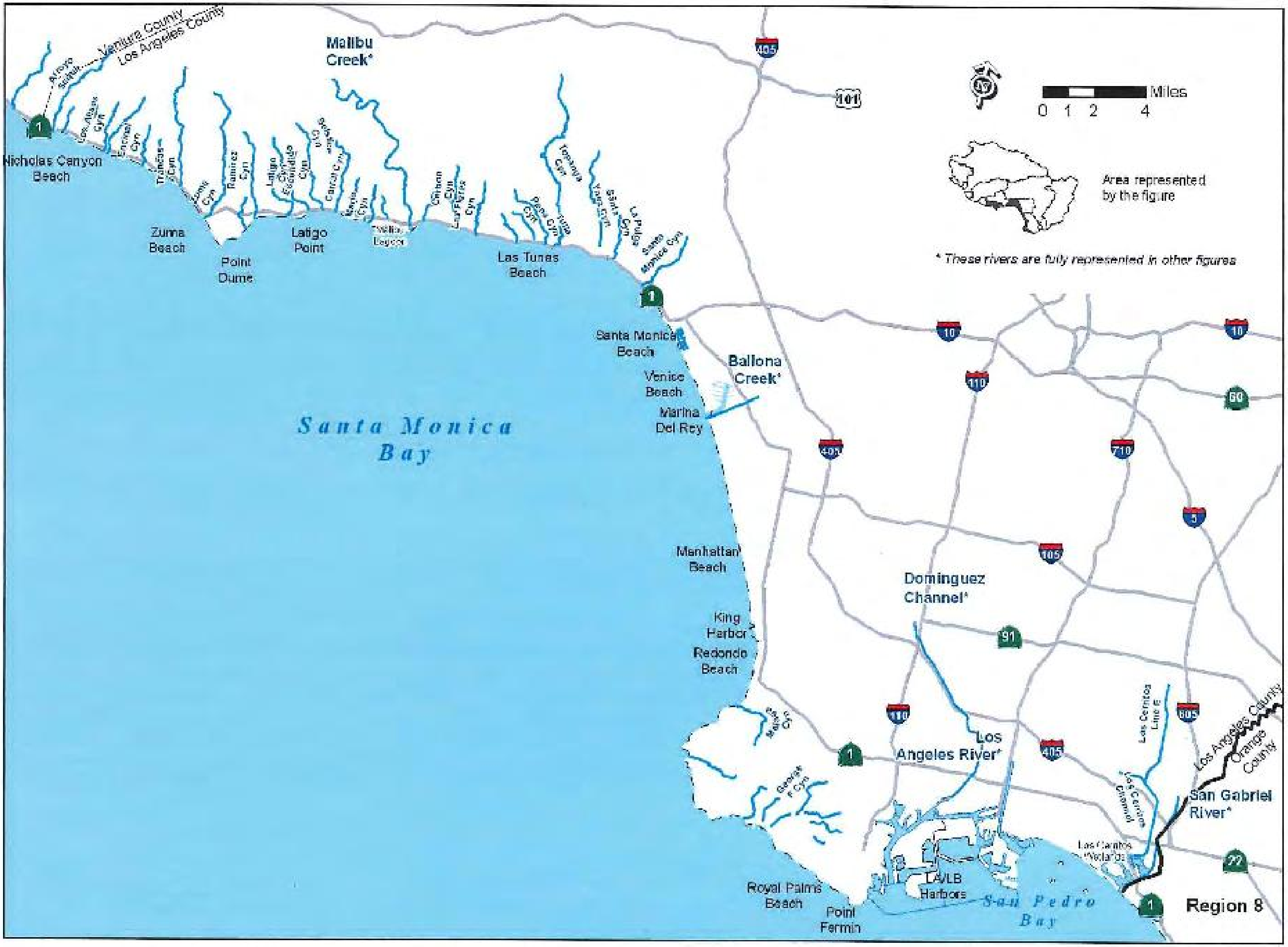


Figure 2-10. Miscellaneous streams and coastal features, Los Angeles County.

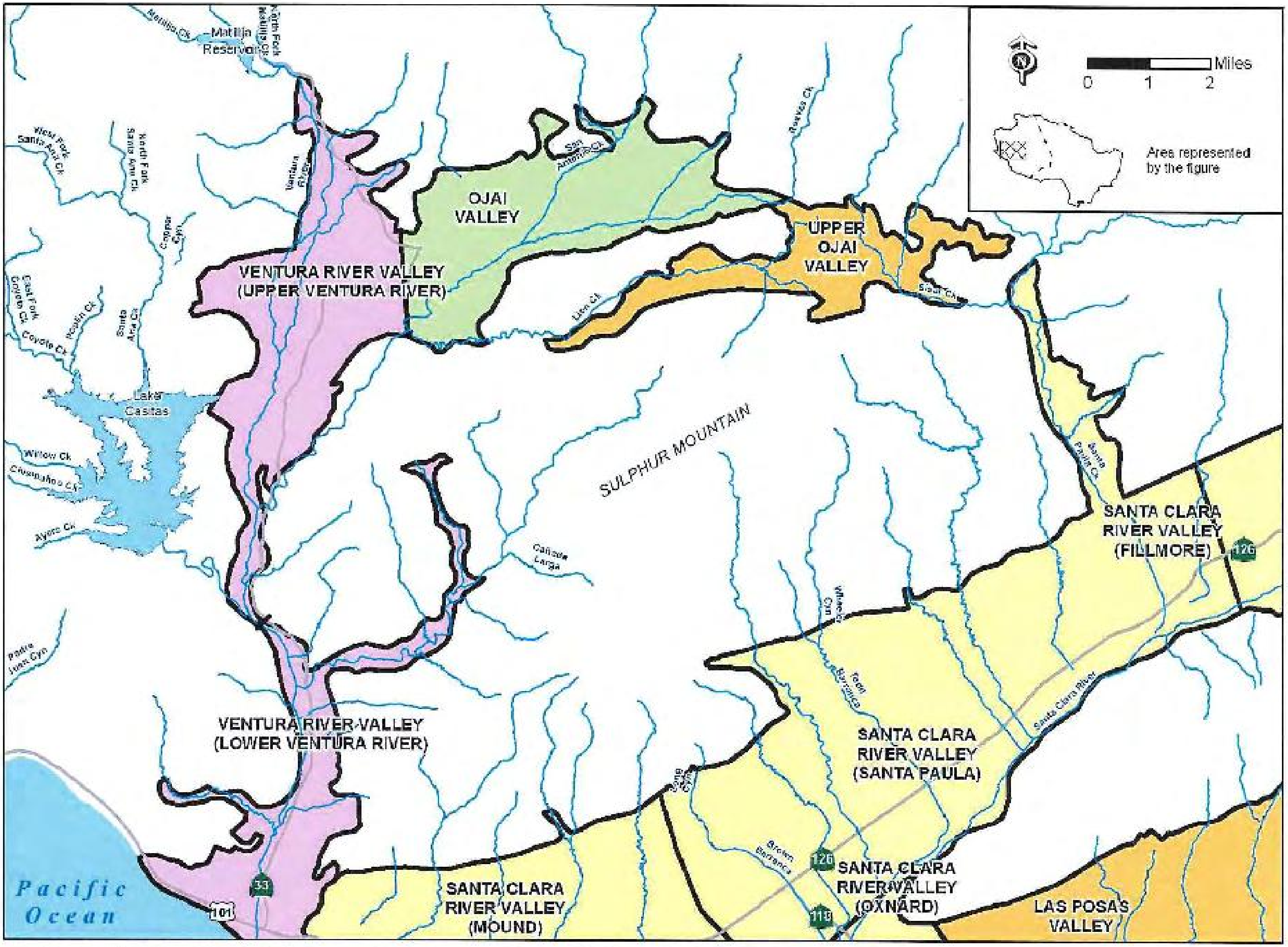


Figure 2-11. Ojai Valley and Ventura River Valley Groundwater Basins.

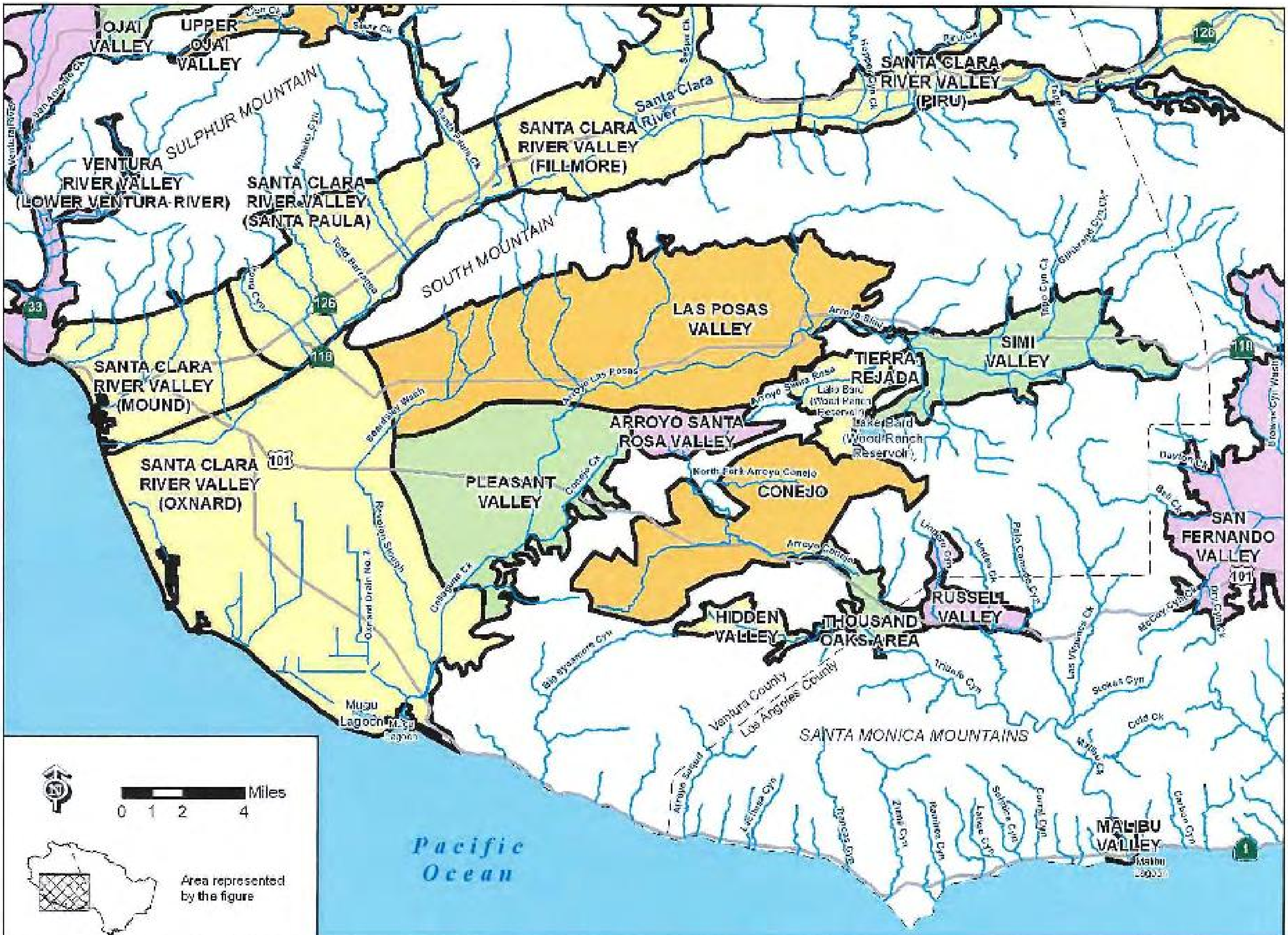


Figure 2-12. Ventura Central Groundwater Basins.

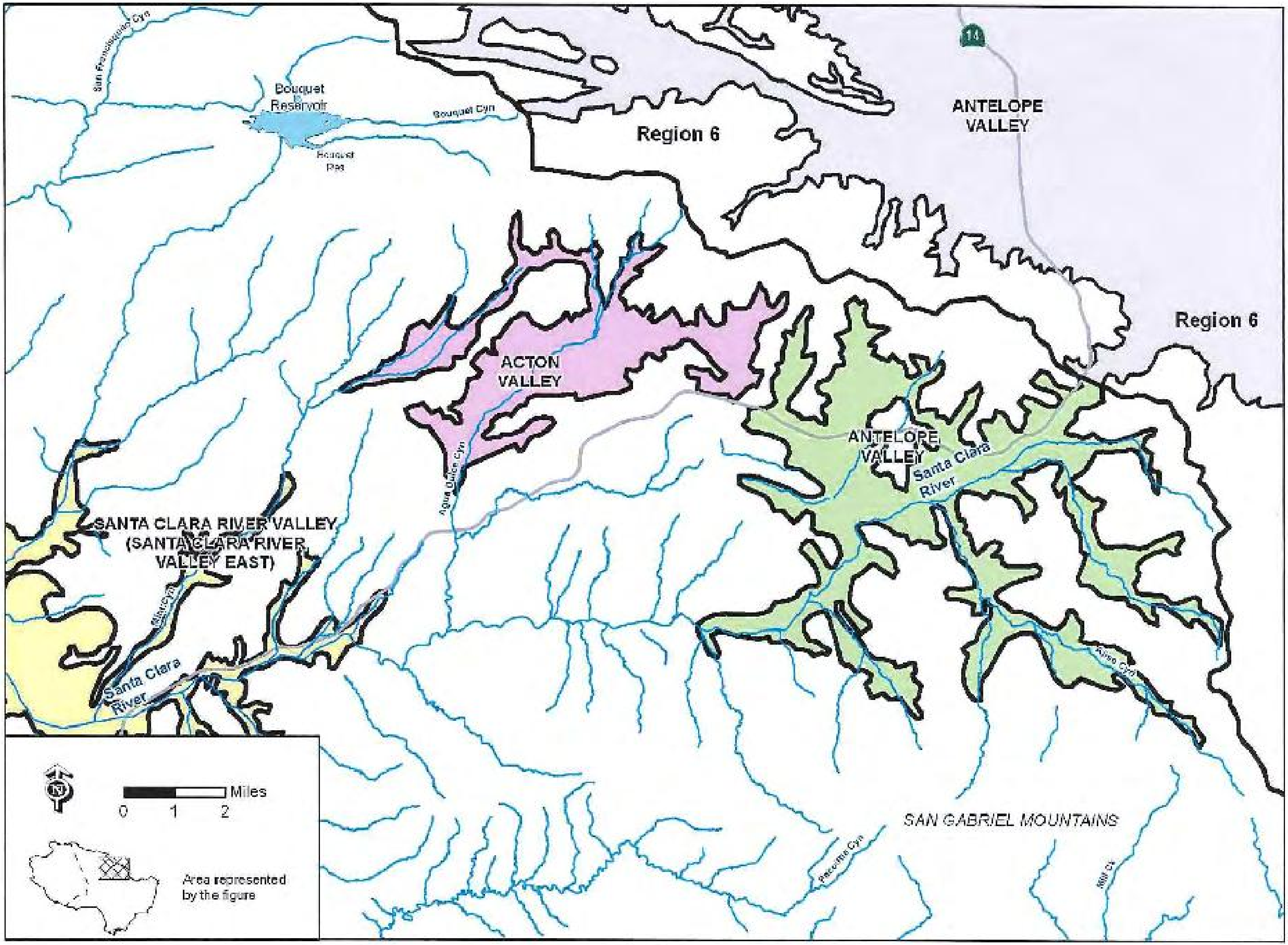


Figure 2-13. Upper Santa Clara Groundwater Basins.

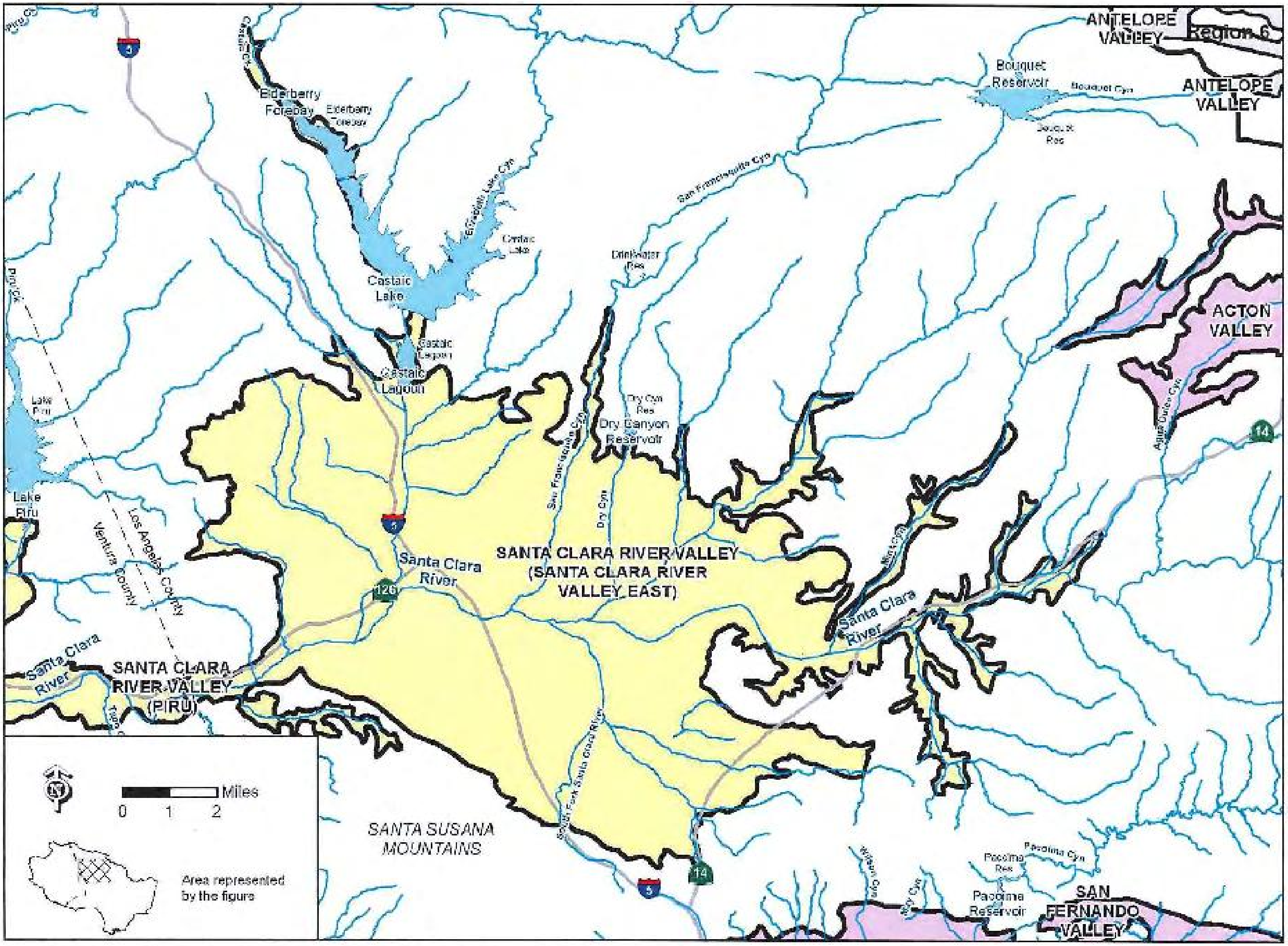


Figure 2-14. Eastern Santa Clara Groundwater Basins.

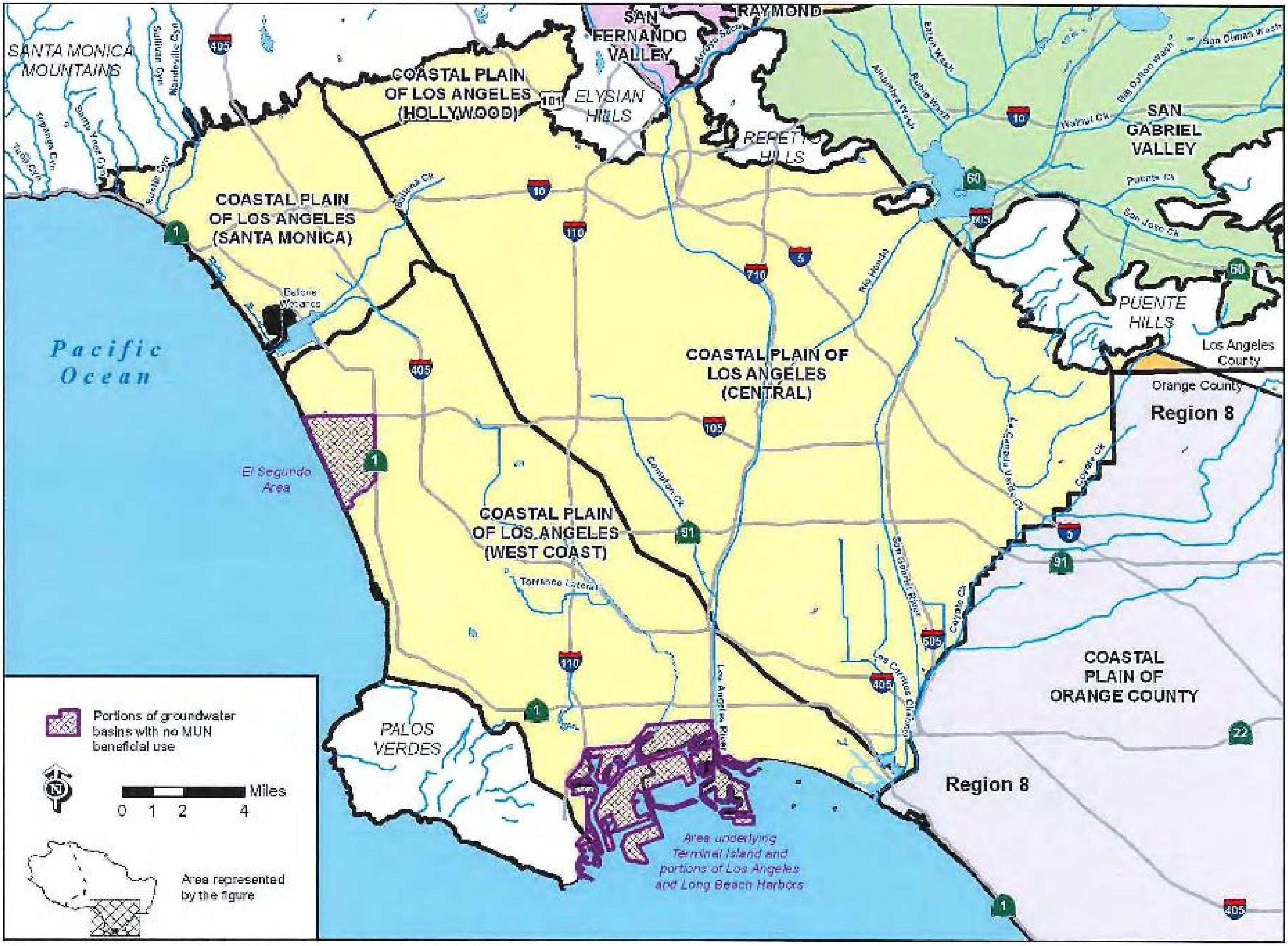


Figure 2-15. Los Angeles Coastal Groundwater Basins.

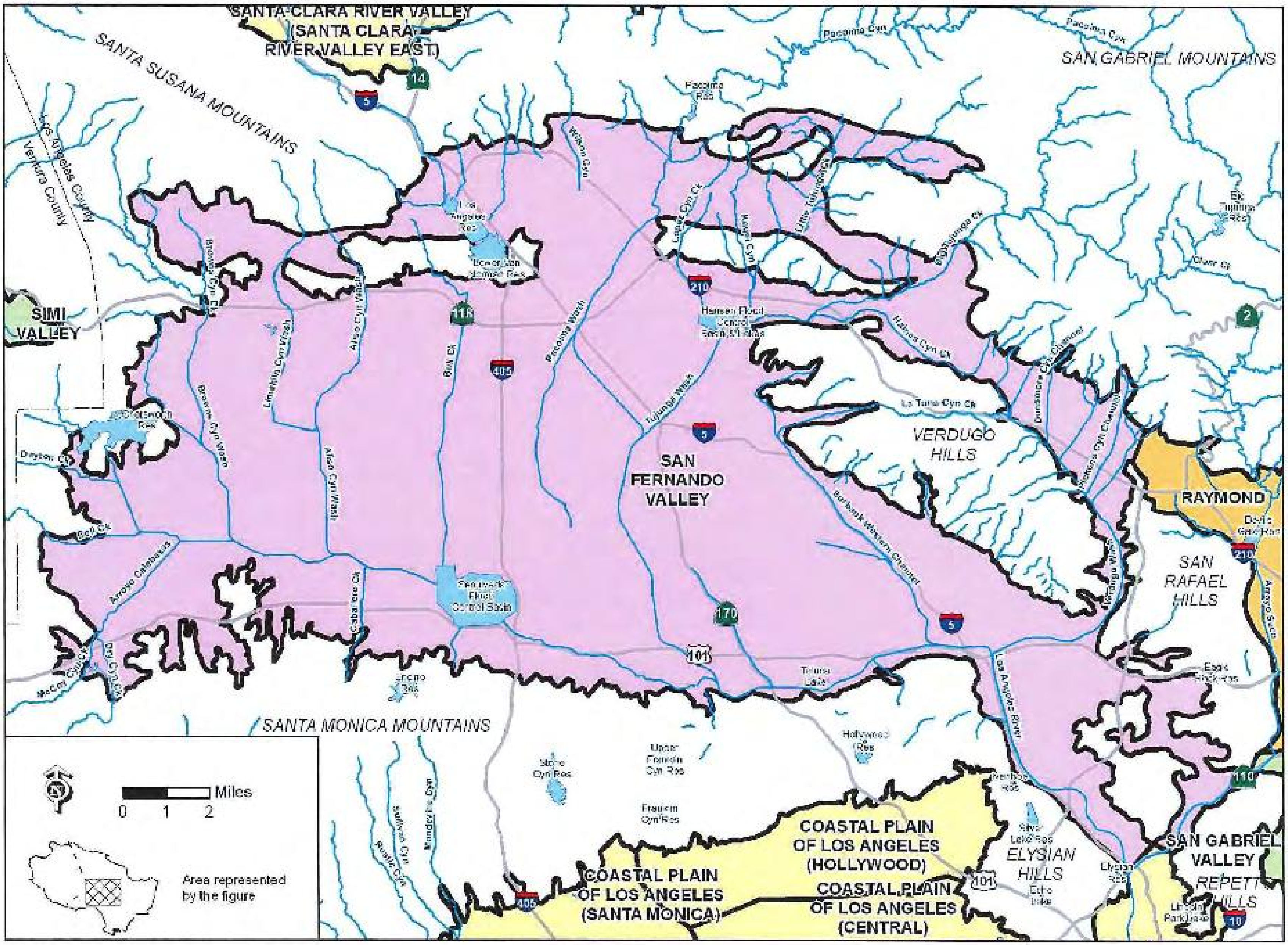


Figure 2-16. San Fernando Valley Groundwater Basins.

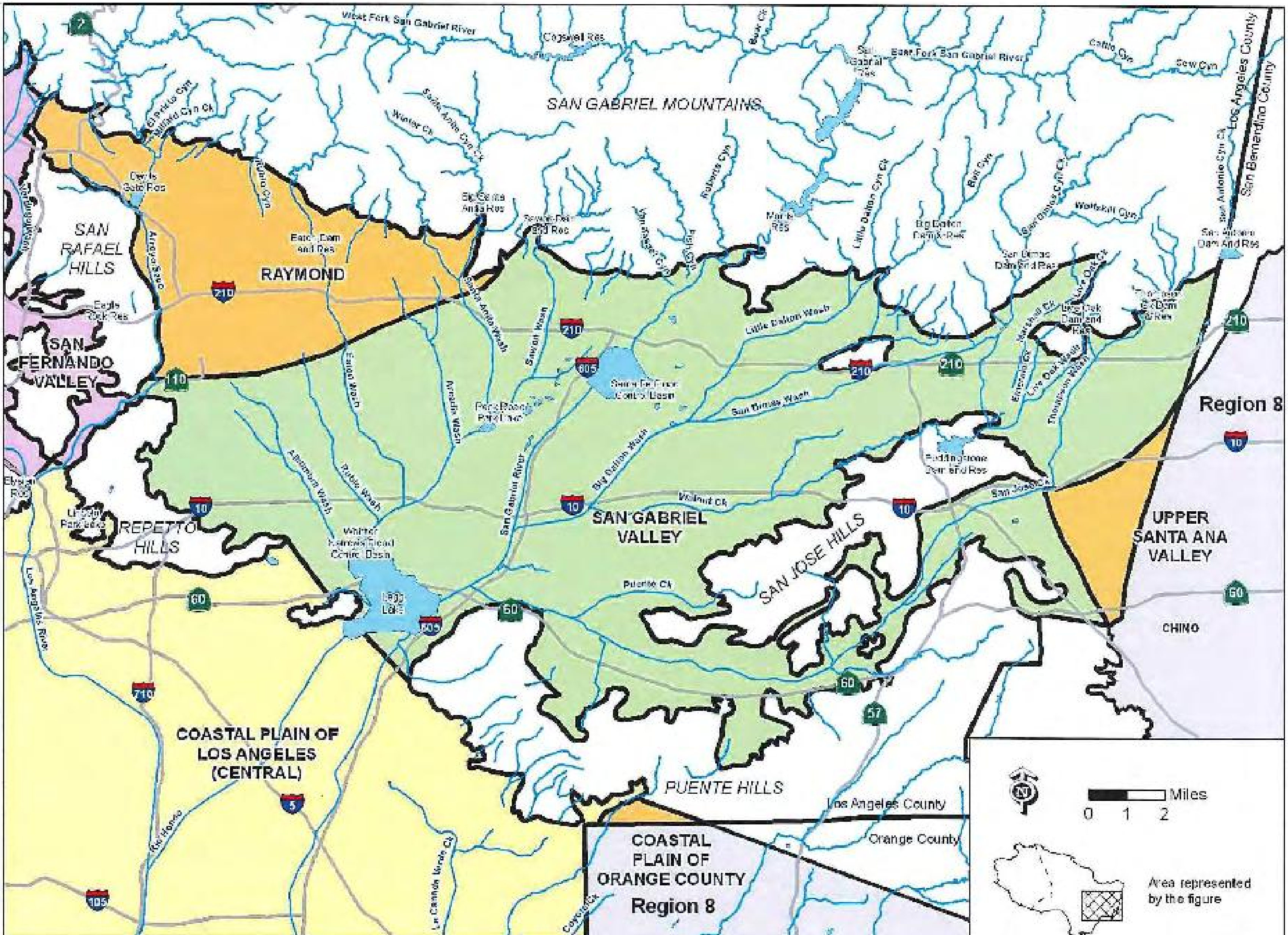


Figure 2-17. San Gabriel Valley and Upper Santa Ana Valley Groundwater Basins.

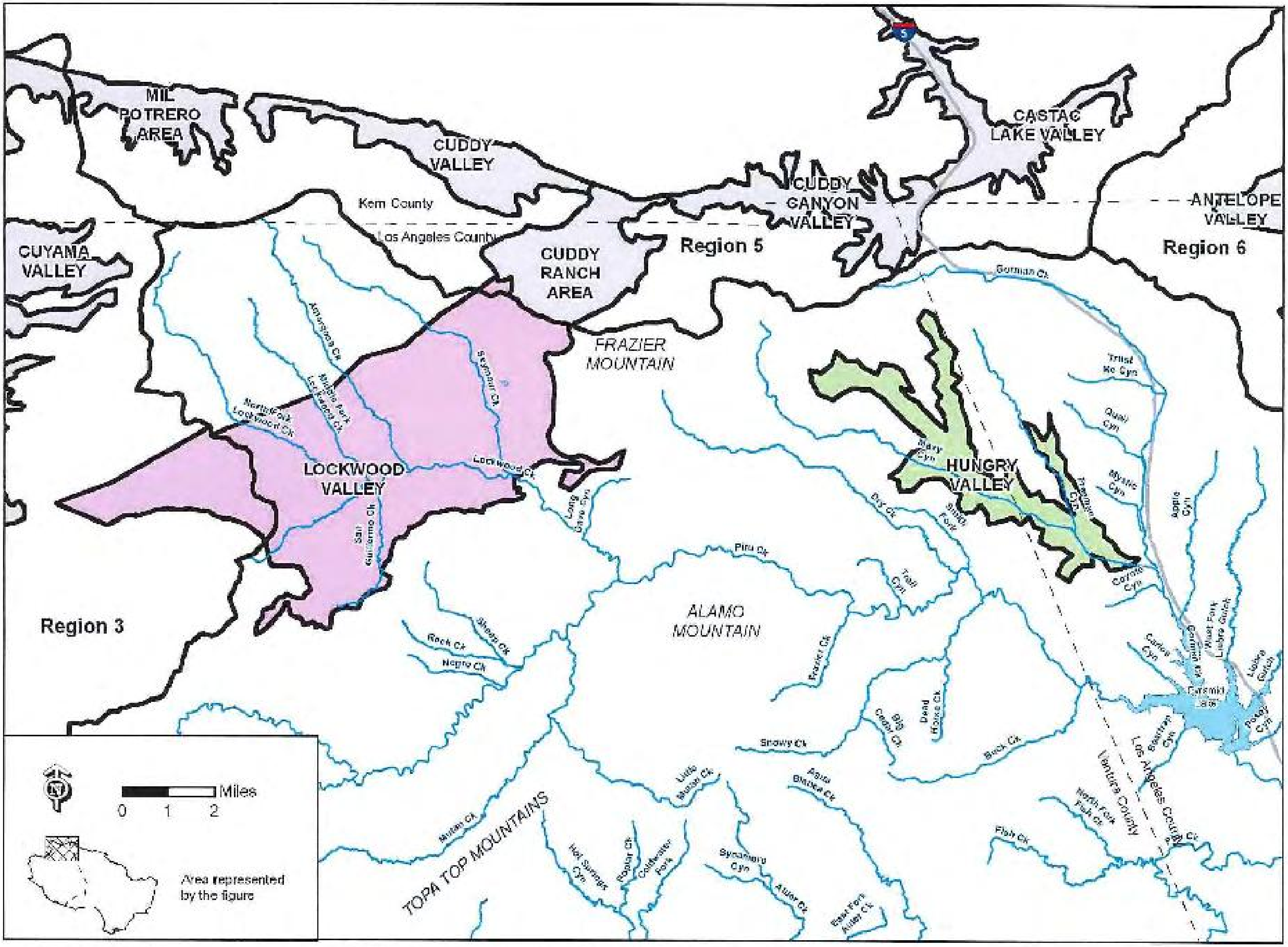


Figure 2-18. Lockwood Valley and Hungry Valley Groundwater Basins.

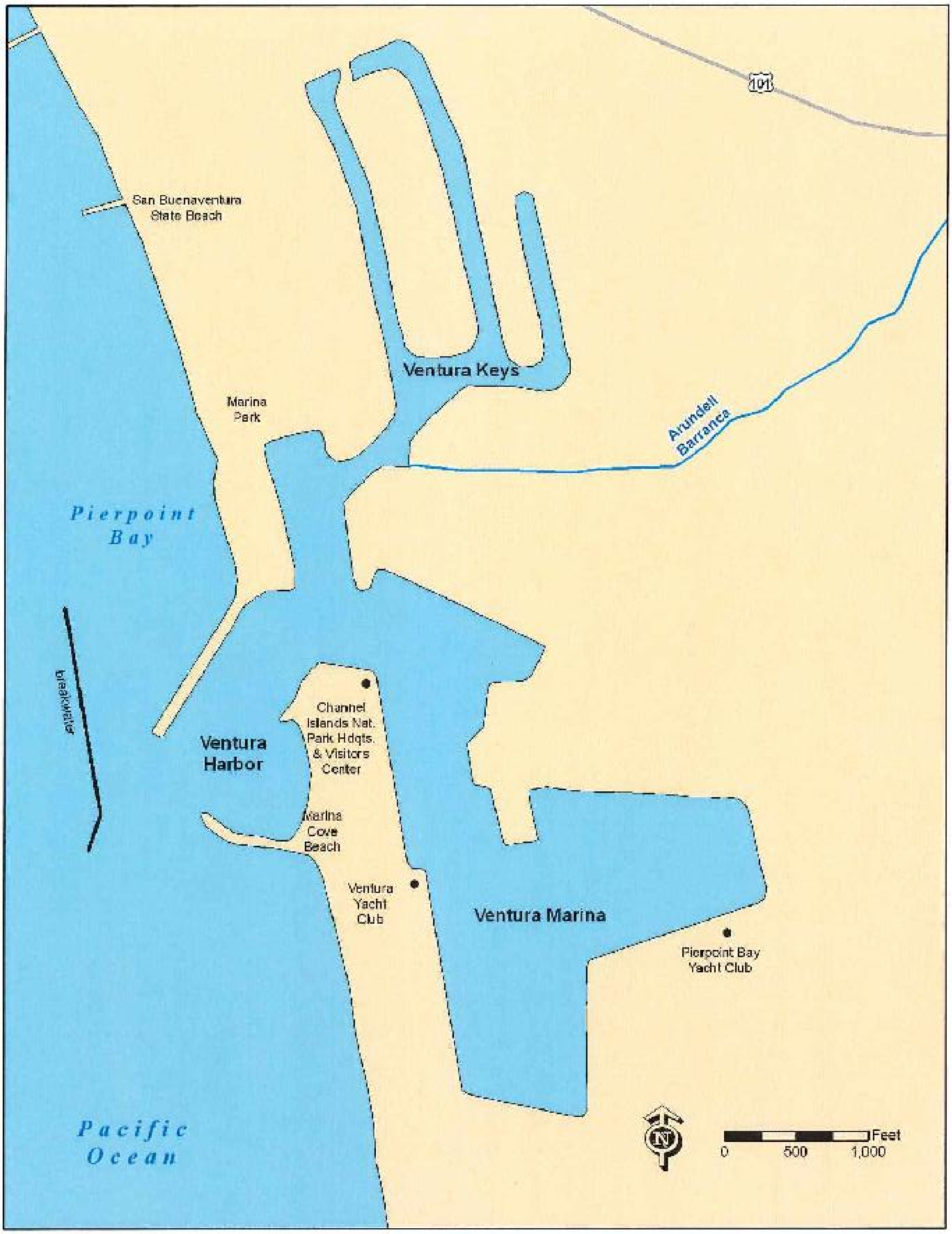


Figure 2-19. Ventura Harbor, Marina, and Keys.

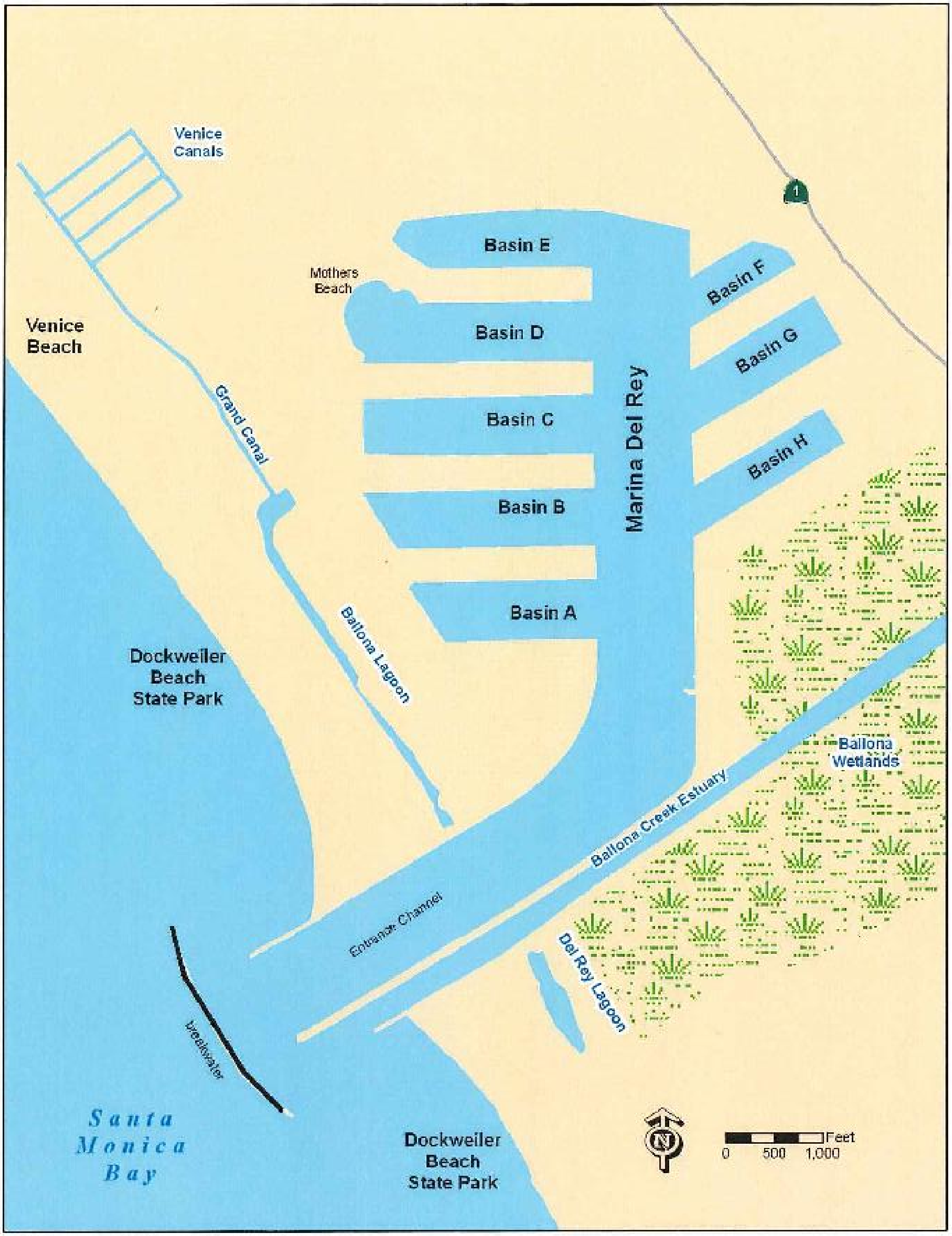


Figure 2-20. Marina Del Rey.

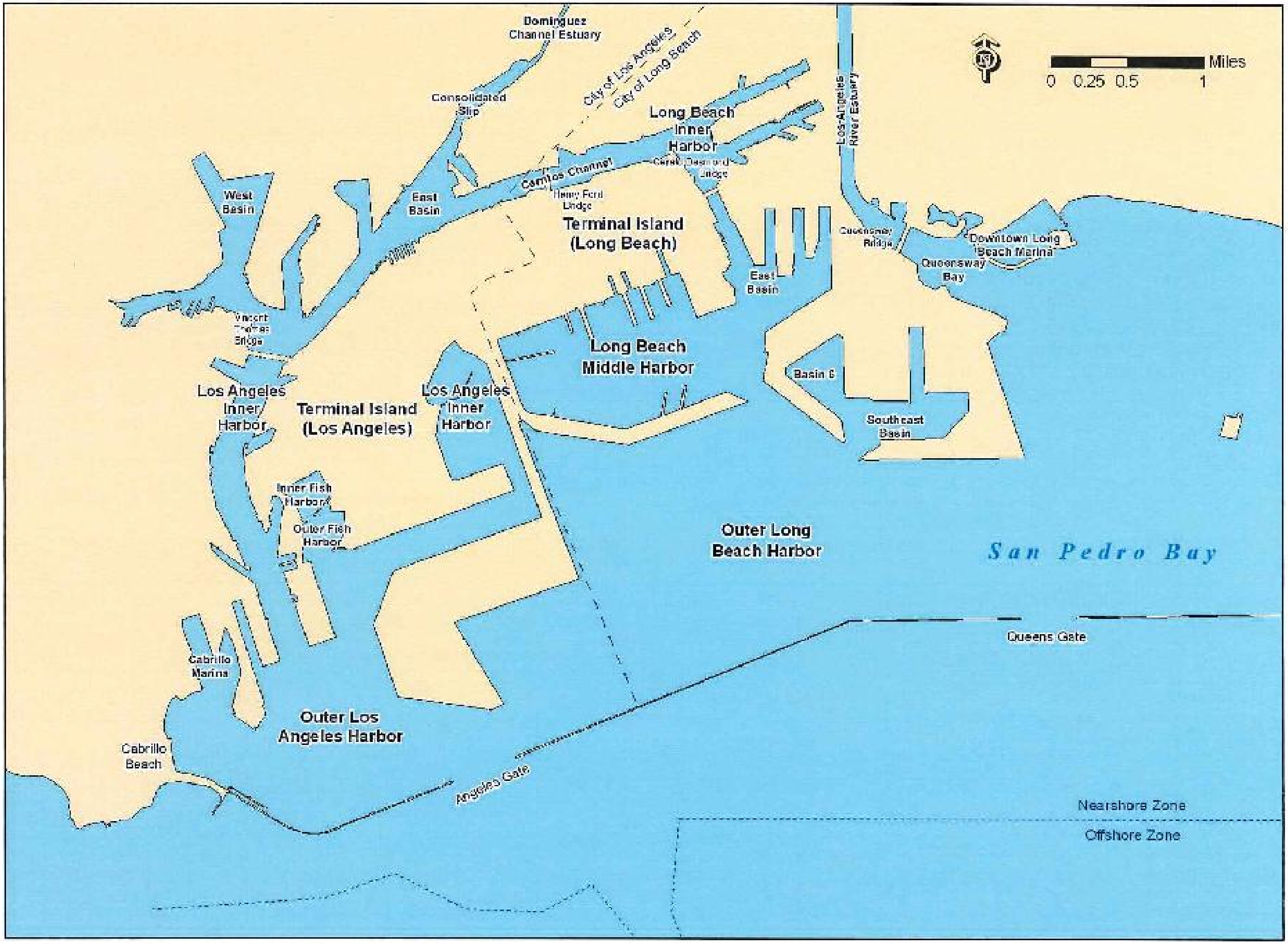


Figure 2-21. Los Angeles Harbor and Long Beach Harbor.

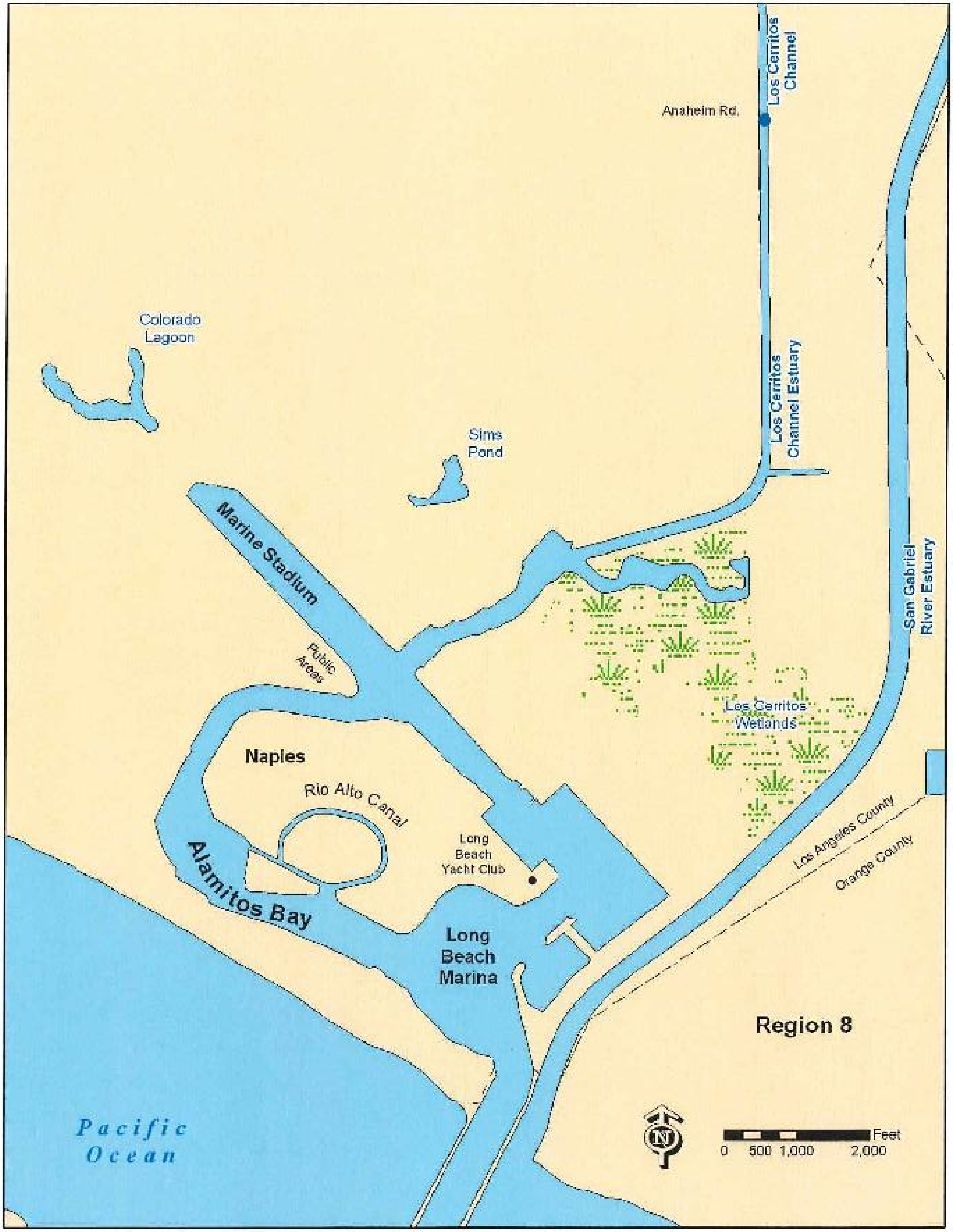


Figure 2-22. Alamitos Bay.

Table 2-1. Beneficial Uses of Inland Surface Waters.

WATERSHED[a]	WBD No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
VENTURA COUNTY COASTAL STREAMS																							
Los Sauces Creek	180701010202	P*	I	I	I	I						I	I				E			I	I		
Poverty Canyon	180701010202	P*	I	I	I	I						I	I				E			I	I		
Madranio Canyon	180701010202	P*	I	I	I	I						I	I				E			I	I		
Javon Canyon	180701010202	P*	I	I	I	I						I	I				E			I	I		E
Padre Juan Canyon	180701010202	P*	I	I	I	I						I	I				E			I	I		
McGrath Lake	180701010202									P					E		E		Ee				E
Big Sycamore Canyon Creek	180701040201	P*				I						I	E				E			P	P		E
Little Sycamore Canyon Creek	180701040202	P*										I					E		E		P		
VENTURA RIVER WATERSHED																							
Ventura River Estuary[c]	180701010106							E		E		E			E	E	E		Ee	Ef	Ef	E	E
Ventura River Reach 1 (Ventura River Estuary to Main St.)	180701010106	P*	E		E	E	E					E	E				E		E	E	E		E
Ventura River Reach 2 (Main St. to Weldon Canyon)	180701010106	P*	E		E	E	E					E	E				E		E	E	E		E
Cañeda Larga	180701010106	P*		I	I	I	I					I	I				E			I	I		
Lake Casitas	180701010105	E	E	E	E	P	P		P			E	E				E		E				
Lake Casitas tributaries	180701010105	E*			P	E						E	E				E		P	E	E		E
Ventura River Reach 3 (Weldon Canyon to Casitas Vista Rd.)	180701010106	P*	E		E	E	E					E	E				E		E	E	E		E
Ventura River Reach 4 (Casitas Vista Rd. to San Antonio Creek)	180701010105	P*	E		E	E	E					E	E				E		E	E	E		E
Ventura River Reach 4 (San Antonio Creek to Camino Cielo Rd.)	180701010104	E	E	E	E	E	E					E	E				E		Eg	E	E		E
Coyote Creek	180701010105	P*				E						E	E				E			E	E		E
San Antonio Creek (Ventura River Reach 4 to Lion Creek)	180701010103	E	E	E	E	E						E	E				E			E	E		E
San Antonio Creek (above Lion Creek)	180701010103	E	E	E	E	E	E					E	E				E			E	E		E
Lion Creek	180701010103	I*	I	I	I							I	I				E						
Reeves Creek	180701010103	I*	I	I	I	I						I	I				E			I	I		
Mirror Lake	180701010104	P*				E						E					E						E
Ojai Wetland	180701010104	P*										E					E						E
Ventura River Reach 5 (above Camino Cielo Rd.)	180701010104	E	E	E	E	E	E					E	E				E		Eg	E	E		E
Matilija Creek Reach 1 (Ventura River Reach 5 to Matilija Reservoir)	180701010101	P*				E							E				E			E	E		E
Matilija Creek Reach 2 (above Matilija Reservoir)	180701010101	P*				E							E				E			E	E		E
Murietta Canyon Creek	180701010101	P*				E							E				E			E	E		E
North Fork Matilija Creek	180701010102	E*	E	E	E	E						E	E				E		E	E	E		E
Matilija Reservoir	180701010101	E			E	E	E					E	E				E			E	E		E

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E,P, and I: shall be protected as required.
* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date (See pages 2-3, 4 for more details).

Footnotes are consistent for all beneficial use tables.
a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b: Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
c: Coastal waterbodies which are also listed in Inland Surface Waters Tables (2-1) or in Wetlands Table (2-4).
e: One or more rare species utilizes all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.
f: Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.
g: Condor refuge.

Table 2-1. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
SANTA CLARA RIVER WATERSHED																							
Santa Clara River Estuary (Ends at Harbor Blvd.)[c]	180701020904							E		E					E	E	E		Ee	Ef	Ef		E
Santa Clara River Reach 1																							
Santa Clara River (Estuary to Highway 101 bridge)	180701020904	P*	E	E	E	E	E					E	E				E		E	E			E
Santa Clara River Reach 2																							
Santa Clara River (Highway 101 bridge to Ellsworth Barranca)	180701020904	P*	E	E	E	E	E					E	E				E		E	E			E
Santa Clara River (Ellsworth Barranca to Freeman Diversion)	180701020903	P*	E	E	E	E	E					E	E				E		E	E			E
Santa Clara River Reach 3																							
Santa Clara River (Freeman Diversion Dam to Santa Paula Creek)	180701020903	P*	E	E	E	E	E					E					E		E	E			E
Santa Clara River (Santa Paula Creek to Sespe Creek)	180701020902	P*	E	E	E	E	E					E					E		E	E			E
Santa Clara River (Sespe Creek to A Street, Fillmore)	180701020802	P*	E	E	E	E	E					E					E		E	E			E
Santa Clara River Reach 4A																							
Santa Clara River (A Street, Fillmore to Piru Creek)	180701020802	P*	E	E	E	E	E					E					E		E	E			E
Santa Clara River Reach 4B																							
Santa Clara River (Piru Creek to Blue Cut gaging station)	180701020403	P*	E	E	E	E	E					E					E		E	E			E
Santa Clara River Reach 5																							
Santa Clara River (Blue Cut gaging station to West Pier Highway 99)	180701020403	P*	E	E	E	E	E					E					E		E				E
Santa Clara River Reach 6																							
Santa Clara River (West Pier Highway 99 to Bouquet Canyon Rd.)	180701020403	P*	E	E	E	E	E					E					E		E				E
Santa Clara River Reach 7																							
Santa Clara River (Bouquet Canyon Rd. to Lang gaging station)	180701020107	P*	E	E	E	E	E					E					E		E				E
Santa Clara River Reach 8																							
Soledad Canyon (Lang gaging station to Agua Dulce Canyon Creek)	180701020107	E*	E	E	E	E	E					E					E		Ei				E
Soledad Canyon (Agua Dulce Canyon Creek to Aliso Canyon Creek)	180701020105	E*	E	E	E	E	E					E					E		Ei				E
Soledad Canyon (above Aliso Canyon Creek)	180701020102	E*	E	E	E	E	E					E					E		Ei				E
Santa Clara River Reach 9																							
Santa Paula Creek (above Santa Paula Water Works Diversion Dam)	180701020901	P	E	E	E	E	E					E	E				E		E	E	E		
Santa Clara River Reach 10																							
Sespe Creek (gaging station below Little Sespe Creek to Hot Springs Canyon)	180701020705	P	E	P	E	E						E	E				E	E	Eg	E	E		E
Sespe Creek (Hot Springs Canyon to Piedra Blanca Creek)	180701020703	P	E	P	E	E						E	E				E	E	Eg	E	E		E
Sespe Creek (Piedra Blanca Creek to Potrero John Creek)	180701020702	P	E	P	E	E						E	E				E	E	Eg	E	E		E
Sespe Creek (above Potrero John Creek)	180701020701	P	E	P	E	E						E	E				E	E	Eg	E	E		E
Santa Clara River Reach 11																							
Piru Creek (gaging station below Santa Felicia Dam to Agua Blanca Creek)	180701020503	P	E	E	E	E	E					E	E				E		Eg	E	E		E
Piru Creek (Agua Blanca Creek to Pyramid Lake)	180701020502	P	E	E	E	E	E					E	E				E		Eg		E		E
Piru Creek (Pyramid Lake to Snowy Creek)	180701020506	P	E	E	E	E	E					E	E				E		Eg		E		E
Piru Creek (Snowy Creek to Lockwood Creek)	180701020505	P	E	E	E	E	E					E	E				E		Eg		E		E
Piru Creek (above Lockwood Creek)	180701020502	P	E	E	E	E	E					E	E				E		Eg		E		E
Santa Paula Creek (Santa Clara River R4A to Santa Paula Water Works Diversion Dam)	180701020901	P	E	E	E	E	E					E	E				E		E	E	E		
Sisar Creek	180701020901	P	E	P	E	E						E	E				E		Eg		E		E

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E,P, and I: shall be protected as required.
* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date (See pages 2-3, 4 for more details).

Footnotes are consistent for all beneficial use tables.
a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b: Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
c: Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4).
e: One or more rare species utilizes all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.
f: Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.
g: Condor refuge.
i: Soledad Canyon is the habitat of the Unarmored Three-Spine Stickleback.

Table 2-1. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
SANTA CLARA RIVER WATERSHED (Cont.)																							
Sespe Creek (Santa Clara River R3 to gaging station below Little Sespe Creek)	180701020706	P*	E	E	E	E						E	E				E	E	E	E	E		E
Timber Creek	180701020703	P*				E							E				E	E	E	E	E		E
Bear Canyon	180701020703	P*				E						E	P				E	E	E	E	E		E
Trout Creek	180701020703	P*				E						E	E				E		E	E	E		E
Piedra Blanca Creek	180701020703	P*				E							E				E		E	E	E		E
Lion Canyon	180701020702	P*				E						E	E				E			E	E		E
Rose Valley Creek	180701020702	P*				E						E	E				E				E		E
Howard Creek	180701020702	P*				E							E				E	E	E	E	E		E
Tule Creek	180701020702	P*				E							P				E	E	E	E	E		E
Potrero John Creek	180701020701	P*				E							P				E		E	E	E		E
Hopper Creek	180701020801	P*	E		E	E	E					E	E				E		Eg				E
Piru Creek (Santa Clara River R4A to Santa Paula Water Works Diversion Dam)	180701020604	P	E	E	E	E	E					E	E				E		Eg	E	E		E
Lake Piru	180701020603	P	E	E	E	E	P					E	E				E		E		E		
Lake Piru	180701020603	P	E	E	E	E	P		P			E	E				E		E		E		
Pyramid Lake	180701020509	E	E	E	E	E	P		E			E	E				E		E				
Gorman Creek	180701020507	I*			I	I						I	I				E		P				
Canada de los Alamos	180701020506	I*			I	I	I					I	I				E		E				
Lockwood Creek	180701020504	I*			I	I						I	I				E						
Lockwood Creek	180701020504	I*			I	I	I					I	I				E						
Tapo Canyon	180701020403	P*			P							E					E						
Castaic Creek (Santa Clara River R5 to Castaic Lake)	180701020306	I	I	I	I	I	I					I					E		E				
Castaic Creek (Castaic Lake to Fish Canyon)	180701020305	I	I	I	I	I	I					I					E		E				
Castaic Creek (above Fish Canyon)	180701020304	I	I	I	I	I	I					I					E		E				
Castaic Lagoon	180701020306	E*	E	E	E	E	E					E					E						
Castaic Lake	180701020305	E	E	E	E	E	E		E			E	I				E		E		E		
Castaic Lake	180701020304	E	E	E	E	E	E		E			E	I				E		E		E		
Elderberry Forebay	180701020305	E	E	E	E	E	E		E			E					E		E		E		
Elizabeth Lake Canyon	180701020304	I	I	I	I	I	I					I					E						
San Francisquito Canyon I	180701020402	I	I	I	I	I	I					I					E		E		I		E
Drinkwater Reservoir	180701020402	P*				E						P					E		E				E
South Fork Santa Clara River	180701020401	I*	I	I	I	I	I					I					E						
Bouquet Canyon (Santa Clara River R6 to Vasquez Canyon)	180701020401	E I	E I	P I	P I	E	P					E	E				E				P		E
Bouquet Canyon (above Vasquez Canyon)	180701020401	P	P	P	E	E	P					E	E				E		E				E
Dry Canyon Creek	180701020202	I	I	I	I	I	I					I					E						
Dry Canyon Reservoir[j]	180701020201	E	E	E	E	P	P		P			E					E						
Bouquet Reservoir	180701020201	E	E	E	E	E	E		P			E					E						
Mint Canyon Creek Reach 1 (Santa Clara River R7 to Rowher Canyon)	180701020105	I	I	I	I	I	I					I					E						
Mint Canyon Creek Reach 2 (above Rowher Canyon)	180701020105	I*	I	I	I	I	I					I					E						
Agua Dulce Canyon Creek (Santa Clara River R8 to Escondido Canyon Rd.)	180701020104	I*	I	I	I	I	I					I					E		E				
Agua Dulce Canyon Creek (above Escondido Canyon Rd.)	180701020104	I*			I	I	I					I					E						
Aliso Canyon Creek	180701020101	P*			P	E						E					E						E
Lake Hughes	180701020301	P	P	P	P	P	P					E					E						
Munz Lake	180701020301	P*	P	P	P	E	P					E					E						
Lake Elizabeth	180701020301	P	P	P	P	P	P					E					E		E				

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E,P, and I shall be protected as required.
* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date (See pages 2-3, 4 for more details).

Footnotes are consistent for all beneficial use tables.
a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b: Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
g: Condor refuge.
j: Out of service.

Table 2-1. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
CALLEGUAS-CONEJO CREEK WATERSHED																							
Calleguas Creek Estuary[c]	180701030107							P		E					E		E		Ee,p	Ef	Ef		E
Calleguas Creek Reach 1																							
Mugu Lagoon[c]	180701030102							E		Ec					E	E	Eo	E	Ee,p	Ef	Ef	Ed	E
Calleguas Creek Reach 2																							
Calleguas Creek (Estuary to Potrero Rd.)	180701030107	P*			E	E	E					E	E				E		Ep				E
Calleguas Creek Reach 3																							
Calleguas Creek (Potrero Rd. to Conejo Creek)	180701030107	P*	E	E	E	E						E					E						
Calleguas Creek Reach 4																							
Revolon Slough (Calleguas Creek Rch 2 to Pleasant Valley Rd.)	*180701030107*	P*	P		E	E						E					E						E
Revolon Slough (Pleasant Valley Rd. to Central Ave.)	*180701030106*	P*	P		E	E						E					E						E
Calleguas Creek Reach 5																							
Beardsley Channel (above Central Ave.)	180701030106	P*					E					E					E						
Calleguas Creek Reach 6																							
Arroyo Las Posas (Calleguas Creek Rch 3 to Long Canyon)	*180701030103*	P*	P	P	P	E						E	P				E						
Arroyo Las Posas (Long Canyon to Hitch Rd.)	180701030103	P*	P	P	P	E	E					E	P				E						
Calleguas Creek Reach 7																							
Arroyo Simi (Hitch Rd. to Happy Camp Canyon)	180701030103	P*	I			I	I					I					E		E				
Arroyo Simi (Happy Camp Canyon to Alamos Canyon)	*180701030102*	*P**	*I*			*I*	*I*					*I*					*E*		*E*				
Arroyo Simi (Alamos Canyon to Tapo Canyon Creek)	*180701030102*	*P**	*I*			*I*	*I*					*I*					*E*						
Arroyo Simi (above Tapo Canyon Creek)	180701030101	I*	I			I	I					I					E						
Calleguas Creek Reach 8																							
Tapo Canyon Creek (above Arroyo Simi)	180701030101	I*		P	P	I						I					E						
Calleguas Creek Reach 9A																							
Conejo Creek (Camrosa Diversion to Camarillo Rd.)	*180701030105*	*P**	*E*	*E*	*E*	*E*						*E*					*E*						
Conejo Creek (Camarillo Rd. to Arroyo Santa Rosa)	*180701030105*	*P**				*I*	*I*					*I*					*E*				*E*		
Calleguas Creek Reach 9B																							
Conejo Creek (Calleguas Creek Rch 3 to Camrosa Diversion)	180701030105	P*	E	E	E	E						E					E						
Calleguas Creek Reach 10																							
Arroyo Conejo (Conejo Creek to North Fork Arroyo Conejo)	180701030105	P*				I	I					I					E		E				
Calleguas Creek Reach 11 (Arroyo Santa Rosa)																							
Arroyo Santa Rosa (above confl. with Conejo Creek)	180701030105	P*				I	I					I					E						
Calleguas Creek Reach 12																							
North Fork Arroyo Conejo (above confl. with Arroyo Conejo)	180701030104	P*		*<del>*	E	E						E					E				E		
Arroyo Conejo (above confl. with North Fork Arroyo Conejo)	180701030104	P*				I	I					I					E						
Gillibrand Canyon Creek (Tapo Canyon Creek to Windmill Canyon)	180701030101	P*				I	I					I					E						
Gillibrand Canyon Creek (above Windmill Canyon)	180701030101	P*				I						I					E						
Lake Bard (Wood Ranch Reservoir)	180701030102	E	E	E	E	P						E					E						

E: Existing beneficial use

P: Potential beneficial use

I: Intermittent beneficial use

E,P, and I shall be protected as required.

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Footnotes are consistent for all beneficial use tables.

a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.

b: Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.

c: Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4).

d: Limited public access precludes full utilization.

e: One or more rare species utilizes all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.

f: Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.

o: Marine habitats of the Channel Islands and Mugu Lagoon serve as pinniped haul-out areas for one or more species (i.e., sea lions).

p: Habitat of the Clapper Rail.

Table 2-1. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
LOS ANGELES COUNTY COASTAL STREAMS																							
Arroyo Sequit	180701040202	P*				I						E	E				E		E	E	E		E
San Nicholas Canyon Creek	180701040202	P*										I					E						
Los Alisos Canyon Creek	180701040202	P*										I					E		E				
Lachusa Canyon Creek	180701040202	P*										I					E						
Encinal Canyon Creek	180701040202	P*										I					E		E				
Trancas Canyon Creek	180701040203	E*										E					E		E				
Zuma Lagoon[c]	180701040203							E		E					E		E		Ea	Pf	Pf		E
Zuma Creek (Zuma Canyon)	180701040203	E*										E	E				E		E	P	P		
Ramirez Canyon Creek	180701040204	I*										I					E				P		
Escondido Canyon Creek	180701040204	I*										I					E		E				
Latigo Canyon Creek	180701040204	I*										I					E		E				
Solstice Canyon Creek	180701040204	E*										E					E			P	P		
Puerco Canyon Creek	180701040204	I*										I					E						
Corral Canyon Creek	180701040204	I*										I					E						
Carbon Canyon Creek	180701040403	P*										I					E						
Las Flores Canyon Creek	180701040403	P*										I					E						
Piedra Gorda Canyon Creek	180701040403	P*										I					E						
Pena Canyon Creek	180701040403	P*										I	E				E						
Tuna Canyon Creek	180701040403	P*										I					E						
Topanga Lagoon[c]	180701040401							E		E					E		E		Ea	Ef	Ef		E
Topanga Canyon Creek	180701040401	P*										E	E				E			P	I		
Santa Ynez Canyon	180701040403	P*										I					E		E				
Santa Ynez Lake (Lake Shrine)	180701040403	P*										E					E						
Santa Monica Canyon Channel	180701040402	P*										P					P						
Rustic Canyon Creek	180701040402	P*										I					E						
Sullivan Canyon Creek	180701040402	P*										I					E						
Mandeville Canyon Creek	180701040402	P*										I					E						
Coastal Streams of Palos Verdes	180701040500	P*				I						I					E		E				
Canyon Streams of Palos Verdes	180701040701	P*				I						I					E		Et				
Bixby Slough	180701040701	P*										E					E		E				E
Machado Lake	180701040701	P*										E					E		E				E
Madrona Marsh	180701040701											P					E						E
Stone Canyon Reservoir	180701040300	E*	E	E		P						E					E						
Hollywood Reservoir	180701040300	E*	E	E		P						E					E						
Franklin Canyon Reservoir	180701040300	E*										Pu											
Upper Franklin Canyon Reservoir	180701040300	E*	E	E		P						E					E						E

E: Existing beneficial use

P: Potential beneficial use

I: Intermittent beneficial use

E,P, and I: shall be protected as required.

* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date (See pages 2-3, 4 for more details).

Footnotes are consistent for all beneficial use tables.

a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.

b: Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.

c: Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4).

e: One or more rare species utilizes all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.

f: Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.

t: Rare applies only to Agua Magna canyon and Sepluveda Canyon areas.

u: This reservoir is covered and thus inaccessible.

Table 2-1. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
MALIBU CREEK WATERSHED																							
Malibu Lagoon[c]	180701040104							E							E	E	E		Ee	Ef	Ef		E
Malibu Creek	180701040104	P*										E	E				E		E	E	E		E
Cold Creek	180701040104	P*											P				E		E		P		E
Las Virgenes Creek	180701040103	P*										E	P				E		E	P	P		E
Century Reservoir	180701040104	P*										E					E						E
Malibu Lake	180701040104	P*						E				E					E		E				E
Medea Creek Reach 1 (Malibou Lake to Lindero Creek Reach 1)	180701040102	P*				I						I	P				E		E				E
Medea Creek Reach 2 (above Lindero Creek Reach 1)	180701040102	I*				I						E					E						E
Lindero Creek Reach 1 (Medea Creek Reach 1 to Lake Lindero)	180701040102	P*										I					E						
Lindero Creek Reach 2 (above Lake Lindero)	180701040102	P*										I					E						
Triunfo Creek Reach 1 (Malibou Lake to Lobo Canyon)	180701040104	P*										I					E						
Triunfo Creek Reach 2 (Lobo Canyon to Westlake Lake)	180701040101	P*				I						I					E		E				
Westlake Lake	180701040101	P*						E				E					E						
Potrero Valley Creek	180701040101	P*				I						P					E						
Lake Eleanor Creek	180701040101	P*				I						I					E						
Lake Eleanor	180701040101	P*				E						E					E		E				E
Las Virgenes (Westlake) Reservoir	180701040101	E	E	E	E							P					E						
Hidden Valley Creek	180701040101	I*				I						I					E						
Lake Sherwood	180701040101	P*				E		E				E					E						E
BALLONA CREEK WATERSHED																							
Ballona Creek Estuary (ends at Centinela Creek)[w]	180701040300							E		E					E	E	E		Ee	Ef	Ef	E	
Ballona Lagoon/ Venice Canals[c]	180701040403							E		E					E	E	E		Ee	Ef	Ef	E	E
Ballona Wetlands[c]	180701040300														E		E		Ee	Ef	Ef		E
Del Rey Lagoon[c]	180701040500							E		E					E		E		Ee	Ef	Ef		E
Ballona Creek Reach 2 (Estuary to National Blvd.)	180701040300	P*										P					P						
Ballona Creek Reach 1 (above National Blvd.)	180701040300	P*										P					E						
LOS CERRITOS CHANNEL WATERSHED																							
Los Cerritos Wetlands[c]	180701040702							E		E					E		E		Ee	Pf	Pf	E	E
Los Cerritos Channel Estuary (Ends at Anaheim Rd.)[c]	180701040702		E					E		E					E	E	E		Ee	Ef	Ef	E	
Sims Pond	180701040702	P*										P					E						E
Los Cerritos Channel	180701040702	P*										I					E						
Colorado Lagoon	180701040702									E		P					E					E	

E: Existing beneficial use

P: Potential beneficial use

I: Intermittent beneficial use

E,P, and I: shall be protected as required.

* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date (See pages 2-3, 4 for more details).

au: The REC-1 use designation does not apply to recreational activities associated with the swimmable goal as expressed in the Federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use in the Basin Plan, or the associated bacteriological objectives set to protect those activities. However, water quality objectives set to protect other REC-1 uses associated with the fishable goal as expressed in the Federal Clean Water Act section 101(a)(2) shall remain in effect for waters where the (ae)-(au) footnote appears.

Footnotes are consistent for all beneficial use tables.

a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.

b: Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.

c: Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4).

e: One or more rare species utilizes all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.

f: Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.

w: These areas are engineered channels. All references to Tidal Prisms in Regional Board documents are functionally equivalent to estuaries.

av: The High Flow Suspension only applies to water contact recreational activities associated with the swimmable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use, non-contact water recreation involving incidental water contact regulated under the REC-2 use, and the associated bacteriological objectives set to protect those activities. Water quality objectives set to protect (1) other recreational uses associated with the fishable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use and (2) other REC-2 uses (e.g., uses involving the aesthetic aspects of water) shall remain in effect at all times for waters where the (ad)- (av) footnote appears.

** The dividing line between "Ballona Creek" and "Ballona Creek to Estuary" is the point at which the vertical channel walls transition to sloping walls.

Table 2-1. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
DOMINGUEZ CHANNEL WATERSHED																							
Dominguez Channel Estuary (Ends at Vermont Ave.) c,w	180701060102							P		E					E	E	E		Ee	Ef	Ef		
Dominguez Channel (Estuary to 135th St.)	180701060102	P*										P					P		E				
Dominguez Channel (above 135th St)	180701060101	P*										P					P		E				
LOS ANGELES RIVER WATERSHED																							
Los Angeles River Estuary (Ends at Willow St.) c,w	180701050402		E					E		E					E	E	E		Ee	Ef	Ef	P	E
Los Angeles River Reach 1 (Estuary to Carson St.)	180701050402	P*	P	P		E						E				E	E		E	P	P	Ps	
Compton Creek	180701050402	P*				E						E					E						E
Los Angeles River Reach 2 (Carson St. to Rio Hondo Reach 1)	180701050402	P*	P			E						E					P						
Los Angeles River Reach 2 (Rio Hondo Reach 1 to Figueroa St.)	180701050401	P*	P			E						E					P						
Rio Hondo Reach 1 (Los Angeles River Reach 2 to Santa Ana Freeway)	180701050303	P*				I						P					I						
Rio Hondo Reach 2 (Santa Ana Freeway to Whittier Narrows Dam)	180701050303	P*				I						P					I						
Rio Hondo Reach 3 (above Whittier Narrows Dam)	180701050302	P*				I						P					I		E				E
Alhambra Wash	180701050303	P*				I						P					P		E				
Rubio Wash	180701050303	P*				I						I					E		P				
Rubio Canyon	180701050301	P*				E						I					E		E				E
Eaton Wash	180701050301	P*				I						I					E						
Eaton Wash (below dam) (Rio Hondo Reach 3 to Eaton Dam)	180701050301	P*				I						I					E						
Eaton Wash (above dam) (Eaton Dam to Mount Wilson Toll Rd.)	180701050301	P*				I						I					E						
Eaton Reservoir	180701050301	P*				I						I					E						
Eaton Canyon Creek (above Mount Wilson Toll Rd.)	180701050301	P*				E						E					E		E		E		E
Arcadia Wash	180701050302	P*				I						P					P						
Arcadia Wash	180701050302	P*				I						P					P						
Santa Anita Wash (lower) (Rio Hondo Reach 3 to Elkins Ave.)	180701050302	P*				I						P					P		E				
Santa Anita Wash (upper) (Elkins Ave. to Big Santa Anita Reservoir)	180701050302	P*				E						E					E		E				
Little Santa Anita Canyon Creek	180701050302	P*				I						I					E						
Big Santa Anita Reservoir	180701050302	P*				E						E	E				E						
Santa Anita Canyon Creek	180701050302	E*				E						E	E				E		E		E		E
Winter Creek	180701050302	P*				I						I					E						E
East Fork Santa Anita Canyon	180701050302	P*				E						E	E				E				E		E
Sawpit Wash	180701050302	I				I						I					E						
Sawpit Canyon Creek	180701050302	P*				I						I					E		E				
Sawpit Reservoir	180701050302	P*				I						I					E						
Monrovia Canyon Creek	180701050302	I				I						I					E						E
Arroyo Seco Reach 1 (Los Angeles River Reach 2 to Holly St.)	180701050209	P*										P					P						
Arroyo Seco Reach 2 (Holly St. to Devils Gate Dam)	180701050209	P*										P					P		E				
Devils Gate Reservoir (lower)	180701050209	P*				I						I					E						
Devils Gate Reservoir (upper)	180701050209	I				I						I					E						
Arroyo Seco Reach 3 (above Devils Gate Dam)	180701050209	E	E	E		E						E	E				E						E
Millard Canyon Creek	180701050209	E*	E	E		E						E					E		E				E
El Prieto Canyon Creek	180701050209	I	I	I		I						I					E						
Little Bear Canyon Creek	180701050209	P*				I						I	I				E						E
Los Angeles River Reach 3 (Figueroa St. to Riverside Dr.)	180701050102	P*	P			E						E					E						E
Verdugo Wash Reach 1 (Los Angeles River Rch 3 to Verdugo Rd./Towne St.)	180701050207	P*				I						P					P						
Verdugo Wash Reach 2 (above Verdugo Rd. @ Towne St.)	180701050207	P*				I						P					P						
Halls Canyon Channel	180701050207	P*	I	I		I						I					E						
Snover Canyon	180701050207	I	I	I		I						I					E						
Pickens Canyon	180701050207	I				I						I					E						
Shields Canyon	180701050207	I	I	I		I						I					E						

E: Existing beneficial use

P: Potential beneficial use

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Footnotes are consistent for all beneficial use tables.

a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.

b: Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.

c: Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4).

e: One or more rare species utilize all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.

f: Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.

s: Access prohibited by Los Angeles County ~~DPW~~ Department of Public Works.

w: These areas are engineered channels. All references to Tidal Prisms in Regional Board documents are functionally equivalent to estuaries.

Table 2-1. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
LOS ANGELES RIVER WATERSHED (cont.)																							
Dunsmore Canyon Creek	180701050207	I	I	I		I						I					E						
Burbank Western Channel	180701050208	P*										P					P						
La Tuna Canyon Lateral and Creek	180701050208	P*				I						I					E						
Tujunga Wash	180701050208	P*				I						P	P				P						
Hansen Flood Control Basin & Lakes	180701050105	P*				E						I	E				E		E				
Lopez Canyon Creek	180701050105	P*				I						I					E						
Little Tujunga Canyon Creek	180701050104	P*				I						I	I				E		E				
Kagel Canyon Creek	180701050104	P*				I						I					E						
Big Tujunga Canyon Creek (Hansen Flood Control Basin to Big Tujunga Reservoir	180701050105	P*				E						I	E				E		E		E		E
Big Tujunga Canyon Creek (above Big Tujunga Reservoir)	180701050103	P*				E						E	E				E		E		E		E
Upper Big Tujunga Canyon Creek	180701050103	P*				E						I	P				E						E
Haines Canyon Creek	180701050105	P*				I						I					E		E				
Vasquez Creek	180701050105	P*				E						P	P				E						E
Clear Creek	180701050105	P*				E						E	E				E						E
Big Tujunga Reservoir	180701050105	P*				E						E	P				E				E		
Mill Creek	180701050102	P*				E						E	E				E						E
Los Angeles River Reach 4 (Riverside Dr. to Sepulveda Dam)	180701050208	P*	P			E						E					E						E
Pacoima Wash	180701050206	P*				E						E					E		E				
Pacoima Reservoir	180701050205	P*				E						E					E						
Pacoima Canyon Creek	180701050205	P*				E						E	E				E		E		E		E
May Canyon Creek	180701050206	P*				I						I					E						
Wilson Canyon Creek	180701050206	P*				I						I					E						
Stetson Canyon Creek	180701050204	P*				I						P					P						
Los Angeles River Reach 5 (Sepulveda Dam to Balboa Blvd.)	180701050208	P*	P			E						E					E						E
Sepulveda Flood Control Basin	180701050208	P*				E						E					E						E
Bull Creek	180701050204	P*				I						I					E						
Los Angeles Reservoir	180701050204	E	E	E		P						E					E		E				
Lower Van Norman Reservoir	180701050204	E*	E	E		E						E					E		E				
Upper Van Norman Reservoir	180701050204	E*										Pu					E						
Los Angeles River Reach 6 (above Balboa Blvd.)	180701050208	P*	P			E						E					E						E
Caballero Creek	180701050208	P*				I						I					E						
Aliso Canyon Wash (Los Angeles River Reach 6 to State Hwy 118)	180701050203	P*				I						I					E						
Aliso Canyon Creek (above State Hwy 118)	180701050203	P*				I						I					E						
Limekiln Canyon Wash	180701050203	P*				I						I					E						
Browns Canyon Wash (Los Angeles River Reach 6 to State Hwy 118)	180701050202	P*				I						I					E						
Browns Canyon Creek (above State Hwy 118)	180701050202	P*				I						I					E						
Arroyo Calabasas	180701050201	P*										P					P						
Dry Canyon Creek	180701050201	P*				I						I					E						
McCoy Canyon Creek	180701050201	P*				I						I					E						
Bell Creek	180701050201	P*				I						I					E						
Chatsworth Reservoir[u]	180701050201	E	E	E								E					E						
Dayton Canyon Creek	180701050201	P*				I						I					E						

E: Existing beneficial use

P: Potential beneficial use

I: Intermittent beneficial use

E,P, and I: shall be protected as required.

* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date (See pages 2-3, 4 for more details).

Footnotes are consistent for all beneficial use tables.

a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.

b: Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.

u: This reservoir is covered and thus inaccessible.

y: Currently dry and no plans for restoration.

Table 2-1. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
LOS ANGELES RIVER WATERSHED (cont.)																							
ISOLATED LAKES AND RESERVOIRS:																							
Eagle Rock Reservoir	180701050402	E*										Pu											
Echo Lake	180701040200	P*										P					E						
El Dorado Lakes	180701060606	P*										P					E						E
Elysian Reservoir	180701050403	P*	E	E								P					E						
Encino Reservoir	180701050208	P*	E	E								P					E						
Ivanhoe Reservoir	180701040200	E*	E	E								P					E						
Lincoln Park Lake Silver Reservoir	180701050403	P*										P					E						
Silver Lake Reservoir	180701040200	E*	E	E								P					E						
Toluca Lake	180701050208	P*										P					E						
SAN GABRIEL RIVER WATERSHED																							
San Gabriel River Estuary (Ends at Willow St.) c,w	180701060606		E					E		E					E	E	E		Ee	Ef	Ef	P	
Coyote Creek (San Gabriel River Estuary to La Canada Verde Creek)	180701060506	P*	P	P								P					P		E				
Coyote Creek (above La Canada Verde Creek)	180701060503	P*	P	P								P					P		E				
San Gabriel River Reach 1 (San Gabriel River Estuary to Firestone Blvd.)	180701060606	P*										P					P						
San Gabriel River Reach 2 (Firestone Blvd. to Whittier Narrows Dam)	180701060606	P*	P	P		I						I					E		E				
Whittier Narrows Flood Control Basin	180701060303	P*				E						E					E		P				
Legg Lake	180701060303	P*				E						E	E				E						E
San Gabriel River Reach 3 (Whittier Narrows Dam to San Jose Creek)	180701060601	P*				I						I					E						
San Gabriel River Reach 3 (San Jose Creek to Ramona Blvd.)	180701060601	P*				I						I					E						
San Jose Creek Reach 1 (San Gabriel River Reach 3 to Temple Ave.)	180701060502	P*				I						I					E						
San Jose Creek Reach 2 (Temple Ave. to Thompson Wash)	180701060501	P*				I						I					E						
Puente Creek	180701060502	P*				I						P					P						
Thompson Wash (San Jose Creek Reach 2 to Web Canyon)	180701060501	P*				I						I					E						
Thompson Creek (above Web Canyon)	180701060501	P*				I						I					E		E				
Thompson Creek Reservoir	180701060501	P*				I						I					E		E				
Walnut Creek Wash	180701060402	P*				I						I					E						E
Big Dalton Wash	180701060402	P*				I						P					P						
Big Dalton Canyon Creek	180701060402	P*				I						I					E						E
Mystic Canyon	180701060402	P*				I						I					E						
Big Dalton Reservoir	180701060402	P*				E						E					E						
Bell Canyon Creek	180701060402	P*				I						I					E						
Little Dalton Wash	180701060402	P*				I						P					P						
Little Dalton Canyon Creek	180701060402	P*				I						I					E						E
San Dimas Wash (lower) (Big Dalton wash to Ham Canyon)	180701060402	P*				I						I					E		E				
San Dimas Wash (upper) (above Ham Canyon)	180701060401	P*				E						I					E						
San Dimas Reservoir	180701060401	E*				E						E	E				E						
San Dimas Canyon Creek	180701060401	E*				E						E	E				E						E
West Fork San Dimas Canyon	180701060401	E*				E						E	P				E						E
Wolfskill Canyon	180701060401	E*				E						E	P				E		E				E
Puddingstone Reservoir	180701060402	E*			E	E						E	E				E		E				
Live Oak Wash	180701060402	E*				I	I					I					E						
Live Oak Creek	180701060402	E*				I	I					I					E						
Live Oak Reservoir	180701060402	E*				E	E					E					E						
Puddingstone Wash	180701060402	E*				I						I					E						
Marshall Creek and Wash (Puddingstone Reservoir to Via Amayo)	180701060402	E*				I						I					E						

E: Existing beneficial use

P: Potential beneficial use

I: Intermittent beneficial use

E,P, and I: shall be protected as required.

* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date (See pages 2-3, 4 for more details).

Footnotes are consistent for all beneficial use tables.

a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.

b: Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.

c: Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4).

e: One or more rare species utilizes all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.

f: Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.

w: These areas are engineered channels. All references to Tidal Prisms in Regional Board documents are functionally equivalent to estuaries.

u: This reservoir is covered and thus inaccessible.

Table 2-1. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
SAN GABRIEL RIVER WATERSHED (cont.)																							
Marshall Creek and Wash (above Via Arroyo)	180701060402	E*				I	I					I					E		E				E
Emerald Creek And Wash	180701060402	E*				I	I					I					E						
San Gabriel River Reach 4 (Ramona Blvd. to Santa Fe Dam)	180701060601	P*				I						I					E						
Santa Fe Flood Control Basin	180701060601	P*				I						I					E						E
UPPER SAN GABRIEL RIVER TRIBUTARIES																							
San Gabriel River Reach 5 (Santa Fe Dam to Huntington Dr.)	180701060601	P*				I						I					E						
San Gabriel River Reach 5 (Huntington Dr. to Van Tassel Canyon)	180701060601	E	E	E	E	E						E	E				E		E	<del>			
San Gabriel River Reach 5 (Van Tassel canyon to San Gabriel Reservoir)	180701060601	E	E	E	E	E						E	E				E				E		E
Bradbury Canyon Creek	180701060601	P*				I						I					E						
Sprinks Canyon Creek	180701060601	P*				I						I					E						
Maddock Canyon Creek	180701060601	P*				I						I					E						
Van Tassel Canyon	180701060601	P*				I						I					E		E				
Fish Canyon Creek	180701060601	P*	I			E						E					E		E		E		E
Roberts Canyon Creek	180701060601	P*				I						I					E		E				E
Morris Reservoir	180701060601	E	E	E	E	E			E			E	E				E				E		
San Gabriel Reservoir	180701060601	E	E	E	E	E			E			E	E				E						
East Fork San Gabriel River (San Gabriel Reservoir to Fish Fork)	180701060301	P*				E						E	E				E		E		E		E
East Fork San Gabriel River (above Fish Fork)	180701060303	P*				E						E	E				E		E		E		E
Cattle Canyon Creek	180701060302	P*				E						E	E				E		E		E		E
Coldwater Canyon Creek	180701060302	P*				E						E	E				E		E		E		E
Cow Canyon Creek	180701060302	P*				E						E	E				E		E		E		E
Allison Gulch	180701060303	P*				E						E	E				E				E		E
Fish Fork	180701060301	P*				E						E	E				E				E		E
West Fork San Gabriel River (San Gabriel Reservoir to Bear Creek)	180701060205	P*				E						E	E				E		E		E		E
West Fork San Gabriel River (above Bear Creek)	180701060202	P*				E						E	E				E		E		E		E
North Fork San Gabriel River	180701060204	P*				E						E	E				E		E		E		E
Bichota Canyon	180701060204	P*				E						E	E				E		P		E		
Coldbrook Creek	180701060204	P*				I						I					E				E		
Soldier Creek	180701060204	P*				I						I					E				E		
Cedar Creek	180701060204	P*				E						E	E				E		E		E		E
Crystal Lake	180701060204	P*										E	E				E				E		
Bear Creek	180701060205	P*				E						E	E				E		E		E		E
Cogswell Reservoir	180701060202	P*				E						E	E				E				E		
Devils Canyon Creek	180701060201	P*				E						E	E				E				E		E
ISLAND WATERCOURSES																							
Anacapa Island	180600140203	P*										P					E		E				
San Nicolas Island	180701070001	P*										P					E		Eaa				
Santa Barbara Island	180701070003	P*										P					E		E				
Santa Catalina Island	180701070002	E*				E						E					E		E				
Middle Ranch System	180701070003	P*				E						E					E		E				
San Clemente Island	180701070004	E*				E						E					E		E				
SAN ANTONIO CREEK WATERSHED [ab]																							
San Antonio Dam And Reservoir	180702030701	E*				E						E					E						
San Antonio Canyon Creek	180702030701	E		E	E	E			E			E	E				E				E		

E: Existing beneficial use

P: Potential beneficial use

I: Intermittent beneficial use

E,P, and I shall be protected as required.

* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date (See pages 2-3, 4 for more details).

Footnotes are consistent for all beneficial use tables.

a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.

b: Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.

aa: Habitat of the Channel Island Fox.

ab: This watershed is also in Region 8 (801.23).

Table 2-1a. Beneficial Uses of Inland Surface Waters.

WATERSHED[a]	WBD No.	REC1	LREC-1	REC2	High Flow Suspension
VENTURA COUNTY COASTAL STREAMS					
Los Sauces Creek	180701010202	I		I	
Poverty Canyon	180701010202	I		I	
Madranio Canyon	180701010202	I		I	
Javon Canyon	180701010202	I		I	
Padre Juan Canyon	180701010202	I		I	
McGrath Lake	180701010202	Ed		Ed	
Big Sycamore Canyon Creek	180701040201	I		I	
Little Sycamore Canyon Creek	180701040202	I		I	
VENTURA RIVER WATERSHED					
Ventura River Estuary[c]	180701010105	E		E	
Ventura River Reach 1 (Ventura River Estuary to Main St.)	180701010106	E		E	
Ventura River Reach 2 (Main St. to Weldon Canyon)	180701010106	E		E	
Cañada Larga	180701010106	I		I	
Lake Casitas	180701010105	Ph		E	
Lake Casitas tributaries	180701010105	E		E	
Ventura River Reach 3 (Weldon Canyon to Casitas Vista Rd.)	180701010106	E		E	
Ventura River Reach 4 (Casitas Vista Rd. to San Antonio Creek)	180701010106	E		E	
Ventura River Reach 4 (San Antonio Creek to Camino Cielo Rd.)	180701010104	E		E	
Coyote Creek	180701010105	P			
San Antonio Creek (Ventura River Reach 4 to Lion Creek)	180701010106	E		E	
San Antonio Creek (above Lion Creek)	180701010103	E		E	
Lion Creek	180701010103	I		I	
Reeves Creek	180701010103	I		I	
Mirror Lake	180701010104	P		E	
Ojai Wetland	180701010104	P		E	
Ventura River Reach 5 (above Camino Cielo Rd.)	180701010104	E		E	
Matilija Creek Reach 1 (Ventura River Reach 5 to Matilija Reservoir)	180701010101	E		E	
Matilija Creek Reach 2 (above Matilija Reservoir)	180701010104	E		E	
Murietta Canyon Creek	180701010101	E		E	
North Fork Matilija Creek	180701010102	E		E	
Matilija Reservoir	180701010101	E		E	

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E,P, and I: shall be protected as required.
* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date (See pages 2-3, 4 for more details).

Footnotes are consistent for all beneficial use tables.
a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
c: Coastal waterbodies which are also listed in Inland Surface Waters Tables (2-1) or in Wetlands Table (2-4).
d: Limited public access precludes full utilization.
h: Water contact recreational activities prohibited by Casitas MWD.

Table 2-1a. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	REC1	LREC-1	REC2	High Flow Suspension
SANTA CLARA RIVER WATERSHED					
Santa Clara River Estuary (Ends at Harbor Blvd.)[c]	180701020904	E		E	
Santa Clara River Reach 1					
Santa Clara River (Estuary to Highway 101 bridge)	180701020904	E		E	
Santa Clara River Reach 2					
Santa Clara River (Highway 101 bridge to Ellsworth Barranca)	180701020904	E		E	
Santa Clara River (Ellsworth Barranca to Freeman Diversion)	180701020902	E		E	
Santa Clara River Reach 3					
Santa Clara River (Freeman Diversion Dam to Santa Paula Creek)	180701020903	Ed		E	
Santa Clara River (Santa Paula Creek to Sespe Creek)	180701020902	Ed		E	
Santa Clara River (Sespe Creek to A Street, Fillmore)	180701020802	Ed		E	
Santa Clara River Reach 4A					
Santa Clara River (A Street, Fillmore to Piru Creek)	180701020802	E		E	
Santa Clara River Reach 4B					
Santa Clara River (Piru Creek to Blue Cut gaging station)	180701020403	E		E	
Santa Clara River Reach 5					
Santa Clara River (Blue Cut gaging station to West Pier Highway 99)	180701020403	E		E	
Santa Clara River Reach 6					
Santa Clara River (West Pier Highway 99 to Bouquet Canyon Rd.)	180701020403	E		E	
Santa Clara River Reach 7					
Santa Clara River (Bouquet Canyon Rd. to Lang gaging station)	180701020107	E		E	
Santa Clara River Reach 8					
Soledad Canyon (Lang gaging station to Agua Dulce Canyon Creek)	180701020107	E		E	
Soledad Canyon (Agua Dulce Canyon Creek to Aliso Canyon Creek)	180701020105	E		E	
Soledad Canyon (above Aliso Canyon Creek)	180701020102	E		E	
Santa Clara River Reach 9					
Santa Paula Creek (above Santa Paula Water Works Diversion Dam)	180701020901	E		E	
Santa Clara River Reach 10					
Sespe Creek (gaging station below Little Sespe Creek to Hot Springs Canyon)	180701020705	E		E	
Sespe Creek (Hot Springs Canyon to Piedra Blanca Creek)	180701020703	E		E	
Sespe Creek (Piedra Blanca Creek to Potrero John Creek)	180701020702	E		E	
Sespe Creek (above Potrero John Creek)	180701020701	E		E	
Santa Clara River Reach 11					
Piru Creek (gaging station below Santa Felicia Dam to Agua Blanca Creek)	180701020603	E		E	
Piru Creek (Agua Blanca Creek to Pyramid Lake)	180701020602	E		E	
Piru Creek (Pyramid Lake to Snowy Creek)	180701020508	E		E	
Piru Creek (Snowy Creek to Lockwood Creek)	180701020505	E		E	
Piru Creek (above Lockwood Creek)	180701020502	E		E	
Santa Paula Creek (Santa Clara River R4A to Santa Paula Water Works Diversion Dam)	180701020901	E		E	
Sisar Creek	180701020901	E		E	

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E,P, and I: shall be protected as required.
~~* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date (See pages 2-3, 4 for more details).~~

Footnotes are consistent for all beneficial use tables.
a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
c: Coastal waterbodies which are also listed in inland Surface Waters Tables (2-1) or in Wetlands Table (2-4).
d: Limited public access precludes full utilization.

Table 2-1a. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	REC1	LREC-1	REC2	High Flow Suspension
SANTA CLARA RIVER WATERSHED (Cont.)					
Sespe Creek (Santa Clara River R3 to gaging station below Little Sespe Creek)	180701020706	E		E	
Timber Creek	180701020703	E		E	
Bear Canyon	180701020703	E		E	
Trout Creek	180701020703	E		E	
Piedra Blanca Creek	180701020703	E		E	
Lion Canyon	180701020702	E		E	
Rose Valley Creek	180701020702	E		E	
Howard Creek	180701020702	E		E	
Tule Creek	180701020702	P		E	
Potrero John Creek	180701020701	E		E	
Hopper Creek	180701020601	E		E	
Piru Creek (Santa Clara River R4A to Santa Paula Water Works Diversion Dam)	180701020604	E		E	
Lake Piru	180701020603	E		E	
Lake Piru	180701020603	E		E	
Pyramid Lake	180701020509	E		E	
Gorman Creek	180701020507	I		I	
Canada de los Alamos	180701020506	I		I	
Lockwood Creek	180701020504	I		I	
Lockwood Creek	180701020504	I		I	
Tapo Canyon	180701020403	P		E	
Castaic Creek (Santa Clara River R5 to Castaic Lake)	180701020306	I		E	
Castaic Creek (Castaic Lake to Fish Canyon)	180701020305	I		E	
Castaic Creek (above Fish Canyon)	180701020304	I		E	
Castaic Lagoon	180701020306	E		E	
Castaic Lake	180701020305	E		E	
Castaic Lake	180701020304	E		E	
Elderberry Forebay	180701020305	Ek		E	
Elizabeth Lake Canyon	180701020304	I		E	
San Francisquito Canyon l	180701020402	I		I	
Drinkwater Reservoir	180701020402	Pk		E	
South Fork Santa Clara River	180701020401	I		I	
Bouquet Canyon (Santa Clara River R6 to Vasquez Canyon)	180701020401	Em		E	
Bouquet Canyon (above Vasquez Canyon)	180701020401	Em		E	
Dry Canyon Creek	180701020202	I		I	
Dry Canyon Reservoir[j]	180701020201	Pk		E	
Bouquet Reservoir	180701020201	Pk		E	
Mint Canyon Creek Reach 1 (Santa Clara River R7 to Rowher Canyon)	180701020106	Im		I	
Mint Canyon Creek Reach 2 (above Rowher Canyon)	180701020106	Im		I	
Agua Dulce Canyon Creek (Santa Clara River R8 to Escondido Canyon Rd.)	180701020104	I		I	
Agua Dulce Canyon Creek (above Escondido Canyon Rd.)	180701020104	I		I	
Aliso Canyon Creek	180701020101	E		E	
Lake Hughes	180701020301	E		E	
Munz Lake	180701020301	E		E	
Lake Elizabeth	180701020301	E		E	

E: Existing beneficial use

P: Potential beneficial use

I: Intermittent beneficial use

E,P, and I shall be protected as required.

* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date (See pages 2-3, 4 for more details).

Footnotes are consistent for all beneficial use tables.

a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.

k: Public access to reservoir and its surrounding watershed is prohibited by Los Angeles County Department of Public Works.

l: The majority of the reach is intermittent; there is a small area of rising ground water creating perennial flow.

m: Access prohibited by Los Angeles Department in the concrete-channelized areas.

j: Out of service.

Table 2-1a. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	REC1	LREC-1	REC2	High Flow Suspension
CALLEGUAS-CONEJO CREEK WATERSHED					
Calleguas Creek Estuary[c]	180701030107	Pn		E	
Calleguas Creek Reach 1					
Mugu Lagoon[c]	180701030102	Pn		E	
Calleguas Creek Reach 2					
Calleguas Creek (Estuary to Potrero Rd.)	180701030107	E		E	
Calleguas Creek Reach 3					
Calleguas Creek (Potrero Rd. to Conejo Creek)	180701030107	Eq		E	
Calleguas Creek Reach 4					
Revolon Slough (Calleguas Creek Rch 2 to Pleasant Valley Rd.)	*180701030107*	Eq		E	
Revolon Slough (Pleasant Valley Rd. to Central Ave.)	*180701030106*	Eq		E	
Calleguas Creek Reach 5					
Beardsley Channel (above Central Ave.)	180701030106	E		E	
Calleguas Creek Reach 6					
Arroyo Las Posas (Calleguas Creek Rch 3 to Long Canyon)	*180701030103*	E		E	
Arroyo Las Posas (Long Canyon to Hitch Rd.)	180701030103	E		E	
Calleguas Creek Reach 7					
Arroyo Simi (Hitch Rd. to Happy Camp Canyon)	180701030103	I		I	
Arroyo Simi (Happy Camp Canyon to Alamos Canyon)	*180701030102*	*I*		*I*	
Arroyo Simi (Alamos Canyon to Tapo Canyon Creek)	*180701030102*	*I*		*I*	
Arroyo Simi (above Tapo Canyon Creek)	180701030101	I		I	
Calleguas Creek Reach 8					
Tapo Canyon Creek (above Arroyo Simi)	180701030101	I		I	
Calleguas Creek Reach 9A					
Conejo Creek (Camrosa Diversion to Camarillo Rd.)	*180701030105*	*Eq*		*E*	
Conejo Creek (Camarillo Rd. to Arroyo Santa Rosa)	*180701030105*	*I*		*I*	
Calleguas Creek Reach 9B					
Conejo Creek (Calleguas Creek Rch 3 to Camrosa Diversion)	180701030105	Eq		E	
Calleguas Creek Reach 10					
Arroyo Conejo (Conejo Creek to North Fork Arroyo Conejo)	180701030105	I		I	
Calleguas Creek Reach 11 (Arroyo Santa Rosa)					
Arroyo Santa Rosa (above confl. with Conejo Creek)	180701030105	I		I	
Calleguas Creek Reach 12					
North Fork Arroyo Conejo (above confl. with Arroyo Conejo)	180701030104	E		E	
Calleguas Creek Reach 13					
Arroyo Conejo (above confl. with North Fork Arroyo Conejo)	180701030104	I		I	
Gillibrand Canyon Creek (Tapo Canyon Creek to Windmill Canyon)	180701030101	I		I	
Gillibrand Canyon Creek (above Windmill Canyon)	180701030101	I		I	
Lake Bard (Wood Ranch Reservoir)	180701030102	Pr		Er	

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E,P, and I: shall be protected as required.
* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date (See pages 2-3, 4 for more details).

Footnotes are consistent for all beneficial use tables.
a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
c: Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands table (2-4).
n: Area is currently under control of the Navy: swimming is prohibited.
q: Whenever flow conditions are suitable.
r: Public access prohibited by Calleguas MWD.

Table 2-1a. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	REC1	LREC-1	REC2	High Flow Suspension
LOS ANGELES COUNTY COASTAL STREAMS					
Arroyo Secuit	180701040202	E		E	
San Nicholas Canyon Creek	180701040202	I		I	
Los Alisos Canyon Creek	180701040202	I		I	
Lachusa Canyon Creek	180701040202	I		I	
Encinal Canyon Creek	180701040202	I		I	
Trancas Canyon Creek	180701040203	Em		E	
Dume Lagoon [c]	180701040203	E		E	
Dume Creek (Zuma Canyon)	180701040203	E		E	
Ramirez Canyon Creek	180701040204	I		I	
Escondido Canyon Creek	180701040204	I		I	
Latigo Canyon Creek	180701040204	I		I	
Solstice Canyon Creek	180701040204	E		E	
Puerco Canyon Creek	180701040204	I		I	
Corral Canyon Creek	180701040204	I		I	
Carbon Canyon Creek	180701040403	I		I	
Las Flores Canyon Creek	180701040403	I		I	
Piedra Gorda Canyon Creek	180701040403	I		I	
Pena Canyon Creek	180701040403	I		I	
Tuna Canyon Creek	180701040403	I		I	
Topanga Lagoon [c]	180701040401	E		E	
Topanga Canyon Creek	180701040401	I		I	
Santa Ynez Canyon	180701040403	I		E	
Santa Ynez Lake (Lake Shrine)	180701040403	Pk		E	
Santa Monica Canyon Channel	180701040402	Ps		I	
Rustic Canyon Creek	180701040402	I		I	
Sullivan Canyon Creek	180701040402	I		I	
Mandeville Canyon Creek	180701040402	I		I	
Coastal Streams of Palos Verdes	180701040500	I		I	
Canyon Streams of Palos Verdes	180701040701	I		I	
Bixby Slough	180701040701	E		E	
Machado Lake	180701040701	E		E	
Madrona Marsh	180701040701	P		E	
Stone Canyon Reservoir	180701040300	Pk		E	
Hollywood Reservoir	180701040300	Pk		E	
Franklin Canyon Reservoir	180701040300	Pk,u			
Upper Franklin Canyon Reservoir	180701040300	P		E	

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E,P, and I: shall be protected as required.
* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date (See pages 2-3, 4 for more details).

Footnotes are consistent for all beneficial use tables.
a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
c: Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands table (2-4).
k: Public access to reservoir and its surrounding watershed is prohibited by Los Angeles County Department of Public Works.
m: Access prohibited by Los Angeles County Department in the concrete-channelized areas.
s: Access prohibited by Los Angeles County DPW Department of Public works.
u: This reservoir is covered and thus inaccessible.

Table 2-1a. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	REC1	LREC-1	REC2	High Flow Suspension
MALIBU CREEK WATERSHED					
Malibu Lagoon [c]	180701040104	E		E	
Malibu Creek	180701040104	E		E	
Cold Creek	180701040104	E		E	
Las Virgenes Creek	180701040103	Em		E	
Century Reservoir	180701040104	E		E	
Malibou Lake	180701040104	E		E	
Medea Creek Reach 1 (Malibou Lake to Lindero Creek Reach 1)	180701040102	Im		I	
Medea Creek Reach 2 (above Lindero Creek Reach 1)	180701040104	Em		E	
Lindero Creek Reach 1 (Medea Creek Reach 1 to Lake Lindero)	180701040102	I		I	
Lindero Creek Reach 2 (above Lake Lindero)	180701040102	I		I	
Triunfo Creek Reach 1 (Malibou Lake to Lobo Canyon)	180701040101	Im		I	
Triunfo Creek Reach 2 (Lobo Canyon to Westlake Lake)	180701040101	Im		I	
Westlake Lake	180701040101	E		E	
Palmero Valley Creek	180701040101	I		I	
Lake Eleanor Creek	180701040101	I		I	
Lake Eleanor	180701040101	E		E	
Las Virgenes (Westlake) Reservoir	180701040101	Ps,v		E	
Hidden Valley Creek	180701040101	I		I	
Lake Sherwood	180701040101	E		E	
BALLONA CREEK WATERSHED					
Ballona Creek Estuary (ends at Centinela Creek) [c,w]	*180701040300*	E		E	
Ballona Lagoon/ Venice Canals [c]	*180701040403*	E		E	
Ballona Wetlands [c]	*180701040300*	E		E	
Del Rey Lagoon [c]	*180701040500*	E		E	
Ballona Creek Reach 2 (Estuary to National Blvd.)	*180701040300*	Ps,au	E	E	Yav
Ballona Creek Reach 1 (above National Blvd.)	*180701040300*	Ps,au		E	Yav
LOS CERRITOS CHANNEL WATERSHED					
Los Cerritos Wetlands [c]	*180701040702*	E		E	
Los Cerritos Channel Estuary (Ends at Anaheim Rd.) [w]	180701040702	Es		E	
Sims Pond	*180701040702*	P		E	
Los Cerritos Channel	*180701040702*	P		I	
Colorado Lagoon	*180701040702*	E		E	

E: Existing beneficial use

P: Potential beneficial use

I: Intermittent beneficial use

E,P, and I: shall be protected as required.

* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date (See pages 2-3, 4 for more details).

au: The REC-1 use designation does not apply to recreational activities associated with the swimmable goal as expressed in the Federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use in the Basin Plan, or the associated bacteriological objectives set to protect those activities. However, water quality objectives set to protect other REC-1 uses associated with the fishable goal as expressed in the Federal Clean Water Act section 1010(a)(2) shall remain in effect for waters where the ~~(ae)~~ (au) footnote appears.

av: The High Flow Suspension only applies to water contact recreational activities associated with the swimmable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use, non-contact water recreation involving incidental water contact regulated under the REC-2 use, and the associated bacteriological objectives set to protect those activities. Water quality objectives set to protect (1) other recreational uses associated with the fishable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use and (2) other REC-2 uses (e.g., uses involving the aesthetic aspects of water) shall remain in effect at all times for waters where the ~~ad~~ (av) footnote appears.

** The dividing line between "Ballona Creek" and "Ballona Creek to Estuary" is the point at which the vertical channel walls transition to sloping walls.

Footnotes are consistent for all beneficial use tables.

a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.

c: Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands table (2-4).

k: Public access to reservoir and its surrounding watershed is prohibited by Los Angeles County Department of Public Works.

m: Access prohibited by Los Angeles County Department in the concrete-channelized areas.

s: Access prohibited by Los Angeles County ~~DPW~~ Department of Public Works.

v: Public water supply reservoir. Owner prohibits public entry.

w: These areas are engineered channels. All references to Tidal Prisms in Regional Board documents are functionally equivalent to estuaries.

Table 2-1a. Beneficial Uses of Inland Surface Waters (Continued).

DOMINGUEZ CHANNEL WATERSHED					
Dominguez Channel Estuary (Ends at Vermont Ave.) [aw]	180701060102	Es		E	
Dominguez Channel (Estuary to 135th St.)	180701060102	Ps		E	Yav
Dominguez Channel (above 135th St)	180701060101	Ps		E	Yav
LOS ANGELES RIVER WATERSHED					
Los Angeles River Estuary (Ends at Willow St.) [aw]	180701050404	E		E	
Los Angeles River Reach 1 (Estuary to Carson St.)	180701050104	Es		E	Yav
Compton Creek	180701050404	Es		E	
Los Angeles River Reach 2 (Carson St. to Rio Hondo Reach 1)	180701050404	Es		E	Yav
Los Angeles River Reach 2 (Rio Hondo Reach 1 to Figueroa St.)	180701050408	Es		E	Yav
Rio Hondo Reach 1 (Los Angeles River Reach 2 to Santa Ana Freeway)	180701050408	Pm		E	Yav
Rio Hondo Reach 2 (Santa Ana Freeway to Whittier Narrows Dam)	180701050403	Im		E	Yav
Rio Hondo Reach 3 (above Whittier Narrows Dam)	180701050402	Im		E	Yav
Alhambra Wash	180701050403	Pm		I	
Rubio Wash	180701050403	Im		I	Yav
Rubio Canyon	180701050401	I		I	
Eaton Wash	180701050401	I		I	
Eaton Wash (below dam) (Rio Hondo Reach 3 to Eaton Dam)	180701050401	Im		I	Yav
Eaton Wash (above dam) (Eaton Dam to Mount Wilson Toll Rd.)	180701050401	I		I	
Eaton Reservoir	180701050401	P		H	
Eaton Canyon Creek (above Mount Wilson Toll Rd.)	180701050401	E		E	
Arcadia Wash	180701050302	Pm		I	Yav
Arcadia Wash	180701050302	Pm		I	Yav
Santa Anita Wash (lower) (Rio Hondo Reach 3 to Elkins Ave.)	180701050302	Pm		E	Yav
Santa Anita Wash (upper) (Elkins Ave. to Big Santa Anita Reservoir)	180701050302	Pm		E	
Little Santa Anita Canyon Creek	180701050302	I		I	
Big Santa Anita Reservoir	180701050302	Px		E	
Santa Anita Canyon Creek	180701050302	E		E	
Winter Creek	180701050302	I		E	
East Fork Santa Anita Canyon	180701050302	E		E	
Sawpit Wash	180701050302	Im		I	Yav
Sawpit Canyon Creek	180701050302	I		I	
Sawpit Reservoir	180701050302	Px		I	
Monrovia Canyon Creek	180701050302	I		I	
Arroyo Seco Reach 1 (Los Angeles River Reach 2 to Holly St.)	180701050209	I		I	
Arroyo Seco Reach 2 (Holly St. to Devils Gate Dam)	180701050209	Im		I	
Devils Gate Reservoir (lower)	180701050209	Im		I	
Devils Gate Reservoir (upper)	180701050209	I		I	
Arroyo Seco Reach 3 (above Devils Gate Dam)	180701050209	Em		E	
Millard Canyon Creek	180701050209	E		E	
El Prieto Canyon Creek	180701050209	I		I	
Little Bear Canyon Creek	180701050209	I		I	
Los Angeles River Reach 3 (Figueroa St. to Riverside Dr.)	180701050402	E		E	Yav
Verdugo Wash Reach 1 (Los Angeles River Rch 3 to Verdugo Rd./Towne St.)	180701050207	Pm		I	Yav
Verdugo Wash Reach 2 (above Verdugo Rd. @ Towne St.)	180701050207	Pm		I	Yav
Halls Canyon Channel	180701050207	Im		I	
Snover Canyon	180701050207	Im		I	Yav
Pickens Canyon	180701050207	Im		I	
Shields Canyon	180701050207	Im		I	Yav

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E,P, and I; shall be protected as required.

Footnotes are consistent for all beneficial use tables.
d: Limited public access precludes full utilization.
m: Access prohibited by Los Angeles County Department in the Concrete-channelized areas.
s: Access prohibited by Los Angeles County ~~DPW~~ Department of Public Works.
x: Owner prohibits entry.

av: The High Flow Suspension only applies to water contact recreational activities associated with the swimmable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use, non-contact water recreation involving incidental water contact regulated under the REC-2 use, and the associated bacteriological objectives set to protect those activities. Water quality objectives set to protect (1) other recreational uses associated with the fishable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use and (2) other REC-2 uses (e.g., uses involving the aesthetic aspects of water) shall remain in effect at all times for waters where the ~~(ad)~~ (av) footnote appears.

Table 2-1a. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	REC1	LREC-1	REC2	High Flow Suspension
LOS ANGELES RIVER WATERSHED (cont.)					
Dunsmore Canyon Creek	180701050207	I		I	
Burbank Western Channel	180701050208	Pm		I	Yav
La Tuna Canyon Lateral and Creek	180701050208	Im		I	
Tujunga Wash	180701050208	Pm		I	Yav
Hansen Flood Control Basin & Lakes	180701050105	E		E	
Lopez Canyon Creek	180701050105	Im		I	
Little Tujunga Canyon Creek	180701050104	I		E	
Kagel Canyon Creek	180701050104	Im		I	
Big Tujunga Canyon Creek (Hansen Flood Control Basin to Big Tujunga Reservoir)	180701050105	E		E	
Big Tujunga Canyon Creek (above Big Tujunga Reservoir)	180701050103	E		E	
Upper Big Tujunga Canyon Creek	180701050103	E		E	
Haines Canyon Creek	180701050105	Im		I	Yav
Vasquez Creek	180701050105	E		E	
Clear Creek	180701050105	E		E	
Big Tujunga Reservoir	180701050105	Pk		E	
Mill Creek	180701050102	E		E	
Los Angeles River Reach 4 (Riverside Dr. to Sepulveda Dam)	180701050208	E		E	Yav
Pacoima Wash	180701050206	Pm		E	
Pacoima Reservoir	180701050205	E		E	
Pacoima Canyon Creek	180701050205	E		E	
May Canyon Creek	180701050206	I		E	
Wilson Canyon Creek	180701050206	Em		E	Yav
Stetson Canyon Creek	180701050204	Pm		E	Yav
Los Angeles River Reach 5 (Sepulveda Dam to Balboa Blvd.)	180701050208	E		E	Yav
Sepulveda Flood Control Basin	180701050208	E		E	
Bull Creek	180701050204	Im		I	
Los Angeles Reservoir	180701050204	Pk		E	
Lower Van Norman Reservoir	180701050204	E		E	
Upper Van Norman Reservoir	180701050204	Pk,u			
Los Angeles River Reach 6 (above Balboa Blvd.)	180701050209	E		E	Yav
Caballero Creek	180701050208	Im		I	Yav
Aliso Canyon Wash (Los Angeles River Reach 6 to State Hwy 118)	180701050203	Im		I	Yav
Aliso Canyon Creek (above State Hwy 118)	180701050203	Im		I	Yav
Limekiln Canyon Wash	180701050203	Im		I	
Browns Canyon Wash (Los Angeles River Reach 6 to State Hwy 118)	180701050202	Im		I	
Browns Canyon Creek (above State Hwy 118)	180701050202	Im		I	
Arroyo Calabasas	180701050201	Pm		I	Yav
Dry Canyon Creek	180701050201	Im		I	
McCoy Canyon Creek	180701050201	I		I	
Bell Creek	180701050201	Im		I	Yav
Chatsworth Reservoir[y]	180701050201	P		E	
Dayton Canyon Creek	180701050201	I		I	

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E,P, and I shall be protected as required.
* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date (See pages 2-3, 4 for more details).

Footnotes are consistent for all beneficial use tables.
a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
k: Public access to reservoir and its surrounding watershed is prohibited by Los Angeles County Department of Public Works.
m: Access prohibited by Los Angeles County Department in the Concrete channelized areas.
u: This reservoir is covered and thus inaccessible.
y: Currently dry and no plans for restoration.

av: The High Flow Suspension only applies to water contact recreational activities associated with the swimmable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use, non-contact water recreation involving incidental water contact regulated under the REC-2 use, and the associated bacteriological objectives set to protect those activities. Water quality objectives set to protect (1) other recreational uses associated with the fishable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use and (2) other REC-2 uses (e.g., uses involving the aesthetic aspects of water) shall remain in effect at all times for waters where the (ad) (av) footnote appears.

Table 2-1a. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	REC1	LREC-1	REC2	High Flow Suspension
LOS ANGELES RIVER WATERSHED (cont.)					
ISOLATED LAKES AND RESERVOIRS:					
Eagle Rock Reservoir	180701050402	Pxu			
Echo Lake	180701040200	P		P	
El Dorado Lakes	180701060505	E		E	
Elysian Reservoir	180701050409	Pk		P	
Encino Reservoir	180701050208	Pk		E	
Machado Reservoir	180701040200	Pk		E	
Lincoln Park Lake Silver Reservoir	180701050109	P		E	
Silver Lake Reservoir	180701040200	Pk		E	
Toluca Lake	180701050208	Pk		E	
SAN GABRIEL RIVER WATERSHED					
San Gabriel River Estuary (Ends at Willow St.) [e,w]	180701060505	E		E	
Coyote Creek (San Gabriel River Estuary to La Canada Verde Creek)	180701060506	Pm		I	Yav
Coyote Creek (above La Canada Verde Creek)	180701060603	Pm		I	Yav
San Gabriel River Reach 1 (San Gabriel River Estuary to Firestone Blvd.)	180701060505	Em		E	Yav
San Gabriel River Reach 2 (Firestone Blvd. to Whittier Narrows Dam)	180701060606	Em		E	Yav
Whittier Narrows Flood Control Basin	180701060303	E		P	
Legg Lake	180701060303	E		E	
San Gabriel River Reach 3 (Whittier Narrows Dam to San Jose Creek)	180701060601	Im		I	Yav
San Gabriel River Reach 8 (San Jose Creek to Ramona Blvd.)	180701060601	Im		I	Yav
San Jose Creek Reach 1 (San Gabriel River Reach 3 to Temple Ave.)	180701060502	Pm		I	Yav
San Jose Creek Reach 2 (Temple Ave. to Thompson Wash)	180701060501	Pm		I	Yav
Puente Creek	180701060502	P		I	
Thompson Wash (San Jose Creek Reach 2 to Web Canyon)	180701060501	Im		I	Yav
Thompson Creek (above Web Canyon)	180701060501	I		I	
Thompson Creek Reservoir	180701060501	Px		I	
Walnut Creek Wash	180701060402	Im		I	
Big Dalton Wash	180701060402	Pm		I	Yav
Big Dalton Canyon Creek	180701060402	I		I	
Mystic Canyon	180701060402	I		I	
Big Dalton Reservoir	180701060402	Px		E	
Bell Canyon Creek	180701060402	I		I	
Little Dalton Wash	180701060402	Pm		I	
Little Dalton Canyon Creek	180701060402	I		I	
San Dimas Wash (lower) (Big Dalton wash to Ham Canyon)	180701060402	Im		I	Yav
San Dimas Wash (upper) (above Ham Canyon)	180701060401	Im		I	
San Dimas Reservoir	180701060401	Px		E	
San Dimas Canyon Creek	180701060401	E		E	
West Fork San Dimas Canyon	180701060401	E		E	
Wolfskill Canyon	180701060401	E		E	
Puddingstone Reservoir	180701060402	E		E	
Live Oak Wash	180701060402	I		I	
Live Oak Creek	180701060402	I		I	
Live Oak Reservoir	180701060402	E		E	
Puddingstone Wash	180701060402	Im		I	Yav
Marshall Creek and Wash (Puddingstone Reservoir to Via Arroyo)	180701060402	Im		I	Yav

E: Existing beneficial use

P: Potential beneficial use

I: Intermittent beneficial use

E,P, and I: shall be protected as required.

av: The High Flow Suspension only applies to water contact recreational activities associated with the swimmable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use, non-contact water recreation involving incidental water contact regulated under the REC-2 use, and the associated bacteriological objectives set to protect those activities. Water quality objectives set to protect (1) other recreational uses associated with the fishable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use and (2 other REC-2 uses (e.g., uses involving the aesthetic aspects of water) shall remain in effect at all times for waters where the ~~(ad)~~ (av) footnote appears.

Footnotes are consistent for all beneficial use tables.

m: Access prohibited by Los Angeles County Department in the Concrete-channelized areas.

u: This reservoir is covered and thus inaccessible.

x: Owner prohibits entry.

w: These areas are engineered channels. All references to Tidal Prisms in Regional Board documents are functionally equivalent to estuaries.

k: Public access to reservoir and its surrounding watershed is prohibited by Los Angeles County Department of Public Works.

Table 2-1a. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	REC1	LREC-1	REC2	High Flow Suspension
SAN GABRIEL RIVER WATERSHED (cont.)					
Marshall Creek and Wash (above Via Arroyo)	*180701060402*	Im		I	
Emerald Creek And Wash	*180701060402*	Im		I	Yav
San Gabriel River Reach 4 (Ramona Blvd. to Santa Fe Dam)	*180701060601*	Im		I	*Yav*
Santa Fe Flood Control Basin	*180701060601*	P		I	
UPPER SAN GABRIEL RIVER TRIBUTARIES					
San Gabriel River Reach 3 (Santa Fe Dam to Huntington Dr.)	*180701060601*	*Im*		*I*	*Yav*
San Gabriel River Reach 5 (Huntington Dr. to Van Tassel Canyon)	*180701060601*	*E*		*E*	
San Gabriel River Reach 5 (Van Tassel Canyon to San Gabriel Reservoir)	*180701060601*	E		E	
Bradbury Canyon Creek	*180701060601*	I		I	
Spinks Canyon Creek	*180701060601*	I		I	
Maddock Canyon Creek	*180701060601*	I		I	
Van Tassel Canyon	*180701060601*	I		I	
Fish Canyon Creek	*180701060601*	E		E	
Roberts Canyon Creek	*180701060601*	I		I	
Morris Reservoir	*180701060601*	P		E	
San Gabriel Reservoir	*180701060601*	E		E	
East Fork San Gabriel River (San Gabriel Reservoir to Fish Fork)	*180701060301*	E		E	
East Fork San Gabriel River (above Fish Fork)	*180701060303*	E		E	
Cattle Canyon Creek	*180701060302*	E		E	
Coldwater Canyon Creek	*180701060302*	E		E	
Iron Canyon Creek	*180701060302*	E		E	
Allison Gulch	*180701060303*	E		E	
Fish Fork	*180701060301*	E		E	
West Fork San Gabriel River (San Gabriel Reservoir to Bear Creek)	*180701060205*	E		E	
West Fork San Gabriel River (above Bear Creek)	*180701060202*	E		E	
North Fork San Gabriel River	*180701060204*	E		E	
Bichota Canyon	*180701060204*	E		E	
Coldbrook Creek	*180701060204*	I		I	
Soldier Creek	*180701060204*	I		I	
Cedar Creek	*180701060204*	E		E	
Crystal Lake	*180701060204*	E		E	
Bear Creek	*180701060205*	E		E	
Cogswell Reservoir	*180701060202*	E		E	
Devils Canyon Creek	*180701060201*	E		E	
ISLAND WATERCOURSES					
Anacapa Island	180600140203	P			
San Nicolas Island	180701070001	P			
Santa Barbara Island	180701070003	E		E	
Santa Catalina Island	180701070002	E		E	
Middle Ranch System	180701070003	E		E	
San Clemente Island	180701070004	E		E	
SAN ANTONIO CREEK WATERSHED [ab]					
San Antonio Dam And Reservoir		E		E	
San Antonio Canyon Creek		E		E	

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E,P, and I: shall be protected as required.

Footnotes are consistent for all beneficial use tables.
a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
m: Access prohibited by Los Angeles County Department in the Concrete-channelized areas.
ab: This watershed is also in Region 8 (801.23).

av: The High Flow Suspension only applies to water contact recreational activities associated with the swimmable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use, non-contact water recreation involving incidental water contact regulated under the REC-2 use, and the associated bacteriological objectives set to protect those activities. Water quality objectives set to protect (1) other recreational uses associated with the fishable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use and (2) other REC-2 uses (e.g., uses involving the aesthetic aspects of water) shall remain in effect at all times for waters where the ~~(ad)~~ (av) footnote appears.

Table 2-1a. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	WBD No.	REC1	LREC-1	REC2	High Flow Suspension
WETLAND[c]	WBD No.				
Ventura River Estuary c	180701010106	E		E	
Santa Clara River Estuary c	180701020304	E		E	
McGrath Lake c	180701030201	Ed		Ed	
Ormond Beach Wetlands c	180701030202	E		E	
Mugu Lagoon c	180701030202	Pn		E	
Dume Lagoon c	180701040403	E		E	
Malibu Lagoon c	180701040104	E		E	
Topanga Lagoon c	180701040501	E		E	
Ballona Lagoon/Venice Canals c	180701040502	E		E	
Ballona Wetlands c	180701040200	E		E	
Del Rey Lagoon c	180701040601	E		E	
Los Cerritos Wetlands c	180701080600	E		E	

*: This list may not be all inclusive. More areas may be added as information becomes available.
E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E,P, and I: shall be protected as required.

Footnotes are consistent for all beneficial use tables.
a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
c: Coastal waterbodies which are also listed in Inland Surface Waters Table (2-1) or in Wetlands Table (2-4).
d: Limited public access precludes full utilization.
n: Area is currently under control of the Navy: swimming is prohibited.

Table 2-2 Beneficial Uses of Ground Waters.[ac]

DWR[ad] Basin No.	BASIN	MUN	IND	PROC	AGR	AQUA
	PITAS POINT AREA aa	E	E	P	E	
4-1	UPPER OJAI VALLEY	E	E	E	E	
4-2	LOWER OJAI VALLEY	E	E	E	E	
4-3	VENTURA RIVER VALLEY					
4-3.01	Upper Ventura	E	E	E	E	
4-3.02	Lower Ventura	P	E	P	E	
4-4	SANTA CLARA RIVER VALLEY af					
4-4.02	Oxnard					
4-4.02	Oxnard Forebay	E	E	E	E	
4-4.02	Confined aquifers	E	E	E	E	
4-4.02	Unconfined and perched aquifers	E	P		E	
4-4.03	Mound					
4-4.03	Confined aquifers	E	E	E	E	
4-4.03	Unconfined and perched aquifers	E	P		E	
4-4.04	Santa Paula					
4-4.04	East of Peck Road	E	E	E	E	
4-4.04	West of Peck Road	E	E	E	E	
4-4.05	Fillmore					
4-4.05	Pole Creek Fan area	E	E	E	E	
4-4.05	South side of Santa Clara River	E	E	E	E	
4-4.05	Remaining Fillmore area	E	E	E	E	E
4-4.05	Topa Topa (upper Sespe) area	P	E	P	E	
4-4.06	Piru					
4-4.06	Upper area (above Lake Piru)	P	E	E	E	
4-4.06	Lower area east of Piru Creek	E	E	E	E	
4-4.06	Lower area west of Piru Creek	E	E	E	E	
4-4.07	*Santa Clara River Valley East*					
4-4.07	Mint Canyon	E	E	E	E	
4-4.07	South Fork	E	E	E	E	
4-4.07	Placerita Canyon	E	E	E	E	
4-4.07	Bouquet and San Francisquito Canyons	E	E	E	E	
4-4.07	Castaic Valley	E	E	E	E	
4-4.07	Saugus Aquifer	E				
4-5	ACTON VALLEY af					
4-5	Acton Valley	E	E	E	E	
4-5	Sierra Pelona Valley (Agua Dulce)	E	E		E	
4-5	Upper Mint Canyon	E	E	E	E	
4-5	Upper Bouquet Canyon	E	P	P	E	
4-5	Green Valley	E	P	P	E	
4-5	Lake Elizabeth - Lake Hughes area	E	P	P	E	
4-6	PLEASANT VALLEY ag					
4-6	Confined aquifers	E	E	E	E	
4-6	Unconfined and perched aquifers	P	E	E	E	
4-7	ARROYO SANTA ROSA VALLEY ag	E	E	E	E	
4-8	LAS POSAS VALLEY ag	E	E	E	E	
4-9	SIMI VALLEY					
	Simi Valley Basin					
	Confined aquifers	E	E	E	E	
	Unconfined aquifers	E	E	E	E	
	Gillibrand Basin	E	E	P	E	
4-10	CONEJO VALLEY	E	E	E	E	
4-11	COASTAL PLAIN OF LOS ANGELES					
4-11.01	Santa Monica	E	E	E	E	
4-11.02	Hollywood	E	E	E	E	
4-11.03	West Coast					
4-11.03	Underlying Ports of Los Angeles & Long Beach		E	E	E	
4-11.03	Underlying El Segundo, Seaward of Barrier		E	E	E	
4-11.03	Remainder of Basin	E	E	E	E	
4-11.04	Central	E	E	E	E	
4-12	SAN FERNANDO VALLEY	Eah	E	E	E	
4-13	SAN GABRIEL VALLEY ai	E	E	E	E	
4-15	TIERRA REJADA	E	P	P	E	
4-16	HIDDEN VALLEY	E	P		E	
4-17	LOCKWOOD VALLEY	E	E		E	
4-18	HUNGRY VALLEY	E	P	E	E	
4-19	THOUSAND OAKS AREA aj	PE	PE	E	E	
4-19	Triunfo Canyon area	P	P		E	
4-19	Lindero Canyon area	P	P		E	
4-19	Las Virgenes Canyon area	P	P		E	
4-20	RUSSELL VALLEY	E	P		E	
4-21	CONEJO-TIERRA REJADA VOLCANIC ak	E			E	
4-22	MALIBU VALLEY al					
4-22	Camarillo area	E	P		E	
4-22	Point Dume area	E	P		E	
4-22	Malibu Valley	P	P		E	
4-22	Topanga Canyon area	P	P		E	
4-23	RAYMOND	E	E	E	E	
	SAN PEDRO CHANNEL ISLANDS am					
	Anacapa Island	P	P			
	San Nicolas Island	E	P			
	Santa Catalina Island	E	P		E	
	San Clemente Island	P	P			
	Santa Barbara Island	P	P			

E: Existing beneficial use
P: Potential beneficial use
See pages 2-1 to 2-3 for description of beneficial use

Footnotes are consistent for all beneficial use tables

ac: Beneficial uses for ground waters outside of the major basins listed on this table and outlined in Fig 1-9 have not been specifically listed. However, ground waters outside of the major basins are, in many cases, significant sources of water. ~~Further existing sources of water for downgradient basins, and such, beneficial uses in the downgradient basins shall apply to these areas.~~ Furthermore, ground waters outside of the major basins are either potential or existing sources of water for downgradient basins, and as such, beneficial uses in the downgradient basins shall apply to these areas.

ad: Basins are numbered according to DWR Bulletin No. 118-Update 2003 (DWR, 2003).
aa: Ground waters in the Pitas Point area (between the lower Ventura River and Rincon Point) are not considered to comprise a major basin and, accordingly, have not been designated a basin number by the DWR or outlined on Fig. 1-9.
af: Santa Clara River Valley Basin was formerly Ventura Central Basin and Acton Valley Basin was formerly Upper Santa Clara Basin (DWR, 1980)
ag: Pleasant Valley, Arroyo Santa Rosa Valley, and Las Posas Valley Basins were formerly subbasins of Ventura Central (DWR, 1980).
ah: Nitrite pollution in the groundwater of the Sunland-Tujunga area currently precludes direct MUN uses. Since the ground water in this area can be treated or blended (or both), it retains the MUN designation.
ai: Raymond Basin was formerly a subbasin of San Gabriel Valley and is now a separate basin. ~~Monk Hill subbasin is now part of San Fernando Valley Basin (DWR, 2003).~~ The Main San Gabriel Basin was formerly separated into Eastern and Western areas. Since these areas had the same beneficial uses as Puente Basin all three areas have been combined into San Gabriel Valley. Any ground water upgradient of these areas is subject to downgradient beneficial uses and objectives, as explained in Footnote ac.
aj: These areas were formerly part of the Russell Valley Basin (DWR, 1980)
ak: Groundwater in the Conejo-Tierra Rejada Volcanic Area occurs primarily in fractured volcanic rocks in the western Santa Monica Mountains and Conejo Mountain areas. These areas have not been delineated on Fig. 1-9.
al: With the exception of ground water in Malibu Valley (DWR Basin No. 4-22) ground waters along the southern slopes of the Santa Monica Mountains are not considered to comprise a major basin and accordingly have not been designated a basin number by DWR
am: DWR has not designated basins for groundwaters on the San Pedro Channel Islands.

Table 2-3. Beneficial Uses of Coastal Waters.

COASTAL FEATURE[a]	WBD No.	MUN	IND	PROC	NAV	POW	COMM	WARM	COLD	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WETb
VENTURA COUNTY COASTAL																		
Nearshore ^			E		E		E				E	E	Ean	Ea	Ef	Ef	E	
Offshore Zone					E		E				E	E		Ee	Ef	Ef	E	
Rincon Beach	180701010201				E		E				E	E			I		E	
Ventura River Estuary c	180701010106				E		E	E		E	E	E		Ea	Ef	Ef	E	E
Ventura Keys (Marina)	180701010202				E		E	E			E	E						
Ventura Marina	180701010904		E		E		E				E	E					E	
Santa Clara River Estuary c	180701010904				E		E			E	E	E		Ea	Ef	Ef		E
Mandalay Beach	180701010201				E		E				E	E		Ea			E	
McGrath Lake c	180701010201						P			E		E		Eo				E
Edison Canal Estuary	180701010201		E								E	E		Ea				
Channel Islands Harbor	180701010201		E		E		E				E	E						
Mandalay Bay (Marina)	180701010201		E		E						E	E						
Port Hueneme (Harbor)	180701010201			E	E		E				E	E						
Ormond Beach	180701010201		E		E	E	E				E	E		Eo		P	E	
Ormond Beach Wetlands c	180701010202									E		E		Ee				E
Mugu Lagoon c	180701010202				E		Ed			E	E	Eo	E	Ea,p	Ef	Ef	Ed	E
Calleguas Creek Estuary c	180701010202				P		E			E		E		Ea,p	Ef	Ef		E
LOS ANGELES COUNTY COASTAL																		
Nearshore Zone ^			E		E		E				E	E	Ean	Ee	Ef	Ef	Ear	
Offshore Zone			E		E		E				E	E		Ee	Ef	Ef	E	
Nicholas Canyon Beach	180701040402				E		E				E	E				P	E	
Trancas Beach	180701040403				E		E				E	E				P	E	
Zuma County (Westward) Beach	180701040403				E		E				E	E				P	Ear	
Dume State Beach	180701040404				E		E				E	E				P	E	
Dume Lagoon c	180701040403				E		E			E		E		Ee	Pf	Pf		E
Escondido Beach	180701040404				E		E				E	E				P	E	
Dan Blocker Memorial (Corral) Beach	180701040404				E		E				E	E				P	E	

*: This list may not be all inclusive. More areas may be added as information becomes available.

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E,P, and I: shall be protected as required.
^: Nearshore is defined as the zone bounded by the shoreline or the 30-foot depth contours, whichever is further from the shoreline. Longshore extent is from Rincon Creek to the San Gabriel River Estuary.

Footnotes are consistent for all beneficial use tables.

a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.

b: Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.

c: Coastal waterbodies which are also listed in inland Surface Waters Tables (2-1) or in Wetlands Table (2-4).

d: Limited public access precludes full utilization.

e: One or more rare species utilizes all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.

f: Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.

o: Marine Habitats of the Channel Islands and Mugu Lagoon serve as pinniped haul-out areas for one or more species (i.e. sea lions)

p: Habitat of the Clapper Rail.

an: Areas of Special Biological Significance (along coast from Latigo Point to Laguna Point) and Big Sycamore Canyon and Abalone Cove Ecological Reserves and Point Fermin Marine Life Refuge.

ar: Areas exhibiting large shellfish populations include Malibu, Point Dume, Point Fermin, White Point and Zuma Beach.

Table 2-3. Beneficial Uses of Coastal Features (Continued).

COASTAL FEATURE*	WBD No.	MUN	IND	PROC	NAV	POW	COMM	WARM	COLD	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WETb
LOS ANGELES COUNTY COASTAL (CONT.)																		
Puerco Beach	180701040404				E		E				E	E				P	E	
Amarillo Beach	180701040404				E		E				E	E				P	E	
Malibu Beach	180701040404				E		E				E	E			E	Eas	Ear	
Malibu Lagoon c	180701040404				E					E	E	E		Ee	Ef	Ef		E
Carbon Beach	180701040502				E		E				E	E				P	E	
La Costa Beach	180701040502				E		E				E	E				P	E	
Las Flores Beach	180701040502				E		E				E	E				P	E	
Las Tunas Beach	180701040502				E		E				E	E				P	E	
Topanga Beach	180701040502				E		E				E	E				P	E	
Topanga Lagoon c	180701040501				E		E			E		E		Ee	Ef	Ef		E
Will Rogers State Beach	180701040502				E		E				E	E				P	E	
Santa Monica Beach	180701040502				E		E				E	E			E	Eas	E	
Venice Beach	180701040502				E		E				E	E		E	E	Eas	E	
Marina Del Rey																		
Harbor	180701040502				E		E				E	E					E	
Public Beach Areas	180701040502				E		E				E	E		E				
All other Areas	180701040502				E		E				E	E		E			E	
Entrance Channel	180701040502				E		E				E	E		E			E	
Ballona Creek Estuary c, w	180701040200				E		E			E	E	E		Ee	Ef	Ef	E	
Ballona Lagoon/Venice Canals c	180701040502				E		E			E	E	E		Ee	Ef	Ef	E	E
Ballona Wetlands c	180701040200									E		E		Ee	Ef	Ef		E
Del Rey Lagoon c	180701040601				E		E			E		E		Ee	Ef	Ef		E
Dockweiler Beach	180701040601		E		E		E				E	E				P		
Manhattan Beach	180701040601				E		E				E	E				P	E	
Hermosa Beach	180701040601				E		E				E	E				Eas	E	
King Harbor	180701040601		E		E		E				E	E		E				
Redondo Beach	180701040601		E		E		E				E	E		E	E	Eas	E	
Torrance Beach	180701040601				E		E				E	E			E	Eas	E	
Point Vicente Beach	180701040601				E		E				E	E				P	E	
Royal Palms Beach	180701040601				E		E				E	E				P	E	

*: This list may not be all inclusive. More areas may be added as information becomes available.

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E,P, and I: shall be protected as required.

Footnotes are consistent for all beneficial use tables.
a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b: Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
c: Coastal waterbodies which are also listed in inland Surface Waters Tables (2-1) or in Wetlands Table (2-4).
e: One or more rare species utilizes all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.
f: Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.
ar: Areas exhibiting large shellfish populations include Malibu, Point Dume, Point Fermin, White Point and Zuma Beach
as: Most frequently used grunion spawning beaches. Other beaches may be used as well.
w: These areas are engineered channels. All references to Tidal Prisms in Regional Board documents are functionally equivalent to estuaries.

Table 2-3. Beneficial Uses of Coastal Features (Continued).

LOS ANGELES COUNTY COASTAL (Cont.)																		
Whites Point County Beach	180701040601				E		E				E	E				P	E	
Cabrillo Beach	180701040302				E		E				E	E			E	Eas	E	
Los Angeles - Long Beach Harbor	180701040602																	
Outer Harbor	180701040602				E		E				E			E			P	
Marinas	180701040602		E		E		E				E			E			P	
Public Beach Areas	180701040602				E		E				E	E		E		P	E	
All Other Inner Areas	180701040602		E		E		E				E			Ea			P	
Dominguez Channel Estuary c,w	180701040302				P		E			E	E	E		Ea	Ef	Ef		
Los Angeles River Estuary c,w	180701040404		E		E		E			E	E	E		Ea	Ef	Ef	P	E
Alamitos Bay	180701040600		E		E		E			E	E	E		E			E	E
Los Cerritos Wetlands c	180701040600				E		E			E		E		Ea	Pf	Pf	E	E
Los Cerritos Channel Estuary c	180701040600		E		E		E			E	E	E		Ea	Ef	Ef	E	
San Gabriel Estuary c, w	180701040506		E		E		E			E	E	E		Ea	Ef	Ef	P	
Long Beach Marina	180701040600						E				E			E			E	
Public Beach Areas	180701040600				E		E				E			E		P		
All other Areas	180701040600						E				E			E			P	
Marine Stadium	180701040600						E				E			E			E	
Long Beach	180701040600				E		E				E	E			E	Eas	E	
ISLANDS:NEARSHORE ZONES ^																		
Anacapa Island	180600140203				E		E				E	Eo	Eat	E		P	E	
San Nicolas Island	180701070001				E		E				E	Eo	Eat	E		P	E	
Begg Rock Nearshore Zone	180701070001						E				E	Eo	Eat	E		P	E	
Santa Barbara Island	180701070003				E		E				E	Eo	Eat	E		P	E	
Santa Catalina Island	180701070003				E		E				E	Eo	Eat	E		P	E	
Santa Catalina Island	180701070002				E		E				E	Eo	Eat	E		P	E	
San Clemente Island	180701070004				E		E				E	Eo	Eat	E		P	E	

*: This list may not be all inclusive. More areas may be added as information becomes available.

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E,P, and I: shall be protected as required.
*Asterisked MUN designations are designated under SB 88-63 and RB-03. Some designations may be considered for exemptions at a later date (See pages 2-3 and 2-4 for more details).
^: Nearshore is defined as the zone bounded by the shoreline and a line 1000 feet from the shoreline or the 30-foot depth contours, whichever is further from the shoreline.

Footnotes are consistent for all beneficial use tables.
a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b: Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
c: Coastal waterbodies which are also listed in Inland Surface Waters Tables (2-1) or in Wetlands Table (2-4).
e: One or more rare species utilizes all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.
f: Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.
o: Marine Habitats of the Channel Islands and Mugu Lagoon serve as pinniped haul-out areas for one or more species (i.e., sea lions).
w: These areas are engineered channels. All references to Tidal Prisms in Regional Board documents are functionally equivalent to estuaries.
as: Most frequently used grunion spawning beaches. Other beaches may be used as well.
at: Areas of Special Biological Significance or ecological reserves.

Table 2-4. Beneficial Uses of Significant Coastal Wetlands.*

WETLAND[a]	WBD No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
Ventura River Estuary c	180701010106							E		E		E			E	E	E		Ee	Ef	Ef	E	E
Santa Clara River Estuary c	180701020904							E		E					E	E	E		Ee	Ef	Ef		E
McGrath Lake c	180701030201									P					E		E		Ee				E
Ormond Beach Wetlands c	180701030202														E		E		Ee				E
Mugu Lagoon c	180701030202							E		Ed					E	E	Eo	E	Ee,p	Ef	Ef	Eo	E
Dume Lagoon c	180701040403							E		E					E		E		Ee	Pf	Pf		E
Malibu Lagoon c	180701040104							E							E	E	E		Ee	Ef	Ef		E
Topanga Lagoon c	180701040501							E		E					E		E		Ee	Ef	Ef		E
Ballona Lagoon/Venice Canals c	180701040502							E		E					E	E	E		Ee	Ef	Ef	E	E
Ballona Wetlands c	180701040200														E		E		Ee	Ef	Ef		E
Del Rey Lagoon c	180701040801							E		E					E		E		Ee	Ef	Ef		E
Los Cerritos Wetlands c	180701060600							E		E					E		E		Ee	Pf	Pf	E	E

*: This list may not be all inclusive. More areas may be added as information becomes available.

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I: shall be protected as required

Footnotes are consistent for all beneficial use tables.

a: Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.

b: Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.

c: Coastal waterbodies which are also listed in Inland Surface Waters Tables (2-1) or in Wetlands Table (2-4).

d: Limited public access precludes full utilization.

e: One or more rare species utilizes all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.

f: Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.

o: Marine Habitats of the Channel Islands and Mugu Lagoon serve as pinniped haul-out areas for one or more species (i.e. sea lions)

p: Habitat of the Clapper Rail.

3. WATER QUALITY OBJECTIVES

Table of Contents

Introduction

The Clean Water Act (§303) requires states to develop water quality standards for all waters and to submit to the USEPA for approval all new or revised water quality standards which are established for inland surface and ocean waters. Water quality standards consist of a combination of beneficial uses (designated in Chapter 2) and water quality objectives (contained in this Chapter).

In addition to the federal mandate, the California Water Code (§13241) specifies that each Regional Water Quality Control Board shall establish water quality objectives. The Water Code defines water quality objectives as "the allowable limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area." Thus, water quality objectives are intended (i) to protect the public health and welfare and (ii) to maintain or enhance water quality in relation to the designated existing and potential beneficial uses of the water. Water quality objectives are achieved through Waste Discharge Requirements and other programs outlined in Chapter 4, Strategic Planning and Implementation. These objectives, when compared with future water quality data, also provide the basis for identifying trends toward degradation or enhancement of regional waters.

These water quality objectives supersede those contained in all previous Basin Plans and amendments adopted by the Los Angeles Regional Board. As new information becomes available, the Regional Board will review the objectives contained herein and develop new objectives as necessary. In addition, this Plan will be reviewed every three years (triennial review) to determine the need for modification.

Statement of Policy with Respect to Maintaining High Quality of Waters in California

A key element of California's water quality standards is the state's Antidegradation Policy. This policy, formally referred to as the *Statement of Policy with Respect to Maintaining High Quality Waters in California* (State Board Resolution No. 68-16), restricts degradation of surface or ground waters. In particular, this policy protects waterbodies where existing quality is higher than is necessary for the protection of beneficial uses.

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 68-16

STATEMENT OF POLICY WITH RESPECT TO MAINTAINING HIGH QUALITY OF WATERS IN CALIFORNIA

WHEREAS the California Legislature has declared that it is the policy of the State that the granting of permits and licenses for unappropriated water and the disposal of wastes into the waters of the State shall be so regulated as to achieve highest water quality consistent with maximum benefit to the people of the State and shall be controlled so as to promote the peace, health, safety and welfare of the people of the State; and

WHEREAS water quality control policies have been and are being adopted for waters of the State; and

WHEREAS the quality of some waters of the State is higher than that established by the adopted policies and it is the intent and purpose of this Board that such higher quality shall be maintained to the maximum extent possible consistent with the declaration of the Legislature;

NOW, THEREFORE, BE IT RESOLVED:

1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

2. Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

3. In implementing this policy, the Secretary of the Interior will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act.

BE IT FURTHER RESOLVED that a copy of this resolution be forwarded to the Secretary of the Interior as part of California's water quality control policy submission.

CERTIFICATION

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on October 24, 1968.

Dated: October 28, 1968

Original signed by
Kerry W. Mulligan, Executive Officer
State Water Resources Control Board

Under the Antidegradation Policy, any actions that can adversely affect water quality in all surface and ground waters (i) must be consistent with the maximum benefit to the people of the state, (ii) must not unreasonably affect present and anticipated beneficial use of such water, and (iii) must not result in water quality less than that prescribed in water quality plans and policies. Furthermore, any actions that can adversely affect surface waters are also subject to the federal Antidegradation Policy (40 CFR 131.12), developed under the CWA. The USEPA, Region IX, has also issued detailed guidance for the implementation of federal antidegradation regulations for surface waters within its jurisdiction (USEPA, 1987).

Regional Objectives for Inland Surface Waters

Narrative or numerical water quality objectives have been developed for the following parameters (listed alphabetically) and apply to all inland surface waters and enclosed bays and estuaries (including wetlands) in the Region. *Water quality objectives are in italics.*

Ammonia

The neutral, un-ionized ammonia species (NH_3) is highly toxic to fish and other aquatic life. The ratio of toxic NH_3 to total ammonia ($NH_4^+ + NH_3$) is primarily a function of pH, but is also affected by temperature and other factors. Additional impacts can also occur as the oxidation of ammonia lowers the dissolved oxygen content of the water, further stressing aquatic organisms. Ammonia also combines with chlorine (often both are present) to form chloramines - persistent toxic compounds that extend the effects of ammonia and chlorine downstream.

Oxidation of ammonia to nitrate may lead to groundwater impacts in areas of recharge.

In order to protect aquatic life, ammonia concentrations in receiving waters shall not exceed the values listed for the corresponding instream conditions in Tables 3-1 to 3-4.

Timing of compliance with this objective will be determined on a case-by-case basis. Discharges will have up to 8 years following the adoption of this plan by the Regional Board to (i) make the necessary adjustments/improvements to meet these objectives or (ii) to conduct studies leading to an approved site-specific objective for ammonia. If it is determined that there is an immediate threat or impairment of beneficial uses due to ammonia, the objectives in Tables 3-1 to 3-4 shall apply.

In order to protect underlying groundwater basins, ammonia shall not be present at levels that when oxidized to nitrate, pose a threat to groundwater.

Bacteria, Coliform

Total and fecal coliform bacteria are used to indicate the likelihood of pathogenic bacteria in surface waters. Water quality objectives for total and fecal coliform vary with the beneficial uses of the waterbody and are described below:

In waters designated for water contact recreation (REC-1), the fecal coliform concentration shall not exceed a log mean of 200/100 ml (based on a minimum of not less than four samples for any 30-day period), nor shall more than 10 percent of total samples during any 30-day period exceed 400/100 ml.

In waters designated for non-water contact recreation (REC-2) and not designated for water contact recreation (REC-1), the fecal coliform concentration shall not exceed a log mean of 2000/100 ml (based on a minimum of not less than four samples for any 30-day period), nor shall more than 10 percent of samples collected during any 30-day period exceed 4000/100 ml.

In all waters where shellfish can be harvested for human consumption (SHELL), the median total coliform concentration throughout the water column for any 30-day period shall not exceed 70/100 ml, nor shall more than ten percent of the samples collected during any 30-day period exceed 230/100 ml for a five-tube decimal dilution test or 330/100 ml when a three-tube decimal dilution test is used.

Table 3-1. One-hour Average Concentration for Ammonia[1,2] for Waters Designated as COLD (Salmonids or Other Sensitive Coldwater Species Present).

pH	Temperature, °C						
	0	5	10	15	20	25	30
	Un-ionized ammonia (mg/liter NH_3)						
6.50	0.0091	0.0129	0.0182	0.026	0.036	0.036	0.036
6.75	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
7.00	0.023	0.033	0.046	0.066	0.093	0.093	0.093
7.25	0.034	0.048	0.068	0.095	0.135	0.135	0.135
7.50	0.045	0.064	0.091	0.128	0.181	0.181	0.181
7.75	0.056	0.080	0.113	0.159	0.22	0.22	0.22
8.00	0.065	0.092	0.130	0.184	0.26	0.26	0.26
8.25	0.065	0.092	0.130	0.184	0.26	0.26	0.26
8.50	0.065	0.092	0.130	0.184	0.26	0.26	0.26
8.75	0.065	0.092	0.130	0.184	0.26	0.26	0.26
9.00	0.065	0.092	0.130	0.184	0.26	0.26	0.26
	Total ammonia (mg/liter NH_3)						
6.50	35	33	31	30	29	20	14.3
6.75	32	30	28	27	27	18.6	13.2
7.00	28	26	25	24	23	16.4	11.6
7.25	23	22	20	19.7	19.2	13.4	9.5
7.50	17.4	16.3	15.5	14.9	14.6	10.2	7.3
7.75	12.2	11.4	10.9	10.5	10.3	7.2	5.2
8.00	8.0	7.5	7.1	6.9	6.8	4.8	3.5
8.25	4.5	4.2	4.1	4.0	3.9	2.8	2.1
8.50	2.6	2.4	2.3	2.3	2.3	1.71	1.28
8.75	1.47	1.40	1.37	1.38	1.42	1.07	0.83
9.00	0.86	0.83	0.83	0.86	0.91	0.72	0.58

1 To convert these values to mg/liter N, multiply by 0.822

2 Source: USEPA, 1986

Table 3-2. One-hour Average Concentration for Ammonia[1,2] for Waters Designated as WARM (Salmonids or Other Sensitive Coldwater Species Absent).

pH	Temperature, °C				
	0	5	10	15	20
Un-ionized ammonia (mg/liter NH_3)					
6.50	0.0091	0.0129	0.0182	0.026	0.036
6.75	0.0149	0.021	0.030	0.042	0.059
7.00	0.023	0.033	0.046	0.066	0.093
7.25	0.034	0.048	0.068	0.095	0.135
7.50	0.045	0.064	0.091	0.128	0.181
7.75	0.056	0.080	0.113	0.159	0.22
8.00	0.065	0.092	0.130	0.184	0.26
8.25	0.065	0.092	0.130	0.184	0.26
8.50	0.065	0.092	0.130	0.184	0.26
8.75	0.065	0.092	0.130	0.184	0.26
9.00	0.065	0.092	0.130	0.184	0.26
Total ammonia (mg/liter NH_3)					
6.50	35	33	31	30	29
6.75	32	30	28	27	27
7.00	28	26	25	24	23
7.25	23	22	20	19.7	19.2
7.50	17.4	16.3	15.5	14.9	14.6
7.75	12.2	11.4	10.9	10.5	10.3
8.00	8.0	7.5	7.1	6.9	6.8
8.25	4.5	4.2	4.1	4.0	3.9
8.50	2.6	2.4	2.3	2.3	2.3
8.75	1.47	1.40	1.37	1.38	1.42
9.00	0.86	0.83	0.83	0.86	0.91

1 To convert these values to mg/liter N, multiply by 0.822

2 Source: USEPA, 1986

Table 3-3. Four-day Average Concentration for Ammonia[1,2] for Waters Designated as COLD (Salmonids or Other Sensitive Coldwater Species Present).

pH	Temperature, °C						
	0	5	10	15	20	25	30
	Un-ionized ammonia (mg/liter NH_3)						
6.50	0.0008	0.0011	0.0016	0.0022	0.0022	0.0022	0.0022
6.75	0.0014	0.0020	0.0028	0.0039	0.0039	0.0039	0.0039
7.00	0.0025	0.0035	0.0049	0.0070	0.0070	0.0070	0.0070
7.25	0.0044	0.0062	0.0088	0.0124	0.0124	0.0124	0.0124
7.50	0.0078	0.0111	0.0156	0.022	0.022	0.022	0.022
7.75	0.0129	0.0182	0.026	0.036	0.036	0.036	0.036
8.00	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
8.25	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
8.50	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
8.75	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
9.00	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
	Total ammonia (mg/liter NH_3)						
6.50	3.0	2.8	2.7	2.5	1.76	1.23	0.87
6.75	3.0	2.8	2.7	2.6	1.76	1.23	0.87
7.00	3.0	2.8	2.7	2.6	1.76	1.23	0.87
7.25	3.0	2.8	2.7	2.6	1.77	1.24	0.88
7.50	3.0	2.8	2.7	2.6	1.78	1.25	0.89
7.75	2.8	2.6	2.5	2.4	1.66	1.17	0.84
8.00	1.82	1.70	1.62	1.57	1.10	0.78	0.56
8.25	1.03	0.97	0.93	0.90	0.64	0.46	0.33
8.50	0.58	0.55	0.53	0.53	0.38	0.28	0.21
8.75	0.34	0.32	0.31	0.31	0.23	0.173	0.135
9.00	0.195	0.189	0.189	0.195	0.148	0.116	0.094

1 To convert these values to mg/liter N, multiply by 0.822.

2 Source: USEPA, 1992

Table 3-4. Four-day Average Concentration for Ammonia[1,2] for Waters Designated as WARM (Salmonids or Other Sensitive Coldwater Species Absent).

pH	Temperature, °C						
	0	5	10	15	20	25	30
Un-ionized ammonia (mg/liter NH_3)							
6.50	0.0008	0.0011	0.0016	0.0022	0.0031	0.0031	0.0031
6.75	0.0014	0.0020	0.0028	0.0039	0.0055	0.0055	0.0055
7.00	0.0025	0.0035	0.0049	0.0070	0.0099	0.0099	0.0099
7.25	0.0044	0.0062	0.0088	0.0124	0.0175	0.0175	0.0175
7.00	0.0078	0.0111	0.0156	0.022	0.031	0031	0.031
7.75	0.0129	0.0182	0.026	0.036	0.051	0.051	0.051
8.00	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
8.25	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
8.50	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
8.75	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
9.00	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
Total ammonia (mg/liter NH_3)							
6.50	3.0	2.8	2.7	2.5	2.5	1.73	1.23
6.75	3.0	2.8	2.7	2.6	2.5	1.74	1.23
7.00	3.0	2.8	2.7	2.6	2.5	1.74	1.23
7.25	3.0	2.8	2.7	2.6	2.5	1.75	1.24
7.50	3.0	2.8	2.7	2.6	2.5	1.76	1.25
7.75	2.8	2.6	2.5	2.4	2.3	1.65	1.18
8.00	1.82	1.70	1.62	1.57	1.55	1.10	0.79
8.25	1.03	0.97	0.93	0.90	0.90	0.64	0.47
8.50	0.58	0.55	0.53	0.53	0.53	0.39	0.29
8.75	0.34	0.32	0.31	0.31	0.32	0.24	0.190
9.00	0.195	0.189	0.189	0.195	0.21	0.163	0.133

1 To convert these values to mg/liter N, multiply by 0.822.

2 Source: USEPA, 1992

Bioaccumulation

Many pollutants can bioaccumulate in fish and other aquatic organisms at levels which are harmful for both the organisms as well as organisms that prey upon these species (including humans).

Toxic pollutants shall not be present at levels that will bioaccumulate in aquatic life to levels which are harmful to aquatic life or human health.

Biochemical Oxygen Demand (BOD_5)

The 5-day BOD test indirectly measures the amount of readily degradable organic material in water by measuring the residual dissolved oxygen after a period of incubation (usually 5 days at 20 °C), and is primarily used as an indicator of the efficiency of wastewater treatment processes.

Waters shall be free of substances that result in increases in the BOD which adversely affect beneficial uses.

Biostimulatory Substances

Biostimulatory substances include excess nutrients (nitrogen, phosphorus) and other compounds that stimulate aquatic growth. In addition to being aesthetical unpleasant (causing taste, odor, or color problems), this excessive growth can also cause other water quality problems.

Waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growth causes nuisance or adversely affects beneficial uses.

Chemical Constituents

Chemical constituents in excessive amounts in drinking water are harmful to human health. Maximum levels of chemical constituents in drinking waters are listed in the California Code of Regulations and the relevant limits are described below.

Surface waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use.

Water designated for use as Domestic or Municipal Supply (MUN) shall not contain concentrations of chemical constituents in excess of the limits specified in the following provisions of Title 22 of the California Code of Regulations which are incorporated by reference into this plan: Table 64431-A of Section 64431 (Inorganic Chemicals), Table 64431-B of Section 64431 (Fluoride), and Table 64444-A of Section 64444 (Organic Chemicals). This incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect. (See Tables 3-5, 3-6, and 3-7.)

Table 3-5. The Maximum Contaminant Levels: Inorganic Chemicals (for MUN beneficial use) specified in Table 64431-A of Section 64431 of Title 22 of the California Code of Regulations as of 9-8-94.

Constituent	Maximum Contaminant Level mg/L
Aluminum	1.
Antimony	0.006
Arsenic	0.05
Asbestos	7 MFL*
Barium	1.
Beryllium	0.004
Cadmium	0.005
Chromium	0.05
Cyanide	0.2
Mercury	0.002
Nickel	0.1
Nitrate (as NO_3)	45.
Nitrate + Nitrite (sum as nitrogen)	10.
Nitrite (as nitrogen)	1.
Selenium	0.05
Thallium	0.002

* MFL = million fibers per liter; MCL for fibers exceeding 10 μm in lenght

Table 3-6. The Limiting and Optimum Concentrations for Fluoride (for MUN beneficial use) specified in Table 64431-B of Section 64431 of Title 22 of the California Code of Regulations as of 9-8-94.

Annual Average of Maximum Daily Air Temperature (°F)	Fluoride Concentration (mg/L)			
	Lower	Optimum	Upper	Maximum Concentration Level
53.7 and below	0.9	1.2	1.7	2.4
53.8 to 58.3	0.8	1.1	1.5	2.2
58.4 to 63.8	0.8	1.0	1.3	2.0
63.9 to 70.6	0.7	0.9	1.2	1.8
70.7 to 79.2	0.7	0.8	1.0	1.6
79.3 to 90.5	0.6	0.7	0.8	1.4

Chlorine, Total Residual

Disinfection of wastewaters with chlorine produces a chlorine residual. Chlorine and its reaction products are toxic to aquatic life.

Chlorine residual shall not be present in surface water discharges at concentrations that exceed 0.1 mg/L and shall not persist in receiving waters at any concentration that causes impairment of beneficial uses.

Color

Color in water can result from natural conditions (e.g., from plant material or minerals) or can be introduced from commercial or industrial sources. Color is primarily an aesthetic consideration, although extremely dark colored water can limit light penetration and cause additional water quality problems. Furthermore, color can impact domestic and industrial uses by discoloring clothing or foods. The secondary drinking water standard is 15 color units (DHS, 1992).

Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses.

Exotic Vegetation

Exotic (non-native) vegetation introduced in and around stream courses is often of little value as habitat (food and cover) for aquatic-dependent biota. Exotic plants can quickly out-compete native vegetation and cause other water quality impairments.

Exotic vegetation shall not be introduced around stream courses to the extent that such growth causes nuisance or adversely affects beneficial uses.

Floating Material

Floating materials can be an aesthetic nuisance as well as provide substrate for undesirable bacterial and algal growth and insect vectors.

Waters shall not contain floating materials, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

Table 3-7. The Maximum Contaminant Levels: Organic Chemicals (for MUN beneficial use) specified in Table 64444-A of Section 64444 of Title 22 of the California Code of Regulations as of 9-8-94.

Constituent	Maximum Contaminant Level mg/L
A. Volatile Organic Chamicals (VOCs)	
Benzene	0.001
Carbon Tetrachloride	0.0005
1,2-Dichlorobenzene	0.6
1,4-Dichlorobenzene	0.005
1,1-Dichloroethane	0.005
1,2-Dichloroethane	0.0005
1,1-Dichloroethylene	0.006
cis-1,2-Dichloroethylene	0.006
trans-1,2-Dichloroethylene	0.01
Dichloromethane	0.005
1,2-Dichloropropane	0.005
1,3-Dichloropropene	0.0005
Ethylbenzene	0.7
Monochlorobenzene	0.07
Styrene	0.1
1,1,2,2-Tetrachlorethane	0.001
Tetrachloroethylene	0.005
Toluene	0.15
1,2,4-Trichlorobenzene	0.07
1,1,1-Trichloroethane	0.200
1,1,2-Trichloroethane	0.005
Trichloroethylene	0.005
Trichlorofluoromethane	0.15
1,1,2-Trichloro-1,2,2-Trifluoroethane	1.2
Vinyl Chloride	0.0005
Xylenes (single isomer or sum of isomers)	1.750
B. Non-Volatile Synthetic Organic Chemicals (SOCs)	
Alachlor	0.002
Atrazine	0.003
Bentazon	0.018

Constituent	Maximum Contaminant Level mg/L
Benzo(a)pyrene	0.0002
Carbofuran	0.018
Chlordane	0.0001
2,4-D	0.07
Dalapon	0.2
1,2-Dibromo-3-chloropropane	0.0002
Di(2-ethylhexyl)adipate	0.4
Di(2-ethylhexyl)phthalate	0.004
Dinoseb	0.007
Diquat	0.02
Endothall	0.1
Endrin	0.002
Ethylene Dibromide	0.00005
Glyphosate	0.7
Heptachlor	0.00001
Heptachlor Epoxide	0.00001
Hexachlorobenzene	0.001
Hexachlorocyclopentadiene	0.05
Lindane	0.0002
Methoxychlor	0.04
Molinate	0.02
Oxamyl	0.2
Pentachlorophenol	0.001
Picloram	0.5
Polychlorinated Biphenyls	0.0005
Simazine	0.004
Thiobencarb	0.07
Toxaphene	0.003
2,3,7,8-TCDD (Dioxin)	$3X10^{-8}$
2,4,5-TP (Silvex)	0.05

Methylene Blue Activated Substances (MBAS)

The MBAS procedure tests for the presence of anionic surfactants (detergents) in water. Positive results can indicate the presence of domestic wastewater. This test can be used to indicate impacts from septic systems. Surfactants disturb the surface tension which affects insects and can affect gills in aquatic life. The secondary drinking water standard for MBAS is 0.5 mg/L (DHS, 1992).

Waters shall not have MBAS concentrations greater than 0.5 mg/L in waters designated MUN.

Mineral Quality

Mineral quality in natural waters is largely determined by the mineral assemblage of soils and rocks and faults near the land surface. Point and nonpoint source discharges of poor quality water can degrade the mineral content of natural waters. High levels of dissolved solids renders waters useless for many beneficial uses. Elevated levels of boron affect agricultural use (especially citrus).

Numerical mineral quality objectives for individual inland surface waters are contained in Table 3-8.

Nitrogen (Nitrate, Nitrite)

High nitrate levels in drinking water can cause health problems in humans. Infants are particularly sensitive and can develop methemoglobinemia (blue-baby syndrome). Excess nitrogen in surface waters also leads to excess aquatic growth and can contribute to elevated levels of NO_3 in ground water as well. The primary drinking water standard for nitrate (as NO_3) is 45 mg/L (DHS, 1992).

Waters shall not exceed 10 mg/L nitrogen as nitrate-nitrogen plus nitrite-nitrogen (NO_3-N + NO_2-N), 45 mg/L as nitrate (NO_3), 10 mg/L as nitrate-nitrogen (NO_3-N), or 1 mg/L as nitrite-nitrogen (NO_2-N) or as otherwise designated in Table 3-8.

Oil and Grease

Oil and grease are not readily soluble in water and form a film on the water surface. Oily films can coat birds and aquatic organisms, impacting respiration and thermal regulation, and causing death. Oil and grease can also cause nuisance conditions (odors and taste), are aesthetically unpleasant, and can restrict a wide variety of beneficial uses.

Waters shall not contain oils, greases, waxes or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.

Oxygen, Dissolved (DO)

Adequate dissolved oxygen levels are required to support aquatic life. Depression of dissolved oxygen can lead to anaerobic conditions resulting in odors or, in extreme cases, in fish kills. Dissolved oxygen requirements are dependent on the beneficial uses of the waterbody.

At a minimum (see specifics below), the ***mean*** *annual dissolved oxygen concentration of* ***all*** *waters shall be greater than 7 mg/L, and no single determination shall be less than 5.0 mg/L, except when natural conditions cause lesser concentrations.*

The dissolved oxygen content of all surface waters designated as WARM shall not be depressed below 5 mg/L as a result of waste discharges.

The dissolved oxygen content of all surface waters designated as COLD shall not be depressed below 6 mg/L as a result of waste discharges.

The dissolved oxygen content of all surface waters designated as both COLD and SPWN shall not be depressed below 7 mg/L as a result of waste discharges.

For that area known as the Outer Harbor area of Los Angeles-Long Beach Harbors, the mean annual dissolved oxygen concentrations shall be 6.0 mg/L or greater, provided that no single determination shall be less than 5.0 mg/L.

Table 3-8. Water Quality Objectives for Selected Constituents in Inland Surface Waters[a].

Reaches are in upstream to downstream order.

WATERSHED/STREAM REACH[b]	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Boron[c] (mg/L)	Nitrogen[d] (mg/L)	SAR[e] (mg/L)
Miscellaneous Ventura Coastal Streams	*no waterbody specific objectives* [f]					
Ventura River Watershed:						
Above Camino Cielo Road	700	300	50	1.0	5	5
Between Camino Cielo Road and Casitas Vista Road	800	300	60	1.0	5	5
Between Casitas Vista Road and confluence with Weldon Canyon	1000	300	60	1.0	5	5
Between confluence with Weldon Canyon and Main Street	1500	500	300	1.5	10	5
Between Main St. and Ventura River Estuary	*no waterbody specific objectives* [f]					
Santa Clara River Watershed:						
Above Lang gaging station	500	100	50	0.5	5	5
Between Lang gaging station and Bouquet Canyon Road Bridge	800	150	100	1.0	5	5
Between Bouquet Canyon Road Bridge and West Pier Highway 99	1000	300	100	1.5	10	5
Between West Pier Highway 99 and Blue Cut gaging station	1000	400	100	1.5	5	10
Between Blue Cut gaging station and A Street, Fillmore	1300	600	100	1.5	5	5
Between A Street, Fillmore and Freeman Diversion "Dam" near Saticoy	1300	650	80	1.5	5	5
Between Freeman Diversion "Dam" near Saticoy and Highway 101 Bridge	1200	600	150	1.5	-	-
Between Highway 101 Bridge and Santa Clara River Estuary	*no waterbody specific objectives* [f]					
Santa Paula Creek above Santa Paula Water Works Diversion Dam	600	250	45	1.0	5	5
Sespe Creek above gaging station, 500' downstream from Little Sespe Creek	800	320	60	1.5	5	5
Piru Creek above gaging station below Santa Felicia Dam	800	400	60	1.0	5	5
Calleguas Creek Watershed:						
Above Potrero Road	850	250	150	1.0	10	f
Below Potrero Road	*no waterbody specific objectives* [f]					

Table 3-8. Water Quality Objectives for Selected Constituents in Inland Surface Waters[a] (cont.)

Reaches are in upstream to downstream order.

WATERSHED/STREAM REACH[b]	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Boron[c] (mg/L)	Nitrogen[d] (mg/L)	SAR[e] (mg/L)
Miscellaneous Los Angeles County Coastal Streams	*no waterbody specific objectives* [f]					
Malibu Creek Watershed	*2000*	*500*	*500*	*2.0*	*10*	-
Ballona Creek Watershed	*no waterbody specific objectives* [f]					
Dominguez Channel Watershed	*no waterbody specific objectives* [f]					
Los Angeles River Watershed:						
Above Figueroa Street	950	300	150	g	8	g
Between Figueroa Street and Los Angeles River Estuary (Willow Street). Includes Rio Hondo below Santa Ana Freeway	1500	350	150	g	8	g
Rio Hondo above Santa Ana Freeway [h]	750	300	150	g	8	g
Santa Anita Creek above Santa Anita spreading grounds	250	30	10	g	f	g
Eaton Canyon Creek above Eaton Dam	250	30	10	g	f	g
Arroyo Seco above spreading grounds	300	40	15	g	f	g
Big Tujunga Creek above Hansen Dam	350	50	20	g	f	g
Pacoima Wash above Pacoima spreading grounds	250	30	10	g	f	g
San Gabriel River Watershed:						
Above Morris Dam	250	30	10	0.6	2	2
Between Morris Dam and Ramona Blvd.	*450*	*100*	*100*	*0.5*	8	g
Between Ramona Blvd. and Firestone Blvd.	750	300	150	*1.0*	8	g
Between Firestone Blvd. and San Gabriel River Estuary (downstream from Willow Street) including Coyote Creek	*no waterbody specific objectives* [f]					
All other minor San Gabriel Mountain streams tributary to San Gabriel Valley [i]	300	40	15	g	f	g
Island Watercourses:						
Anacapa Island	*no waterbody specific objectives* [f]					
San Nicolas Island	*no waterbody specific objectives* [f]					
Santa Barbara island	*no waterbody specific objectives* [f]					
Santa Catalina Island	*no waterbody specific objectives* [f]					
San Clemente Island	*no waterbody specific objectives* [f]					

Table 3-8. Water Quality Objectives for Selected Constituents in Inland Surface Waters[a] (cont.)

Reaches are in upstream to downstream order.

WATERSHED/STREAM REACH[b]	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Boron[c] (mg/L)	Nitrogen[d] (mg/L)	SAR[e] (mg/L)
Other Watercourses:						
San Antonio Creek[j]	225	25	6	–	–	–
Chino Creek[j]	–	–	–	–	–	–

a. As part of the State's continuing planning process, data will continue to be collected to support the development of numerical water quality objectives for waterbodies and constituents where sufficient information is presently unavailable. Any new recommendations for water quality objectives will be brought before the Regional Board in the future.

b. All references to watersheds, streams and reaches include all tributaries. Water quality objectives are applied to all waters tributary to those specifically listed in the table. See Figures 2-1 to 2-10 for locations.

c. Where naturally occurring boron results in concentrations higher than the stated objective, a site-specific objective may be determined on a case-by-case basis.

d. Nitrate-nitrogen plus nitrite-nitrogen (NO3-N + NO2-N). The lack of adequate nitrogen data for all streams precluded the establishment of numerical objectives for all streams.

e. Sodium adsorption ratio (SAR) predicts the degree to which irrigation water tends to enter into cation-exchange reactions in soil.

SAR = Na+/((Ca++ + Mg++)/2)1/2

f. Site-specific objectives have not been determined for these reaches at this time. These areas are often impaired (by high levels of minerals) and there is not sufficient historic data to designate objectives based on natural background conditions. The following table illustrates the mineral or nutrient quality necessary to protect different categories of beneficial uses and will be used as a guideline for establishing effluent limits in these cases. Protection of the most sensitive beneficial use(s) would be the determining criteria for the selection of effluent limits.

Recommended objective (mg/L)	Beneficial Use Categories				
	MUN (Drinking Water Standards) [1]	PROC	AGR	AQ LIFE*(Frshwtr)	GWR
TDS	500 (USEPA secondary MCL)	50-1500 [2,7,9]	450-2000 [2,3,6]		Limits based on appropriate groundwater basin objectives and/or beneficial uses
Chloride	250 (USEPA secondary MCL)	20-1000 [2,9]	100-355 [2,3,8]	230 (4 day ave. continuous conc) [4]	
Sulfate	400-500 (USEPA proposed MCL)	20-300 [2,9]	350-600 [2,8]		
Boron			0.5-4.0 [2,6,8]		
Nitrogen	10 (USEPA MCL)				

References: 1) USEPA CFR § 141 et seq., 2) McKee and Wolf, 1963, 3) Ayers and Westcot, 1985, 4) USEPA, 1988, 5) Water Pollution Control Federation, 1989, 6) USEPA, 1973, 7) USEPA 1980, 8) Ayers, 1977.
* Aquatic life includes a variety of Beneficial Uses including WARM, COLD, SPWN, MIGR and RARE.

g. Agricultural supply is not a beneficial use of the surface water in the specified reach.

h. Rio Hondo spreading grounds are located above the Santa Ana Freeway

i. The stated objectives apply to all other surface streams originating within the San Gabriel Mountains and extend from their headwaters to the canyon mouth.

j. These watercourses are primarily located in the Santa Ana Region. The water quality objectives for these streams have been established by Santa Ana Region. Dashed lines indicate that numerical objectives have not been established, however, narrative objectives shall apply. Refer to the Santa Ana Region Basin Plan for more details.

Pesticides

Pesticides are used ubiquitously for a variety of purposes; however, their release into the environment presents a hazard to aquatic organisms and plants not targeted for their use. The extent of risk to aquatic life depends on many factors including the physical and chemical properties of the pesticide. Those of greatest concern are those that persist for long periods and accumulate in aquatic life and sediments.

No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life.

Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of pesticides in excess of the limiting concentrations specified in Table 64444-A of Section 64444 (Organic Chemicals) of Title 22 of the California Code of Regulations which is incorporated by reference into this plan. This incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect. (See Table 3-7.)

pH

The hydrogen ion activity of water (pH) is measured on a logarithmic scale, ranging from 0 to 14. While the pH of "pure" water at 25 °C is 7.0, the pH of natural waters is usually slightly basic due to the solubility of carbon dioxide from the atmosphere. Minor changes from natural conditions can harm aquatic life.

The pH of inland surface waters shall not be depressed below 6.5 or raised above 8.5 as a result of waste discharges. Ambient pH levels shall not be changed more than 0.5 units from natural conditions as a result of waste discharge.

The pH of bays or estuaries shall not be depressed below 6.5 or raised above 8.5 as a result of waste discharges. Ambient pH levels shall not be changed more than 0.2 units from natural conditions as a result of waste discharge.

Polychlorinated Biphenyls (PCBs)

Polychlorinated biphenyls (PCBs) are a highly toxic and persistent group of organic chemicals that have been historically released into the environment. Many historic discharges still exist as sources in the environment.

The purposeful discharge of PCBs (the sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, and Aroclor-1260) to waters of the Region, or at locations where the waste can subsequently reach waters of the Region, is prohibited.

Pass-through or uncontrollable discharges to waters of the Region, or at locations where the waste can subsequently reach water of the Region, are limited to 70 pg/L (30 day average) for protection of human health and 14 ng/L and 30 ng/L (daily average) to protect aquatic life in inland fresh waters and estuarine waters respectively.

Radioactive Substances

Radioactive substances are generally present in natural waters in extremely low concentrations. Mining or industrial activities increase the amount of radioactive substances in waters to levels that are harmful to aquatic life, wildlife or humans.

Radionuclides shall not be present in concentrations that are deleterious to human, plant, animal, or aquatic life or that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal, or aquatic life.

Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of radionuclides in excess of the limits specified in Table 4 of Section 64443 (Radioactivity) of Title 22 of the California Code of Regulations which is incorporated by reference into this plan. This incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect. (See Table 3-9.)

Table 3-9. The Maximum Contaminant Levels: Radioactivity (for MUN beneficial use) specified in Table 4 of Section 64443 of Title 22 of the California Code of Regulations as of 12-22-88.

MCL Radioactivity	Maximum Contaminant Level pCi/L
Combined Radium-226 and Radium-228	5
Gross Alpha particle activity (including Radium-226 but excluding Radon and Uranium)	15
Tritium	20,000
Strontium-90	8
Gross Beta particle activity	50
Uranium	20

(pCi/L = picocuries = curies x 10^{-12})

Solid, Suspended, or Settleable Materials

Surface waters carry various amounts of suspended and settleable materials from both natural and human sources. Suspended sediments limit the passage of sunlight into waters, which in turn inhibits the growth of aquatic plants. Excessive deposition of sediments can destroy spawning habitat, blanket benthic (bottom dwelling) organisms, and abrade the gills of larval fish.

Waters shall not contain suspended or settleable material in concentrations that cause nuisance or adversely affect beneficial uses.

Taste and Odor

Undesirable tastes and odors in water are an aesthetic nuisance, can impact recreational and other uses, and can indicate the presence of other pollutants.

Waters shall not contain taste or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible aquatic resources, cause nuisance, or adversely affect beneficial uses.

Temperature

Discharges of wastewaters can cause unnatural and/or rapid changes in the temperature of receiving waters which can adversely affect aquatic life.

The natural receiving water temperature of all regional waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses. Alterations that are allowed must meet the requirements below.

For waters designated WARM, water temperature shall not be altered by more than 5 °F above the natural temperature. At no time shall these WARM-designated waters be raised above 80 °F as a result of waste discharges.

For waters designated COLD, water temperature shall not be altered by more than 5 °F above the natural temperature.

Temperature objectives for enclosed bays and estuaries are specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California" (Thermal Plan), including any revisions thereto. See Chapter 5 for a description of the Thermal Plan.

Toxicity

Toxicity is the adverse response of organisms to chemical or physical agents. When the adverse response is mortality, the result is termed acute toxicity. When the adverse response is not mortality but instead reduced growth in larval organisms or reduced reproduction in adult organisms (or other appropriate measurements), a critical life stage effect (chronic toxicity) has occurred. The use of aquatic bioassays (toxicity tests) is widely accepted as a valid approach to evaluating toxicity of waste and receiving waters.

All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in, human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration or other appropriate methods as specified by the State or Regional Board.

The survival of aquatic life in surface waters, subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same waterbody in areas unaffected by the waste discharge or, when necessary, other control water.

There shall be no acute toxicity in ambient waters, including mixing zones. The acute toxicity objective for discharges dictates that the average survival in undiluted effluent for any three consecutive 96-hour static or continuous flow bioassay tests shall be at least 90%, with no single test having less than 70% survival when using an established USEPA, State Board, or other protocol authorized by the Regional Board.

There shall be no chronic toxicity in ambient waters outside mixing zones. To determine compliance with this objective, critical life stage tests for at least three species with approved testing protocols shall be used to screen for the most sensitive species. The test species used for screening shall include a vertebrate, an invertebrate, and an aquatic plant. The most sensitive species shall then be used for routine monitoring. Typical endpoints for chronic toxicity tests include hatchability, gross morphological abnormalities, survival, growth, and reproduction.

Effluent limits for specific toxicants can be established by the Regional Board to control toxicity identified under Toxicity Identification Evaluations (TIEs).

Turbidity

Turbidity is an expression of the optical property that causes light to be scattered in water due to particulate matter such as clay, silt, organic matter, and microscopic organisms. Turbidity can result in a variety of water quality impairments. The secondary drinking water standard for turbidity is 5 NTU (nephelometric turbidity units).

Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in natural turbidity attributable to controllable water quality factors shall not exceed the following limits:

Where natural turbidity is between 0 and 50 NTU, increases shall not exceed 20%.

Where natural turbidity is greater than 50 NTU, increases shall not exceed 10%.

Allowable zones of dilution within which higher concentrations may be tolerated may be defined for each discharge in specific Waste Discharge Requirements.

Regional Narrative Objectives for Wetlands

In addition to the regional objectives for inland surface waters (including wetlands), the following narrative objectives apply for the protection of wetlands in the Region.

Hydrology

Natural hydrologic conditions necessary to support the physical, chemical, and biological characteristics present in wetlands shall be protected to prevent significant adverse effects on:

- *natural temperature, pH, dissolved oxygen, and other natural physical/chemical conditions,*
- *movement of aquatic fauna,*
- *survival and reproduction of aquatic flora and fauna, and*
- *water levels.*

Habitat

Existing habitats and associated populations of wetlands fauna and flora shall be maintained by:

- *maintaining substrate characteristics necessary to support flora and fauna which would be present naturally,*
- *protecting food supplies for fish and wildlife,*
- *protecting reproductive and nursery areas, and*
- *protecting wildlife corridors.*

Regional Objectives for Ground Waters

The following objectives apply to all ground waters of the Region:

Bacteria

Total and fecal coliform bacteria are used to indicate the likelihood of pathogenic bacteria in waters.

In ground waters used for domestic or municipal supply (MUN) the concentration of coliform organisms over any seven day period shall be less than 1.1/100 ml.

Chemical Constituents and Radioactivity

Chemical constituents in excessive amounts in drinking water are harmful to human health. Maximum levels of chemical constituents in drinking waters are listed in the California Code of Regulations and the relevant limits are described below.

Ground waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents and radionuclides in excess of the limits specified in the following provisions of Title 22 of the California Code of Regulations which are incorporated by reference into this plan: Table 64431-A of section 64431 (Inorganic chemicals), Table 64431-B of Section 64431 (Fluoride), Table 64444-A of Section 64444 (Organic Chemicals), and Table 4 of Section 64443 (Radioactivity). This incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect. (See Tables 3-5, 3-6, 3-7, and 3-9.)

Ground waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use.

Mineral Quality

Inorganic constituents in ground waters are largely influenced by thermodynamic reactions that occur as ground water comes into contact with various rock and soil types. For example, ground water that flows through beds of gypsum ($CaSO_4 \cdot 2H_2O$) typically has relatively high levels of calcium cations and sulfate anions. Ground water flowing through limestone ($CaCO_3$) also has relatively high levels of calcium cations, but coupled with bicarbonate anions instead of sulfate. Ground waters with these ions at levels greater than 120 mg/L (expressed as $CaCO_3$) are considered hard waters (Hem, 1989).

Human activities and land use practices can influence inorganic constituents in ground waters. Surface waters carrying abnormally high levels of salts (e.g., irrigation return flows) can degrade the ground waters that they recharge. Abnormally high levels of inorganic constituents can impair and preclude beneficial uses. For example, high levels of boron preclude agricultural use (especially for citrus crops) of ground waters. Hard waters present nuisance problems and may require softening prior to industrial use.

Numerical mineral quality objectives for individual groundwater basins are contained in Table 3-10.

Nitrogen (Nitrate, Nitrite)

High nitrate levels in drinking water can cause health problems in humans. Infants are particularly sensitive and can develop methemoglobinemia (blue-baby syndrome). The primary drinking water standard for nitrate (as NO_3) is 45 mg/L (DHS, 1992).

Human activities and land use practices can also influence nitrogen concentration in ground waters. For example, effluents from wastewater treatment plants, septic tanks and confined animal facilities can add high levels of nitrogen compounds to the ground water that they recharge. Irrigation water containing fertilizers can add high levels of nitrogen to ground water.

Ground waters shall not exceed 10 mg/L nitrogen as nitrate-nitrogen plus nitrite-nitrogen (NO_3-N + NO_2-N), 45 mg/L as nitrate (NO_3), 10 mg/L as nitrate-nitrogen (NO_3-N), or 1 mg/L as nitrite-nitrogen (NO_2-N).

Taste and Odor

Undesirable tastes and odors in water are an aesthetic nuisance and can indicate the presence of other pollutants.

Ground waters shall not contain taste or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses.

Table 3-10. Water Quality Objectives for Selected Constituents in Regional Ground Waters[a].

DWR Basin No.[b]	BASIN	OBJECTIVES (mg/L)			
		TDS	Sulfate	Chloride	Boron
	Pitas Point Area [c]	None specified			
	Ojai Valley				
4-1	Upper Ojai Valley				
	West of Sulfur Mountain Road	1,000	300	200	1.0
	Central area	700	50	100	1.0
	Sisar area	700	250	100	0.5
4-2	Lower Ojai Valley				0.5
	West of San Antonio–Senior Canyon Creeks	1,000	300	200	0.5
	East of San Antonio–Senior Canyon Creeks	700	200	50	
4-3	**Ventura River Valley**				
	Upper Ventura	800	300	100	0.5
	San Antonio Creek area	1,000	300	100	1.0
	Lower Ventura	1,500	500	300	1.5
	Ventura Central [d]				
4-4	Santa Clara–Piru Creek area				
	Upper area (above Lake Piru)	1,100	400	200	2.0
	Lower area east of Piru Creek	2,500	1,200	200	1.5
	Lower area west of Piru Creek	1,200	600	100	1.5
	Santa Clara–Sespe Creek area				
	Topa Topa (upper Sespe) area	900	350	30	2.0
	Fillmore area				
	Pole Creek Fan area	2,000	800	100	1.0
	South side of Santa Clara River	1,500	800	100	1.1
	Remaining Fillmore area	1,000	400	50	0.7
	Santa Clara–Santa Paula area				
	East of Peck Road	1,200	600	100	1.0
	West of Peck Road	2,000	800	110	1.0
	Oxnard Plain				
	Oxnard Forebay	1,200	600	150	1.0
	Confined aquifers	1,200	600	150	1.0
	Unconfined and perched aquifers	3,000	1,000	500	--
4-6	Pleasant Valley				
	Confined aquifers	700	300	150	1.0
	Unconfined and perched aquifers	--	--	--	--
4-7	Arroyo Santa Rosa	900	300	150	1.0
4-8	Las Posas Valley				
	South Las Posas area				
	NW of Grimes Cyn Rd & LA Ave & Somis Rd	700	300	100	0.5
	E of Grimes Cyn Rd and Hitch Blvd	2,500	1,200	400	3.0
	S of LA Ave between Somis Rd & Hitch Blvd	1,500	700	250	1.0
	Grimes Canyon Rd & Broadway area	250	30	30	0.2
	North Las Posas area	500	250	150	1.0
4-5	**Upper Santa Clara**				
	Acton Valley	550	150	100	1.0
	Sierra Pelona Valley (Agua Dulce)	600	100	100	0.5
	Upper Mint Canyon	700	150	100	0.5
	Upper Bouquet Canyon	400	50	30	0.5
	Green Valley	400	50	25	--
	Lake Elizabeth–Lake Hughes area	500	100	50	0.5

Table 3-10. Water Quality Objectives for Selected Constituents in Regional Ground Waters[a] (cont.)

DWR Basin No.[b]	BASIN	OBJECTIVES (mg/L)			
		TDS	Sulfate	Chloride	Boron
4-4.07	**Eastern Santa Clara**				
	Santa Clara–Mint Canyon	800	150	150	1.0
	South Fork	700	200	100	0.5
	Placerita Canyon	700	150	100	0.5
	Santa Clara--Bouquet & San Francisquito Canyons	700	250	100	1.0
	Castaic Valley	1,000	350	150	1.0
	Saugus Aquifer	--	--	--	--
4-9	**Simi Valley**				
	Simi Valley Basin				
	Confined aquifers	1,200	600	150	1.0
	Unconfined aquifers	--	--	--	--
	Gillibrand Basin	900	350	50	1.0
4-10	**Conejo Valley**	800	250	150	1.0
4-11	**Los Angeles Coastal Plain**				
	Central Basin	700	250	150	1.0
	West Coast Basin	800	250	250	1.5
	Hollywood Basin	750	100	100	1.0
	Santa Monica Basin	1,000	250	200	0.5
4-12	**San Fernando Valley**				
	Sylmar Basin	600	150	100	0.5
	Verdugo Basin	600	150	100	0.5
	San Fernando Basin				
	West of Highway 405	800	300	100	1.5
	East of Highway 405 (overall)	700	300	100	1.5
	Sunland-Tugunga area [e]	400	50	50	0.5
	Foothill area [e]	400	100	50	1.0
	Area encompassing RT-Tujunga-Erwin-N. Hollywood-Whithall-LA/Verdugo-Crystal Springs-Headworks-Glendale/Burbank Well Fields	600	250	100	1.5
	Narrows area (below confluence of Verdugo Wash with the LA River)	900	300	150	1.5
	Eagle Rock Basin	800	150	100	0.5
4-13	**San Gabriel Valley**				
	Raymond Basin				
	Monk Hill sub-basin	450	100	100	0.5
	Santa Anita area	450	100	100	0.5
	Pasadena area	450	100	100	0.5
	Main San Gabriel Basin				
	Western area [f]	450	100	100	0.5
	Eastern area [f]	600	100	100	0.5
	Puente Basin	1,000	300	150	1.0
4-14 8-2 [g]	**Upper Santa Ana Valley**				
	Live Oak area	450	150	100	0.5
	Claremont Heights area	450	100	50	--
	Pomona area	300	100	50	0.5
	Chino area	450	20	15	--
	Spadra area	550	200	120	1.0
4-15	**Tierra Rejada**	700	250	100	0.5
4-16	**Hidden Valley**	1,000	250	250	1.0
4-17	**Lockwood Valley**	1,000	300	20	2.0
4-18	**Hungry Valley and Peace Valley**	500	150	50	1.0

Table 3-10. Water Quality Objectives for Selected Constituents in Regional Ground Waters[a] (cont.)

DWR Basin No.[b]	BASIN	OBJECTIVES (mg/L)			
		TDS	Sulfate	Chloride	Boron
4-19	Thousand Oaks area	1,400	700	150	1.0
4-20	Russell Valley				
	Russell Valley	1,500	500	250	1.0
	Triunfo Canyon area	2,000	500	500	2.0
	Lindero Canyon area	2,000	500	500	2.0
	Las Virgenes Canyon area	2,000	500	500	2.0
4-21	Conejo-Tierra Rejada Volcanic area [h]	--	--	--	--
	Santa Monica Mountains--southern slopes [i]				
	Camarillo area	1,000	250	250	1.0
	Point Dume area	1,000	250	250	1.0
4-22	Malibu Valley	2,000	500	500	2.0
	Topanga Canyon area	2,000	500	500	2.0
	San Pedro Channel Islands [j]				
	Anacapa Island	--	--	--	--
	San Nicolas Island	1,100	150	350	--
	Santa Catalina Island	1,000	100	250	1.0
	San Clemente Island	--	--	--	--
	Santa Barbara Island	--	--	--	--

a. Objectives for ground waters outside of the major basins listed on this table and outlined in Figure 1-9 have not been specifically listed. However, ground waters outside of the major basins are, in many cases, significant sources of water. Furthermore, ground waters outside of the major basins are either potential or existing sources of water for downgradient basins and, as such, objectives in the downgradient basins shall apply to these areas.

b. Basins are numbered according to Bulletin 118-80 (Department of Water Resources, 1980).

c. Ground waters in the Pitas Point area (between the lower Ventura River and Rincon Point) are not considered to comprise a major basin, and accordingly have not been designated a basin number by the California Department of Water Resources (DWR) or outlined on Figure 1-9.

d. The Santa Clara River Valley (4-4), Pleasant Valley (4-6), Arroyo Santa Rosa Valley (4-7) and Las Posas Valley (4-8) Ground Water Basins have been combined and designated as the Ventura Central Basin (DWR, 1980).

e. The category for the Foothill Wells area in previous Basin Plan incorrectly groups ground water in the Foothill area with ground water in the Sunland-Tujunga area. Accordingly, the new categories, Foothill area and Sunland-Tujunga area, replace the old Foothill Wells area.

f. All of the ground water in the Main San Gabriel Basin is covered by the objectives listed under Main San Gabriel Basin – Eastern area and Western area. Walnut Creek, Big Dalton Wash, and Little Dalton Wash separate the Eastern area from the Western area (see dashed line on Figure 2-17). Any ground water upgradient of these areas is subject to downgradient beneficial uses and objectives, as explained in Footnote a.

g. The border between Regions 4 and 8 crosses the Upper Santa Ana Valley Ground Water Basin.

h. Ground water in the Conejo-Tierra Rejada Volcanic Area occurs primarily in fractured volcanic rocks in the western Santa Monica Mountains and Conejo Mountain areas. These areas have not been delineated on Figure 1-9.

i. With the exception of ground water in Malibu Valley (DWR Basin No. 4-22), ground waters along the southern slopes of the Santa Monica Mountains are not considered to comprise a major basin and accordingly have not been designated a basin number by the California Department of Water Resources (DWR) or outlined on Figure 1-9.

j. DWR has not designated basins for ground waters on the San Pedro Channel Islands.

Statewide Objectives for Ocean Waters

The State Board's *Water Quality Control Plan for Ocean Waters of California* (Ocean Plan) and the *Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California* (Thermal Plan) and any revision thereto, shall also apply to all ocean waters of the Region. These plans are described in Chapter 5, Plans and Policies. Copies of these plans can be obtained at the Office of Legislative and Public Affairs (OLPA) in Sacramento or at the Regional Board office.

Site Specific Objectives

While many pollutants are regulated under federal, state or regionally applied water quality standards, the Regional Board supports the idea of developing site-specific objectives (SSOs) in appropriate circumstances. Site-specific, or reach-specific, objectives are already in place for some parameters (i.e., mineral quality). These were established to protect a specific beneficial use or were based on antidegradation policies. The development of site-specific objectives requires complex and resource intensive studies; resources will limit the number of studies that will be performed in any given year. In addition, a Use Attainability Analysis (UAA) study will be necessary if the attainment of designated aquatic life or recreational beneficial uses is in question. UAAs include waterbody surveys and assessments which define existing uses, determine appropriateness of the existing and designated uses, and project potential uses by examining the waterbody's physical, chemical, and biological characteristics. Under certain conditions, a designated use may be changed if attaining that use would result in substantial and widespread economic and social impacts. Uses that have been attained can not be removed under a UAA analysis. If a UAA study is necessary, that study must be completed before a SSO can be determined. Early planning and coordination with Regional Board staff will be critical to the development of a successful plan for developing SSOs.

Site-specific objectives must be based on sound scientific data in order to assure protection of beneficial uses. There may be several acceptable methods for developing site-specific objectives. A detailed workplan will be developed with Regional Board staff and other agencies (if appropriate) based on the specific pollutant and site involved. State Board staff and the USEPA will participate in the development of the studies so that there is agreement on the process from the beginning of the study.

Although each study will be unique, there are several elements that should be addressed in order to justify the need for a site-specific objective. These may include, but are not limited to:

- Demonstration that the site in question has different beneficial uses (e.g., more or less sensitive species) as demonstrated in a UAA or that the site has physical or chemical characteristics that may alter the biological availability or toxicity of the chemical.
- Provide a thorough review of current technology and technology-based limits which can be achieved at the facility(ies) on the study reach.
- Provide a thorough review of historical limits and compliance with these limits at all facilities in the study reach.
- Conduct a detailed economic analysis of compliance with existing, proposed objectives.
- Conduct an analysis of compliance and consistency with all federal, state, and regional plans and policies.

Once it is agreed that a site-specific objective is needed, the studies are performed, and an objective is developed, the following criteria must be addressed in the proposal for the new objective.

- Assurance that aquatic life and terrestrial predators are not currently threatened or impaired from bioaccumulation of the specific pollutant <u>and</u> that the biota will not be threatened or impaired by the proposed site-specific level of this pollutant. Safe tissue concentrations will be determined from the literature and from consultation with the California Department of Fish and Game and the U.S. Fish and Wildlife Service.

  For terrestrial predators, the presence, absence, or threat of harmful bioaccumulated pollutants will be determined through consultation with the

California Department of Fish and Game and the U.S. Fish and Wildlife Service.

- Assurance that human consumers of fish and shellfish are currently protected from bioaccumulation of the study pollutant, and will not be affected from bioaccumulation of this pollutant under the proposed site-specific objective.
- Assurance that aquatic life is currently, and will be protected from chronic toxicity from the proposed site-specific objective.
- Assurance that the integrity of the aquatic ecosystem will be protected under the proposed site-specific objective.
- Assurance that no other beneficial uses will be threatened or impaired by the proposed site-specific objective.

Appendix C

Los Angeles Regional Water Quality Control Board, June 2012, Regional Water Board Assistance in Guiding Salt and Nutrient Management Plan Development in the Los Angeles Region

Regional Water Board Assistance in Guiding Salt and Nutrient Management Plan Development in the Los Angeles Region

Further clarification and information to assist development of Salt and Nutrient Management Plans set forth in the State Water Board's Recycled Water Policy

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, LOS ANGELES REGION

JUNE 28, 2012

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1. INTRODUCTION

The State Water Resources Control Board (State Water Board) adopted the Recycled Water Policy (State Water Board Resolution No. 2009-0011) on February 3, 2009. The purpose of the Recycled Water Policy (hereinafter, Policy) is to protect groundwater resources and increase the beneficial use of recycled water from municipal wastewater sources in a manner consistent with state and federal water quality laws and regulations. The Policy provides direction to the Regional Water Quality Control Boards (Regional Water Boards), proponents of recycled water projects, and the public regarding the appropriate criteria to be used by the State Water Board and the Regional Water Boards in issuing permits for recycled water projects.

The Policy recognizes the potential for increased salt and nutrient loading to groundwater basins as a result of increased recycled water use, and therefore, requires the development of regional or sub-regional salt and nutrient management plans.
In requiring such plans, the Policy acknowledges that recycled water may not be the sole cause of high concentrations of salts and nutrients in groundwater basins, and therefore regulation of recycled water alone will not address such conditions. The intent of this requirement is for salts and nutrients from all sources to be managed on a basin-wide or watershed-wide basis in a manner that ensures the attainment of water quality objectives and protection of beneficial use.

The Recycled Water Policy states:

a) Every basin/sub-basin shall have a consistent salt and nutrient management plan (hereinafter, SNMP);
b) SNMPs shall be tailored to address the water quality concerns in each basin;
c) Shall be developed or funded pursuant to the provisions of Water Code sections 10750 ***et seq.*** or other appropriate authority;
d) SNMPs shall be completed and proposed to the Regional Water Board within five years from the adoption date of the Policy;
e) SNMPs are not required in areas where a Regional Water Board has approved a functionally equivalent salt and nutrient plan; and
f) SNMPs may address constituents other than salt and nutrients that adversely affect groundwater quality.

Within one year of the receipt of a proposed SNMP, the Regional Water Board is expected to consider for adoption revised implementation plans, consistent with Water Code section 13242, for those groundwater basins within their regions where water quality objectives for salts or nutrients are being, or are threatening to be, exceeded. The implementation plans are to be based on the salt and nutrient plans required by the Policy.

The Policy spells out the required elements of an SNMP. In addition, State Water Board staff provided additional detail on the contents of a SNMP by developing “Suggested Elements” as a means of indicating the nature and extent of information to be provided in the plans. State Water Board staff also provided templates for Regional Water Board adoption of the implementation aspects of the SNMPs into each region’s Water Quality Control Plan (hereinafter, Basin Plan).

The Policy is clear that the SNMP process should be stakeholder-led and conducted in a collaborative manner among interested parties. The Regional Water Board’s role is that of an overseer and facilitator of the SNMP development process – providing regulatory guidance as necessary and technical and regulatory oversight of the process to ensure that the final product is compliant with the specific requirements of the Policy and state and federal water quality laws. Board staff has been attending stakeholder meetings for various groundwater basin/sub-basin groups to provide support and information as necessary.

The purpose of this document is to provide information and guidance to assist on certain aspects of the SNMP development identified by stakeholder groups. Recognizing that each basin has its own unique set of conditions and constraints, this document does not seek to dictate the methods by which stakeholders should manage salt and nutrient loads to their basins. It does, however, provide clarification of the regulatory requirements of SNMPs along with other considerations. By providing such information, the Regional Water Board will promote adherence with SNMP requirements for groundwater basins in the Los Angeles Region. This document is not a policy or regulation of the Regional Water Board and has no regulatory affect; it is intended to assist in the development of SNMPs.

2. GROUNDWATER BASINS IN THE LOS ANGELES REGION

The Los Angeles subregion overlies 24 groundwater basins and encompasses most of Ventura and Los Angeles counties (Figure 2-1). Within this subregion, the Ventura River Valley, Santa Clara River Valley, and Coastal Plain of Los Angeles basins are divided into sub-basins. The basins in the Los Angeles subregion underlie 1.01 million acres (1,580 square miles) or about 40 percent of the total surface area of the subregion (DWR, 2003). Groundwater is found in unconfined alluvial aquifers in most of the inland basins of the Los Angeles subregions. In some larger basins, such as those underlying the coastal plain, groundwater occurs in multiple aquifers separated by aquitards that create confined groundwater conditions (DWR, 2003). Coastal basins in this hydrologic region are prone to intrusion of seawater. Seawater intrusion barriers are maintained along the coastal plain. In Los Angeles County, imported and recycled water is injected to maintain a seawater intrusion barrier (DWR, 2003).

FIGURE 2-1: GROUNDWATER BASINS IN THE LOS ANGELES REGION

For purposes of regulation by the Regional Water Board pursuant to its authority under the California Water Code, the groundwater basins in the Los Angeles Region are identified in the Basin Plan. Basin descriptions in the Basin Plan were updated in 2011 based on the Department of Water Resources (DWR) 2003 revision of Bulletin 118 (Figure 2-1). The basins include the Central and West Coast Basins, which underlie the Los Angeles Coastal Plain; the San Fernando and San Gabriel Basins, which lie between the Santa Monica Mountains and the San Gabriel and Santa Susanna Range; and the Santa Clara and Ventura Basins, which lie between Oak Ridge and the Transverse Ranges.
General characteristics of the major basins/sub-basins are summarized in Table 2-1.

TABLE 2-1: GENERAL CHARACTERISTICS OF THE LOS ANGELES REGION GROUNDWATER BASINS

MAJOR GROUNDWATER BASIN(S) AND SUB-BASINS	**STORAGE CAPACITY (AC-FT)**	**BASIN RECHARGE**[1]
COASTAL PLAINS OF LOS ANGELES		
Santa Monica	~1,100,000	Natural/Recycled
Hollywood	200,000	Natural
West Coast Basin	~6,500,000	Natural/Recycled/Imported
Central	13,800,000	Natural/Recycled/Imported
SAN GABRIEL	10,740,000	Natural
RAYMOND	450,000	Natural
SAN FERNANDO	3,670,000	Natural/ Recycled
SANTA CLARA RIVER VALLEY		
Oxnard	7,140,000	Natural/ Recycled/ Septics
Mound	n.a	
Santa Paula	800,000	Recycled/Septics
Fillmore	1,100,000	Recycled/Septics
Piru	1,979,000	Recycled/Septics
Santa Clara River Valley East	n.a.	Natural/Recycled/Septics
PLEASANT VALLEY	1,886,000	Natural/Recycled/Septics
LAS POSAS VALLEY	345,000	Natural/Irrigation
ARROYO SANTA ROSA	103,600	Natural/Irrigation/Septics
UPPER/LOWER OJAI	~84,000	Natural/Septics
VENTURA RIVER VALLEY	10,000	
SIMI VALLEY	180,000	Natural/IRecycled/Septics
TIERRA REJADA	80,000	
THOUSAND OAKS	130,000	
CONEJO VALLEY	7,106	
RUSSELL VALLEY	10,570	
HIDDEN VALLEY	n.a.	
MALIBU VALLEY	n.a.	Natural/Irrigation/Septics

n.a: not available

The Central and West Coast Basins, San Gabriel and Raymond Basins, and the Piru, Fillmore, Mound and Oxnard Forebay sub-basins beneath the Santa Clara River Valley have large storage capacities with significant existing or proposed municipal groundwater use in both urbanized and agricultural areas. The water levels are stable or declining and imported and/or recycled water is used to replenish and help manage

[1] Managed and natural stormwater recharge takes place in most of these basins.

groundwater supplies. The hydrogeology and groundwater of the basins have been extensively studied and documented, and groundwater quality and transport have been studied using computer models. Potential groundwater management alternatives for these basins have also been extensively studied. The San Gabriel Basin has no confining layers, but the Regional Water Board and USEPA's management of twelve plumes of Volatile Organic Compounds (VOCs) and five plumes of nitrates, where groundwater exceeds the Maximum Contaminant Level (MCL), has limited the impact to adjudicated drinking water resources. Basin water quality has also benefited from management practices and implementation of groundwater remediation conducted by the Watermaster in conjunction with local water purveyors.
The San Fernando Basin and Santa Clara River also have large storage capacities, but have declining water levels, significantly less municipal groundwater use, and no existing conjunctive use. The groundwater quality is variable, but remains locally usable as a source of irrigation or municipal supply. Wastewater and recycling agencies within these basins experience periodic noncompliance with groundwater quality objectives. In general, the basins have been studied less extensively than the Central and West Coast, San Gabriel and Raymond and Lower Santa Clara River Valley basins, although the potential yields from these basins are equally large. In the San Fernando Basin, impacts from a VOC plume and four nitrate plumes along with the irregular presence of confining layers have impacted the use of the basin for drinking water uses. In the upgradient portion of Santa Clara River Valley, contamination of the groundwater and its exfiltrates by salts, nutrients and bacteria as a result of increasing urbanization has impacted the use of groundwater as a source of domestic supply.

Nine groundwater basins in rural areas[2] are the sole source of local drinking water supply. They have smaller storage capacities (less than 10,000 acre-feet) in unconsolidated sediment. Wastewater, recycling agencies and facilities with onsite wastewater treatment systems (hereinafter, OWTS) may experience periodic noncompliance with Basin Plan groundwater quality objectives in these basins. Fewer studies and resources exist to characterize basin hydrogeology, groundwater quality, and groundwater transport. The California Department of Public Health, the State Water Board's Division of Water Rights, and USEPA's drinking water protection programs identify problems with water quality upon delivery, and efforts to isolate pollutants from the underlying potable supply are implemented through waste discharge requirements from the Regional Water Board.

The Oxnard Plain, Ventura River, Sylmar, Pomona, and Thousand Oaks/Pleasant Valley/Fox Canyon basins are moderately sized agricultural and urbanized groundwater basins with higher salinity levels. Wastewater and recycled water can usually comply with Basin Plan groundwater quality objectives, but the quality is improved by potable water conjunctive use. The coastal areas of the Region are underlain by porous sediments or fractured bedrock, both of which may have been intruded by saltwater during historic municipal, agricultural and industrial use of the aquifers. Fresh or recycled water injection is used to limit seawater intrusion in the Central, West Coast and Oxnard Plain basins. The tidally influenced and impacted areas may be heavily studied or un-evaluated, but wastewater and recycled water permits generally require compliance with Basin Plan objectives for salt. Public water supplies are not currently developed within these areas.

[2] Ojai Valley, Acton, Sierra Pelona Valley, Lake Elizabeth, Santa Rosa Valley, Hidden Valley, Santa Susana Knolls, Lockwood Valley, and Hungry Valley.

Beneficial uses of the groundwater basins in the region include Municipal and Domestic Supply (MUN), Agricultural Supply (AGR), Industrial Services Supply (IND), Industrial Process Supply (PROC), and Aquaculture (AQUA). The designated beneficial uses for these basins are shown in Table 2-2.

TABLE 2-2: BENEFICIAL USES OF GROUND WATERS IN THE LOS ANGELES REGION.[1]

DWR[2] Basin No.	BASIN	MUN	IND	PROC	AGR	AQUA
	PITAS POINT AREA[3]	E	E	P	E	
4-1	**UPPER OJAI VALLEY**	E	E	E	E	
4-2	**OJAI VALLEY**	E	E	E	E	
4-3	**VENTURA RIVER VALLEY**					
4-3.01	Upper Ventura	E	E	E	E	
4-3.02	Lower Ventura	P	E	P	E	
4-4	**SANTA CLARA RIVER VALLEY[4]**					
4-4.02	Oxnard					
4-4.02	Oxnard Forebay	E	E	E	E	
4-4.02	Confined aquifers	E	E	E	E	
4-4.02	Unconfined and perched aquifers	E	P		E	
4-4.03	Mound					
4-4.03	Confined aquifers	E	E	E	E	
4-4.03	Unconfined and perched aquifers	E	P		E	
4-4.04	Santa Paula					
4-4.04	East of Peck Road	E	E	E	E	
4-4.04	West of Peck Road	E	E	E	E	
4-4.05	Fillmore					
4-4.05	Pole Creek Fan area	E	E	E	E	
4-4.05	South side of Santa Clara River	E	E	E	E	
4-4.05	Remaining Fillmore area	E	E	E	E	E
4-4.05	Topa Tapa (upper Sespe) area	P	E	P	E	
4-4.06	Piru					
4-4.06	Upper area (upper Lake Piru)	P	E	E	E	
4-4.06	Lower area east of Piru Creek	E	E	E	E	
4-4.06	Lower area west of Piru Creek	E	E	E	E	
4-4.07	Santa Clara River Valley East					
4-4.07	Mint Canyon	E	E	E	E	
4-4.07	South Fork	E	E	E	E	
4-4.07	Placerita Canyon	E	E	E	E	
4-4.07	Bouquet and San Francisquito Canyons	E	E	E	E	
4-4.07	Castaic Valley	E	E	E	E	
4-4.07	Saugus Aquifer	E				
4-5	**ACTON VALLEY[4]**					
4-5	Acton Valley	E	E	E	E	
4-5	Sierra Pelona Valley (Agua Dulce)	E	E		E	
4-5	Upper Mint Canyon	E	E	E	E	
4-5	Upper Bouquet Canyon	E	P	P	E	

DWR[2] Basin No.	**BASIN**	**MUN**	**IND**	**PROC**	**AGR**	**AQUA**
4-5	Green Valley	E	P	P	E	
4-5	Lake Elizabeth- Lake Hughes area	E	P	P	E	
4-6	**PLEASANT VALLEY[5]**					
4-6	Confined Aquifers	E	E	E	E	
4-6	Unconfined and perched aquifers	P	E	E	E	
4-7	**ARROYO SANTA ROSA VALLEY[5]**	E	E	E	E	
4-8	**LAS POSAS VALLEY[5]**	E	E	E	E	
4-9	**SIMI VALLEY**					
	Simi Valley Basin					
	Confined aquifers	E	E	E	E	
	Unconfined aquifers	E	E	E	E	
	Gillibrand Basin	E	E	P	E	
4-10	**CONEJO**	E	E	E	E	
4-11	**COASTAL PLAIN OF LOS ANGELES**					
4-11.01	Santa Monica	E	E	E	E	
4-11.02	Hollywood	E	E	E	E	
4-11.03	West Coast					
	Underlying Ports of Los Angeles & Long Beach		E	E	E	
4-11.03	Underlying El Segundo, Seaward of Barrier		E	E	E	
4-11.03	Remainder of Basin	E	E	E	E	
4-11.04	Central	E	E	E	E	
4-12	**SAN FERNANDO VALLEY**	E[6]	E	E	E	
4-13	**SAN GABRIEL VALLEY[7]**	E	E	E	E	
4-15	**TIERRA REJADA**	E	P	P	E	
4-16	**HIDDEN VALLEY**	E	P		E	
4-17	**LOCKWOOD VALLEY**	E	E		E	
4-18	**HUNGRY VALLEY**	E	P	E	E	
4-19	**THOUSAND OAKS AREA[8]**	E	E	E	E	
4-19	Triunfo Canyon area	P	P		E	
4-19	Lindero Canyon area	P	P		E	
4-19	Las Virgenes Canyon area	P	P		E	
4-20	**RUSSELL VALLEY**	E	P		E	
4-21	**CONEJO-TIERRA REJADA VOLCANIC[9]**	E			E	
4-22	**MALIBU VALLEY[10]**					
4-22	Camarillo area	E	P		E	
4-22	Point Dume area	E	P		E	
4-22	Malibu Valley	P	P		E	
4-22	Topanga Canyon area	P	P		E	
4-23	**RAYMOND**	E	E	E	E	
	SAN PEDRO CHANNEL ISLANDS[11]					
	Anacapa Island	P	P			
	San Nicolas Island	E	P			

DWR[2] Basin No.	BASIN	MUN	IND	PROC	AGR	AQUA
	Santa Catalina Island	E	P		E	
	San Clemente Island	P	P			
	Santa Barbara Island	P	P			

E: Existing beneficial use
P: Potential beneficial use
1: Beneficial uses for ground waters outside of the major basins listed on this table have not been specifically listed. However, ground waters outside of the major basins are, in many cases, significant sources of water. Furthermore, ground waters outside of the major basins are either potential or existing source of water for downgradient basins, and as such, beneficial uses in the downgradient basins shall apply to these areas.
2: Basins are numbered according to DWR Bulletin No. 118-Update 2003 (DWR, 2003).
3: Ground waters in the Pitas Point area (between the lower Ventura River and Rincon Point) are not considered to comprise a major basin and, accordingly, have not been designated a basin number by the DWR or outlined on Fig. 2-1.
4: Santa Clara River Valley Basin was formerly Ventura Central Basin and Acton Valley Basin was formerly Upper Santa Clara Basin (DWR, 1980).
5: Pleasant Valley, Arroyo Santa Rosa Valley, and Las Posas Valley Basins were formerly sub-basins of Ventura Central (DWR, 1980).
6: Nitrite pollution in the groundwater of the Sunland-Tujunga area currently precludes direct MUN use. Since the groundwater in this area can be treated or blended (or both), it retains the MUN designation.
7: Raymond Basin was formerly a sub-basin of San Gabriel Valley and Monk Hill sub-basin is now part of San Fernando Valley Basin (DWR, 2003). The Main San Gabriel Basin was formerly separated into Eastern and Western areas. Since these areas had the same beneficial uses as Puente Basin all three areas have been combined into San Gabriel Valley. Any groundwater upgradient of these areas is subject to downgradient beneficial uses and objectives, as explained in Footnote 1.
8: These areas were formerly part of the Russell Valley Basin (DWR, 1980).
9: Groundwater in the Conejo-Tierra Rejada Volcanic Area occurs primarily in fractured volcanic rocks in the western Santa Monica Mountains and Conejo Mountain areas. These areas have not been delineated on Fig. 2-1.
10: With the exception of groundwater in Malibu Valley (DWR Basin No. 4-22) ground waters along the southern slopes of the Santa Monica Mountains are not considered to comprise a major basin and accordingly have not been designated a basin number by DWR.
11: DWR has not designated basins for ground waters on the San Pedro Channel Islands.

3. REGIONAL GROUNDWATER QUALITY OBJECTIVES

As set forth in the Policy, ***SNMPs shall be tailored to address water quality concerns in each basin and may include constituents other than salt and nutrients that adversely impact basin/sub-basin water quality.***

GROUND WATER QUALITY OBJECTIVES

Water quality objectives for ground waters in the Los Angeles Region are contained in the Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties (Basin Plan). The same water quality objectives for Nitrogen, Chemical Constituents and Radioactivity, Bacteria, and Taste and Odor, apply to all ground waters in the region (Table 3-1).

TABLE 3-1: WATER QUALITY OBJECTIVES FOR GROUNDWATER BASINS IN THE LOS ANGELES REGION

PARAMETER	**WATER QUALITY OBJECTIVE**
Nitrogen NO_3-N + NO_2-N NO_3 NO_3-N NO_2-N	 10 mg/L 45 mg/L 10 mg/L 1 mg/L
Chemical Constituents and Radioactivity	For ground waters designated for use as domestic or municipal supply, Maximum Contaminant Levels (MCLs) contained in Title 22 of the California Code of Regulations apply. In addition, ground waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use.
Bacteria	In ground waters used for domestic or municipal supply (MUN), the concentration of coliform organisms over any seven day period shall be less than 1.1/100 mL.
Taste and Odor	Ground waters shall not contain taste or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses.

The Basin Plan also contains site-specific objectives for mineral water quality for individual basins/sub-basins (Table 3-2).

TABLE 3-2: WATER QUALITY OBJECTIVES FOR SELECTED CONSTITUENTS IN REGIONAL GROUND WATERS

2011 Basin Plan Name	Bulletin 118-03 update number	1994 Basin Plan Name	Bulletin 118-80 number	TDS	Sulfate	Chloride	Boron
Upper Ojai Valley	**4-1**	**Ojai Valley**	**4-1**				
Upper Ojai Valley	4-1	Upper Ojai Valley	4-1				
Upper Ojai Valley	4-1	West of Sulfur Mountain Road	4-1	1000	300	200	1.0
Upper Ojai Valley	4-1	Central Area	4-1	700	50	100	1.0
Upper Ojai Valley	4-1	Sisar Area	4-1	700	250	100	0.5
Ojai Valley	**4-2**	**Lower Ojai Valley**	**4-2**				**0.5**
Ojai Valley	4-2	West of San Antonio-Senior Canyon	4-2	1000	300	200	0.5
Ojai Valley	4-2	East of San Antonio-Senior Canyon	4-2	700	200	50	
Ventura River Valley	**4-3**	**Ventura River Valley**	**4-3**				
Upper Ventura River	4-3.01	Upper Ventura	4-3	800	300	100	0.5
Upper Ventura River	4-3.01	San Antonio Creek Area	4-3	1000	300	100	1.0
Lower Ventura River	4-3.02	Lower Ventura	4-3	1500	500	30	1.5
Santa Clara River Valley	**4-4**	**Ventura Central**	**4-4**				
Piru	4-4.06	Santa Clara-Piru Creek Area	4-4				
Piru	4-4.06	Upper Area (above Lake Piru)	4-4	1100	400	200	2.0
Piru	4-4.06	Lower Area East of Piru Creek	4-4	2500	1200	200	1.5
Piru	4-4.06	Lower Area West of Piru Creek	4-4	1200	600	100	1.5
Fillmore	4-4.05	Santa Clara-Sespe Creek Area	4-4				
Fillmore	4-4.05	Topa Topa (upper Sespe) Area	4-4	900	350	30	2.0
Fillmore	4-4.05	Fillmore Area	4-4				
Fillmore	4-4.05	Pole Creek Fan Area	4-4	2000	800	100	1.0
Fillmore	4-4.05	South Side of Santa Clara River	4-4	1500	800	100	1.1
Fillmore	4-4.05	Remaining Fillmore Area	4-4	1000	400	50	0.7
Santa Paula	4-4.04	Santa Clara-Santa Paula Area	4-4				
Santa Paula	4-4.04	East of Peck Road	4-4	1200	600	100	1.0
Santa Paula	4-4.04	West of Peck Road	4-4	2000	800	110	1.0

2011 Basin Plan Name	Bulletin 118-03 update number	1994 Basin Plan Name	Bulletin 118-80 number	TDS	Sulfate	Chloride	Boron
Oxnard	4-4.02	Oxnard Plain	4-4				
Mound	4-4.03	Oxnard Plain	4-4				
Oxnard	4-4.02	Oxnard Forebay	4-4	1200	600	150	1.0
Oxnard	4-4.02	Confined Aquifers	4-4	1200	600	150	1.0
Oxnard	4-4.02	Unconfined & Perched Aquifers	4-4	3000	1000	500	
Pleasant Valley	**4-6**	**Pleasant Valley**	**4-6**				
Pleasant Valley	4-6	Confined Aquifers	4-6	700	300	150	1.0
Pleasant Valley	4-6	Unconfined & Perched Aquifers	4-6				
Arroyo Santa Rosa Valley	**4-7**	**Arroyo Santa Rosa**	**4-7**	900	300	150	1.0
Las Posas Valley	**4-8**	**Las Posas Valley**	**4-8**				
Las Posas Valley	4-8	South Las Posas Area	4-8				
Las Posas Valley	4-8	NW of Grimes Cyn Rd. & LA Ave. & Somis Rd.	4-8	700	300	100	0.5
Las Posas Valley	4-8	E of Grimes Cyn Rd & Hitch Blvd.	4-8	2500	1200	400	3.0
Las Posas Valley	4-8	S of LA Ave Between Somis Rd & Hitch Blvd.	4-8	1500	700	250	1.0
Las Posas Valley	4-8	Grimes Canyon Rd. & Broadway Area	4-8	250	30	30	0.2
Las Posas Valley	4-8	North Las Posas Area	4-8	500	250	150	1.0
Acton Valley	**4-5**	**Upper Santa Clara**	**4-5**				
Acton Valley	4-5	Acton Valley	4-5	550	150	100	1.0
Acton Valley	4-5	Sierra Pelona Valley (Agua Dulce)	4-5	600	100	100	0.5
Acton Valley	4-5	Upper Mint Canyon	4-5	700	150	100	0.5
Acton Valley	4-5	Upper Bouquet Canyon	4-5	400	50	30	0.5
Acton Valley	4-5	Green Valley	4-5	400	50	25	
Acton Valley	4-5	Lake Elizabeth-Lake Hughes Area	4-5	500	100	50	0.5
Santa Clara River Valley East	**4-4.07**	**Eastern Santa Clara**	**4-4.07**				
Santa Clara River Valley	4-4.07	Santa Clara-Mint Canyon	4-4.07	800	150	150	1.0

2011 Basin Plan Name	Bulletin 118-03 update number	1994 Basin Plan Name	Bulletin 118-80 number	TDS	Sulfate	Chloride	Boron
East							
Santa Clara River Valley East	4-4.07	South Fork	4-4.07	700	200	100	0.5
Santa Clara River Valley East	4-4.07	Placentia Canyon	4-4.07	700	150	100	0.5
Santa Clara River Valley East	4-4.07	Santa Clara-Bouquet & San Fransisquito Canyons	4-4.07	700	250	100	1.0
Santa Clara River Valley East	4-4.07	Castaic Valley	4-4.07	1000	350	150	1.0
Santa Clara River Valley East	4-4.07	Saugus Aquifer	4-4.07				
Simi Valley	**4-9**	**Simi Valley**	**4-9**				
Simi Valley	4-9	Simi Valley Basin	4-9				
Simi Valley	4-10	Confined Aquifers	4-9	1200	600	150	1.0
Simi Valley	4-11	Unconfined & Perched Aquifers	4-9				
Simi Valley	4-12	Gillibrand Basin	4-9	900	350	50	1.0
Conejo Valley	**4-10**	**Conejo Valley**	**4-10**	**800**	**250**	**150**	**1.0**
Coastal Plain of Los Angeles	**4-11**	**Los Angeles Coastal Plain**	**4-11**				
Central	4-11.04	Central Basin	4-11	700	250	150	1.0
West Coast	4-11.03	West Coast Basin	4-11	800	250	250	1.5
Hollywood	4-11.02	Hollywood Basin	4-11	750	100	100	1.0
Santa Monica	4-11.01	Santa Monica Basin	4-11	1000	250	200	0.5
San Fernando Valley	**4-12**	**San Fernando Valley**	**4-12**				
San Fernando Valley	4-12	Sylmar Basin	4-12	600	150	100	0.5
San Fernando Valley	4-12	Verdugo Basin	4-12	600	150	100	0.5
San Fernando Valley	4-12	San Fernando Basin	4-12				
San Fernando Valley	4-12	West of Highway 405	4-12	800	300	100	1.5
San Fernando Valley	4-12	East of Highway 405 (overall)	4-12	700	300	100	1.5
San Fernando Valley	4-12	Sunland-Tujunga Area	4-12	400	50	50	0.5
San Fernando Valley	4-12	Foothill Area	4-12	400	100	50	1.0
San Fernando Valley	4-12	Area Encompassing RT-Tujunga -Erwin-N. Hollywood-Whithall-LA/Verdugo-Crystal	4-12	600	250	100	1.5

2011 Basin Plan Name	Bulletin 118-03 update number	1994 Basin Plan Name	Bulletin 118-80 number	TDS	Sulfate	Chloride	Boron
		Springs-Headworks-Glendale/Burbank Well Fields					
San Fernando Valley	4-12	Narrows Area (below confluence of Verdugo Wash with the LA River	4-12	900	300	150	1.5
San Fernando Valley	4-12	Eagle Rock Basin	4-12	800	150	100	0.5
San Gabriel Valley/Raymond/San Fernando Valley	**4-13**	**San Gabriel Valley**	**4-13**				
Raymond	4-23	Raymond Basin	4-13				
San Fernando Valley	4-12	Monk Hill Sub-Basin	4-13	450	100	100	0.5
Raymond	4-23	Santa Anita Area	4-13	450	100	100	0.5
Raymond	4-23	Pasadena Area	4-13	450	100	100	0.5
San Gabriel Valley	4-13	Main San Gabriel Basin	4-13				
San Gabriel Valley	4-13	Western Area	4-13	450	100	100	0.5
San Gabriel Valley	4-13	Eastern Area	4-13	600	100	100	0.5
San Gabriel Valley	4-13	Puente Basin	4-13	1000	300	150	1.0
Upper Santa Ana Valley/San Gabriel Valley	**8-2.01**	**Upper Santa Ana Valley**	**4-14**				
San Gabriel Valley	4-13	Live Oak Area	8-2	450	150	100	0.5
San Gabriel Valley	4-13	Claremont Heights Area	8-2	450	100	50	
San Gabriel Valley	4-13	Pomona Area	8-2	300	100	50	0.5
Upper Santa Ana Valley/ San Gabriel Valley	8-2.01/4-13	Chino Area	8-2	450	20	15	
San Gabriel Valley	4-13	Spadra Area	8-2	550	200	120	1.0
Tierra Rejada	**4-15**	**Tierra Rejada**	**4-15**	**700**	**250**	**100**	**0.5**
Hidden Valley	**4-16**	**Hidden Valley**	**4-16**	**1000**	**250**	**250**	**1.0**
Lockwood Valley	**4-17**	**Lockwood Valley**	**4-17**	**1000**	**300**	**20**	**2.0**
Hungry Valley	**4-18**	**Hungry Valley & Peace Valley**	**4-18**	**500**	**150**	**50**	**1.0**
Conejo Valley	**4-10**	**Thousand Oaks Area**	**4-19**	**1400**	**700**	**150**	**1.0**
Russell Valley	**4-20**	**Russell Valley**	**4-20**				
Russell Valley	4-20	Russell Valley	4-20	1500	500	250	1.0
Thousand Oaks Area	4-19	Triunfo Canyon Area	4-20	2000	500	500	2.0

2011 Basin Plan Name	Bulletin 118-03 update number	1994 Basin Plan Name	Bulletin 118-80 number	TDS	Sulfate	Chloride	Boron
Thousand Oaks Area	4-20	Lindero Canyon Area	4-20	2000	500	500	2.0
Thousand Oaks Area	4-21	Las Virgenes Canyon Area	4-20	2000	500	500	2.0
Deleted	**Deleted**	**Conejo-Tierra Rejada Volcanic Area**	**4-21**				
Malibu Valley	**4-22**	**Santa Monica Mountains-Southern Slopes**	**4-22**				
Malibu Valley	4-22	Camarillo Area	4-22	1000	250	250	1.0
Malibu Valley	4-22	Point Dume Area	4-22	1000	250	250	1.0
Malibu Valley	4-22	Malibu Valley	4-22	2000	500	500	2.0
Malibu Valley	4-22	Topanga Canyon Area	4-22	2000	500	500	2.0
San Pedro Channel Islands		**San Pedro Channel Islands**					
Anacapa Island	No DWR#	Anacapa Island	No DWR#				
San Nicholas Island	No DWR#	San Nicholas Island	No DWR#	1100	150	350	
Santa Catalina Island	No DWR#	Santa Catalina Island	No DWR#	1000	100	250	1.0
San Clemente Island	No DWR#	San Clemente Island	No DWR#				
Santa Barbara	No DWR#	Santa Barbara Island	No DWR#				

GROUNDWATER BASIN WATER QUALITY

The following section presents information on general water quality conditions as provided by the Department of Water Resources in their Bulletin 118- 2003 update. This information is meant to provide a general overview of the conditions within the basins. It is anticipated that more current information will be provided in the Salt and Nutrient Management Plans developed for each basin.

According to DWR's Bulletin 118-2003, nitrate content is elevated in some parts of the subregion. Volatile organic compounds (VOCs) have caused groundwater impairments in some of the industrialized portions of the region. The San Gabriel Valley and San Fernando Valley groundwater basins both have multiple sites of contamination from VOCs. The main constituents in the contamination plumes are trichloroethylene (TCE) and tetrachloroethylene (PCE). Some of the locations have been declared federal Superfund sites. Contamination plumes containing high concentrations of TCE and PCE also occur in the Bunker Hill Sub-basin of the Upper Santa Ana Valley Groundwater Basin. Some of these plumes are also designated as Superfund sites. Also, perchlorate has been identified as a significant pollutant in some areas of the Los Angeles Region.

Basin-specific information on water quality in the region's major basins/sub-basins is provided in Table 3-3. This information is summarized from DWR's Bulletin 118-2003 and includes monitoring results from public supply wells sampled under the DHS Title 22 program from 1994 through 2000. Per this bulletin, the information is intended as an indicator of the types of activities that cause contamination in a given basin. It represents the water quality at the sample location. It does not indicate the water quality delivered to the consumer. More detailed drinking water quality information can be obtained from the local water purveyor and its annual Consumer Confidence Report.

TABLE 3-3: WATER QUALITY IN MAJOR BASINS/SUB-BASINS IN THE LOS ANGELES REGION

Basin/sub-basin	Status	TDS	Constituent Group[3]	Number of wells sampled[4]	Number of wells with a concentration above an MCL[5]
Central Basin		Range: 200-2500 mg/l Average: 453 mg/l (293 public wells)	Inorganic – Primary Radiological Nitrates Pesticides VOCs and SVOCs Inorganics- Secondary	316 315 315 322 344 316	15 1 2 0 43 113
West Coast Basin	Injection wells create a groundwater ridge, which inhibits the inland flow of saltwater into the sub-basin to protect and maintain groundwater elevations.		Inorganic – Primary Radiological Nitrates Pesticides VOCs and SVOCs Inorganics- Secondary	45 45 46 46 44 45	0 1 0 0 0 30
San Fernando Valley Basin	Groundwater contamination from VOCs and hexavalent chromium (CrVI) continues to be a serious problem for water supply in the eastern portion of the San Fernando Valley		Inorganic – Primary Radiological Nitrates Pesticides VOCs and SVOCs Inorganics- Secondary	129 122 129 134 134 129	6 13 44 3 90 17
San Gabriel[6]	Four areas of the San Gabriel Valley Basin are Superfund sites. Trichloroethylene, Perchloroethylene, and Carbon Tetrachloride contaminate the Whittier Narrows, Puente basin, Baldwin Park and El Monte areas.		Inorganic – Primary Radiological Nitrates Pesticides VOCs and SVOCs Inorganics- Secondary	287 278 300 292 301 287	3 4 73 1 85 20

[3] A description of each member in the constituent groups and a generalized discussion of the relevance of these groups are included in ***California's Groundwater–Bulletin 118*** by DWR (2003).

[4] Represents distinct number of wells sampled as required under DHS Title 22 program from 1994 through 2000.

[5] Each well reported with a concentration above an MCL was confirmed with a second detection above an MCL. This information is intended as an indicator of the types of activities that cause contamination in a given basin. It represents the water quality at the sample location. It does not indicate the water quality delivered to the consumer. More detailed drinking water quality information can be obtained from the local water purveyor and its annual Consumer Confidence Report.

[6] There are six operable units (O.U.) within the Main San Gabriel Basin: the Baldwin Park O.U., the Puente Valley O.U., the Whittier Narrows O.U., the South El Monte O.U., and the Area 3 (Alhambra) O.U.

Basin/sub-basin	Status	TDS	Constituent Group[3]	Number of wells sampled[4]	Number of wells with a concentration above an MCL[5]
Raymond	Fluoride content occasionally exceeds recommended levels of 1.6 mg/L, near the San Gabriel Mountain front. Volatile organic compounds are detected in wells near Arroyo Seco and radiation is occasionally detected near the San Gabriel Mountains.	Range: 38-780 mg/l Average: 346 mg/l (70 public wells)	Inorganic – Primary Radiological Nitrates Pesticides VOCs and SVOCs Inorganics- Secondary	66 55 78 57 60 66	9 8 23 0 19 9
Santa Monica		Range: 729-1,156 mg/L Average: 916 mg/L (7 public wells)	Inorganic – Primary Radiological Nitrates Pesticides VOCs and SVOCs Inorganics- Secondary	13 12 13 12 12 13	0 1 0 0 9 8
Hollywood	Public water supply from imported surface water, groundwater quality information scarce.	Single sample 526 mg/L (Truran, 2001).			
Oxnard	Nitrate concentrations can exceed the state Maximum Contaminant Level (MCL) of 45 mg/L. Intrusion of seawater has occurred near Pt. Mugu and Port Hueneme. Elevated levels of DDT and PCB are found near Pt. Mugu.	Range: 160-1,800 mg/L Average: 1,102 mg/L (69 public supply wells)	Inorganic – Primary Radiological Nitrates Pesticides VOCs and SVOCs Inorganics- Secondary	73 69 80 63 68 73	6 8 14 1 2 49
Piru	Agricultural return flows may lead to high nitrate concentrations particularly during dry periods. Urban stormwater runoff within the Santa Clara River Watershed tends to concentrate salts and other contaminants. The most prominent natural contaminants in the sub-basin are boron and sulfate.		Inorganic – Primary Radiological Nitrates Pesticides VOCs and SVOCs Inorganics- Secondary	3 3 3 3 3 3	0 0 0 0 0 1

Basin/sub-basin	Status	TDS	Constituent Group[3]	Number of wells sampled[4]	Number of wells with a concentration above an MCL[5]
Fillmore	Agricultural return flows may lead to high nitrate concentrations particularly during dry periods. Urban stormwater runoff within the Santa Clara River Watershed tends to concentrate salts and other contaminants. Other contaminants in the sub-basin are boron, sulfate, and nitrates.		Inorganic – Primary Radiological Nitrates Pesticides VOCs and SVOCs Inorganics- Secondary	13 10 14 10 10 13	0 1 1 0 1 3
Santa Paula	Nitrate concentrations can fluctuate significantly.	Range: 470-1,800 mg/L Average: 1,198 mg/L (13 public wells)	Inorganic – Primary Radiological Nitrates Pesticides VOCs and SVOCs Inorganics- Secondary	16 12 16 9 9 16	3 1 2 0 0 15
Mound		Range: 1,498-1,908 mg/L Average: 1,644 mg/L (4 public wells)	Inorganic – Primary Radiological Nitrates Pesticides VOCs and SVOCs Inorganics- Secondary	2 2 2 2 2 2	1 0 0 0 0 2
Las Posas		Range: 338-1,700 mg/L Average: 742 mg/L (23 public wells)	Inorganic – Primary Radiological Nitrates Pesticides VOCs and SVOCs Inorganics- Secondary	22 22 24 22 22 22	1 2 0 1 0 16
Santa Rosa			Inorganic – Primary Radiological Nitrates Pesticides VOCs and SVOCs Inorganics- Secondary	1 1 1 1 1 1	0 0 0 0 0 1

Basin/sub-basin	Status	TDS	Constituent Group[3]	Number of wells sampled[4]	Number of wells with a concentration above an MCL[5]
Pleasant Valley		Range: 597-1,420 mg/L Average: 922 mg/L (10 public wells)	Inorganic – Primary Radiological Nitrates Pesticides VOCs and SVOCs Inorganics- Secondary	10 10 10 10 10 10	0 1 0 0 0 10
Lower Santa Clara	Drinking water standards are met at public supply wells without the use of treatment methods. Areas with somewhat elevated mineral levels have been observed in the northern basin. Some wells with elevated nitrate concentration have been identified in the southern portion of the basin.		Inorganic – Primary Radiological Nitrates Pesticides VOCs and SVOCs Inorganics- Secondary	257 234 268 253 252 257	9 1 10 3 4 29
Upper Santa Clara	Nitrate content has exceeded 45 mg/L in some parts of the sub-basin with a well in the central part of the sub-basin reaching 68 mg/L. Trichloroethylene and ammonium perchlorate have been detected in four wells in the eastern part of the sub-basin.	Range: 300-1,662 mg/L Average: 695 mg/L (59 public wells)	Inorganic – Primary Radiological Nitrates Pesticides VOCs and SVOCs Inorganics- Secondary	67 56 74 66 66 67	4 2 2 4 0 7

4. CLARIFICATION OF SNMP REQUIREMENTS

The Policy states that SNMPs are to be developed for every groundwater basin in California. This will allow water purveyors and basin management agencies to take advantage of a streamlined permit process for recycled water projects that is intended to expedite the implementation of recycled water projects. The required elements of a SNMP, as specified by the Policy include:

a) Development of a basin-wide monitoring plan;
b) Annual monitoring of Constituents of Emerging Concern;
c) Consideration of Water Recycling/Stormwater Recharge/Use;
d) Source identification/Source loading and assimilative capacity estimates;
e) Implementation measures; and
f) Anti-degradation analyses.

Development of SNMPs will lead to a more comprehensive approach to basin water quality management. SNMP proponents will have the opportunity to collectively determine the implementation strategies necessary to comply with water quality objectives established to restore and maintain the beneficial use of the ground waters.

SNMPs are required for each groundwater basin in the state. However, there is flexibility in the level of detail required in each plan depending on the size, complexity and level of activity within the basin. That notwithstanding, an initial assessment of water quality (past and present) and use (including future use) is necessary in order to determine the level of specificity warranted in each basin. The following sections discuss the required SNMP elements in greater detail, providing clarification where communications with stakeholders have indicated it to be necessary.

STAKEHOLDER COLLABORATION

As stated in the Policy***:***
"…local water and wastewater entities, together with local salt/nutrient contributing stakeholders, will fund locally driven and controlled, collaborative processes open to all stakeholders that will prepare salt and nutrient management plans for each basin/sub-basin in California, including compliance with CEQA and participation by Regional Water Board staff."

Stakeholder collaboration may be within or between basins. While the Policy requires that every basin/sub-basin in the state have a SNMP, this does not preclude stakeholders working across basin boundaries to accommodate existing and future stakeholder structures and basin management efforts. Also, some differences exist between DWR Bulletin-118 basin/sub-basin definitions and court-adjudicated basins, which may influence formation of stakeholder groups.

Key stakeholders include local agencies involved in groundwater management, owners and operators of recharge facilities, water purveyors, water districts, water masters, and salt and nutrient contributing dischargers. These agencies have access to basin-specific data and information that is essential to the development of successful SNMPs. Private well owners may also have essential water quality information. Nongovernmental entities may have information about ecosystems associated with groundwater exfiltration. Other parties from regulatory agencies, environmental groups, industry, and interested persons may also provide important support. No single entity is wholly responsible for SNMP development. While a lead agency is necessary to coordinate the development effort, the point of a collaborative process is to take advantage of the collective expertise, resources and information of the participating entities. Therefore, participation to varying degrees by all stakeholders is encouraged. Table 4-1 lists the agencies already engaged in, and others that should consider being involved in salt and nutrient management for each groundwater basin or sub-basin group. This is not an exhaustive list.

TABLE 4-1: PARTICIPATING AND POTENTIAL STAKEHOLDERS FOR EACH BASIN/SUB-BASIN GROUP AS OF FEBRUARY 2012

Basin/sub-basin	**Participating and Potential Stakeholders**
Central and West Coast Basins	Water Replenishment District (WRD) of Southern California City of Los Angeles Department of Water & Power County Sanitation Districts of Los Angeles County Metropolitan Water District of Southern California West Basin Municipal Water District Central Basin Municipal Water District Los Angeles County Department of Public Works California Department of Public Health
San Fernando Basin	Upper Los Angeles River Area Water Master Los Angeles Department of Water and Power City of Glendale City of Burbank City of San Fernando City of La Crescenta Metropolitan Water District US Environmental Protection Agency California Department of Public Health
San Gabriel/	San Gabriel Basin Water Master City of Alhambra* City of Arcadia* City of Pasadena* Crescenta Valley Water District* Metropolitan Water District County Sanitation Districts of Los Angeles County
Raymond Basin	Raymond Basin Management Board City of Alhambra* City of Pasadena* Metropolitan Water District County Sanitation Districts of Los Angeles County
Three Valleys (Six Basins)	Three Valleys Municipal Water District*
Lower Santa Clara Pleasant Valley, Las Posas, Oxnard	Fox Canyon United Water Conservation District Metropolitan Water District City of Oxnard
Lower Santa Clara	Ventura County Watershed Protection District City of Fillmore County of Ventura City of Santa Paula United Water Conservation District
Eastern Santa Clara	Castaic Lake Water Agency

Basin/sub-basin	Participating and Potential Stakeholders
Saugus Aquifer, Santa Clara Castaic Valley, South Fork, Placerita Canyon, Santa Clara-Bouquet and San Francisquito Canyons, Santa Clara-Mint Canyon, Acton/Sierra Pelona/Upper Mint Canyon Basins	Los Angeles County Sanitation Districts City of Santa Clara
Tierra Rejada/Gillibrand/Simi/Thousand Oaks/Conejo/Hidden Valley/Russell Valley Basins	Calleguas Municipal Water District Calleguas Creek Watershed Management Plan
Hollywood and Santa Monica Basins	***City of Beverly Hills* City of Santa Monica****
Pleasant Valley, Las Posas, Oxnard and Tierra Rejada/Gillibrand/Simi/Thousand Oaks/Conejo/Hidden Valley/Russell Valley Basins	Calleguas Creek Watershed Management Plan, Fox Canyon, City of Oxnard, United Water Conservation District.
Ventura/Ojai	County of Ventura
Malibu Valley	City of Malibu* La Paz Treatment Facility

Potentia Stakeholders

Ideally, participation in the SNMP development process should not be limited to those agencies directly involved with basin management or salt and nutrient contributors. Other parties from regulatory agencies, environmental groups, industry, and interested persons may be included and/or kept informed; and their input solicited for each major task. Groundwater basin adjudication may impact the roles of stakeholders not identified as parties in the applicable judgments.

The Regional Water Board's role in preparing SNMPs is to:

a) Facilitate interaction and information sharing within and among groundwater basin stakeholder groups,
b) Provide regulatory guidance on the SNMP requirements of the Policy,
c) Provide technical and regulatory oversight of the SNMP process to maintain consistency in scope and content of these plans and ensure compliance with the Policy's requirements, and
d) Adopt, as appropriate, the implementation measures included in SNMPs into the Water Quality Control Plan for the Los Angeles Region.

The Regional Water Board conducted its first stakeholder workshop in November 2010 to introduce the SNMP requirement to stakeholders and initiate the development process. Since then stakeholder groups have been formed for the major groundwater basins and Regional Water Board staff have been made available to each group to provide basin-specific technical guidance and oversight of individual plans. A second stakeholder workshop was held in November 2011 to provide further clarification on certain regulatory aspects of the SNMP development process that were identified as issues of concern by stakeholders.

<u>SPECIFIC SNMP REQUIREMENTS</u>

It is the intent of the Policy "… ***that salts and nutrients from all sources be managed on a basin-wide or watershed-wide basis in a manner that ensures attainment of water quality objectives and protection of beneficial uses***."

The Policy also specifies that each salt and nutrient management plan shall include:

a) A basin/sub-basin wide monitoring plan that includes an appropriate network of monitoring locations to determine whether concentrations of salt, nutrients, and other constituents of concern are consistent with applicable water quality objectives.

b) A provision for annual monitoring of Emerging Constituents/Constituents of Emerging Concern

c) Water recycling and stormwater recharge/use goals and objectives.

d) Salt and nutrient source identification, basin/sub-basin assimilative capacity and loading estimates, together with fate and transport of salts and nutrients.

e) ***Implementation measures to manage salt and nutrient loading in the basin on a sustainable basis.***

f) An antidegradation analysis demonstrating that the projects included within the plan will, collectively, satisfy the requirements of the Antidegradation Policy (Resolution No. 68-16).

SNMP "SUGGESTED ELEMENTS"

In 2010, at the direction of the Executive Director, State Water Board staff provided a draft list of suggested elements for SNMPs that would assure that the requirements of the Policy were met (Appendix I). These elements are not considered additions to the requirements; rather they are meant to provide specifics as to how the requirements can be met, and indicate the appropriate level of detail necessary in a SNMP. They are purely recommendations and stakeholders have the option of arriving at the Policy's SNMP requirements via alternative means. This is illustrated in Table 4-2 where the suggested elements provided by State Water Board staff are lined up with the SNMP requirements as enumerated in the Policy.

TABLE 4-2: SNMP SUGGESTED ELEMENTS AND CORRESPONDING REQUIREMENTS FROM THE RECYCLED WATER POLICY

RECYCLED WATER POLICY SECTION	**RECYCLED WATER POLICY REQUIREMENT**	**SNMP SUGGESTED ELEMENTS**
6b(1)	…local water and wastewater entities, together with local salt/nutrient contributing stakeholders, will fund locally driven and controlled, collaborative processes open to all stakeholders that will prepare salt and nutrient management plans for each basin/sub-basin in California, including compliance with CEQA …	**CEQA ANALYSIS**
6b(1)(a)	It is the intent of this Policy for every groundwater basin/sub-	**GROUNDWATER BASIN CHARACTERISTICS** GROUNDWATER BASIN OVERVIEW

RECYCLED WATER POLICY SECTION	RECYCLED WATER POLICY REQUIREMENT	SNMP SUGGESTED ELEMENTS

	basin in California to have a consistent salt/nutrient management plan. The degree of specificity within these plans and the length of these plans will be dependent on a variety of site-specific factors, including but not limited to size and complexity of a basin, source water quality, stormwater recharge, hydrogeology, and aquifer water quality.	▪ Physiographic Description
		▪ Groundwater Basin and/or Sub-Basin Boundaries
		▪ Watershed Boundaries
		▪ Geology
		▪ Hydrogeology/Hydrology
		▪ Aquifers
		▪ Recharge Areas
		▪ Hydrologic Areas Tributary to the Groundwater Basin
		▪ Climate
		▪ Land Cover and Land Use
		▪ Water Sources
		
		GROUNDWATER INVENTORY
		▪ Groundwater Levels
		▪ Historical, Existing, Regional Changes
		▪ Groundwater Storage
		▪ Historical, Existing, Changes
		▪ Groundwater Production
		▪ Historical, Existing, Spatial and Temporal Changes, Safe Yield
		▪ Groundwater Mixing and Movement
		▪ Subsurface Inflow/Outflow
		▪ Horizontal and Vertical Movement and Mixing
		
		BASIN EVALUATION
		WATER BALANCE
		▪ Conceptual Model
		▪ Basin Inflow/Outflow
		▪ Groundwater, Surface Water, Imported Water, Water Transfers, Recycled Water Irrigation, Waste Water Discharges, Agricultural Runoff, Stormwater Runoff (Urban, Agriculture, Open Space), Precipitation
		▪ Infiltration, Evaporation, Evapotranspiration, Recharge, Surface Water and Groundwater Connectivity
		
		PROJECTED WATER QUALITY
		
		BASIN WATER QUALITY
		▪ Groundwater Quality
		    ▪ Background, Historical, Existing
		    ▪ Water Quality Objectives
		▪ Surface Water Quality
		▪ Delivered Water Quality
		▪ Imported Water Quality
		▪ Recycled Water Quality

6b(3)(a)	A basin/sub-basin wide monitoring plan that includes an appropriate network of monitoring locations.	**BASIN MANAGEMENT PLAN ELEMENTS** BASIN MONITORING PROGRAMS ▪ Identify Responsible Stakeholder(s) Implementing the Monitoring ▪ Monitoring Program Goals

RECYCLED WATER POLICY SECTION	RECYCLED WATER POLICY REQUIREMENT	SNMP SUGGESTED ELEMENTS

6b(3)(a)(i)
 	
6b(3)(a)(iii)
	The plan must focus on basin water quality near water supply wells and areas proximate to large water recycling projects, particularly groundwater recharge projects. Also, monitoring locations shall, where appropriate, target groundwater and surface waters where groundwater has connectivity with adjacent surface waters.
	
	The monitoring plan shall identify those stakeholders responsible for conducting, compiling, and reporting the monitoring data.
		▪ Sampling Locations
		▪ Water Quality Parameters
		▪ Sampling Frequency
		▪ Quality Assurance/Quality Control
		▪ Database Management
		▪ Data Analysis and Reporting
		▪ Groundwater Level Monitoring
		▪ Basin Water Quality Monitoring
		▪ Groundwater Quality Monitoring
		    ▪ Areas of Surface Water and Groundwater Connectivity
		    ▪ Areas of Large Recycled Water Projects
		    ▪ Recycled Water Recharge Areas
		▪ Surface Water Quality Monitoring
		▪ Stormwater Monitoring
		▪ Wastewater Discharge Monitoring
		▪ Recycled Water Quality Monitoring
		▪ Salt and Nutrient Source Loading Monitoring
		▪ Other Constituents of Concern
		▪ Water Balance Monitoring
		    ▪ Climatological Monitoring
		    ▪ Surface Water Flow Monitoring
		    ▪ Groundwater Production Monitoring

6b(3)(b)	A provision for annual monitoring of Emerging Constituents/ Constituents of Emerging Concern (e.g., endocrine disrupters, personal care products or pharmaceuticals) (CECs) consistent with recommendations by CDPH and consistent with any actions by the State Water Board taken pursuant to paragraph 10(b) of this Policy.	**BASIN EVALUATION** CONSTITUENTS OF EMERGING CONCERNS (CECs) ▪ Constituents ▪ CEC Source Identification
6b(3)(c)	Water recycling and stormwater recharge/use goals and objectives.	**BASIN MANAGEMENT PLAN ELEMENTS** GROUNDWATER MANAGEMENT GOALS ▪ Recycled Water and Stormwater Use/Recharge Goals and Objectives
6b(3)(d)	Salt and nutrient source identification, basin/sub-basin assimilative capacity and loading estimates, together with fate and transport of salts and nutrients.	**BASIN EVALUATION** SALT AND NUTRIENT BALANCE ▪ Conceptual Model ▪ Salt and Nutrient Source Identification ▪ Salt and Nutrient Loading Estimates ▪ Historical, Existing, Projected ▪ Import/Export ▪ Basin/Sub-Basin Assimilative Capacity for Salt and Nutrients ▪ Fate and Transport of Salt and Nutrients
6b(3)(e)	Implementation measures to	**BASIN MANAGEMENT PLAN ELEMENTS**

Recycled Water Policy Section	**Recycled Water Policy Requirement**	**SNMP Suggested Elements**

	manage salt and nutrient loading in the basin on a sustainable basis.	GROUNDWATER MANAGEMENT GOALS
		▪ Groundwater Management Goals
		
		SALT AND NUTRIENT LOAD ALLOCATIONS
		
		SALT AND NUTRIENT MANAGEMENT STRATEGIES
		▪ Load Reduction Goals
		▪ Future Land Development and Use
		▪ Salt/Nutrient Management Options
		▪ Salt/Nutrient Management Strategies and Modeling
		▪ Management Strategy Model Results
		▪ Feasibility
		▪ Cost
		
		PLAN IMPLEMENTATION
		SALT AND NUTRIENT MANAGEMENT PROGRAM
		▪ Organizational Structure
		▪ Stakeholder Responsibilities
		▪ Implementation Measures to Manage Salt and Nutrient Loading
		▪ Salt/Nutrient Management
		    ▪ Water Supply Quality
		    ▪ Regulations of Salt/Nutrients
		    ▪ Load Allocations
		    ▪ Salt and Nutrient Source Control
		    ▪ CEC Source Control
		    ▪ Site Specific Requirements
		▪ Groundwater Resource Protection
		▪ Additional Studies
		
		PERIODIC REVIEW OF SALT/NUTRIENT MANAGEMENT PLAN
		▪ Adaptive Management Plan
		▪ Performance Measures
		▪ Performance Evaluation
		
		COST ANALYSIS
		▪ CWC § 13141, "…prior to implementation of any agricultural water quality control program, an estimate of the total cost of such a program, together with an identification of potential sources of funding, shall be indicated in any regional water quality control plan."
		
		IMPLEMENTATION SCHEDULE

6b(3)(f)	An antidegradation analysis demonstrating that the projects included within the plan will, collectively, satisfy the requirements of Resolution No. 68-16.	**ANTIDEGRADATION ANALYSIS**
No specific reference	While the background information listed in State	**BACKGROUND** ▪ Purpose

RECYCLED WATER POLICY SECTION	RECYCLED WATER POLICY REQUIREMENT	SNMP SUGGESTED ELEMENTS
	Water Board's "Suggested Elements" is not specifically identified by the Recycled Water Policy, it would provide the necessary information in support of the conceptual basis for the plan.	▪ Protection of Beneficial Use ▪ Sustainability of Water Resources ▪ Problem Statement ▪ Salt/Nutrient Management Objectives ▪ Regulatory Framework ▪ Groundwater Beneficial Uses ▪ Stakeholder Roles and Responsibilities ▪ Process to Develop Salt/Nutrient Management Plan

The Policy recognizes that:
The degree of specificity within these plans and the length of these plans will be dependent on a variety of site-specific factors, including but not limited to size and complexity of a basin, source water quality, stormwater recharge, hydrogeology, and aquifer water quality.

In response to this, State Water Board staff has suggested three classes of basins in the context of SNMP development to assist in determining the extent of information required for each class: Major, Saline/Coastal, and No Threat basins. They are defined as follows:

a) Major: Large in size, complex land use, heavily used, water quality threatened;
b) Saline/Coastal: Basins with naturally saline groundwater not currently used as a source of water; and
c) Low threat: Basins with minimal or no known or current threat to water quality.

The State Water Board staff have also provided draft Basin Plan Amendment templates to indicate the amount of information necessary for each classification. The templates for each basin class are provided in Appendix I. Groundwater basins in the Los Angeles Region do not necessarily fit neatly into these classes; the scope of information for a SNMP will also be influenced by basin-specific attributes, conditions and water quality concerns. However, stakeholders are encouraged to use the templates as a guide.

Regardless of how a basin may be categorized, the Policy states that the SNMP must include "implementation measures to manage salt and nutrient loading in the basin on a sustainable basis."
Where applicable, implementation strategies may be developed to address issues such as pollution prevention, water quality restoration, basin recharge with storm water and recycled water and groundwater-surface water interaction.

A. BASIN/SUB-BASIN WIDE MONITORING PLAN

As set forth in the Policy Part 6(b)(3)(a), each SNMP shall include ***"a basin/sub-basin wide monitoring plan that includes an appropriate network of monitoring locations. The scale of the basin/sub-basin monitoring plan is dependent upon the site-specific conditions and shall be adequate to provide a reasonable, cost-effective means of determining whether the concentrations of salt, nutrients, and other constituents of concern as identified in the salt and nutrient plans are consistent with applicable water***

quality objectives. Salts, nutrients, and the constituents identified in paragraph 6(b)(1)(f) shall be monitored. The frequency of monitoring shall be determined in the salt/nutrient management plan and approved by the Regional Water Board pursuant to paragraph 6(b)(2).

(i) The monitoring plan must be designed to determine water quality in the basin. The plan must focus on basin water quality near water supply wells and areas proximate to large water recycling projects, particularly groundwater recharge projects. Also, monitoring locations shall, where appropriate, target groundwater and surface waters where groundwater has connectivity with adjacent surface waters.

(ii) The preferred approach to monitoring plan development is to collect samples from existing wells if feasible as long as the existing wells are located appropriately to determine water quality throughout the most critical areas of the basin.

(iii) The monitoring plan shall identify those stakeholders responsible for conducting, compiling, and reporting the monitoring data. The data shall be reported to the Regional Water Board at least every three years.

The objective of this requirement is to develop a basin wide monitoring plan that would allow for a comprehensive assessment of basin water quality in relation to beneficial uses supported by the basin and applicable water quality objectives. Several localized and project-specific monitoring programs exist throughout the basins in the region. These include monitoring of ground and surface waters by various agencies to comply with regulatory requirements, as well as voluntary monitoring efforts by these agencies and environmental groups. In keeping with the Policy's preferred approach, it is recommended that all parties engaged in water quality monitoring and data collection within each groundwater basin be identified as a starting point in developing a basin-wide monitoring plan. Compilation and review of existing programs and groundwater quality reports will reduce the potential for redundancy, and also assist in identifying data gaps that need to be addressed.

Regulatory agencies are involved in statewide monitoring of groundwater quality for the purpose of assessing and protecting groundwater basins. These agencies include the State Water Board, the California Department of Public Health, Department of Water Resources, Department of Toxic Substances Control, Department of Pesticide Regulation, and the U.S. Geological Survey. State Water Board's online groundwater information system, GeoTracker GAMA provides access to groundwater quality monitoring data from these agencies as well as other Regional Boards and the Lawrence Livermore National Laboratory. This information is available on the Groundwater Ambient Monitoring and Assessment (GAMA) program website at: http://www.waterboards.ca.gov/water_issues/programs/gama/geotracker_gama.shtml. Results from these monitoring efforts may be used in conjunction with those generated by water purveyors, managers and private entities in determining the scope of the monitoring plan.

The monitoring plan should clearly define the areal extent of the basin or sub-basin to be monitored. The region's major basin boundaries were most recently updated by the Department of Water Resources in its 2003 update of Bulletin 118 (DWR, 2003). While this update omitted some of the sub-basins that were identified in the previous version, the Regional Water Board's Basin Plan still retains these basins/sub-basin as ground waters to be protected under the California Water Code.

In developing sampling locations within a given basin, stakeholders are encouraged to consider:

a) Location of existing monitoring locations;
b) Location of existing and potential contributing sources, including areas with significant groundwater-surface water interaction; and
c) Existing and proposed recycled water projects/facilities and groundwater recharge areas.

Stakeholders are also encouraged to use the 2003 U.S. Geological Survey report titled "Framework for a Ground Water Quality and Assessment Program for California" as a resource when developing the monitoring plan. This document is available at: http://www.waterboards.ca.gov/water_issues/programs/gama/docs/usgs_rpt_72903_wri034166.pdf

The parameters to be monitored should be reflective of the water quality conditions and applicable water quality objectives within a given basin or sub-basin. Per the Policy, salts, nutrients, and CECs will be monitored in all basins. It is recommended that a draft monitoring plan be submitted to the Regional Water Board for review prior to finalizing the SNMP of which it would be a component. As with other groundwater monitoring programs in the region, data generated from SNMP monitoring programs should be submitted to the State Water Board's online groundwater information system – GeoTracker.

The Policy also states that Salt and Nutrient Management Plans may include constituents other than salt and nutrients which may impact water quality in the basin/sub-basin. However, inclusion of additional parameters is at the discretion of stakeholders involved in the SNMP development process. Stakeholders are encouraged to consider existing groundwater quality information and their knowledge of localized conditions, in determining which other parameters of concern should be monitored. Table 4-3 lists some of the known parameters of concern in the major basins and sub-basins in the Los Angeles Region.

TABLE 4-3: PARAMETERS OF CONCERN IN THE LOS ANGELES REGION'S MAJOR BASINS

<table>
<tr><th colspan="2">Groundwater Basin</th><th>Primary Parameters of Concern*</th></tr>
<tr><td colspan="2">West Coast
Central</td><td>Seawater Intrusion</td></tr>
<tr><td colspan="2">San Gabriel
Raymond</td><td>VOCs, SVOCs</td></tr>
<tr><td colspan="2">San Fernando</td><td>VOCs, Cr^{VI}</td></tr>
<tr><td>Santa Clara Watershed</td><td>Oxnard
Mound
Santa Paula
Fillmore
Piru
East Santa Clara</td><td>Nitrate, Salts, TDS, DDT, PCBs</td></tr>
<tr><td colspan="2">Pleasant Valley</td><td>Nitrates, TDS, Salts</td></tr>
</table>

Groundwater Basin		Primary Parameters of Concern*
Ojai Ventura River		Nitrates
Calleguas Watershed	Conejo Valley Russell Valley Hidden Valley Simi Valley Tierra Rejada Thousand Oaks	Nitrates, TDS, Salts
Malibu Valley		Seawater Intrusion

*This is not a complete list of parameters of concern.

B. MONITORING OF CONSTITUENTS OF EMERGING CONCERN

Constituents of emerging concerns (CECs) include several types of chemicals that may be classified as (i) persistent organic pollutants (ii) pharmaceuticals and personal care products, (iii) veterinary medicines, (iv) endocrine disruptors, and others. Such constituents present water quality concerns due to their large number and variety, their prevalence in the environment, and their potential for harmful effects on aquatic life. Much less is known about their potential effects on humans. Increasing recycled water use has the potential to increase the occurrence of CECs in ground water basins through indirect potable reuse or groundwater recharge reuse (i.e., augmentation of drinking water aquifers using recycled water), as well as urban landscape irrigation. Staff are coordinating with EPA, the Southern California Coastal Water Research Project, and others in studying this issue.

Recycled Water Policy CEC Monitoring Requirements:
As stated in the Policy, ***"[e]ach Salt and Nutrient Management Plan shall include a provision for annual monitoring of Emerging Constituents/Constituents of Emerging Concern (CECs) consistent with recommendations by CDPH and consistent with any actions by the State Water Board taken pursuant to paragraph 10(b) of this Policy."***

Paragraph 10(b) of the Policy directs the State Water Board, in consultation with the California Department of Public Health (CDPH), to convene a "blue-ribbon" advisory panel to guide future actions relating to constituents of emerging concern.

The advisory panel (Panel) completed its report (Panel Report) on CECs in June 2010. State Water Board staff developed a staff report (SWRCB, 2010) based on recommendations from the Panel and those provided by the CDPH. In December 2010, the State Water Board held a public hearing regarding proposed CEC monitoring requirements presented in the staff report.
The Panel Report employed a risk-based screening process to identify CECs of toxicological relevance to monitor for potable and non-potable recycled water use scenarios (i.e., groundwater recharge reuse and landscape irrigation). The screening approach focused the universe of CECs based on their potential for health effects and their occurrence in recycled water in California. The Panel Report recommends monitoring of selected performance indicator CECs to evaluate the performance of treatment processes to remove CECs; and recommends monitoring of surrogate parameters, such as turbidity, dissolved organic carbon, and conductivity, to verify that treatment units are working as designed.

Health-based CECs selected for monitoring include caffeine, 17-beta-estradiol (17β-estradiol), n-nitrosodimethylamine (NDMA), and triclosan.

The Panel also selected a set of performance-based indicator CECs. Each selected performance-based indicator CEC represents a group or a family of CECs. The removal of the performance-based indicator CEC through a treatment process provides an indication of the removal of the other CECs in the group, provide they have similar properties. The six compounds selected to serve as performance-based indicator CECs are caffeine, gemfibrozil, n,n-diethyl-meta-toluamide (DEET), iopromide, NDMA, and sucralose. Caffeine and NDMA serve as both health and performance-based indicator CECs.

Upon reviewing the oral and written comments received on the publicly noticed staff report, the State Water Board drafted an amendment to the Policy prescribing monitoring requirements for CECs in recycled water used for groundwater recharge reuse and landscape irrigation. The draft Policy amendment ("Requirements for Monitoring Emerging Constituents/Constituents of Emerging Concern for Recycled Water") was released for public comment on May 9, 2012. The proposed amendment and accompanying attachment can be found on the State Water Board's website at: http://www.waterboards.ca.gov/water_issues/programs/water_recycling_policy/draft_amendment_to_policy.shtml

Other Considerations

The California Department of Public Health has released a draft of their Groundwater Replenishment Reuse Regulations, which are used to regulate recycled water for replenishment projects. Upon adoption of the final regulation, where the CEC monitoring requirements differ from those specified by the State Water Board in the amendment to the Policy, monitoring for the additional constituents specified by California Department of Public Health regulations should be included where groundwater recharge using recycled water is a consideration.

Section 60320.120(c) of the draft regulations requires annual monitoring of indicator CECs specified by CDPH and the Regional Water Board by proponents of groundwater replenishment and reuse projects (GRRPs). Stakeholders may take this into consideration in developing CEC monitoring programs for each basin/sub-basin where such projects exist or are planned. .

Regional Board Considerations

The Los Angeles Regional Board has taken early actions to begin to address CECs. The Board currently includes CEC Special Study Requirements in NPDES permits for Publicly Owned Treatment Works (POTWs), during permit renewal.
In addition, the development of a CEC monitoring strategy for the region was identified as a priority project during the project-selection phase of the 2011-13 triennial review. The Regional Board has also directed resources toward establishing some baseline information on CEC occurrence, and fate and transport in inland surface waters throughout the region. The information gathered from on-going monitoring and other applicable studies will inform future monitoring strategies.

Where site specific CEC monitoring is required for existing or proposed projects within a groundwater basin or sub-basin, SNMP proponents are encouraged to consider including them as part of the CEC monitoring strategies developed for the basin or sub-basin

C. SALT AND NUTRIENT ANALYSIS

As stated in the Policy***, "[e]ach SNMPs shall include salt and nutrient source identification, basin/sub-basin assimilative capacity and loading estimates, together with fate and transport of salts and nutrients…"*** in order to ***"… address and implement provisions, as appropriate, for all sources of salt and/or nutrients to groundwater basins, including recycled water irrigation projects and groundwater recharge reuse projects."***

Identification of existing and planned future sources of salts and nutrients is an essential part of a SNMP. This allows for a more accurate assessment of the pollutant loads to the basin and analysis of the final impact on basin water quality as determined through fate and transport analysis. A comprehensive consideration of sources will lead to a robust assessment and a more effective implementation strategy for basin management. Table 4-5 provides examples of source considerations in conducting this analysis.

TABLE 4-6: LIKELY SOURCES OF SALTS, NUTRIENTS, AND OTHER POLLUTANTS OF CONCERN IN GROUNDWATER BASINS

Source Considerations	Examples
Land uses	Agricultural and landscape irrigation
Groundwater recharge	Recycled water, Municipal water supply, Stormwater
Point source discharges to groundwater	Municipal and Industrial facilities, Other permitted facilities (e.g. landfills)
Non-point source discharges	Agricultural and nursery facilities, on-site wastewater treatment system discharges
Specific point sources	Injection wells*, percolation basins*
Surface water-groundwater interaction	Percolation from stream flow, stormwater runoff infiltration
Sub-surface inflow	Seawater intrusion, upstream inflow
Discrete discharges	Chemical spills, leaking tanks, improper disposal

*associated with oil production

In order to estimate pollutant loads to these basins, it will be necessary to quantify the mass loadings of all identifiable sources to each basin/sub-basin, and evaluate their fate and transport Stakeholders have the flexibility to apply any scientifically defensible methodology to make these determinations.

D. WATER RECYCLING AND STORMWATER RECHARGE/USE GOALS AND OBJECTIVES

Recycled Water Use

As stated in the Policy, ***"[e]ach SNMP shall include water recycling and stormwater recharge goals and objectives."*** With the intent of moving towards sustainable management of surface waters and groundwater, the Policy adopts the goals of increasing the use of recycled water in California over 2002 levels by at least one million acre-feet per year (afy) by 2020 and by at least two million afy by 2030***.***

There are a significant number of recycled water facilities in the Los Angeles Region. The State Water Board conducted a 2009 survey of recycled water use throughout the state to determine the amount of recycled water used and the beneficial uses to which recycled water was put. Only publicly-owned wastewater and water recycling agencies were included in the survey. Due to the low response rate from agencies solicited (18%), data from a similar 2001 survey were included in the overall results. Table 4-6 shows survey results for responding agencies in the Los Angeles Region. More details on the survey are available on the State Water Board's website at http://www.waterboards.ca.gov/water_issues/programs/grants_loans/water_recycling/munirec.shtml.

TABLE 4-7: SURVEY RESULTS OF RECYCLED WATER USE BY POTWS AND WATER RECYCLING AGENCIES IN THE LOS ANGELES REGION

Agency	Total Reuse (AFY)	Beneficial Use
Burbank Water and Power	2090	Golf Course and Landscape Irrigation, Industrial
City of Burbank	879	Landscape Irrigation, Geothermal/Energy Production
City of Los Angeles Bureau of Sanitation	40,787	Recreational Impoundment, Natural systems restoration, Wetlands, Wildlife Habitat
City of Los Angeles Department of Water and Power	32,113	Golf Course & Landscape Irrigation, Industrial, Seawater Intrusion Barrier, Recreational Impoundment, Natural systems restoration, Wetlands, Wildlife Habitat
City of Los Angeles Department of Public Works	3,683	Landscape Irrigation, Geothermal/Energy Production
Camarillo Sanitation District/City of Camarillo	1,293	Agriculture Irrigation
Camrosa Water District	779	Agriculture Irrigation
City of Fillmore	110	Landscape Irrigation
County Sanitation Districts of Los Angeles County	80,000	Unspecified (likely groundwater recharge)
Las Virgenes Municipal Water District	5,174	Landscape Irrigation
Los Angeles County Department of Public Works	148	Landscape Irrigation
Long Beach Water Department	6,380	Golf Course & Landscape Irrigation, Commercial, Seawater Barrier
Ventura County Waterworks District 1	428	Golf Course Irrigation
Ventura County Waterworks District 1	63	Commercial
West Basin Municipal Water District	26,032	Landscape Irrigation, Industrial, Seawater Intrusion Barrier

While the majority of facilities surveyed used their recycled water for irrigation, a significant portion of the recycled water is used for groundwater recharge. In the Central and West Coast Groundwater Basins, recycled water is used extensively by the Water Replenishment District of Southern California for groundwater recharge and to maintain seawater intrusion barriers. An innovative form of recycling is practiced by the City of Santa Monica using its Santa Monica Urban Runoff Recycling Facility, which collects and treats 90% of the City's urban runoff in the dry season for use in landscape irrigation.

Substituting potable water with recycled water is another means of increasing recycled water use and reducing dependence on imported water supplies. This may be achieved by developing an indirect potable use program similar to the one initiated by the Orange County Water District.

SNMPs should include goals and objectives for water recycling. As part of developing these goals, it may be helpful to examine master plans for water recycling that have been developed by recycled water producers, distributors, and municipalities, as well as Urban Water Management Plans.

Stormwater Use

Another goal of the Policy, with the intent of increasing sustainable local water supplies, is to increase the use of stormwater over the levels in 2007 by at least 500,000 afy by 2020 and by at least one million afy by 2030.The Policy recognizes that stormwater is typically lower in nutrients and salts and can augment local water supplies, and therefore deems the inclusion of a significant stormwater use and recharge component within the salt/nutrient management plans to be critical to the long-term sustainable use of water in California. In support of this, the State Water Board expects to develop additional policies to encourage the use of stormwater, encourage water conservation, encourage the conjunctive use of surface and groundwater, and improve the use of local water supplies.

The Regional Water Board also recognizes stormwater as a valuable resource and contains a requirement in its Municipal Separate Stormwater Systems (MS4) permits that new developments and significant redevelopments retain stormwater onsite using low impact development (LID) best management practices (BMPs), with an allowance for regional and other alternative compliance approaches. MS4 permits require that land development projects be designed to infiltrate, harvest and use, evapotranspire, or bio-treat a specified volume of stormwater onsite using LID BMPs, if technically feasible. The intent of this requirement is twofold – first, to achieve improvements in water quality by preventing pollutants conveyed by stormwater from being discharged to receiving waters and, second, to increase the use of stormwater for groundwater recharge.

Since new developments and redevelopments will not necessarily occur in areas where infiltration or recharge is feasible, it is important that stormwater use be considered on a regional scale to maximize the potential for stormwater infiltration and use. Basin stakeholders are encouraged to consider such an approach in developing their implementation strategies for increasing stormwater use.

E. Implementation Measures

As stated in the Policy, ***"[e]ach SNMP shall include implementation measures to manage salt and nutrient loading in the basin on a sustainable basis."***

Implementation strategies should integrate water quantity and quality, groundwater and surface water, and recharge area protection in order to maintain a sustainable long-term supply for multiple beneficial uses. These strategies will be dictated to a large degree by basin-specific characteristics and conditions. Depending on conditions within each basin/sub-basin, strategies may generally be geared towards:

a) Pollution prevention to maintain and protect ground water quality at levels consistent with Basin Plan objectives and the State's anti-degradation policy;
b) Source load reductions to groundwater basins;
c) Treatment and management of areas of impaired water quality;
d) Increasing groundwater recharge by storm water; and
e) Increasing recycled water use.

Based on water quality conditions within a basin and the results of the source loading and fate and transport analysis, salts and nutrients from identifiable non-point and point sources should be managed in a manner that will support attainment of applicable water quality objectives. Measurable parameters should be identified for evaluation of the effectiveness of the strategies, and an implementation schedule and monitoring program should be developed to track progress toward basin management goals. Implementation measures may also include, as appropriate, strategies for local water supply development including increasing the use of recycled water, and plans for stormwater retention for use or recharge.

The consideration of implementation alternatives should take into account the interest of all parties currently involved in basin use and management in order to resolve any potential competing or conflicting interests prior to finalizing the basin management approach. To the greatest extent feasible, input from all stakeholders and interested parties should be solicited as part of the development process.

The Regional Water Board recognizes that a number of agencies have developed basin management plans for specific basins; while others have developed specific management measures for salt and/or nutrient impairments. Existing basin or sub-basin management plans and salt and nutrient management strategies should be assessed to determine their applicability towards the SNMP requirements of the Policy. For the purpose of SNMP development, these efforts may be supplemented as necessary to provide missing elements or address inconsistencies and demonstrate compliance with SNMP requirements. In instances where water quality from a sub-basin or basin may impact or be impacted by that of adjacent basins, all stakeholders concerned are encouraged to collaborate in developing salt and nutrient management strategies.

F. ANTI-DEGRADATION REQUIREMENTS

As stated in the Policy, ***"[e]ach Salt and Nutrient Management Plan shall include an antidegradation analysis demonstrating that the projects included within the plan will, collectively, satisfy the requirements of Resolution No. 68-16."***

Resolution No. 68-16 is the State Water Board's "Statement of Policy with respect to Maintaining High Quality of Waters in California" also known as the State Anti-degradation Policy. It requires that:

> ***Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.***

> ***Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.***

The intent of Resolution 68-16 is to preserve the State's high quality waters. Any activity that results in the discharge of waste must be subject to treatment or controls that assure that the discharge will not cause the receiving water to exceed water quality objectives set forth in the applicable Basin Plan or cause pollution or nuisance. In addition, the discharge should be controlled to achieve the highest water quality feasible. In other words, water quality should be the best it can be, but at least not exceed water quality objectives or impact beneficial uses. The water quality objectives are set forth in the Regional Water Board Basin Plans, the State Water Board's Sources of Drinking Water Policy, and the California Ocean Plan. The baseline water quality to maintain refers to the highest existing quality since Resolution No. 68-16 was adopted in 1968, although if a lowering of water quality was formally approved in the past, this could adjust the baseline.

In some instances, degradation of existing water quality may be allowed so long as such degradation is consistent with the maximum benefit to the people of the state. Modification of existing water quality through the development of site specific objectives should only be considered when all other salt and nutrient management alternatives have been exhausted; and even so should be part of a larger salt and nutrient load reduction strategy. Such changes to water quality objectives may only occur where the existing water quality is better than that required to support the most sensitive beneficial use(s) of the basin (i.e. where there is assimilative capacity). Basin-wide management strategies should always be developed in a manner that would be protective of the most sensitive beneficial uses within a basin.

Where project(s) within SNMPs have the potential to degrade the water quality within a basin, stakeholders are required to conduct an anti-degradation analysis. The rigor of the analysis required depends on the nature and extent of the potential degradation. The guidelines and requirements for such analysis are provided below and parallel, to a large extent, those provided in the Policy for basins where plans are yet to be completed. This analysis will be part of the supporting documentation for the Basin Plan amendment incorporating the implementation plan(s) consistent with implementation measures identified in the SNMP. Implementation projects must be demonstrated to be consistent with Resolution 68-16 as supported by the anti-degradation analysis conducted as part of SNMP development.

The Policy recognizes that groundwater recharge and landscape irrigation projects are to the benefit of the people of the state, despite having the potential to lower water quality within the basin. As such, the Policy provides a threshold below which less rigorous analysis will be conducted for the anti-degradation analysis – during the period before SNMPs have been developed.

The Regional Water Board will apply the same considerations, on a basin-wide scale, once SNMPs are in place.

(1) Generally, a basin-wide implementation strategy that utilizes less than 20 percent of the available assimilative capacity in a basin/sub-basin need only conduct an anti-degradation analysis verifying the use of the assimilative capacity. For those basins /sub-basins where the Regional Water Boards have not determined the baseline assimilative capacity, the baseline assimilative capacity shall be calculated by the initial project proponent, with review and approval by the Regional Water Board. The available assimilative capacity shall be calculated by comparing the water quality objectives with the average concentration of the basin/sub-basin[7], either over the most recent five years of data available or using a data set approved by the Regional Water Board Executive Officer. Though the Policy expresses assimilative capacity in units of concentration, the Regional Water Board recognizes that, depending on the complexity of the basin, it may be more appropriate to calculate and express assimilative capacity as a load. Historical groundwater quality data will be reviewed in order to inform decisions about assimilative capacity and conclusions drawn about anti-degradation requirements. In determining whether the available assimilative capacity will be exceeded by the basin-wide implementation strategy, the Regional Water Board will consider the impacts of the strategy over at least a ten-year time frame, based on an analysis of these impacts provided by the project proponent(s), and other relevant data and information.

(2) In the event a basin wide implementation strategy utilizes more than 20 percent of the available assimilative capacity in a basin/sub-basin), a more rigorous anti-degradation analysis shall be performed to comply with Resolution No. 68-16. Proponents of the strategy shall provide sufficient information for the Regional Water Board to make this determination.

In addition to verification of the assimilative capacity to be used, the analysis should show:

a) That the strategy is necessary to accommodate important economic or social development;
b) Any reduction in water quality will be consistent with maximum benefit to people of the State;
c) Reduction in water quality will not unreasonably affect actual or potential beneficial uses; and
d) Water quality will not fall below water quality objectives set to protect beneficial uses as prescribed in the Basin Plan.

The severity and extent of water quality reduction will be considered when evaluating the benefits required to compensate for the degradation. The magnitude of the proposed strategy and potential reduction in water quality will also determine the scope of impact assessment. The Regional Water Board will ensure that a systematic impact assessment is conducted.

Factors that should be considered when determining whether a strategy is necessary to accommodate social or economic development and is consistent with maximum benefit to the people of the State, include:

1. Past, present, and probable beneficial uses of the water.

[7] More than one average concentration may be necessary for a given basin/sub-basin to fully evaluate variability between sub-areas or sub-basins.

2. Economic and social costs, tangible and intangible, of the proposed strategy compared to benefits. The economic impacts to be considered may include the cost of alternative actions in lieu of the proposed strategy, as well as the cost of any mitigation necessary to address degradation resulting from the proposed strategy. The long-term and short-term socioeconomic impacts of maintaining existing water quality must be considered. Examples of social and economic parameters that could be affected are employment, housing, community services, income, tax revenues, and land value. To accurately assess the impact of the proposed strategy, the projected baseline socioeconomic profile of the affected community without the strategy should be compared to the projected profile with the strategy.
3. The environmental aspects of the proposed discharge must be evaluated. The proposed discharge, while actually causing a reduction in water quality in a given water body, may be simultaneously causing an increase in water quality in a more environmentally sensitive body of water from which the discharge in question is being diverted.
4. The implementation of feasible alternative control measures, which might reduce, eliminate, or compensate for negative impacts of the proposed action.

Participation from the public and appropriate government agencies should be solicited in the "maximum benefit" determination to ensure that the environmental, social, and economic impacts of the strategy are accurately assessed.

The Regional Water Board will ultimately make the decision as to whether or not it is to the maximum benefit of the people of the State to use more than 20% of the assimilative capacity of a basin or sub-basin as part of a SNMP's implementation strategy. Consideration will be given to providing buffers for varying environmental conditions such as droughts, as well as the needs of future generations.

Where no assimilative capacity exists for salts and/or nutrients within a basin/sub-basin, stakeholders may explore and implement strategies for creating such assimilative capacity. As previously mentioned, modifying water quality objectives should only be considered where all other alternatives have been exhausted and then only as part of a larger comprehensive salt and nutrient reduction strategy. Any modifications to water quality objectives shall be done in a manner that protects the most sensitive beneficial uses in a basin/ sub-basin.

The Policy includes an example of an approved method for conducting an anti-degradation analysis based on a numeric groundwater model. It was used by the State Water Board in connection with Resolution No. 2004-0060 and the Regional Water Board in connection with Resolution No. R8-2004-0001. However, stakeholders have the flexibility to use other methods that have been deemed acceptable by the Regional Board. SNMP proponents should vet any such other methods with Regional Board staff prior to embarking on an analysis using the method. The Policy also encourages an integrated approach (using surface water, groundwater, recycled water, stormwater, pollution prevention, water conservation, etc.) to the implementation of Resolution No. 68-16.

An anti-degradation analysis will not be required where it has been demonstrated that implementation strategies are not expected to result in water quality degradation in a groundwater basin.

E. Discharges covered by the Recycled Water Policy

The Policy is specifically geared towards increasing the use of recycled water from municipal wastewater sources permitted through Wastewater Recycling Requirements (WRRs). Land discharges of wastewater are addressed through separate Waste Discharge Requirements (WDRs), however, this does not preclude them from the SNMP development process. Such discharges (existing and proposed) should be accounted for in determining source loading estimates, determination of assimilative capacity, and in basin management planning. In the same vein, recycled water projects already in progress should be considered during the same phases of SNMP development.

5. CEQA REQUIREMENTS

The Policy requires that salt and nutrient management plans developed for basin/sub-basins comply with the applicable California Environmental Quality Act (CEQA) requirements. The following outlines the CEQA requirements for the Regional Board adoption of SNMP implementation strategies into the Water Quality Control Plan for the Los Angeles Region (Basin Plan). SNMP proponents may be required to comply with other CEQA requirements related to specific implementation strategies for salt and nutrient management contained in their plans. SNMP proponents are to conduct the environmental analysis required for Regional Board adoption.

The CEQA requires state and local agencies determine the potential significant environmental impacts of proposed projects and identify measures to avoid or mitigate these impacts where feasible. The CEQA Guidelines, which provide the protocol by which state and local agencies comply with CEQA requirements, are detailed in California Code of Regulations, Title 14 § 15000 et seq.

The basic purposes of CEQA are to: 1) inform decision makers and public about the potential significant environmental effects of a proposed project, 2) identify ways that environmental damage may be mitigated, 3) prevent significant, avoidable damage to the environment by requiring changes in projects, through the selection of alternative projects or the use of mitigation measures when feasible, and 4) disclose to the public why an agency approved a project if significant effects are involved (Cal. Code Regs., tit. 14, § 15002(a)).

LEAD AND RESPONSIBLE AGENCIES UNDER CEQA

As set forth in the Policy, stakeholders will fund SNMP development including any necessary analysis and documentation to comply with CEQA. Stakeholders will develop implementation strategies, which may include projects requiring environmental analysis. Public agencies that carry out or implement projects associated with the SNMPs are considered the lead agencies under CEQA for these individual projects. However, in addition, the implementation measures identified in a SNMP may be adopted as amendments to the Basin Plan by the Regional Water Board, and CEQA analysis is a required part of the adoption process in accordance with the State Water Board's certified regulatory program. As such, for the purpose of Water Board adoption of a Basin Plan amendment, the Regional Water Board will be the lead agency for purposes of CEQA. Therefore, it will be necessary for stakeholders and Regional Water Board staff to work in collaboration.

REQUIRED ENVIRONMENTAL ANALYSIS

The California Secretary for Natural Resources has certified the State and Regional Water Boards' basin planning process as exempt from certain requirements of CEQA, including preparation of an initial study, negative declaration, and environmental impact report (California Code of Regulations, Title 14, Section 15251(g)).

The basin planning process is certified by the Secretary for Natural Resources as a regulatory program exempt from the requirements to prepare an Environmental Impact Report, Negative Declaration, and Initial Study (Title 14, California Code of Regulations (CCR), Section 15241(g)). However, a certified program is subject to other provisions in CEQA (Pub. Resources Code, Section 21000 et seq.), such as the requirement to avoid significant adverse effects to the environment where feasible. The Regional Board is required to comply with State Water Board regulations set forth in California Code of Regulations, Title 23, sections 3775 et. seq, and Public Resources Code section 21159.

Requirements of California Code of Regulations, Title 23, Section 3777(a)

The “certified regulatory program” of the Regional Water Board is also subject to the substantive requirements of California Code of Regulations, Title 23, Section 3777(a), which requires a written report that includes a description of the proposed activity, an analysis of reasonable alternatives, and an identification of mitigation measures to minimize any significant adverse environmental impacts. Section 3777(a) also requires the Regional Water Board to complete an environmental checklist as part of its substitute environmental documents.

Any water quality control plan, state policy for water quality control, and any other components of California's water quality management plan as defined in Code of Federal Regulations, title 40, sections 130.2(k) and 130.6, proposed for board approval or adoption must include or be accompanied by Substitute Environmental Documentation (SED) and supported by substantial evidence in the administrative record. The Draft SED may be comprised of a single document or a compilation of documents. The Draft SED must be circulated prior to board action approving or adopting a project, as specified in sections 3778 and 3779. The Draft SED shall consist of:

a) A written report prepared for the board, containing an environmental analysis of the project;
b) A completed Environmental Checklist (a sample of which is contained in Appendix II). The sample Environmental Checklist may be modified as appropriate to meet the particular circumstances of a project. The issues identified in the Environmental Checklist must be evaluated in the checklist or elsewhere in the SED; and
c) Other documentation as the board may include.

The Draft SED shall include, at a minimum, the following information:

a) A brief description of the proposed project;
b) An identification of any significant or potentially significant adverse environmental impacts of the proposed project;
c) An analysis of reasonable alternatives to the project and mitigation measures to avoid or reduce any significant or potentially significant adverse environmental impacts; and
d) An environmental analysis of the reasonably foreseeable methods of compliance. The environmental analysis shall include, at a minimum, all of the following:
    i. An identification of the reasonably foreseeable methods of compliance with the project;

ii. An analysis of any reasonably foreseeable significant adverse environmental impacts associated with those methods of compliance;
iii. An analysis of reasonably foreseeable alternative methods of compliance that would have less significant adverse environmental impacts; and
iv. An analysis of reasonably foreseeable mitigation measures that would minimize any unavoidable significant adverse environmental impacts of the reasonably foreseeable methods of compliance.

In the preparation of the environmental analysis described in d) above, the board may utilize numerical ranges or averages where specific data are not available; however, the board shall not be required to engage in speculation or conjecture. The environmental analysis shall take into account a reasonable range of environmental, economic, and technical factors, population and geographic areas, and specific sites, but the board shall not be required to conduct a site-specific project level analysis of the methods of compliance, which CEQA may otherwise require of those agencies who are responsible for complying with the plan or policy when they determine the manner in which they will comply.

As to each environmental impact, the SED shall contain findings as described in State CEQA Guidelines section 15091, and if applicable, a statement described in section 15093.

If the board determines that no fair argument exists that the project could result in any reasonably foreseeable significant adverse environmental impacts, the SED shall include a finding to that effect in lieu of the analysis of project alternatives and mitigation measures.

If the board determines that no fair argument exists that the reasonably foreseeable methods of compliance with the project could result in any reasonably foreseeable significant adverse environmental impacts, the SED shall include a finding to that effect in lieu of the analysis of alternative methods of compliance and associated mitigation measures.

Requirements of Public Resources Code section 21159

Public Resources Code section 21159 has the same minimum requirements for the environmental analysis which the Regional Water Board is also required to fulfill along with the same considerations. Section 21159(c) requires that the environmental analysis take into account a reasonable range of:

a) Environmental, economic, and technical factors,
b) Population and geographic areas, and
c) Specific sites.

A “reasonable range” does not require an examination of every site, but a reasonably representative sample of them. The statute specifically states that the section shall not require the agency to conduct a “project-level analysis” (Public Resources Code § 21159(d)). Rather, a project-level analysis must be performed by the local agencies that will implement the strategies and projects identified in the SNMP (Public Resources Code §21159.2). Notably, the Regional Water Board is prohibited from specifying the manner of compliance with its regulations (Cal. Water Code §13360), and accordingly, the actual environmental impacts will necessarily depend upon the compliance strategy selected by the local agencies and other permittees.

State Water Board Finding

As set forth in the Policy, the State Water Board finds that the use of recycled water which supports the sustainable use of groundwater and/or surface water that is sufficiently treated so as not to adversely impact public health or the environment and which ideally substitutes for use of potable water is presumed to have a beneficial impact. Other public agencies are encouraged to use this presumption in evaluating the impacts of recycled water projects on the environment as required by the CEQA.

Public Participation Requirements for the CEQA Process

Pursuant to California Public Resources Code section 21083.9, a CEQA Scoping Meeting will be held to receive comments on the appropriate scope and content of substitute environmental documents supporting amendments to the Basin Plan to incorporate salt and nutrient management plans for groundwater basins in the Los Angeles Region. The purpose of this meeting is to scope the proposed projects and/or strategies for groundwater basin management and to determine, with input from interested agencies and persons, if those means would result in significant adverse impacts to the environment. Information garnered from this process will be considered during development of the draft SED and, where applicable, may be incorporated into the final document.

ROLES OF STAKEHOLDER GROUPS AND REGIONAL WATER BOARD STAFF IN THE CEQA PROCESS

Both Regional Water Board staff and stakeholder groups will be significantly involved in the environmental analysis for the SNMPs. Table 5-1 lists the different aspects of the CEQA process and identifies the roles of each party.

TABLE 5-1: ROLES OF STAKEHOLDERS AND REGIONAL WATER BOARD STAFF IN THE CEQA PROCESS FOR BASIN PLAN AMENDMENTS

TASK	REGIONAL WATER BOARD	STAKEHOLDERS
LEAD AGENCY	Lead	
CEQA SCOPING MEETING	Co-Lead	Co-Lead
ENVIRONMENTAL ANALYSIS	Oversight	Lead
SED DEVELOPMENT	Oversight	Lead
DOCUMENT REVIEW	Lead	
RESPONSE TO COMMENTS	Lead - Regulatory	Lead - Technical
REVISIONS	Oversight/Review	Lead
PUBLIC HEARING	Lead	
PROJECT LEVEL EIR		Lead

The CEQA scoping meeting will be held jointly by Regional Water Board staff and stakeholder groups, while the environmental analysis will be conducted primarily by the groundwater basin stakeholder groups with oversight and review by Regional Water Board staff. Following the release of the draft environmental document for public review, it is anticipated that there will be comments on its technical and regulatory aspects. The Regional Water Board will take the lead in responding to the regulatory comments, while stakeholders will be the lead for responding to technical comments. Any revisions necessary in response to public comments will be the purview of the stakeholder groups with oversight by Regional Water Board staff. Preparation of the environmental documentation for consideration and adoption by the Regional Water Board will be the responsibility of Regional Water Board and staff. Finally, once the SNMPs have been adopted and specific projects are to be implemented, basin stakeholders will be responsible for the development of project-specific environmental analysis and other related CEQA requirements.

TIMELINE FOR THE CEQA PROCESS IN RELATION TO SNMP DEVELOPMENT

The SED will be considered by the Regional Water Board as part of the adoption of the implementation provisions contained in the SNMPs. Approval of the SED is separate from approval of a specific project alternative or a component of an alternative. Approval of the SED refers to the process of: (1) addressing comments, (2) confirming that the Regional Water Board considered the information in the SED, and (3) affirming that the SED reflects independent judgment and analysis by the Regional Water Board - CEQA Guidelines Section 10590 and 15090 (Title 14 of CCR).

Stakeholders are encouraged to begin the CEQA process once potential basin management strategies have been identified during SNMP development. The CEQA scoping meeting should be held early enough in the process for consideration of public comments during the development of the substitute environmental document. Ideally the SED should be completed at the same time as the SNMP for timely consideration and adoption by the Regional Water Board.
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6. BOARD ADOPTION OF SNMPS

As stated in the Policy: ***Salt and nutrient plans shall be completed and proposed to the Regional Water Board within five years from the date of this Policy unless a Regional Water Board finds that the stakeholders are making substantial progress towards completion of a plan. In no case shall the period for the completion of a plan exceed seven years.***

Stakeholders are encouraged to complete and submit SNMPs for each basin by May 2014 as specified in the Policy. However, the Policy allows for an extension where significant progress has been made but this deadline cannot be met. For this purpose, the Regional Water Board will consider "significant progress" as follows: (i) upon completion of a collaborative stakeholder developed basin wide monitoring plan that meets the requirements set forth in the Policy, (ii) completion of the salt/nutrient source identification, loading and linkage analysis, and (iii) commencement of the development of implementation strategies for basin management. Stakeholders will also be required to make a showing that completion by the May 2014 deadline is infeasible. SNMPs that have not achieved significant progress may warrant greater Regional Board involvement or Regional Board developed plans, and will be addressed on a case-by-case basis.

Within one year of the receipt of a proposed salt and nutrient management plan, the Regional Water Boards shall consider for adoption revised implementation plans, consistent with Water Code section 13242, for those groundwater basins within their regions where water quality objectives for salts or nutrients are being, or are threatening to be, exceeded. The implementation plans shall be based on the salt and nutrient plans required by this Policy.

The Regional Water Board expects to adopt the implementation provisions of each SNMP within one year of submission by basin/sub-basin stakeholders. State Water Board staff have provided templates for these Basin Plan amendments (see Appendix I) as a guide to the scope of information to be provided in the amendment language. Table 6-1 provides a tentative schedule of stakeholder tasks and submissions.

TABLE 6-1: TENTATIVE SCHEDULE OF STAKEHOLDER SUBMISSIONS

Tasks	Date
CEQA Scoping Meeting	June 2013
Initial Draft SNMP & CEQA submittal	November 2013
Final Draft SNMP & CEQA submittal	May 2014
Regional Water Board Consideration and Adoption	May 2015 and beyond

Regional and State Water Board Resources

Regional Water Board staff expects to continue working collaboratively with groundwater basin stakeholders during the SNMP development process, as well as through the Board adoption process. In addition to staff assigned for this purpose, the following resources are available to stakeholders to facilitate the process.

Regional Water Board SNMP website:

www.waterboards.ca.gov/losangeles/water_issues/programs/salt_and_nutrient_management/index.shtml

SNMP E-mail list subscription:
http://www.waterboards.ca.gov/resources/email_subscriptions/reg4_subscribe.shtml

Groundwater Ambient Monitoring and Assessment (GAMA) website:
www.waterboards.ca.gov/losangeles/water_issues/programs/sgama/geotracker_gama.html

State Water Board website:
http://www.swrcb.ca.gov/water_issues/programs/water_recycling_policy/index.shtml

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Appendix D

Final Revised Workplan of the Salt/Nutrient Management Plan, Central Basin and West Coast Basin, October 24, 2011, and the Los Angeles Regional Water Quality Control Board Workplan Approval Letter

California Regional Water Quality Control Board
Los Angeles Region

320 W. 4th Street, Suite 200, Los Angeles, California 90013
(213) 576-6600 • FAX (213) 576-6640
http://www.waterboards.ca.gov/losangeles

Matthew Rodriquez
Secretary for Environmental Protection

Edmund G. Brown Jr.
Governor

December 13, 2011

Theodore A. Johnson
Chief Hydrogeologist
Water Replenishment District
4040 Paramount Boulevard
Lakewood, CA 90712

WORK PLAN FOR THE SALT AND NUTRIENT MANAGEMENT PLAN FOR THE CENTRAL AND WEST COAST GROUNDWATER BASINS

Thank you for your submittal of the revised work plan for the Salt and Nutrient Management Plan (SNMP) for the Central and West Coast Groundwater Basins (CWCB) on October 24, 2011. The initial draft workplan was submitted on August 30, 2011 and was modified to incorporate comments from Regional Board staff with respect to reflecting the full intent of the Recycled Water Policy's SNMP requirements. It is apparent from the efforts invested in the development of the workplan that CWCB stakeholders recognize the benefits of developing and implementing SNMPs for the preservation of the quality of the Los Angeles Region's groundwater resources.

In keeping with the expectations of the Recycled Water Policy, this work plan was developed in a collaborative manner including key water agencies/purveyors and other interested parties in the Central and West Coast Groundwater Basins. Staff has reviewed this revised plan and has found that it contains the SNMP requirements as provided in the State Recycled Water Policy, along with those clarifying elements provided by State Board. While noting that the work plan adequately outlines the steps for SNMP development, as we have articulated at recent meetings, it may be necessary to expand on or modify some of these elements as the development process progresses.

Regional Board staff hereby endorse the approach to Salt and Nutrient Management Plan development outlined in the revised workplan. Regional Board staff also encourage CWCB stakeholders to fully address all the elements contained therein during development of the SNMP for the Central and West Coast Groundwater Basins, while maintaining the flexibility to modify or expand on these elements as the need arises.

We expect to continue to work closely with your agency and other CWCB stakeholders throughout the SNMP development process. If you have any questions please contact the Regional Board's project leads for the CWCB - Dr. Don Tsai at dtsai@waterboards.ca.us or (213) 576-6665 and Mr. Adnan Siddiqui at asiddiqui@waterboards.ca.gov or (213) 576-6812.

You may also contact the Regional Board's SNMP development coordinator Dr. Ginachi Amah at gamah@waterboards.ca.gov or (213) 576-6685.

Sincerely,

Deborah J. Smith
Chief Deputy Executive Officer

cc. Phuong Ly, Water Replenishment District

FINAL REVISED WORKPLAN
Salt/Nutrient Management Plan

Central Basin and West Coast Basin
Southern Los Angeles County, California

October 24, 2011

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ACRONYMS AND ABBREVIATIONS

Basin Plan	LARWQCB Water Quality Control Plan
CBMWD	Central Basin Municipal Water District
CDPH	California Department of Public Health
CECs	Constituents of Emerging Concern
CEQA	California Environmental Quality Act
CWCB	Central and West Coast Basins
DWR	California Department of Water Resources
ELWRF	WBMWD Edward C. Little Water Recycling Facility
LACDPW	Los Angeles County Department of Public Works
LACFD	Los Angeles County Flood Control District
LADWP	City of Los Angeles, Department of Water and Power
LARWQCB	Regional Water Quality Control Board, Los Angeles Region
LBWD	City of Long Beach Water Department
LJVL Plant	WRD Leo J. Vander Lans Advanced Wastewater Treatment Facility
MF	Microfiltration
mg/L	milligrams per liter
MWD	Metropolitan Water District of Southern California
NDMA	n-Nitrosodimethylamine
NIU	Newport-Inglewood Uplift
NPDES	National Pollutant Discharge Elimination Systems
O&M	operation and maintenance
PCE	Tetrachloroethene
Policy	SWRCB Recycled Water Policy
QA/QC	Quality Assurance/Quality Control
RO	Reverse osmosis
RWQCB	Regional Water Quality Control Board
SDLAC	Sanitation Districts of Los Angeles County
SNMP	Salt/Nutrient Management Plan
SWRCB	California State Water Resources Control Board
TCE	Trichloroethene
TDS	Total dissolved solids
TITP	LADWP Terminal Island Treatment Plant
TON	Threshold Odor Number
TMDLs	Total Maximum Daily Loads
ug/L	micrograms per liter
USGS	United States Geological Survey
VOCs	Volatile organic compounds

ACRONYMS AND ABBREVIATIONS (continued)

WBMWD	West Basin Municipal Water District
WMA	Watershed Management Area
WRD	Water Replenishment District of Southern California
WRP	Water Reclamation Plant

FINAL REVISED WORKPLAN OF THE SALT/NUTRIENT MANAGEMENT PLAN (SNMP)
Central Basin and West Coast Basin (CWCB)
Southern Los Angeles County, California
October 24, 2011

In accordance with the 2009 State Water Resources Control Board's (SWRCB) Recycled Water Policy (Policy), this Workplan for the Salt/Nutrient Management Plan (SNMP) was prepared through a collaborative process involving major stakeholders in the Central Basin and West Coast Basin (CWCB), including the Water Replenishment District of Southern California (WRD), Los Angeles County Department of Public Works (LACDPW), City of Los Angeles Department of Water and Power (LADWP), Sanitation Districts of Los Angeles County (SDLAC), Metropolitan Water District of Southern California (MWD), West Basin Municipal Water District (WBMWD), Council for Watershed Health, Heal the Bay, Central Basin Municipal Water District (CBMWD), and additional input from other interested parties.

I. BACKGROUND

As highlighted in the 2009 SWRCB Policy (refer to Appendix A), California is facing an unprecedented water crisis. This crisis stems from the feared collapse of the Bay-Delta ecosystem, climate change, continuing population growth, severe drought on the Colorado River and the threat of failing levees in the Delta. This new reality is severely testing California's ability to provide water supplies that are adequate, reliable, secure, affordable, sustainable, and of suitable quality for beneficial uses to protect, preserve, and enhance watersheds, communities, and environmental and agricultural resources.

In Southern California, increasing demands for water, limitations on imported supplies, and persistent droughts continue to demonstrate the invaluable contribution of the groundwater basins to the region's economy and public well being. Two of the most important groundwater basins in Southern California are the Central Basin and the West Coast Basin (CWCB), which are located in the southern portion of Los Angeles County (refer to Figure 1 below). Groundwater in the CWCB meets approximately a third of the overall water supply needs of nearly 4 million residents and businesses in the 43 cities overlying the basins.

For over 50 years, local agencies, including WRD, SDLAC, LACDPW, LADWP, MWD, WBMWD, CBMWD, and numerous cities have been collaborating and implementing critical measures, such as water reclamation and reuse, water conservation, improved maintenance of supply and delivery infrastructure, and the capture and use of stormwater, to prevent overdraft and replenish the CWCB aquifer system. The use of recycled water in the CWCB has played a vital role in increasing the reliability and sustainability of the overall water supply.

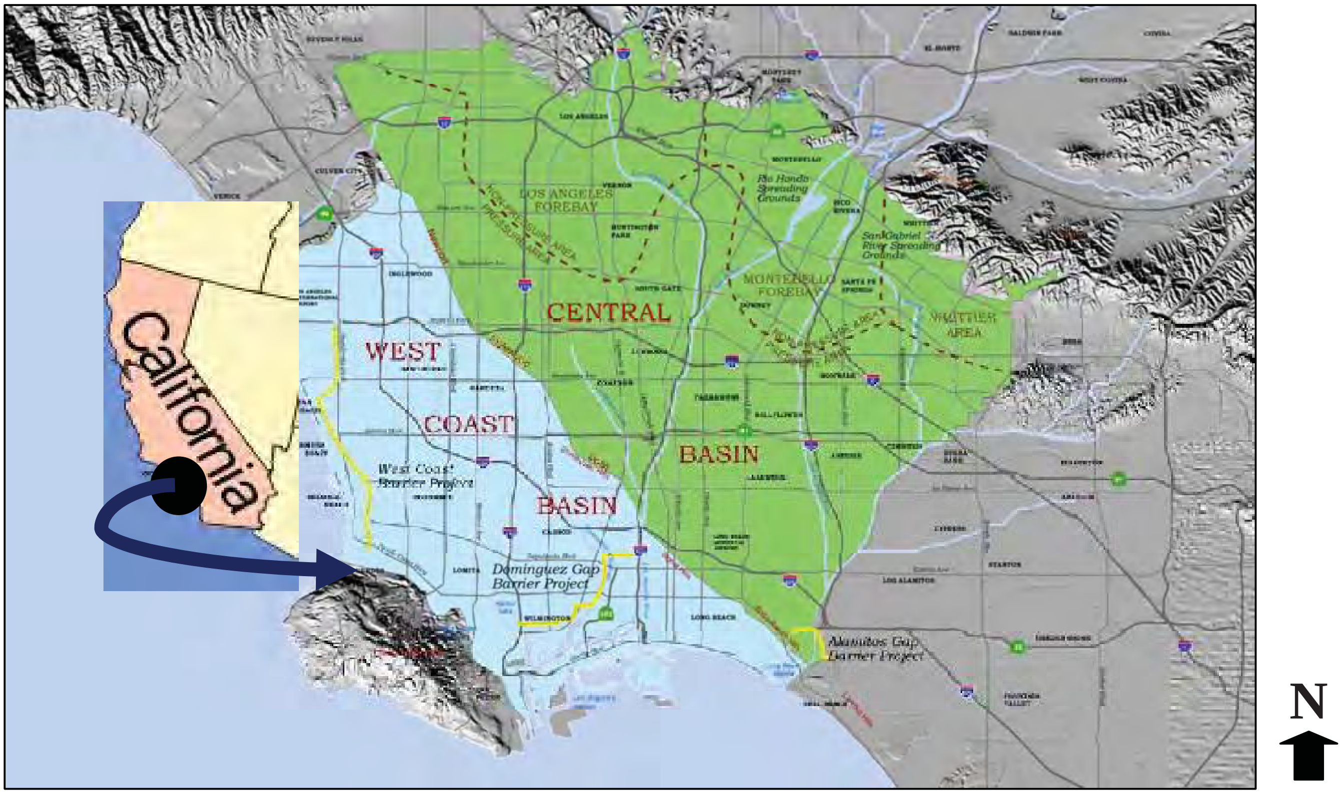

FIGURE 1
West Coast Basin and Central Basin, Southern Los Angeles County

Source: WRD

1. PROBLEM STATEMENT

Some groundwater basins in the State contain salts and nutrients that exceed or threaten to exceed water quality objectives established in the applicable Water Quality Control Plans, which were developed and have been implemented by the Regional Water Quality Control Boards (RWQCBs) (SWRCB, 2009). A copy of the Water Quality Control Plan (Basin Plan) that was developed by the Los Angeles RWQCB (LARWQCB) and is applicable to the CWCB is provided as Appendix B. SWRCB further states in the 2009 Recycled Water Policy (refer to Appendix A) that not all Basin Plans include adequate implementation procedures for achieving or ensuring compliance with the water quality objectives for salt or nutrients. These conditions can be caused by natural soils/conditions, discharges of waste, irrigation using surface water, groundwater, or recycled water, and water supply augmentation using surface or recycled water. Regulation of recycled water alone will not address these conditions. Thus, SWRCB finds that the appropriate way to address salt and nutrient issues is through the development of regional or subregional SNMPs that ensures attainment of water quality objectives and protection of beneficial uses.

2. REGULATORY FRAMEWORK

In February 2009, SWRCB adopted Resolution No. 2009-0011 which established a statewide Recycled Water Policy (refer to Appendix A), which became effective on May 14, 2009. As stated in the SWRCB Policy, its purpose is ". . . to increase the use of recycled water from municipal wastewater sources that meet the definition of Water Code Section 15050(n), in a manner that implements State and Federal water quality laws."

As required by the SWRCB Policy, local water and wastewater entities, together with local salt/nutrient contributing stakeholders, must prepare Salt/Nutrient Management Plans (SNMPs) for each groundwater basin in California, with participation by RWQCB staff. The degree of specificity within the SNMP and the length of the SNMP will be dependent on a variety of site-specific factors, including but not limited to size and complexity of a basin, source water quality, stormwater recharge, hydrogeology, and aquifer water quality. Specific elements required in the SNMP are listed in Section 6 of the SWRCB Policy (refer to Appendix A).

In addition to the Policy, SWRCB issued "Suggested Elements" (refer to Appendix E), which is essentially a draft outline of the SNMP. The SWRCB Suggested Elements were used as a basis for this Workplan of the CWCB SNMP. The CWCB SNMP shall comply or be consistent with the following:

- LARWQCB Basin Plan for the Los Angeles and (refer to Appendix B),
- California Department of Water Resources (DWR) Water Plan Update 2009 – Bulletin 160-09 (refer to Appendix C),
- SWRCB Antidegradation Policy – Resolution No. 68-16 (refer to Appendix D), and
- California Environmental Quality Act (CEQA) regulations.

The SWRCB Policy establishes a deadline of May 14, 2014 for submittal of all SNMPs to RWQCB for approval and adoption. However, RWQCB may grant a two-year extension if it finds that the stakeholders are making substantial progress towards completion of a SNMP.

3. PURPOSE

The purpose of this Workplan of the CWCB SNMP is to obtain approval from the LARWQCB on the outline and elements that will be included in the final CWCB SNMP. This Workplan was developed through a collaborative process involving the CWCB stakeholders (refer to Section II) and contains a general overview of the elements and data to be provided in the final CWCB SNMP. It is the intent of the CWCB stakeholders to involve and obtain technical and regulatory guidance from LARWQCB throughout the SNMP development process, and as a result, the stakeholders would like LARWQCB to review, provide comments, and approve this Workplan by the upcoming meeting between the CWCB stakeholders and LARWQCB that is scheduled on September 29, 2011. Once this Workplan is approved by LARWQCB, the stakeholders will move forward with developing the CWCB SNMP, with active participation and input from LARWQCB throughout this process.

A. Sustainability of Water Resources

SWRCB's mission is to "preserve, enhance and restore the quality of California's water resources to the benefit of present and future generations" (SWRCB, 2009). The SWRCB Policy (refer to Appendix A) was developed to encourage the use of stormwater, promote water conservation, increase the conjunctive use of surface water and groundwater, and improve the use of local water supplies.

B. Protection of Beneficial Use

The major water bodies, including inland surface waters, groundwater, coastal waters, and coastal wetlands, in the CWCB are designated by the LARWQCB as having one or more beneficial uses. These beneficial uses are identified in Section 2 of the Basin Plan (refer to Appendix B) and are used by the LARWQCB to establish regulatory thresholds and protect the water supply. The objective of the SNMP is to manage ". . . salts and nutrients from all sources . . . on a basin-wide or watershed-wide basis in a manner that ensures attainment of water quality objectives and protection of beneficial uses" (SWRCB, 2009). The CWCB SNMP will comply with the water quality objectives established by LARWQCB in the Basin Plan for groundwater in the CWCB, as further discussed in Section III.3.A.ii. of this Workplan.

C. Groundwater Beneficial Uses

As discussed in Section 2 of the Basin Plan (refer to Appendix B), the current beneficial uses designated for groundwater in the CWCB include municipal and domestic supply, agricultural supply, industrial process supply, and industrial service supply.

4. SALT/NUTRIENT MANAGEMENT OBJECTIVES

The objective of the SNMP is to manage salts and nutrients from all sources ". . . on a basin-wide or watershed-wide basis in a manner that ensures attainment of water quality objectives and protection of beneficial uses" (SWRCB, 2009). The following elements will be included in the final CWCB SNMP:

- Summary of the hydrogeology of the CWCB,
- Details of the groundwater inventory, including water levels, storage, production, and mixing and movement of groundwater within the CWCB,
- Evaluation of water recycling, groundwater recharge, and inflows/outflows in the CWCB,
- Historical and existing water quality data for groundwater, surface water, recycled water, and delivered water in the CWCB,

- Loading estimates and the fate and transport of salt and nutrients, specifically chloride, total dissolved solids (TDS) and nitrate, in the CWCB,
- The assimilative capacity of the CWCB for salt and nutrients (i.e., chloride, TDS and nitrate),
- Assessment of current monitoring programs (types, locations, frequency, costs, and responsible agencies) and developing a monitoring plan to adequately characterize concentrations of salt and nutrients (i.e., chloride, TDS, and nitrate) in the CWCB,
- Implementation measures for maintaining/achieving water quality objectives and managing salt and nutrient (i.e., chloride, TDS and nitrate) loading in the CWCB,
- An antidegradation analysis demonstrating that the projects identified in the SNMP will collectively satisfy the requirements of the SWRCB Antidegradation Policy (refer to Appendix D), and
- Demonstration of compliance with CEQA.

5. PROCESS TO DEVELOP SALT/NUTRIENT MANAGEMENT PLAN

Since July 2009, major stakeholders in the CWCB have been meeting and discussing key elements that will be addressed in the SNMP. Stakeholder efforts to date to develop the CWCB SNMP include the following:

- Formation of stakeholder groups, including the Core Group, Working Group, and Interested Parties,
- Attended numerous industry, municipal, and regulatory agency conferences/workshops to obtain further regulatory agency guidance on preparing the SNMP,
- Developed a preliminary schedule for major tasks to be completed for submittal of the CWCB SNMP to LARWQCB by the deadline of May 2014, and
- In May 2011, began bimonthly stakeholder meetings to develop the CWCB SNMP.

This Workplan was developed through a collaborative process involving major stakeholders in the CWCB and provides an outline and elements that will be included in the final CWCB SNMP. It is the intent of the CWCB stakeholders to involve and obtain guidance from LARWQCB throughout the SNMP development process, and as a result, the stakeholders would like LARWQCB to review and approve this Workplan and provide comments at the upcoming September 29, 2011 meeting between the CWCB stakeholders and LARWQCB. Once this Workplan is approved by LARWQCB, the stakeholders will move forward with developing the CWCB SNMP, with active participation from LARWQCB throughout this process. Table 1 below provides a preliminary schedule of major tasks to complete the CWCB SNMP by the deadline of May 2014.

TABLE 1
PRELIMINARY SCHEDULE OF MAJOR TASKS

Date	Major Task	Task Description	LARWQCB Approval?
August 30, 2011	Submittal of Workplan of CWCB SNMP to LARWQCB for review	• This Workplan contains an outline and elements that will be included in the final CWCB SNMP	Yes, LARWQCB approves Workplan of the CWCB SNMP by September 29, 2011

TABLE 1 PRELIMINARY SCHEDULE OF MAJOR TASKS			
Date	**Major Task**	**Task Description**	**LARWQCB Approval?**
	and approval	• Confirmed with LARWQCB to have meeting on September 29, 2011 with stakeholders to obtain LARWQCB approval on the Workplan	
September 29, 2011	Meeting with LARWQCB and CWCB stakeholders	LARWQCB provides comments and approves Workplan of the CWCB SNMP	Yes, LARWQCB approves Workplan of the CWCB SNMP on September 29, 2011
November 15, 2011	Attendance of LARWQCB Workshop	Stakeholders will attend this LARWQCB Workshop to obtain further guidance on SNMP requirements and identify areas where additional LARWQCB input is required	N/A
2011 to 2014	Regular stakeholder meetings	• Stakeholder meetings will be held continuously, with active participation by the LARWQCB • Prepare Draft CWCB SNMP through a collaborative process involving stakeholders and interested parties • Develop cost sharing agreements amongst stakeholders	N/A
Mid-2013	Submit Draft CWCB SNMP to LARWQCB for review and comments	LARWQCB comments will be received by stakeholders within 2 months of the Draft CWCB SNMP submittal	Yes, LARWQCB will provide comments on the Draft CWCB SNMP within 2 months of receipt
May 2014	Submit final CWCB SNMP to LARWQCB for approval and adoption	The final CWCB SNMP will incorporate comments received by LARWQCB on the Draft CWCB SNMP	Yes, LARWQCB will approve and adopt the final CWCB SNMP

II. STAKEHOLDER ROLES AND RESPONSIBILITIES

Table 2 below lists the current stakeholders that are actively involved in the development of the CWCB SNMP and provides a summary of their roles and responsibilities in this process. Additional stakeholders may be added to this table once this Workplan is approved by LARWQCB.

TABLE 2 STAKEHOLDER ROLES AND RESPONSIBILITIES	
Stakeholders	**Roles and Responsibilities**
1. Water Replenishment District of Southern California (WRD)	• Manages groundwater in the CWCB • Monitors groundwater quality, water levels, seawater intrusion, and groundwater production throughout the CWCB • Monitors groundwater quality associated with operation of the Montebello Forebay spreading grounds, the Dominguez Gap Barrier, the Alamitos Barrier, and the West Coast Basin Barrier • Owns the Leo J. Vander Lans Advanced Water Treatment Facility (LJVL Plant) that produces advanced treated recycled water for injection at the Alamitos Barrier • For the SNMP, WRD will provide groundwater data (levels, storage, production, recharge,

TABLE 2 STAKEHOLDER ROLES AND RESPONSIBILITIES	
Stakeholders	**Roles and Responsibilities**
	and water quality) and recycled water data associated with the Alamitos Barrier Recycled Water Project
2. Los Angeles County Department of Public Works (LACDPW)	• Owns and operates the Montebello Forebay spreading grounds • Owns and operates the West Coast Basin Barrier, the Dominguez Gap Barrier, and the Alamitos Barrier • Monitors receiving water quality resulting from urban runoff and during storm events in Los Angeles County • For the SNMP, LACDPW will provide stormwater monitoring data
3. Metropolitan Water District of Southern California (MWD)	• Imports water from northern California (State Water Project) and the Colorado River (Colorado River Aqueduct) to the CWCB for potable and non-potable uses • Monitors water quality of the imported water, which has many uses, including groundwater replenishment at the Montebello Forebay spreading grounds and for injection at the Dominguez Gap Barrier, the Alamitos Barrier, and the West Coast Basin Barrier to prevent seawater intrusion • For the SNMP, MWD will provide imported water quality data
4. County Sanitation Districts of Los Angeles County (SDLAC)	• Owns and operates the Pomona, San Jose Creek, Whittier Narrows, Los Coyotes, and Long Beach WRPs that produce tertiary-treated recycled water that is delivered for irrigation and industrial uses throughout the CWCB and is delivered to the Montebello Forebay spreading grounds for groundwater recharge • For the SNMP, SDLAC will provide river water sampling data and recycled water quality data
5. City of Los Angeles, Department of Water and Power (LADWP)	• Municipal utility that delivers groundwater, imported water, and recycled water to residents and businesses in the City of Los Angeles • Imports water from the Mono and Owens River Basins in the Eastern Sierra Nevada Mountains to the City of Los Angeles via the Los Angeles Aqueduct • Operates the Terminal Island Treatment Plant (TITP) that produces advanced treated recycled water for injection at the Dominguez Gap Barrier • For the SNMP, LADWP will provide imported water quality data and recycled water data associated with the Dominguez Gap Barrier Project
6. West Basin Municipal Water District (WBMWD)	• Purchases imported water from MWD and wholesales to cities and water companies/agencies in the West Coast Basin for potable and non-potable uses and for groundwater replenishment • Owns and operates the Edward C. Little Water Recycling Facility (ELWRF) that produces recycled water for irrigation and industrial uses in the West Coast Basin and for injection at the West Coast Basin Barrier • For the SNMP, WBMWD will provide recycled water data associated with the West Coast Basin Barrier Project
7. Council for Watershed Health	• Facilitates the preservation, restoration, and enhancement of the Los Angeles River and San Gabriel River Watersheds • For the SNMP, will provide river water quality data
8. Heal the Bay	• Environmental nonprofit organization working to make southern California's coastal waters and watersheds safe, healthy and clean • Actively involved in developing the SNMP for the CWCB
9. Central Basin Municipal Water District (CBMWD)	• Purchases imported water from MWD and wholesales to cities and water companies/agencies in the Central Basin for potable and non-potable uses and for groundwater replenishment • Distributes recycled water in the Central Basin for irrigation and industrial uses • Actively involved in developing the SNMP for the CWCB
10. Other stakeholders to be determined	• Assisting in the development of the SNMP

III. GROUNDWATER BASIN CHARACTERISTICS

1. GROUNDWATER BASIN OVERVIEW

The following is a general overview of the Sections to be covered in the final CWCB SNMP.

A. Physiographic Description

The Central Basin and the West Coast Basin (CWCB) are two groundwater basins in the Coastal Plain of Los Angeles County, California (refer to Figure 1). The major land forms of the Coastal Plain consist of bordering highlands and foothills, older plains and hills, younger alluvial plains, the rivers which drain the area, and the offshore topography. Refer to Figure 2 below for the physiographic features of the Los Angeles region.

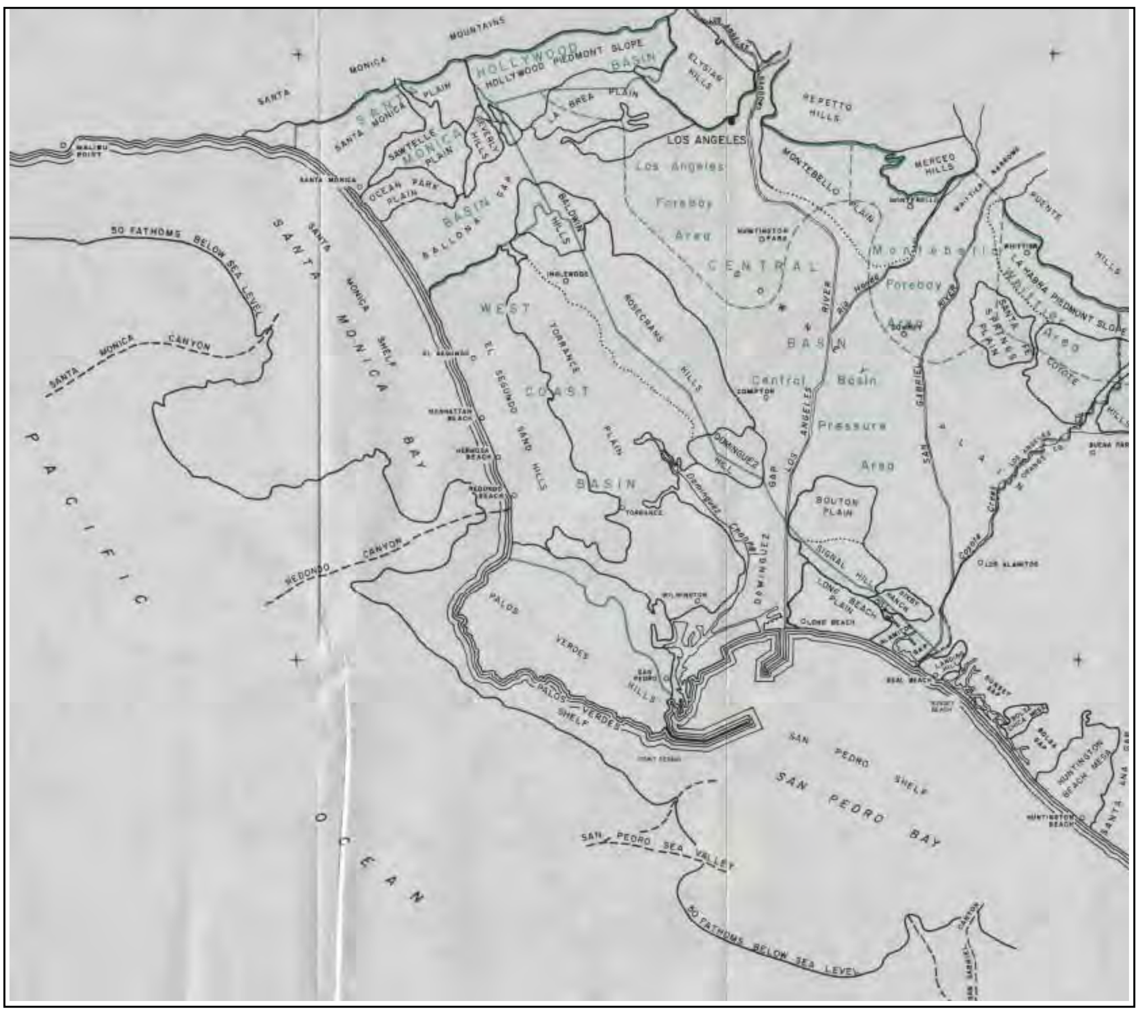

FIGURE 2
Physiographic Features of the Los Angeles Region

Source: DWR

B. Groundwater Basin and/or Sub-Basin Boundaries

The Central Basin covers approximately 270 square miles and is bounded on the north by the Hollywood Basin and the Elysian, Repetto, Merced, and Puente Hills, to the east by the Los Angeles County/Orange County line, and to the south and west by the Newport-Inglewood Uplift, a series of discontinuous faults and folds that form a prominent line of northwest-trending hills including the Baldwin Hills, Dominguez Hills, and Signal Hill.

The West Coast Basin covers approximately 140 square miles and is bounded on the north by the Baldwin Hills and the Ballona Escarpment (a bluff just south of Ballona Creek), on the east by the Newport-Inglewood Uplift, to the south by San Pedro Bay and the Palos Verdes Hills, and to the west by Santa Monica Bay.

Figure 3 below depicts the cities in the CWCB.

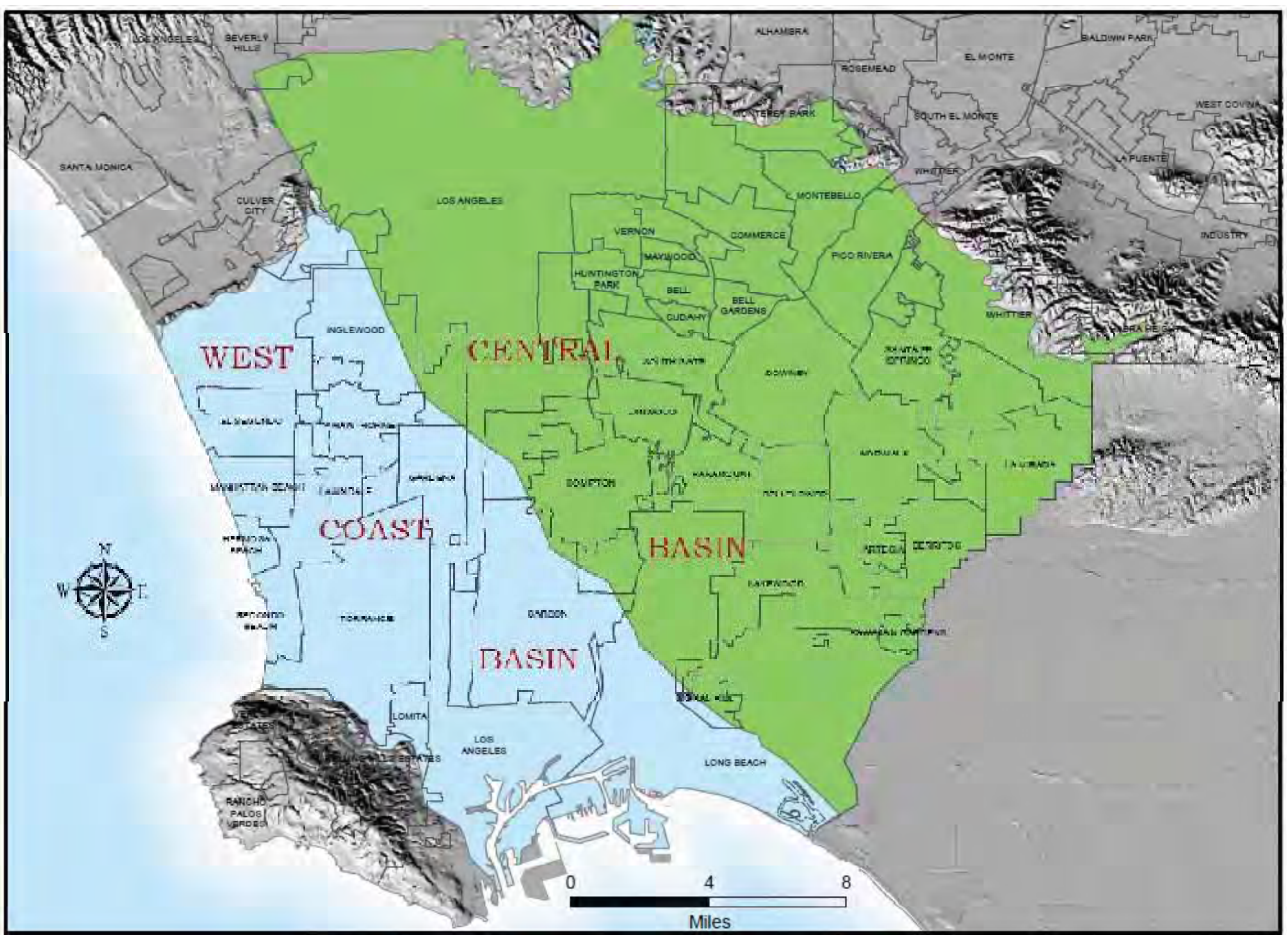

FIGURE 3
Cities in the CWCB

Source: WRD

C. Watershed Boundaries

LARWQCB has identified five major watershed management areas (WMAs) in the CWCB (refer to Figure 4 below): South Santa Monica Bay, Los Angeles River, Dominguez Channel, San Gabriel River, and Los Cerritos Channel & Alamitos Bay (LARWQCB, 2007).

FIGURE 4
Watershed Management Areas (WMAs) in the CWCB

Source: LARWQCB

South Santa Monica Bay Watershed: The 87-square mile South Santa Monica Bay Watershed (refer to Figure 5) is located in the southwest portion of Los Angeles County along the Pacific Ocean. The watershed is bounded by the Santa Monica Mountains on the north and extends south to the Palos Verdes Peninsula. It is mostly urbanized and includes portions of the cities of Los Angeles, Santa Monica, Culver City, El Segundo, Manhattan Beach, Redondo Beach, Torrance, Hermosa Beach, Palos Verdes Estates, Rancho Palos Verdes, Rolling Hills Estates, Rolling Hills, and unincorporated Los Angeles County. The entire Santa Monica Bay Watershed stretches along the coast from the Ventura-Los Angeles County line in the north to the Palos Verdes Peninsula in the south. The Santa Monica Bay is the submerged portion of the Coastal Plain and thus, it slopes relatively gently to the west towards the Pacific Ocean.

FIGURE 5
South Santa Monica Bay Watershed

Source: LACDPW

FIGURE 6
Los Angeles River Watershed

Source: LACDPW

<u>*Los Angeles River Watershed*</u>: The 834-square mile Los Angeles River Watershed (refer to Figure 6) is shaped by the Los Angeles River, which flows south from its headwaters in the Santa Monica Mountains, through the San Fernando Valley, the Glendale Narrows, the center of the CWCB, and ultimately into San Pedro Bay. The river's major tributaries are the Arroyo Calabasas and Bell Creek (at the river's origin), Brown's Canyon Wash, the Burbank Western Channel, Tujunga Wash, Arroyo Seco, Rio Hondo, and Compton Creek. The watershed contains 22 lakes and flood control reservoirs, as well as a number of spreading grounds. The Los Angeles River is hydraulically connected to the San Gabriel River through the Whittier Narrows Reservoir, although this occurs primarily during large storm events. The Los Angeles River, which once flowed freely over the Coastal Plain, was channelized between 1914 and 1970 to control runoff and reduce the impacts of major flood events in the region. Today, over 90% of the Los Angeles River is concrete-lined. The watershed has impaired water quality in the middle and lower portions of the basin due to urban runoff from dense urbanization (DWR, 2009).

<u>*Dominguez Channel Watershed*</u>: The 110-square mile Dominguez Channel Watershed (refer to Figure 7) is defined by a complex network of storm drains and smaller flood control channels. The Dominguez Channel is located in the West Coast Basin and extends from the Los Angeles International Airport to the Los Angeles Harbor and drains a large portion, if not all, of the cities of Inglewood, Hawthorne, El Segundo, Gardena, Lawndale, Redondo Beach, Torrance, Carson, and Los Angeles.

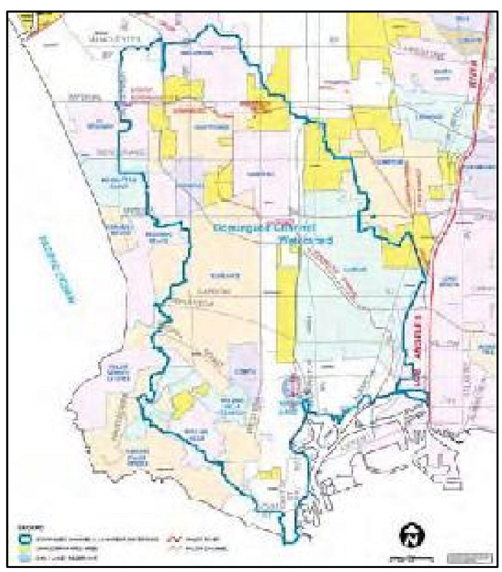

FIGURE 7
Dominguez Channel Watershed

Source: LACDPW

FIGURE 8
San Gabriel River Watershed

Source: LACDPW

San Gabriel River Watershed: The 640-square mile San Gabriel River Watershed (refer to Figure 8) extends from the San Gabriel Mountains to the Pacific Ocean at the City of Seal Beach. Drainage is provided by the San Gabriel River and its tributaries, which include Coyote Creek. Although the watershed contains portions of 37 incorporated cities in eastern Los Angeles County, only 26 percent of its total land area is developed. The San Gabriel River runs through the Central Basin and its surrounding areas are densely urbanized. Flows in the San Gabriel River are diverted into the Montebello Forebay spreading grounds and impounded behind several rubber dams in order to control flow for groundwater recharge.

Los Cerritos Channel and Alamitos Bay Watershed: Los Cerritos Channel is concrete-lined above the tidal prism and drains a relatively small, densely urbanized area of east Long Beach. The channel's tidal prism connects with Alamitos Bay through Marine Stadium (a recreation facility built in 1932 that is used for boating, water skiing, and jet skiing). Alamitos Bay is composed of Marine Stadium, Long Beach Marina, and the Bay proper, which includes several small canals, a bathing beach, and several popular clamming areas. A small bathing lagoon, Colorado Lagoon in Long Beach, has a tidal connection with the Bay and a small wildlife pond, Sims Pond, also has a tidal connection. The latter is heavily used by overwintering migratory birds (LARWQCB, 2007).

D. Geology

The CWCB lies within the western portion of the Transverse Ranges Geomorphic Province. The water-bearing deposits in the CWCB tapped for beneficial use are mostly comprised of Quaternary-age sediments (less than 1.8 million years old) of gravel, sand, silt, and clay that were deposited in alternating layers from the erosion of nearby hills and mountains whose sediments were carried by wind and water flow, and from historic beaches and shallow ocean floors that covered the area at various times in the past. Underlying these Quaternary sediments are basement rocks of the Pliocene Pico Formation that generally do not provide sufficient quantities of groundwater to wells for economic development. Dividing the CWCB is the Newport-Inglewood Uplift.

E. Hydrogeology/Hydrology

The Central Basin is divided into four sections: the Los Angeles Forebay, the Montebello Forebay, the Whittier Area, and the Pressure Area (DWR, 1961). The two forebays represent areas of unconfined (water table) aquifers that allow percolation of surface water down into the deeper production aquifers to replenish the rest of the basin. The Whittier Area and Pressure Area are confined aquifer systems that receive relatively minimal recharge from surface water, but are replenished from the upgradient forebay areas or other groundwater basins.

In the West Coast Basin, aquifers are generally confined and receive the majority of their natural replenishment from adjacent groundwater basins or from the Pacific Ocean (seawater intrusion). Both the Newport-Inglewood Uplift and the Charnock Fault (in the West Coast Basin) are partial barriers to groundwater flow, causing differences in water levels on opposite sides of each fault system. Groundwater flows between the Central Basin and the West Coast Basin based on the groundwater elevations on either side of the Newport-Inglewood Uplift. Most of the groundwater in the CWCB remains at an elevation below sea level due to historic overpumping, so the importance of maintaining the seawater barrier wells to keep out the intruding saltwater is of vital importance.

F. Aquifers

Groundwater occurs in the pore spaces of the sediments in the CWCB. Where these sediments are thick and transmissive enough to supply sufficient quantities of water to wells for beneficial use, they are termed "aquifers." In contrast, the name "aquitard" is given to the less permeable silt and clay layers that separate the aquifers. The major aquifers identified in the CWCB include the following, from shallowest to deepest:

- Gaspur Aquifer and semiperched aquifers of the Holocene Alluvium Formation;
- Exposition, Artesia, Gage, and Gardena Aquifers of the Upper Pleistocene Lakewood Formation;
- Hollydale, Jefferson, Lynwood, and Silverado Aquifers of the Lower Pleistocene Upper San Pedro Formation; and
- Sunnyside Aquifer of the Lower Pleistocene Lower San Pedro Formation.

Aquifer depths can reach over 2,000 feet in the Central Basin and 1,500 feet in the West Coast Basin.

G. Hydrologic Areas Tributary to the Groundwater Basin

The CWCB is located within the Los Angeles-San Gabriel Hydrologic Unit, which is a drainage area that totals approximately 1,608 square miles. Within the Los Angeles–San Gabriel Hydrologic Unit, the CWCB is located in the Coastal Plain Hydrologic Area and the Palos Verdes, West Coast, and Central Hydrologic Subareas. Land use within these hydrologic subareas is predominantly residential, commercial, and industrial, and thus, the vast majority of the area is covered with semi-permeable or non-permeable material (e.g., paved). The Los Angeles River and the San Gabriel River, which are the major drainage systems in the Coastal Plain Hydrologic Area, drain the coastal watersheds of the Transverse Ranges. These surface waters also recharge large reserves of groundwater that exist in alluvial aquifers underlying the CWCB. Groundwater in the CWCB is also recharged through the operation of the Montebello Forebay spreading grounds, the seawater intrusion barriers along the coast (West Coast Basin Barrier, Dominguez Gap Barrier, and Alamitos Barrier), and other recharge areas, as further discussed in Section III.1.K. below.

H. Climate

The CWCB is characterized by a Mediterranean climate, i.e. warm to hot, dry summers and mild to cool, wet winters, with relatively modest transitions in temperature. Most of the rainfall occurs during winter and spring (between December and March). Rainfall data will be provided in the final CWCB SNMP.

I. Land Cover and Land Use

The CWCB covers approximately 420 square miles in southern Los Angeles County and consists of 43 cities with a population of nearly 4 million residents. Most of the CWCB is developed as urban areas with buildings and paved surfaces. Predominant land uses include urban residential, commercial, and industrial. The economy in the CWCB is primarily industrial, commercial, and service.

J. Water Sources

Water sources in the CWCB, including groundwater, imported water, recycled water, and stormwater, will be further defined in the final SNMP.

K. Recharge Areas

Groundwater recharge areas in the CWCB, including the Montebello Forebay spreading grounds, the seawater intrusion barriers along the coast (West Coast Basin Barrier, Dominguez Gap Barrier, and Alamitos Barrier), and others, will be further discussed in the final SNMP.

2. GROUNDWATER INVENTORY

A. Groundwater Levels

i. Historical, Existing, Regional Changes

Groundwater levels are an indication of the amount of groundwater in the basins. They reveal areas of recharge and discharge from the basins, suggest which way the groundwater is moving so that recharge water or contaminants can be tracked, are used to determine when additional replenishment water is required, and are used to calculate storage changes. Groundwater levels can also be used to demonstrate possible source areas for seawater intrusion or show the effectiveness of seawater barrier wells.

Groundwater levels in the CWCB have been monitored and recorded since the early 1900s. WRD tracks groundwater levels throughout the year by measuring the depth to water in monitoring wells and production wells located throughout the CWCB. WRD will provide data in the final SNMP that presents historical, current, and changes in groundwater level measurements collected throughout the CWCB. General groundwater elevation contours in the CWCB are shown on Figure 9 below.

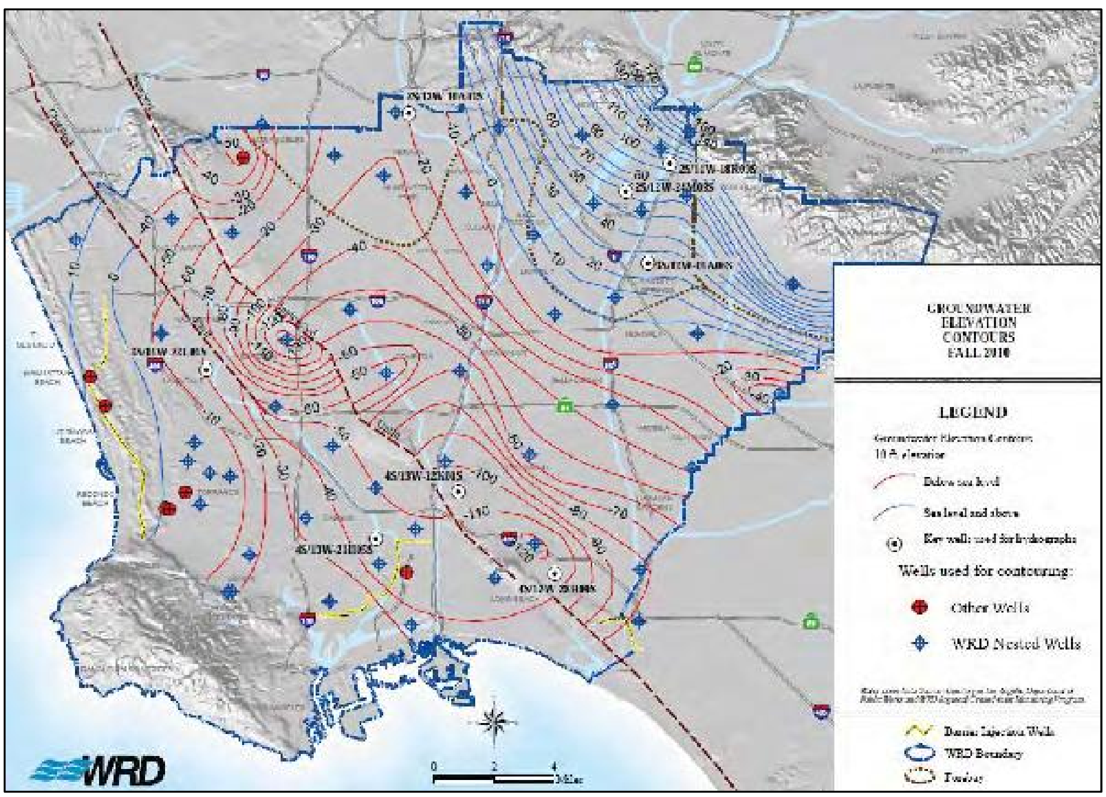

FIGURE 9
Groundwater Elevation Contours in the CWCB (Fall 2010)

Source: WRD

B. Groundwater Storage

i. Historical, Existing, Changes

Information regarding groundwater storage in the CWCB will be discussed in the final SNMP. WRD will provide historical, existing, and changes in the groundwater storage data.

C. Groundwater Production

i. Historical, Existing, Spatial and Temporal Changes, Safe Yield

Groundwater production wells are the main source of groundwater extraction and usage in the CWCB. There are currently over 560 active production wells in the CWCB (refer to Figure 10 below). Details regarding groundwater production in the CWCB will be discussed in the final SNMP. WRD will provide historical data, existing data, spatial and temporal changes, and the safe yield of groundwater production in the CWCB.

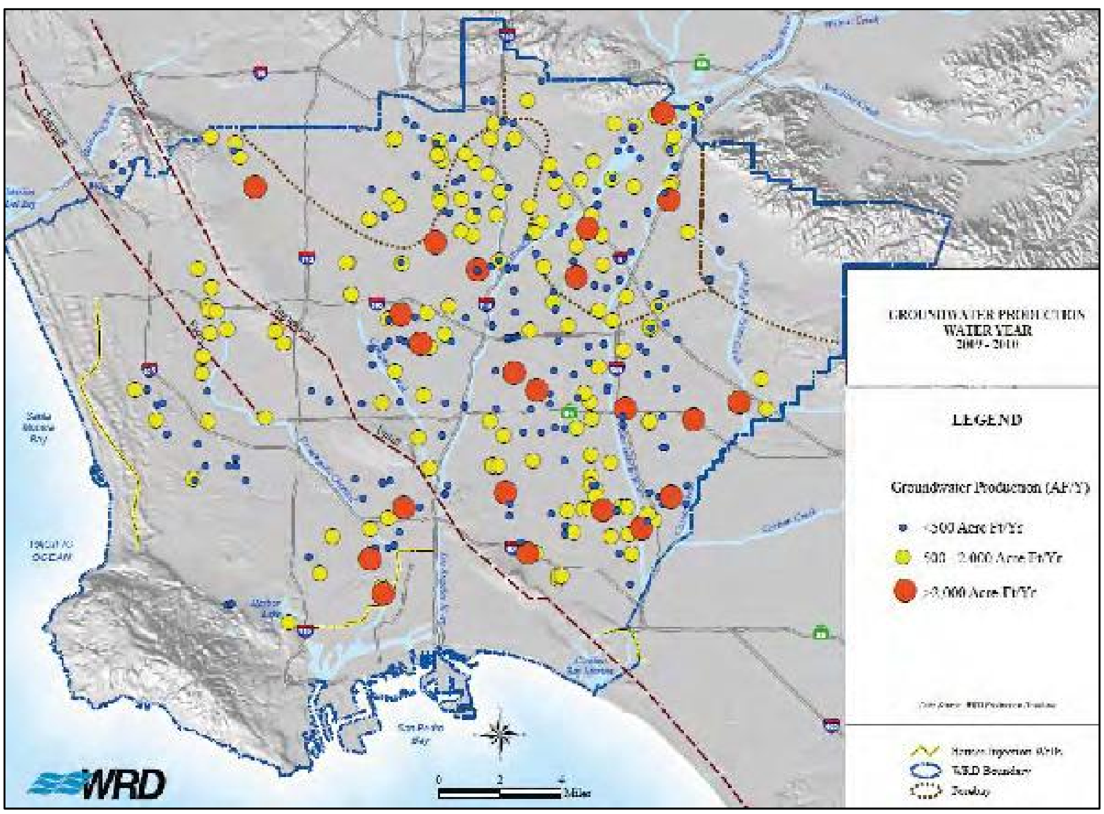

FIGURE 10
Groundwater Production Wells in the CWCB (Water Year 2009 – 2010)

Source: WRD

D. Groundwater Mixing and Movement

i. Subsurface Inflow/Outflow

Groundwater recharge in the CWCB can occur through underflow from adjacent groundwater basins (such as the Main San Gabriel Basin and the Santa Monica Basin), the Montebello Forebay spreading grounds, the seawater intrusion barriers along the coast (West Coast Basin Barrier, Dominguez Gap Barrier, and Alamitos Barrier), areal recharge from precipitation on the basin floor and hillside runoff, return flow of irrigation water that penetrates beyond the root zone, percolation through unlined river channels, and continued seawater intrusion in certain areas. Subsurface underflow is primarily by pumping, but also underflow to adjacent basins. All significant inflow/outflow sources will be identified and discussed in the final SNMP.

ii. Horizontal and Vertical Movement and Mixing

Groundwater moves horizontally and vertically in the CWCB based on hydraulic gradients and the physical properties of the aquifers. Further details regarding horizontal and vertical movement and mixing of groundwater in the CWCB will be provided in the final SNMP.

3. BASIN WATER QUALITY

A. Groundwater Quality

i. Background, Historical, Existing

Between the 1900s and 1950s, groundwater was an important factor in urbanization of the CWCB. Excessive overpumping in the CWCB caused severe overdraft and created a hydraulic gradient that resulted in seawater intrusion, which contaminated the coastal groundwater aquifers. To address this problem and halt the intrusion, three seawater intrusion barriers were constructed by LACDPW: the West Coast Basin Barrier Project was initiated in the mid-1950s, the Alamitos Barrier Project in the early 1960s, and the Dominguez Gap Barrier Project in the early 1970s. LACDPW owns and operates all three barrier projects and WRD purchases all the water for injection.

While the water injection activities at the barriers were successful in halting further seawater intrusion, these efforts could not address the seawater which had already intruded into the West Coast Basin before the barrier was constructed. These large plumes of saline water, referred to as "saline plume," (see Figures 11 and 12 below) have been trapped inland of the injection wells, thereby degrading significant volumes of groundwater with high concentrations of chloride and decreasing the ability of affected aquifers to provide groundwater storage.

FIGURE 11
Saline Plume in the West Coast Basin

Source: WRD

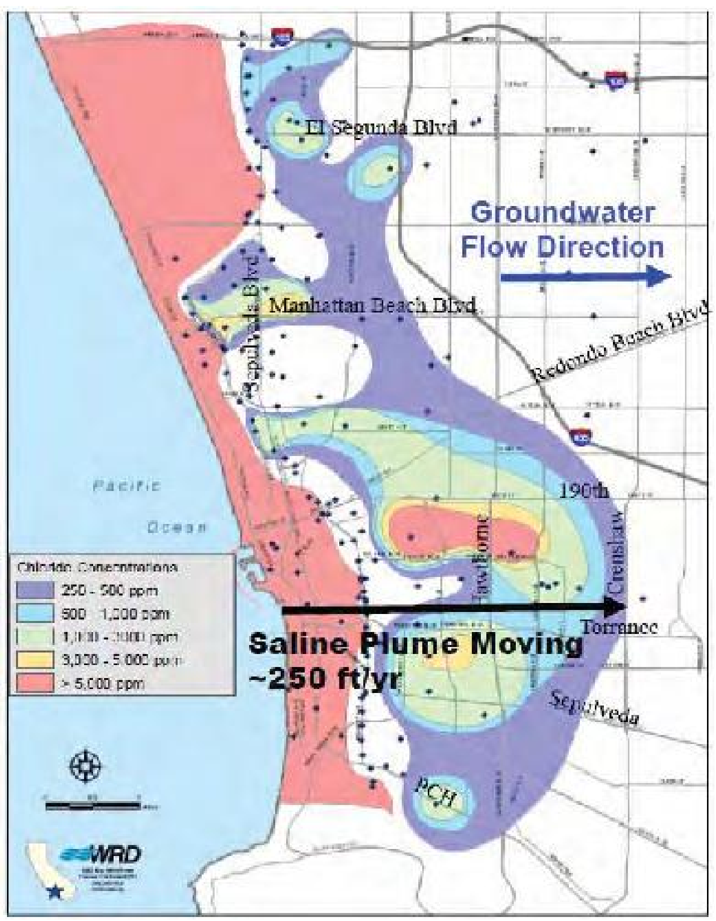

FIGURE 12
Saline Plume in the West Coast Basin (2010)

Source: WRD

Groundwater quality in the CWCB also reflects current land uses. As an urban developed area, commercial and industrial activities (e.g., leaking aboveground and underground storage tanks, leaking sewer and oil pipelines, and illegal discharges) have contaminated groundwater with localized plumes of petroleum fuels, solvents, and other hazardous substances. In general, these plumes are limited to shallow groundwater. However, as the aquifers and confining layers in these alluvial basins are typically interfingered, the quality of groundwater in the deeper production aquifers is threatened by the migration of pollutants from the upper aquifers.

ii. Water Quality Objectives

Water quality objectives in the CWCB were established by LARWQCB and are provided in Chapter 3 of the Basin Plan (refer to Appendix B). A summary of these water quality objectives are provided in Table 3 below and will be discussed further in the final SNMP.

TABLE 3
WATER QUALITY OBJECTIVES FOR GROUNDWATER IN THE CWCB

Selected Constituent	Central Basin	West Coast Basin
TDS	700 mg/L	800 mg/L
Sulfate	250 mg/L	250 mg/L
Chloride	150 mg/L	250 mg/L
Boron	1.0 mg/L	1.5 mg/L
Nitrate (NO_3)	45 mg/L	45 mg/L
Nitrate-Nitrogen (NO_3-N)	10 mg/L	10 mg/L
Nitrite-Nitrogen (NO_2-N)	1 mg/L	1 mg/L
Nitrogen as Nitrate-Nitrogen plus Nitrite-Nitrogen (NO_3-N + NO_2-N)	10 mg/L	10 mg/L
Arsenic	10 ug/L	10 ug/L
Iron	300 ug/L	300 ug/L
Manganese	50 ug/L	50 ug/L
Color	15 Units	15 Units
Odor	3 TON	3 TON

NOTES:
Source: LARWQCB Basin Plan (refer to Appendix B)
mg/L = milligrams per liter
ug/L = micrograms per liter
TON = Threshold Odor Number

B. Surface Water Quality

i. Stormwater Quality Data

Stormwater quality data are collected by LACDPW throughout each storm season at mass emissions (river) and tributary stations. Stormwater quality monitoring data will be provided by LACDPW in the final SNMP. Cities in the CWCB will also be contacted for any other available stormwater quality data.

ii. River Water Quality Data

In the CWCB, river water quality data is collected by the Council for Watershed Health and SDLAC. The Council for Watershed Health collects annual river water quality data as part of its interagency mission to monitor the health of the Los Angeles and San Gabriel River Watersheds. SDLAC collects samples in the rivers upstream and downstream of their recycled water discharge points. River water quality data will be provided by the Council for Watershed Health and SDLAC in the final SNMP. Cities in the CWCB will also be contacted for any other available river water quality data.

C. Imported Water Quality

Water is imported into the CWCB from three major sources: the Sacramento-San Joaquin Delta (northern California), Colorado River, and Owens Valley/Mono Basin (eastern Sierra Nevada Mountains). MWD imports river water from northern California (State Water Project) and the Colorado River (via the 242-mile Colorado River Aqueduct) to the CWCB. LADWP imports water from the Owens Valley/Mono Basin to the City of Los Angeles via the Los Angeles Aqueduct. Imported water quality data will be provided by MWD and LADWP in the final SNMP.

D. Recycled Water Quality

In the CWCB, recycled water has many uses, including groundwater recharge, urban landscape irrigation, agricultural irrigation, industrial and commercial process water, recreational facilities, and wildlife habitat maintenance. Treatment plants in the CWCB that produce this recycled water are owned and operated by SDLAC, WBMWD, LADWP, and WRD. Recycled water quality data will be provided by these agencies in the final SNMP.

E. Delivered Water Quality

In the CWCB, recharge water delivered to the Montebello Forebay spreading grounds and the three seawater intrusion barriers (West Coast Basin Barrier, Dominguez Gap Barrier, and Alamitos Barrier) receive a blend of various waters for groundwater recharge. Water quality data for the water delivered to the spreading grounds and the seawater intrusion barriers will be provided by WRD, WBMWD, LADWP, and SDLAC in the final SNMP.

Data regarding water that is delivered throughout the CWCB for potable use (such as imported water and groundwater) and non-potable use (such as stormwater and recycled water) are discussed in Sections III.3.A., III.3.B., III.3.C., and III.3.D. of this Workplan.

IV. BASIN EVALUATION

1. WATER BALANCE

A. Conceptual Model

A conceptual model summarizing water supplies and distribution of water uses within the CWCB for the past 10 water years will be developed and presented in the final SNMP. This conceptual model will be developed similar to Figure SC-4 (shown below as Figure 12) in Volume 3 of DWR's California Water Plan – Update 2009 (refer to Appendix C).

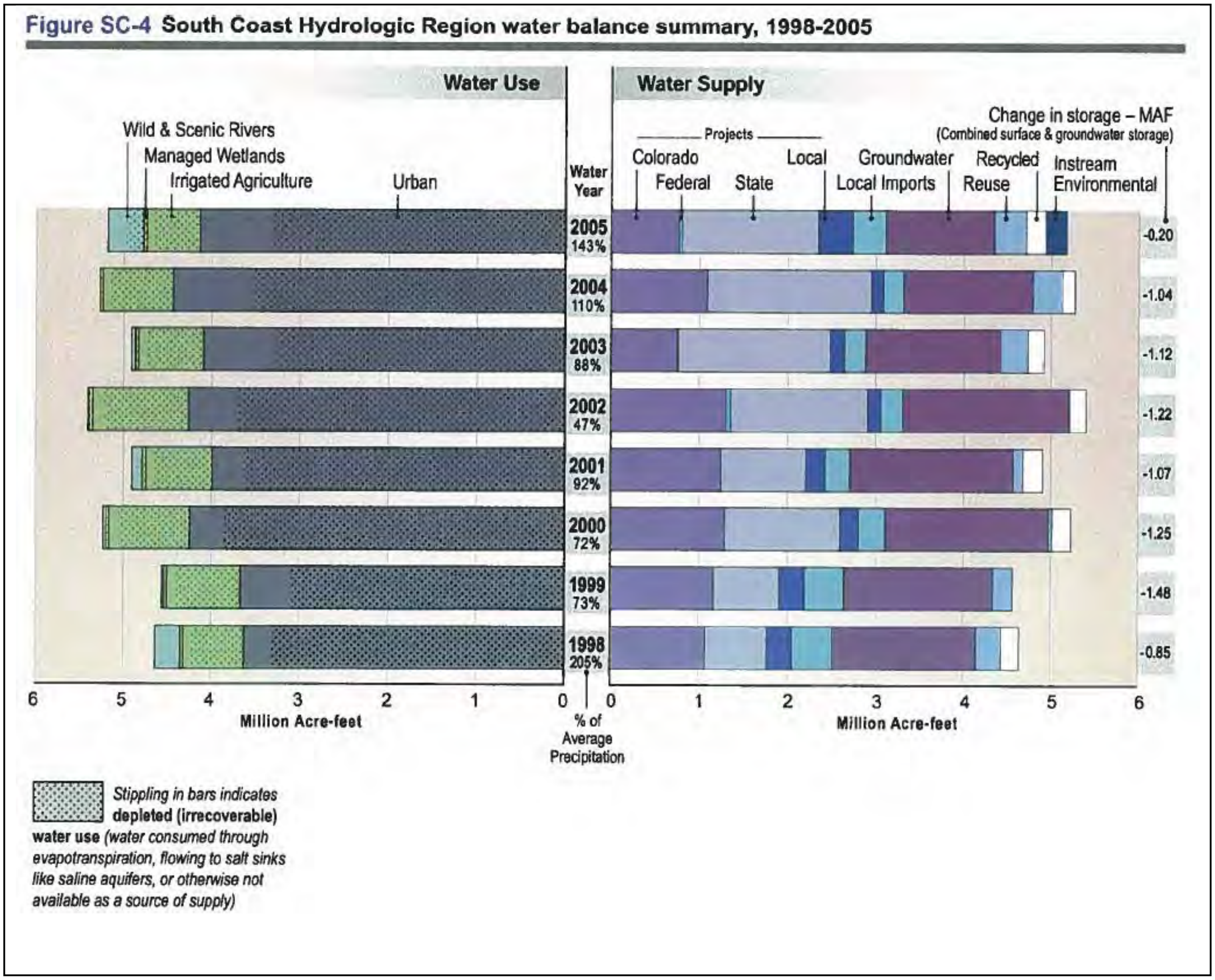

FIGURE 12
Example of Conceptual Model of Water Balance to be Developed for the CWCB

Source: DWR

B. Basin Inflow/Outflow

Estimated quantities of various types of water flowing in and out of the CWCB for the past 10 water years will be summarized in Table 3 below and provided in the final SNMP. This table is similar to Table SC-3 in Volume 3 of DWR's California Water Plan – Update 2009 (refer to Appendix C).

TABLE 4
WATER BALANCE OF THE CENTRAL BASIN AND WEST COAST BASIN
(thousand acre-feet)

Type of Water Inflow/Outflow	Water Year									
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Water Entering the CWCB										
I-1 Imported Water										
I-2 Surface Water										
I-3 Groundwater from Adjacent Basins and Seawater										
I-4 Stormwater Runoff (Urban, Agriculture, Open Space)										
I-5 Recharge (spreading grounds and seawater intrusion barriers)										
I-6 Urban/Agricultural Runoff										
I-7 Irrigation using Recycled, Imported, and Groundwater										
I-8 Water Transfers										
I-9 Wastewater Discharges (Treated Sewage Effluent, NPDES, etc.)										
I-10 Planned Low Impact Developments (LID)										
I-11 Aquifer Storage and Recovery (ASR)										
I-12 Wetlands, Lakes, Rivers, Parks, etc.										
I-13 Illegal Discharges from Contam. Sites										
I-14 Other Inflows										
TOTAL										
Water Leaving the CWCB										
O-1 Groundwater Production Wells										
O-2 Groundwater Remediation Wells										
O-3 Groundwater Outflow to Adjacent Basins										
O-4 Rising Groundwater/Springs										
O-5 Desalination/Desalters										
O-6 Evaporation, Evapotranspiration of Vegetation, Natural and Incidental Runoff										
O-7 Other Outflows										
TOTAL										

2. SALT AND NUTRIENT BALANCE

A. Conceptual Model

A conceptual model of the import and export of chloride, total dissolved solids (TDS), and nitrate in the CWCB will be developed and presented in the final SNMP. An evaluation of the other Basin Plan constituents with water quality objectives will be performed to ensure that TDS, chloride, and nitrate are indicators of water quality for the rest. A discussion will be added to the SNMP explaining why these chemicals are considered as the "indicator" chemicals for the salt and nutrient balance in the CWCB.

B. Salt and Nutrient Source Identification

The sources of chloride, TDS, and nitrate in the CWCB will be identified and presented in the final SNMP.

C. Salt and Nutrient Import/Export

i. Historical, Existing, Projected

Chloride, TDS, and nitrate data for the past 10 years, current data, and projected data for the next 10 years will be provided in the final SNMP. Loading estimates and water quality data will be provided by WRD, MWD, WBMWD, SDLAC, LACDPW, and LADWP.

E. Basin/Sub-Basin Assimilative Capacity for Salt and Nutrients

The assimilative capacity for chloride, TDS, nitrate in CWCB groundwater will be provided in the final SNMP.

F. Fate and Transport of Salt and Nutrients

The fate and transport of chloride, TDS, nitrate in CWCB groundwater will be discussed in the final SNMP.

3. CONSTITUENTS OF EMERGING CONCERN (CECs)

The SWRCB Policy (refer to Appendix A) requires that the SNMP include "a provision for annual monitoring of Emerging Constituents/Constituents of Emerging Concern (e.g., endocrine disrupters, personal care products, or pharmaceuticals) (CECs) consistent with recommendations by CDPH and consistent with any actions by the State Water Board . . . ." SWRCB is currently considering adoption of a resolution for monitoring of CECs in recycled water that is used for groundwater recharge/reuse and landscape irrigation projects based their review of the June 25, 2010 Final Report for Monitoring Strategies for CECs in Recycled Water (Science Advisory Panel, 2010) and public comments that were received by SWRCB regarding the monitoring of CECs in municipal recycled water. Additionally, CDPH is in the process of finalizing the groundwater recharge reuse regulations, which will include requirements for CEC monitoring for groundwater recharge projects. With respect to CEC monitoring requirements, the CWCB SNMP will be consistent with these applicable CDPH and SWRCB regulations once they are adopted.

Annual monitoring of CECs, including endocrine disrupting chemicals, personal care products, and pharmaceuticals, is currently required in some permits issued by the LARWQCB for projects that involve the use of recycled water, such as the West Coast Basin Barrier Project, the Dominguez Gap Barrier Project, and the Alamitos Barrier Recycled Water Project. Details and data associated with these CEC monitoring requirements will be provided in the final CWCB SNMP.

A. Constituents

In their 2010 report, the Science Advisory Panel identified four chemicals, 17 beta-estradiol, caffeine, triclosan, and N-nitrosodimethylamine (NDMA), that should be monitored for groundwater recharge projects that utilize recycled water (Science Advisory Panel, 2010). In addition, four additional CECs were identified for monitoring as viable performance indicator compounds in surface spreading and direct injection operations, including N,N-Diethyl-meta-toluamide (DEET), gemfibrozil, iopromide, and sucralose with certain surrogate parameters (e.g., ammonia, dissolved organic carbon, and conductivity). It was noted by the Science Advisory Panel that any monitoring program discussed in their report is for information only and is not intended to be used for regulatory compliance purposes. They further recommended that responses to the detection of these and any other CECs are to be flexible and adjustable, based on findings, and may include repeat monitoring, source investigations, and/or shutdown of operations.

CECs that are currently identified and required for annual monitoring in permits issued by the LARWQCB for projects that involve the use of recycled water, such as the West Coast Basin Barrier Project, the Dominguez Gap Barrier Project, and the Alamitos Barrier Recycled Water Project, will be listed and discussed in the final CWCB SNMP.

B. CEC Source Identification

The sources of CECs in the CWCB will be identified in the final SNMP.

4. OTHER CHEMICALS OF CONCERN

Groundwater quality in the CWCB is affected by current land uses. As an urban developed area, commercial and industrial activities (e.g., leaking aboveground and underground storage tanks, leaking sewer and oil pipelines, and illegal discharges) have contaminated groundwater with localized plumes of petroleum fuels, solvents, and other hazardous substances. In general, these plumes are limited to shallow groundwater. However, as the aquifers and confining layers in these alluvial basins are typically interfingered, the quality of groundwater in the deeper production aquifers is threatened by the migration of pollutants from the upper aquifers. The final SNMP will identify chemicals of concern in the CWCB that are associated with contaminated sites, such as volatile organic compounds (VOCs), 1,4-dioxane, and metals. Additionally, a brief overview of these contaminants of concern and how they are being managed in the CWCB will be provided in the SNMP.

5. PROJECTED WATER QUALITY

Based on current estimates of inflow and outflow in the CWCB (refer to Section IV.1.B.), groundwater quality will be projected for the next 10 years in the final SNMP.

V. SALT AND NUTRIENT MANAGEMENT STRATEGIES

1. LOAD REDUCTION GOALS

Load reduction goals for chloride, TDS, and nitrates will be determined and provided in the final SNMP.

2. FUTURE LAND DEVELOPMENT AND USE

As mentioned earlier, most of the CWCB is developed as an urban area, i.e. predominantly residential, commercial, and industrial land uses. Any major changes to future land development or use will be identified in the final SNMP.

3. SALT/NUTRIENT MANAGEMENT OPTIONS

Management options for chloride, TDS, and nitrate will be determined and provided in the final SNMP.

4. SALT/NUTRIENT MANAGEMENT STRATEGIES AND MODELING

A. Management Strategy Model Results

If necessary, modeling may be conducted to develop the management strategy for chloride, TDS, and nitrate in the CWCB. These modeling results will be presented in the final SNMP.

B. Feasibility

The feasibility of implementing the management strategies for salt and nutrients (chloride, TDS, and nitrate) in the CWCB will be discussed in the final SNMP.

C. Cost

All potential costs for the management of salt and nutrients (chloride, TDS, and nitrates) in the CWCB will be discussed in the final SNMP.

VI. BASIN MANAGEMENT PLAN ELEMENTS

1. GROUNDWATER MANAGEMENT GOALS

The overall CWCB groundwater management goals will be developed and provided in the final SNMP.

A. Recycled Water Use/Recharge Goals and Objectives

The goals and objectives for recycled water use and groundwater recharge in the CWCB will be developed and provided in the final SNMP.

B. Stormwater Use/Recharge Goals and Objectives

The goals and objectives for stormwater use and groundwater recharge in the CWCB will be developed and provided in the final SNMP.

2. BASIN MONITORING PROGRAMS

A. Basin Monitoring Programs and Goals

There are existing monitoring programs for groundwater, imported water, recycled water, stormwater, and surface water in the CWCB that are being managed by various agencies/entities to comply with regulatory permits (such as groundwater recharge projects), current State and Federal requirements, or as voluntary actions. The goals of these monitoring programs with respect to salt and nutrient (chloride, TDS, and nitrate) management in the CWCB will be discussed in the final SNMP.

B. Stakeholders Responsible for Implementing the Monitoring

Stakeholders that currently conduct monitoring/sampling of groundwater, imported water, recycled water, stormwater, and/or surface water include WRD, LACDPW, SDLAC, MWD, LADWP, WBMWD, Council for Watershed Health, and other agencies that may be identified during the development of the final SNMP. Further details regarding their monitoring programs will be provided in the final SNMP.

C. Water Quality Parameters

Water quality parameters for existing monitoring programs for groundwater, imported water, recycled water, stormwater, and surface water in the CWCB will be identified in the final SNMP.

D. Sampling Locations

Details regarding sampling locations of existing monitoring programs for groundwater, imported water, recycled water, stormwater, and surface water in the CWCB will be provided in the final SNMP.

E. Sampling Frequency

Details regarding the sampling frequency of existing monitoring programs for groundwater, imported water, recycled water, stormwater, and surface water in the CWCB will be provided in the final SNMP.

F. Quality Assurance/Quality Control (QA/QC)

Details regarding the QA/QC of data collected from existing monitoring programs for groundwater, imported water, recycled water, stormwater, and surface water in the CWCB will be provided in the final SNMP.

G. Database Management

Details regarding the management of databases associated with existing monitoring programs for groundwater, imported water, recycled water, stormwater, and surface water in the CWCB will be provided in the final SNMP.

H. Data Analysis and Reporting

Details regarding the analysis and reporting of data collected from existing monitoring programs for groundwater, imported water, recycled water, stormwater, and surface water in the CWCB will be provided in the final SNMP.

I. Groundwater Level Monitoring

WRD's Regional Groundwater Monitoring Program includes the collection of water levels at nearly 280 monitoring wells at over 50 locations across the CWCB (refer to Figure 14 below). Water levels are measured daily in most monitoring wells with automatic dataloggers, and confirmed with manual field measurements quarterly. Details regarding the groundwater level monitoring program in the CWCB will be provided by WRD in the final SNMP.

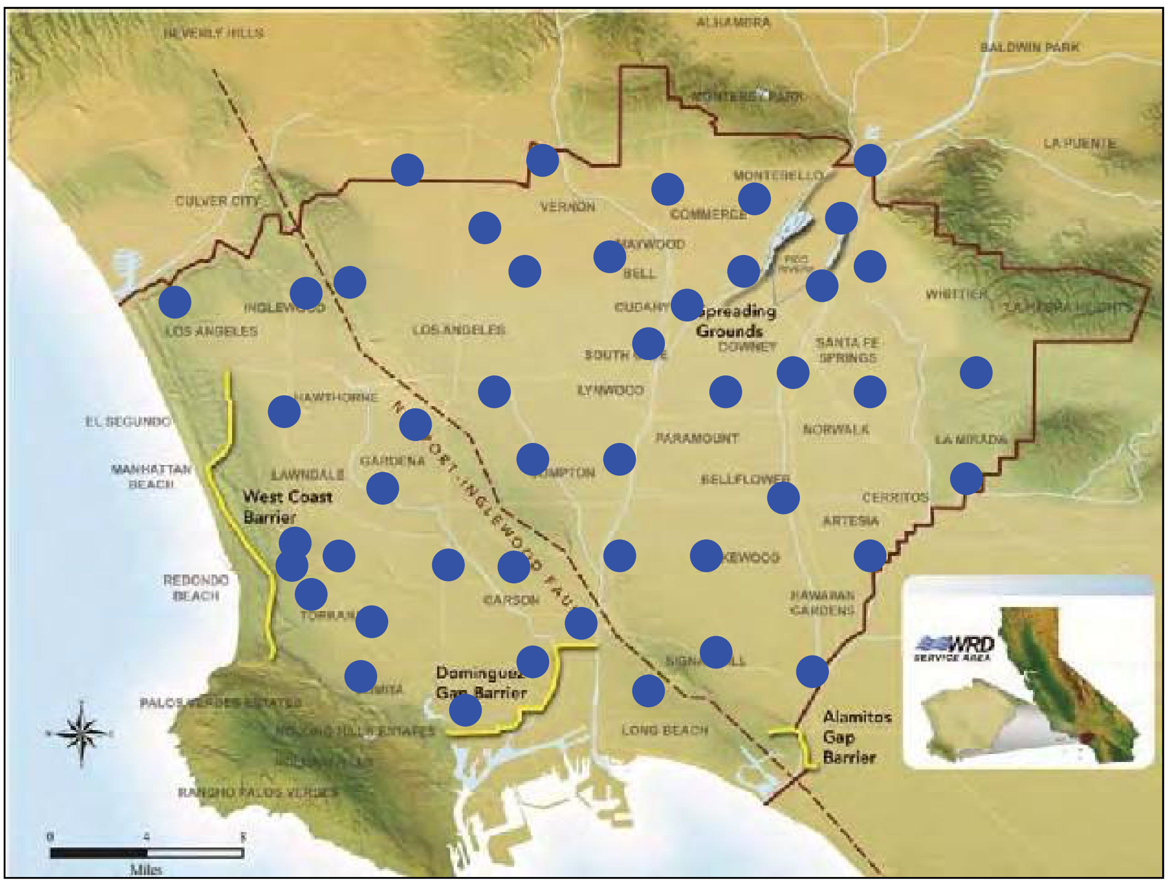

FIGURE 14
WRD Groundwater Monitoring Well Locations in the CWCB

Source: WRD

J. Imported Water Quality Monitoring

Water is imported into the CWCB from three major sources: the Sacramento-San Joaquin Delta (northern California), Colorado River, and Owens Valley/Mono Basin (eastern Sierra Nevada Mountains). MWD imports river water from northern California (State Water Project) and the Colorado River (via the 242-mile Colorado River Aqueduct) to the CWCB. LADWP imports water from the Owens Valley/Mono Basin to the City of Los Angeles via the Los Angeles Aqueduct. Details regarding the imported water quality monitoring program will be provided by MWD and LADWP in the final SNMP.

K. Groundwater Quality Monitoring

WRD's Regional Groundwater Monitoring Program includes for the collection of water quality data at nearly 280 monitoring wells at over 50 locations across the CWCB (refer to Figure 14 above), supplemented by water quality data from existing groundwater production wells obtained through the California Department of Public Health's (CDPH) Title 22 monitoring program. Details regarding the groundwater quality monitoring programs in the CWCB will be provided by WRD in the final SNMP.

i. Areas of Surface Water and Groundwater Connectivity

Details regarding the groundwater quality monitoring program in the vicinity of areas of surface water and groundwater connectivity in the CWCB will be provided by WRD in the final SNMP.

ii. Recycled Water Recharge Areas

Groundwater recharge areas in the CWCB that utilize recycled water include the Montebello Forebay spreading grounds, the seawater intrusion barriers along the coast (West Coast Basin Barrier, Dominguez Gap Barrier, and Alamitos Barrier), and other areas where recycled water is used for irrigation. WRD is responsible for groundwater quality monitoring in the vicinity of the recharge operations at the Montebello Forebay spreading grounds and the seawater intrusion barriers. Details regarding the groundwater quality monitoring programs in the CWCB will be provided by WRD and others in the final SNMP.

iii. Areas of Large Recycled Water Projects

Details regarding areas of large recycled water projects, other than those already identified in Section VI.2.K.iii., will be provided in the final CWCB SNMP. The groundwater quality monitoring programs associated with these large recycled water projects will also be provided in the final SNMP.

L. Surface Water Quality Monitoring

Agencies that currently conduct monitoring of surface water, i.e. river water, in the CWCB include SDLAC, the Council for Watershed Health, and other agencies/cities that may be identified during the SNMP development process. Further details regarding their monitoring programs will be provided by the respective agencies in the final SNMP.

M. Stormwater Monitoring

Stormwater quality is monitored by LACDPW throughout each storm season at mass emissions (river) and tributary stations. Details regarding the stormwater monitoring program will be provided by LACDPW in the final SNMP. Cities in the CWCB will also be contacted for any other existing stormwater monitoring programs.

N. Wastewater Discharge Monitoring

Wastewater discharges in the CWCB, such as treated sewage discharges and National Pollutant Discharge Elimination Systems (NPDES) discharges, will be identified in the final SNMP. Details regarding existing wastewater discharge monitoring program(s) in the CWCB will be provided in the final SNMP.

O. Recycled Water Quality Monitoring

Agencies that currently produce and conduct monitoring of recycled water in the CWCB include WRD, SDLAC, LADWP, and WBMWD. Further details regarding their monitoring programs will be provided by the respective agencies in the final SNMP.

P. Salt and Nutrient Source Loading Monitoring

There are existing monitoring programs in the CWCB that include sampling for salt and nitrates, i.e. chloride, TDS, and nitrates. Details regarding these salt and nutrient source loading monitoring programs will be provided in the final SNMP.

Q. Other Constituents of Concern

Existing monitoring programs in the CWCB for other constituents of concern will be identified in the final SNMP.

R. Water Balance Monitoring

Details regarding a water balance monitoring program in the CWCB will be developed and provided in the final SNMP.

i. Climatological Monitoring

Details regarding a climatological monitoring program in the CWCB will be provided in the final SNMP.

ii. Surface Water Flow Monitoring

Details regarding a surface water flow monitoring program in the CWCB will be developed and provided in the final SNMP.

iii. Groundwater Production Monitoring

Groundwater production in the CWCB is currently being monitored by WRD and DWR (Watermaster in the CWCB). Details regarding the monitoring program for groundwater production in the CWCB will be provided by WRD in the final SNMP.

3. SALT AND NUTRIENT LOAD ALLOCATIONS

Salt and nutrient load allocations, specifically for chloride, TDS, and nitrate, in the CWCB will be developed and provided in the final SNMP.

VII. CEQA ANALYSIS

LARWQCB has acknowledged that they are the lead agency for the environmental analysis of the SNMP. However, the CWCB stakeholders will be responsible for conducting the environmental analysis of the SNMP, similar to Basin Plan Amendments. This section will be further developed through a collaborative process involving the CWCB stakeholders and LARWQCB.

VIII. ANTIDEGRADATION ANALYSIS

The Recycled Water Policy requires projects included within SNMPs to satisfy the requirements of Resolution 68-16 (refer to Appendix D) which is the State's Anti-degradation Policy requiring that waters of the State be regulated to achieve the highest water quality consistent with the maximum benefit to the people of the State. Activities involving the disposal of waste that could impact high quality waters are required to implement best practicable treatment or control of the discharge necessary to ensure that pollution or nuisance will not occur, and the highest water quality consistent with the maximum benefit to the people of the State will be maintained.

Groundwater recharge with recycled water for later extraction and use in accordance with Resolution 68-18 and State and Federal water quality law is to the benefit of the people of the State of California. Nonetheless, SWRCB finds that groundwater recharge projects using recycled water have the potential to lower water quality within a basin. The proponent of a groundwater recharge project must demonstrate compliance with Resolution No. 68-16. Until such time as an SNMP is in effect, such compliance may be demonstrated in accordance with the Recycled Water Policy as follows:

(1) A project that utilizes less than 10% of the available assimilative capacity in a basin/sub-basin (or multiple projects utilizing less than 20% of the available assimilative capacity in a basin/sub-basin) need only conduct an antidegradation analysis verifying the use of the assimilative capacity. For those basins/sub-basins where the RWQCBs have not determined the baseline assimilative capacity, the baseline assimilative capacity shall be calculated by the initial project proponent, with review and approval by the RWQCB, until such time as the SNMP is approved by RWQCB and is in effect. For compliance with this requirement, the available assimilative capacity shall be calculated by comparing the mineral water quality objective with the average concentration of the basin/sub-basin[1], either over the most recent five years of data available or using a data set approved by the RWQCB Executive Officer. Historical groundwater quality data will be reviewed in order to inform decisions about assimilative capacity and conclusions drawn about anti-degradation requirements. In determining whether the available assimilative capacity will be exceeded by the project or projects, the RWQCB shall calculate the impacts of the project or projects over at least a 10 year time frame, based on an analysis of these impacts provided by the project proponent(s), and other relevant data and information.

(2) In the event a project or multiple projects utilize more than the fraction of the assimilative capacity designated in the requirement above, then an RWQCB-deemed acceptable antidegradation analysis shall be performed to comply with Resolution No. 68-16. The project proponent shall provide sufficient information for the RWQCB to make this determination. An example of an approved method is the method used by the SWRCB in connection with Resolution No. 2004-0060 and the RWQCB in connection with Resolution No. R8-2004-0001. An integrated approach (using surface water, groundwater, recycled water, stormwater, pollution prevention, water conservation, etc.) to the implementation of Resolution No. 68-16 is encouraged.

[1] It may be necessary to use more than one average concentration for a given basin to fully characterize groundwater quality in sub-areas or sub-basins and, subsequently, to accurately determine assimilative capacity in light of intra-basin variability in groundwater quality.

Landscape irrigation with recycled water in accordance with the Recycled Water Policy is to the benefit of the people of the State of California. Nonetheless, the SWRCB finds that the use of water for irrigation may, regardless of its source, collectively affect groundwater quality over time. SWRCB intends to address these impacts in part through the development of SNMPs described in paragraph 6 of the Recycled Water Policy (refer to Appendix A).

(1) A project that meets the criteria for a streamlined irrigation permit and is within a basin where an SNMP satisfying the provisions of paragraph 6(b) of the Recycled Water Policy is in place may be approved without further antidegradation analysis, provided that the project is consistent with the SNMP.

(2) A project that meets the criteria for a streamlined irrigation permit and is within a basin where an SNMP satisfying the provisions of paragraph 6(b) of the Recycled Water Policy is being prepared may be approved by the RWQCB by demonstrating through a salt/nutrient mass balance or similar analysis that the project uses less than 10% of the available assimilative capacity as estimated by the project proponent in a basin/sub-basin (or multiple projects using less than 20% of the available assimilative capacity as estimated by the project proponent in a groundwater basin).

IX. PLAN IMPLEMENTATION

1. SALT AND NUTRIENT MANAGEMENT PROGRAM

A. Organizational Structure

The organizational structure of the salt and nutrient management program in the CWCB will be developed and provided in the final SNMP.

B. Stakeholder Responsibilities

Stakeholder responsibilities for implementing the SNMP will be provided in the final SNMP.

C. Implementation Measures to Manage Salt and Nutrient Loading

Implementation measures to manage salt and nutrients (chloride, TDS, and nitrate) loading in the CWCB will be developed and discussed in the final SNMP.

D. Salt/Nutrient Management

i. Water Supply Quality

Refer to Section II.3. of this Workplan for the current water supply quality in the CWCB.

ii. Regulations of Salt/Nutrients

Refer to Section I.2. of this Workplan for current regulations established for salt and nutrient management in the CWCB.

iii. Load Allocations

Load allocations for management of salt and nutrients (chloride, TDS, and nitrate) in the CWCB will be developed and discussed in the final SNMP.

iv. Salt and Nutrient Source Control

Salt and nutrient (chloride, TDS, and nitrate) source control strategies in the CWCB will be developed and provided in the final SNMP.

v. CEC Source Control

CEC source control strategies in the CWCB will be developed and provided in the final SNMP.

vi. Site Specific Requirements

Site specific requirements for management of salt and nutrients (chloride, TDS, and nitrate) in the CWCB will be developed and specified in the final SNMP.

E. Groundwater Resource Protection

The implementation plan for groundwater resource protection in the CWCB will be developed and specified in the final SNMP.

F. Additional Studies

Any additional studies that were or will be conducted to manage salt and nutrients (chloride, TDS, and nitrates) in the CWCB will be identified and discussed in the final SNMP.

2. PERIODIC REVIEW OF SALT/NUTRIENT MANAGEMENT PLAN

A. Adaptive Management Plan

The final SNMP is intended to be a living document, so the salt and nutrient management program, including the goals, existing basin conditions, monitoring programs, etc., will be reviewed every 10 years by the CWCB stakeholders and revisions will be made when necessary.

B. Performance Measures

Performance measures for the SNMP will be developed and presented in the final SNMP.

C. Performance Evaluation

Every 10 years, CWCB stakeholders will review the SNMP for its consistency with the SWRCB Recycled Water Policy (refer to Appendix A), the LARWQCB Basin Plan (refer to Appendix B), the DWR California Water Plan (refer to Appendix C), the SWRCB Antidegradation Policy (refer to Appendix E), and other applicable regulatory documents. The SNMP will be updated as necessary to reflect current conditions and projections in the CWCB. Salt and nutrient (chloride, TDS, and nitrates) management strategies and options will be updated in accordance with actions that have been taken (or in response to expanded salinity problems due to action not taken) since the previous review.

3. COST ANALYSIS

A cost analysis of salt and nutrient (chloride, TDS, and nitrates) management in the CWCB will be conducted and presented in the final SNMP.

4. IMPLEMENTATION SCHEDULE

An implementation schedule of the SNMP will be developed and presented in the final SNMP.

5. PUBLIC HEARING AND ADOPTION

With assistance from the LARWQCB, a public hearing will be conducted after the final SNMP is submitted to LARWQCB for adoption.

X. CONCLUSION

This Workplan of the CWCB SNMP was developed through a collaborative process involving major CWCB stakeholders (refer to Section II) and contains a general overview of the elements and data to be provided in the final CWCB SNMP. The purpose of this Workplan is to obtain approval from the LARWQCB on the outline and elements that will be included in the final CWCB SNMP.

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APPENDIX A

2009 SWRCB Recycled Water Policy

Recycled Water Policy

1. *Preamble*

California is facing an unprecedented water crisis.

The collapse of the Bay-Delta ecosystem, climate change, and continuing population growth have combined with a severe drought on the Colorado River and failing levees in the Delta to create a new reality that challenges California's ability to provide the clean water needed for a healthy environment, a healthy population and a healthy economy, both now and in the future.

These challenges also present an unparalleled opportunity for California to move aggressively towards a sustainable water future. The State Water Resources Control Board (State Water Board) declares that we will achieve our mission to "preserve, enhance and restore the quality of California's water resources to the benefit of present and future generations." To achieve that mission, we support and encourage every region in California to develop a salt/nutrient management plan by 2014 that is sustainable on a long-term basis and that provides California with clean, abundant water. These plans shall be consistent with the Department of Water Resources' Bulletin 160, as appropriate, and shall be locally developed, locally controlled and recognize the variability of California's water supplies and the diversity of its waterways. We strongly encourage local and regional water agencies to move toward clean, abundant, local water for California by emphasizing appropriate water recycling, water conservation, and maintenance of supply infrastructure and the use of stormwater (including dry-weather urban runoff) in these plans; these sources of supply are drought-proof, reliable, and minimize our carbon footprint and can be sustained over the long-term.

We declare our independence from relying on the vagaries of annual precipitation and move towards sustainable management of surface waters and groundwater, together with enhanced water conservation, water reuse and the use of stormwater. To this end, we adopt the following goals for California:

- ➢ Increase the use of recycled water over 2002 levels by at least one million acre-feet per year (afy) by 2020 and by at least two million afy by 2030.
- ➢ Increase the use of stormwater over use in 2007 by at least 500,000 afy by 2020 and by at least one million afy by 2030.
- ➢ Increase the amount of water conserved in urban and industrial uses by comparison to 2007 by at least 20 percent by 2020.
- ➢ Included in these goals is the substitution of as much recycled water for potable water as possible by 2030.

The purpose of this Policy is to increase the use of recycled water from municipal wastewater sources that meets the definition in Water Code section 13050(n), in a manner that implements state and federal water quality laws. The State Water Board expects to develop additional policies to encourage the use of stormwater, encourage water conservation, encourage the conjunctive use of surface and groundwater, and improve the use of local water supplies.

When used in compliance with this Policy, Title 22 and all applicable state and federal water quality laws, the State Water Board finds that recycled water is safe for approved uses, and strongly supports recycled water as a safe alternative to potable water for such approved uses.

2. *Purpose of the Policy*

a. The purpose of this Policy is to provide direction to the Regional Water Quality Control Boards (Regional Water Boards), proponents of recycled water projects, and the public regarding the appropriate criteria to be used by the State Water Board and the Regional Water Boards in issuing permits for recycled water projects.

b. It is the intent of the State Water Board that all elements of this Policy are to be interpreted in a manner that fully implements state and federal water quality laws and regulations in order to enhance the environment and put the waters of the state to the fullest use of which they are capable.

c. This Policy describes permitting criteria that are intended to streamline the permitting of the vast majority of recycled water projects. The intent of this streamlined permit process is to expedite the implementation of recycled water projects in a manner that implements state and federal water quality laws while allowing the Regional Water Boards to focus their limited resources on projects that require substantial regulatory review due to unique site-specific conditions.

d. By prescribing permitting criteria that apply to the vast majority of recycled water projects, it is the State Water Board's intent to maximize consistency in the permitting of recycled water projects in California while also reserving to the Regional Water Boards sufficient authority and flexibility to address site-specific conditions.

e. The State Water Board will establish additional policies that are intended to assist the State of California in meeting the goals established in the preamble to this Policy for water conservation and the use of stormwater.

f. For purposes of this Policy, the term "permit" means an order adopted by a Regional Water Board or the State Water Board prescribing requirements for a recycled water project, including but not limited to water recycling requirements, master reclamation permits, and waste discharge requirements.

3. *Benefits of Recycled Water*

The State Water Board finds that the use of recycled water in accordance with this Policy, that is, which supports the sustainable use of groundwater and/or surface water, which is sufficiently treated so as not to adversely impact public health or the environment and which ideally substitutes for use of potable water, is presumed to have a beneficial impact. Other public agencies are encouraged to use this presumption in evaluating the impacts of recycled water projects on the environment as required by the California Environmental Quality Act (CEQA).

4. *Mandate for the Use of Recycled Water*

a. The State Water Board and Regional Water Boards will exercise the authority granted to them by the Legislature to the fullest extent possible to encourage the use of recycled water, consistent with state and federal water quality laws.

(1) The State Water Board hereby establishes a mandate to increase the use of recycled water in California by 200,000 afy by 2020 and by an additional 300,000 afy by 2030. These mandates shall be achieved through the cooperation and collaboration of the State Water Board, the Regional Water Boards, the environmental community, water purveyors and the operators of publicly owned treatment works. The State Water Board will evaluate progress toward these mandates biennially and review and revise as necessary the implementation provisions of this Policy in 2012 and 2016.

(2) Agencies producing recycled water that is available for reuse and not being put to beneficial use shall make that recycled water available to water purveyors for reuse on reasonable terms and conditions. Such terms and conditions may include payment by the water purveyor of a fair and reasonable share of the cost of the recycled water supply and facilities.

(3) The State Water Board hereby declares that, pursuant to Water Code sections 13550 *et seq*., it is a waste and unreasonable use of water for water agencies not to use recycled water when recycled water of adequate quality is available and is not being put to beneficial use, subject to the conditions established in sections 13550 *et seq*. The State Water Board shall exercise its authority pursuant to Water Code section 275 to the fullest extent possible to enforce the mandates of this subparagraph.

b. These mandates are contingent on the availability of sufficient capital funding for the construction of recycled water projects from private, local, state, and federal sources and assume that the Regional Water Boards will effectively implement regulatory streamlining in accordance with this Policy.

c. The water industry and the environmental community have agreed jointly to advocate for $1 billion in state and federal funds over the next five years to fund projects needed to meet the goals and mandates for the use of recycled water established in this Policy.

d. The State Water Board requests the California Department of Public Health (CDPH), the California Public Utilities Commission (CPUC), and the California Department of Water Resources (CDWR) to use their respective authorities to the fullest extent practicable to assist the State Water Board and the Regional Water Boards in increasing the use of recycled water in California.

5. *Roles of the State Water Board, Regional Water Boards, CDPH and CDWR*

The State Water Board recognizes that it shares jurisdiction over the use of recycled water with the Regional Water Boards and with CDPH. In addition, the State Water Board recognizes that CDWR and the CPUC have important roles to play in encouraging the use of recycled water. The State Water Board believes that it is important to clarify the respective roles of each of these agencies in connection with recycled water projects, as follows:

a. The State Water Board establishes general policies governing the permitting of recycled water projects consistent with its role of protecting water quality and sustaining water supplies. The State Water Board exercises general oversight over recycled water projects, including review of Regional Water Board permitting practices, and shall lead the effort to meet the recycled water use goals set forth in the Preamble to this Policy. The State Water Board is also charged by statute with developing a general permit for irrigation uses of recycled water.

b. The CDPH is charged with protection of public health and drinking water supplies and with the development of uniform water recycling criteria appropriate to particular uses of water. Regional Water Boards shall appropriately rely on the expertise of CDPH for the establishment of permit conditions needed to protect human health.

c. The Regional Water Boards are charged with protection of surface and groundwater resources and with the issuance of permits that implement CDPH recommendations, this Policy, and applicable law and will, pursuant to paragraph 4 of this Policy, use their authority to the fullest extent possible to encourage the use of recycled water.

d. CDWR is charged with reviewing and, every five years, updating the California Water Plan, including evaluating the quantity of recycled water presently being used and planning for the potential for future uses of recycled water. In undertaking these tasks, CDWR may appropriately rely on urban water management plans and may share the data from those plans with the State Water Board and the Regional Water Boards. CDWR also shares with the State Water Board the authority to allocate and distribute bond funding, which can provide incentives for the use of recycled water.

e. The CPUC is charged with approving rates and terms of service for the use of recycled water by investor-owned utilities.

6. *Salt/Nutrient Management Plans*

a. *Introduction.*

(1) Some groundwater basins in the state contain salts and nutrients that exceed or threaten to exceed water quality objectives established in the applicable Water Quality Control Plans (Basin Plans), and not all Basin Plans include adequate implementation procedures for achieving or ensuring compliance with the water quality objectives for salt or nutrients. These conditions can be caused by natural soils/conditions, discharges of waste, irrigation using surface water, groundwater or recycled water and water supply augmentation using surface or recycled water. Regulation of recycled water alone will not address these conditions.

(2) It is the intent of this Policy that salts and nutrients from all sources be managed on a basin-wide or watershed-wide basis in a manner that ensures attainment of water quality objectives and protection of beneficial uses. The State Water Board finds that the appropriate way to address salt and nutrient issues is through the development of regional or subregional salt and nutrient management plans rather than through imposing requirements solely on individual recycled water projects.

b. *Adoption of Salt/ Nutrient Management Plans.*

(1) The State Water Board recognizes that, pursuant to the letter dated December 19, 2008 and attached to the Resolution adopting this Policy, the local water and wastewater entities, together with local salt/nutrient contributing stakeholders, will fund locally driven and controlled, collaborative processes open to all stakeholders that will prepare salt and nutrient management plans for each basin/sub-basin in California, including compliance with CEQA and participation by Regional Water Board staff.

(a) It is the intent of this Policy for every groundwater basin/sub-basin in California to have a consistent salt/nutrient management plan. The degree of specificity within these plans and the length of these plans will be dependent on a variety of site-specific factors, including but not limited to size and complexity of a basin, source water quality, stormwater recharge, hydrogeology, and aquifer water quality. It is also the intent of the State Water Board that because stormwater is typically lower in nutrients and salts and can augment local water supplies, inclusion of a significant stormwater use and recharge component within the salt/nutrient management plans is critical to the long-term sustainable use of water in California. Inclusion of stormwater recharge is consistent with State Water Board Resolution No. 2005-06, which establishes sustainability as a core value for State Water Board programs and also assists in implementing Resolution No. 2008-30, which requires sustainable water resources management and is consistent with Objective 3.2 of the State Water Board Strategic Plan Update dated September 2, 2008.

(b) Salt and nutrient plans shall be tailored to address the water quality concerns in each basin/sub-basin and may include constituents other than salt and nutrients that impact water quality in the basin/sub-basin. Such plans shall address and implement provisions, as appropriate, for all sources of salt and/or nutrients to groundwater basins, including recycled water irrigation projects and groundwater recharge reuse projects.

(c) Such plans may be developed or funded pursuant to the provisions of Water Code sections 10750 *et seq.* or other appropriate authority.

(d) Salt and nutrient plans shall be completed and proposed to the Regional Water Board within five years from the date of this Policy unless a Regional Water Board finds that the stakeholders are making substantial progress towards completion of a plan. In no case shall the period for the completion of a plan exceed seven years.

(e) The requirements of this paragraph shall not apply to areas that have already completed a Regional Water Board approved salt and nutrient plan for a basin, sub-basin, or other regional planning area that is functionally equivalent to paragraph 6(b)3.

(f) The plans may, depending upon the local situation, address constituents other than salt and nutrients that adversely affect groundwater quality.

(2) Within one year of the receipt of a proposed salt and nutrient management plan, the Regional Water Boards shall consider for adoption revised implementation plans, consistent with Water Code section 13242, for those groundwater basins within their regions where water quality objectives for salts or nutrients are being, or are threatening to be, exceeded. The implementation plans shall be based on the salt and nutrient plans required by this Policy.

(3) Each salt and nutrient management plan shall include the following components:

(a) A basin/sub-basin wide monitoring plan that includes an appropriate network of monitoring locations. The scale of the basin/sub-basin monitoring plan is dependent upon the site-specific conditions and shall be adequate to provide a reasonable, cost-effective means of determining whether the concentrations of salt, nutrients, and other constituents of concern as identified in the salt and nutrient plans are consistent with applicable water quality objectives. Salts, nutrients, and the constituents identified in paragraph 6(b)(1)(f) shall be monitored. The frequency of monitoring shall be determined in the salt/nutrient management plan and approved by the Regional Water Board pursuant to paragraph 6(b)(2).

(i) The monitoring plan must be designed to determine water quality in the basin. The plan must focus on basin water quality near water supply wells and areas proximate to large water recycling projects, particularly groundwater recharge projects. Also, monitoring locations shall, where appropriate, target groundwater and surface waters where groundwater has connectivity with adjacent surface waters.

(ii) The preferred approach to monitoring plan development is to collect samples from existing wells if feasible as long as the existing wells are located appropriately to determine water quality throughout the most critical areas of the basin.

(iii) The monitoring plan shall identify those stakeholders responsible for conducting, compiling, and reporting the monitoring data. The data shall be reported to the Regional Water Board at least every three years.

(b) A provision for annual monitoring of Emerging Constituents/ Constituents of Emerging Concern (e.g., endocrine disrupters, personal care products or pharmaceuticals) (CECs) consistent with recommendations by CDPH and consistent with any actions by the State Water Board taken pursuant to paragraph 10(b) of this Policy.

(c) Water recycling and stormwater recharge/use goals and objectives.

(d) Salt and nutrient source identification, basin/sub-basin assimilative capacity and loading estimates, together with fate and transport of salts and nutrients.

(e) Implementation measures to manage salt and nutrient loading in the basin on a sustainable basis.

(f) An antidegradation analysis demonstrating that the projects included within the plan will, collectively, satisfy the requirements of Resolution No. 68-16.

(4) Nothing in this Policy shall prevent stakeholders from developing a plan that is more protective of water quality than applicable standards in the Basin Plan. No Regional Water Board, however, shall seek to modify Basin Plan objectives without full compliance with the process for such modification as established by existing law.

7. *Landscape Irrigation Projects*

a. *Control of incidental runoff.* Incidental runoff is defined as unintended small amounts (volume) of runoff from recycled water use areas, such as unintended, minimal over-spray from sprinklers that escapes the recycled water use area. Water leaving a recycled water use area is not considered incidental if it is part of the facility design, if it is due to excessive application, if it is due to intentional overflow or application, or if it is due to negligence. Incidental runoff may be regulated by waste discharge requirements or, where necessary, waste discharge requirements that serve as a National Pollutant Discharge Elimination System (NPDES) permit, including municipal separate storm water system permits, but regardless of the regulatory instrument, the project shall include, but is not limited to, the following practices:

(1) Implementation of an operations and management plan that may apply to multiple sites and provides for detection of leaks, (for example, from broken sprinkler heads), and correction either within 72 hours of learning of the runoff, or prior to the release of 1,000 gallons, whichever occurs first,

(2) Proper design and aim of sprinkler heads,

(3) Refraining from application during precipitation events, and

(4) Management of any ponds containing recycled water such that no discharge occurs unless the discharge is a result of a 25-year, 24-hour storm event or greater, and there is notification of the appropriate Regional Water Board Executive Officer of the discharge.

b. *Streamlined Permitting*

(1) The Regional Water Boards shall, absent unusual circumstances (i.e., unique, site-specific conditions such as where recycled water is proposed to be used for irrigation over high transmissivity soils over a shallow (5' or less) high quality groundwater aquifer), permit recycled water projects that meet the criteria set forth in this Policy, consistent with the provisions of this paragraph.

(2) If the Regional Water Board determines that unusual circumstances apply, the Regional Water Board shall make a finding of unusual circumstances based on substantial evidence in the record, after public notice and hearing.

(3) Projects meeting the criteria set forth below and eligible for enrollment under requirements established in a general order shall be enrolled by the State or Regional Water Board within 60 days from the date on which an application is deemed complete by the State or Regional Water Board. For projects that are not enrolled in a general order, the Regional Water Board shall consider permit adoption within 120 days from the date on which the application is deemed complete by the Regional Water Board.

(4) Landscape irrigation projects that qualify for streamlined permitting shall not be required to include a project specific receiving water and groundwater monitoring component unless such project specific monitoring is required under the adopted salt/nutrient management plan. During the interim while the salt management plan is under development, a landscape irrigation project proponent can either perform project specific monitoring, or actively participate in the development and implementation of a salt/nutrient management plan, including basin/sub-basin monitoring. Permits or requirements for landscape irrigation projects shall include, in addition to any other appropriate recycled water monitoring requirements, recycled water monitoring for CECs on an annual basis and priority pollutants on a twice annual basis. Except as requested by CDPH, State and Regional Water Board monitoring requirements for CECs shall not take effect until 18 months after the effective date of this Policy. In addition, any permits shall include a permit reopener to allow incorporation of appropriate monitoring requirements for CECs after State Water Board action under paragraph 10(b)(2).

(5) It is the intent of the State Water Board that the general permit for landscape irrigation projects be consistent with the terms of this Policy.

c. *Criteria for streamlined permitting*. Irrigation projects using recycled water that meet the following criteria are eligible for streamlined permitting, and, if otherwise in compliance with applicable laws, shall be approved absent unusual circumstances:

(1) Compliance with the requirements for recycled water established in Title 22 of the California Code of Regulations, including the requirements for treatment and use area restrictions, together with any other recommendations by CDPH pursuant to Water Code section 13523.

(2) Application in amounts and at rates as needed for the landscape (i.e., at agronomic rates and not when the soil is saturated). Each irrigation project shall be subject to an operations and management plan, that may apply to multiple sites, provided to the Regional Water Board that specifies the agronomic rate(s) and describes a set of reasonably practicable measures to ensure compliance with this requirement, which may include the development of water budgets for use areas, site

supervisor training, periodic inspections, tiered rate structures, the use of smart controllers, or other appropriate measures.

(3) Compliance with any applicable salt and nutrient management plan.

(4) Appropriate use of fertilizers that takes into account the nutrient levels in the recycled water. Recycled water producers shall monitor and communicate to the users the nutrient levels in their recycled water.

8. *Recycled Water Groundwater Recharge Projects*

a. The State Water Board acknowledges that all recycled water groundwater recharge projects must be reviewed and permitted on a site-specific basis, and so such projects will require project-by-project review.

b. Approved groundwater recharge projects will meet the following criteria:

(1) Compliance with regulations adopted by CDPH for groundwater recharge projects or, in the interim until such regulations are approved, CDPH's recommendations pursuant to Water Code section 13523 for the project (e.g., level of treatment, retention time, setback distance, source control, monitoring program, etc.).

(2) Implementation of a monitoring program for constituents of concern and a monitoring program for CECs that is consistent with any actions by the State Water Board taken pursuant to paragraph 10(b) of this Policy and that takes into account site-specific conditions. Groundwater recharge projects shall include monitoring of recycled water for CECs on an annual basis and priority pollutants on a twice annual basis.

c. Nothing in this paragraph shall be construed to limit the authority of a Regional Water Board to protect designated beneficial uses, *provided* that any proposed limitations for the protection of public health may only be imposed following regular consultation by the Regional Water Board with CDPH, consistent with State Water Board Orders WQ 2005-0007 and 2006-0001.

d. Nothing in this Policy shall be construed to prevent a Regional Water Board from imposing additional requirements for a proposed recharge project that has a substantial adverse effect on the fate and transport of a contaminant plume or changes the geochemistry of an aquifer thereby causing the dissolution of constituents, such as arsenic, from the geologic formation into groundwater.

e. Projects that utilize surface spreading to recharge groundwater with recycled water treated by reverse osmosis shall be permitted by a Regional Water Board within one year of receipt of recommendations from CDPH. Furthermore, the Regional Water Board shall give a high priority to review and approval of such projects.

9. *Antidegradation*

a. The State Water Board adopted Resolution No. 68-16 as a policy statement to implement the Legislature's intent that waters of the state shall be regulated to achieve the highest water quality consistent with the maximum benefit to the people of the state.

b. Activities involving the disposal of waste that could impact high quality waters are required to implement best practicable treatment or control of the discharge necessary to ensure that pollution or nuisance will not occur, and the highest water quality consistent with the maximum benefit to the people of the state will be maintained.

c. Groundwater recharge with recycled water for later extraction and use in accordance with this Policy and state and federal water quality law is to the benefit of the people of the state of California. Nonetheless, the State Water Board finds that groundwater recharge projects using recycled water have the potential to lower water quality within a basin. The proponent of a groundwater recharge project must demonstrate compliance with Resolution No. 68-16. Until such time as a salt/nutrient management plan is in effect, such compliance may be demonstrated as follows:

(1) A project that utilizes less than 10 percent of the available assimilative capacity in a basin/sub-basin (or multiple projects utilizing less than 20 percent of the available assimilative capacity in a basin/sub-basin) need only conduct an antidegradation analysis verifying the use of the assimilative capacity. For those basins/sub-basins where the Regional Water Boards have not determined the baseline assimilative capacity, the baseline assimilative capacity shall be calculated by the initial project proponent, with review and approval by the Regional Water Board, until such time as the salt/nutrient plan is approved by the Regional Water Board and is in effect. For compliance with this subparagraph, the available assimilative capacity shall be calculated by comparing the mineral water quality objective with the average concentration of the basin/sub-basin, either over the most recent five years of data available or using a data set approved by the Regional Water Board Executive Officer. In determining whether the available assimilative capacity will be exceeded by the project or projects, the Regional Water Board shall calculate the impacts of the project or projects over at least a ten year time frame.

(2) In the event a project or multiple projects utilize more than the fraction of the assimilative capacity designated in subparagraph (1), then a Regional Water Board-deemed acceptable antidegradation analysis shall be performed to comply with Resolution No. 68-16. The project proponent shall provide sufficient information for the Regional Water Board to make this determination. An example of an approved method is the method used by the State Water Board in connection with Resolution No. 2004-0060 and the Regional Water Board in connection with Resolution No. R8-2004-0001. An integrated approach (using surface water, groundwater, recycled water, stormwater, pollution prevention, water conservation, etc.) to the implementation of Resolution No. 68-16 is encouraged.

d. Landscape irrigation with recycled water in accordance with this Policy is to the benefit of the people of the State of California. Nonetheless, the State Water Board finds that the use of water for irrigation may, regardless of its source, collectively affect groundwater quality over time. The State Water Board intends to address these impacts in part through the development of salt/nutrient management plans described in paragraph 6.

(1) A project that meets the criteria for a streamlined irrigation permit and is within a basin where a salt/nutrient management plan satisfying the provisions of paragraph 6(b) is in place may be approved without further antidegradation analysis, provided that the project is consistent with that plan.

(2) A project that meets the criteria for a streamlined irrigation permit and is within a basin where a salt/nutrient management plan satisfying the provisions of paragraph 6(b) is being prepared may be approved by the Regional Water Board by demonstrating through a salt/nutrient mass balance or similar analysis that the project uses less than 10 percent of the available assimilative capacity as estimated by the project proponent in a basin/sub-basin (or multiple projects using less than 20 percent of the available assimilative capacity as estimated by the project proponent in a groundwater basin).

10. *Emerging Constituents/Chemicals of Emerging Concern*

a. *General Provisions*

(1) Regulatory requirements for recycled water shall be based on the best available peer-reviewed science. In addition, all uses of recycled water must meet conditions set by CDPH.

(2) Knowledge of risks will change over time and recycled water projects must meet legally applicable criteria. However, when standards change, projects should be allowed time to comply through a compliance schedule.

(3) The state of knowledge regarding CECs is incomplete. There needs to be additional research and development of analytical methods and surrogates to determine potential environmental and public health impacts. Agencies should minimize the likelihood of CECs impacting human health and the environment by means of source control and/or pollution prevention programs.

(4) Regulating most CECs will require significant work to develop test methods and more specific determinations as to how and at what level CECs impact public health or our environment.

b. *Research Program.* The State Water Board, in consultation with CDPH and within 90 days of the adoption of this Policy, shall convene a "blue-ribbon" advisory panel to guide future actions relating to constituents of emerging concern.

(1) The panel shall be actively managed by the State Water Board and shall be composed of at least the following: one human health toxicologist, one environmental toxicologist, one epidemiologist, one biochemist, one civil engineer familiar with the design and construction of recycled water treatment facilities, and one chemist familiar with the design and operation of advanced laboratory methods for the detection of emerging constituents. Each of these panelists shall have extensive experience as a principal investigator in their respective areas of expertise.

(2) The panel shall review the scientific literature and, within one year from its appointment, shall submit a report to the State Water Board and CDPH describing the current state of scientific knowledge regarding the risks of emerging constituents to public health and the environment. Within six months of receipt of the panel's report the State Water Board, in coordination with CDPH, shall hold a public hearing to consider recommendations from staff and shall endorse the recommendations, as appropriate, after making any necessary modifications. The panel or a similarly constituted panel shall update this report every five years.

(3) Each report shall recommend actions that the State of California should take to improve our understanding of emerging constituents and, as may be appropriate, to protect public health and the environment.

(4) The panel report shall answer the following questions: What are the appropriate constituents to be monitored in recycled water, including analytical methods and method detection limits? What is the known toxicological information for the above constituents? Would the above lists change based on level of treatment and use? If so, how? What are possible indicators that represent a suite of CECs? What levels of CECs should trigger enhanced monitoring of CECs in recycled water, groundwater and/or surface waters?

c. *Permit Provisions.* Permits for recycled water projects shall be consistent both with any CDPH recommendations to protect public health and with any actions by the State Water Board taken pursuant to paragraph 10(b)(2).

11. *Incentives for the Use of Recycled Water*

a. *Funding*

The State Water Board will request CDWR to provide funding ($20M) for the development of salt and nutrient management plans during the next three years (i.e., before FY 2010/2011). The State Water Board will also request CDWR to provide priority funding for projects that have major recycling components; particularly those that decrease demand on potable water supplies. The State Water Board will also request priority funding for stormwater recharge projects that augment local water supplies. The State Water Board shall promote the use of the State Revolving Fund (SRF) for water purveyor, stormwater agencies, and water recyclers to use for water reuse and stormwater use and recharge projects.

b. *Stormwater*

The State Water Board strongly encourages all water purveyors to provide financial incentives for water recycling and stormwater recharge and reuse projects. The State Water Board also encourages the Regional Water Boards to require less stringent monitoring and regulatory requirements for stormwater treatment and use projects than for projects involving untreated stormwater discharges.

c. TMDLs

Water recycling reduces mass loadings from municipal wastewater sources to impaired waters. As such, waste load allocations shall be assigned as appropriate by the Regional Water Boards in a manner that provides an incentive for greater water recycling.

APPENDIX B

LARWQCB Water Quality Control Plan (Basin Plan) for the Coastal Watersheds of Los Angeles and Ventura Counties

WATER QUALITY CONTROL PLAN
Los Angeles Region

Basin Plan
for the
Coastal Watersheds of
Los Angeles and Ventura Counties

California Regional Water Quality Control Board

Los Angeles Region (4)

WATER QUALITY CONTROL PLAN

Los Angeles Region

Adopted by

California Regional Water Quality Control Board, Los Angeles Region on June 13, 1994.

Approved by

State Water Resources Control Board on November 17, 1994.

State Office of Administrative Law on February 23, 1995.

California Regional Water Quality Control Board, Los Angeles Region
101 Centre Plaza Drive
Monterey Park, CA 91754

Telephone (213) 266-7500
Fax (213) 266-7600

STATE OF CALIFORNIA

PETE WILSON, Governor
JAMES M. STROCK, Secretary, Environmental Protection Agency

State Water Resources Control Board

John P. Caffrey, *Chair*
Marc Del Piero, *Vice Chair*
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Mary Jane Forster, *Member*
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Walt Pettit, *Executive Director*

California Regional Water Quality Control Board, Los Angeles Region

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Charlotte Craven	Public Member
Terry L. Dipple	County Government
Clark Drane	Water Quality
Elizabeth D. Rogers, Ph.D.	Water Quality
John A. Slezak	Recreation, Fish, and Wildlife
Larry Zarian	Municipal Government

Robert P. Ghirelli, D.Env., *Executive Officer*

This report was prepared under the direction of

Richard A. Harris, *Assistant Executive Officer*
Dennis Dasker, *Chief, Regional Programs*

by

Deborah J. Smith, *Chief, Planning Unit*
Wendy Phillips, *Associate Engineering Geologist*
Ana Corado, *Water Resources Control Engineer*
Heather Trim, *Engineering Geologist*
Manjunath Venkatanarayana, *Environmental Specialist II*
Gerhardt Hubner, *Engineering Geologist*
Toby Moore, *Intern*
Pamela Hicks, *Graduate Student Assistant*

Assistance provided by the following State Water Resources Control Board staff

John Ladd, *Chief, Basin Planning Unit*
Stephen Fagundes, *Associate Water Resource Control Engineer*
Jean Ladyman, *Associate Government Program Analyst*
Rene Bozzuto, *Office Technician*

Cover Art by

Alex Fu, *Sanitary Engineer Associate, CRWQCB-LA*

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Appendix One

1. INTRODUCTION

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The State and Regional Boards

Responsibility for the protection of water quality in California rests with the State Water Resources Control Board (hereinafter referred to as the State Board) and nine Regional Water Quality Control Boards. The State Board sets statewide policies and develops regulations for the implementation of water quality control programs mandated by state and federal water quality statutes and regulations. Regional Water Quality Control Boards develop and implement Water Quality Control Plans (Basin Plans) that consider regional beneficial uses, water quality characteristics, and water quality problems.

The California Regional Water Quality Control Board, Los Angeles Region (hereinafter referred to as the Los Angeles Regional Board or Regional Board) has jurisdiction over the coastal drainages between Rincon Point (on the coast of western Ventura County) and the eastern Los Angeles County line (Figure 1-1). The Regional Board is governed by nine members, all of whom are appointed by the Governor and confirmed by the State Senate. Regional Board members represent certain categories related to the control of water quality and must reside in, or have a principal place of business within, the Region. Members of the Regional Board hold regular meetings at different sites throughout the Region. The staff at the Regional Board implement Regional Board policies under the direction of the Executive Officer who is appointed by the Regional Board. The public may address the Regional Board regarding any matter within the Regional Board's jurisdiction during the public forum period at any regular Regional Board meeting. Copies of the Regional Board meeting agendas are available for examination at the office of the Regional Board during regular working hours.

Function of the Basin Plan

The Los Angeles Regional Board's Basin Plan is designed to preserve and enhance water quality and protect the beneficial uses of all regional waters. Specifically, the Basin Plan (i) designates beneficial uses for surface and ground waters, (ii) sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to the state's antidegradation policy, and (iii) describes implementation programs to protect all waters in the Region. In addition, the Basin Plan incorporates (by reference) all applicable State and Regional Board plans and policies and other pertinent water quality policies and regulations. Major State and Regional Board plans and policies are summarized in Chapter 5. Those of other agencies are referenced in appropriate sections throughout the Basin Plan.

The Basin Plan is a resource for the Regional Board and others who use water and/or discharge wastewater in the Los Angeles Region. Other agencies and organizations involved in environmental permitting and resource management activities also use the Basin Plan. Finally, the Basin Plan provides valuable information to the public about local water quality issues.

The Basin Plan is reviewed and updated as necessary. Following adoption by the Regional Board, the Basin Plan and subsequent amendments are subject to approval by the State Board, the

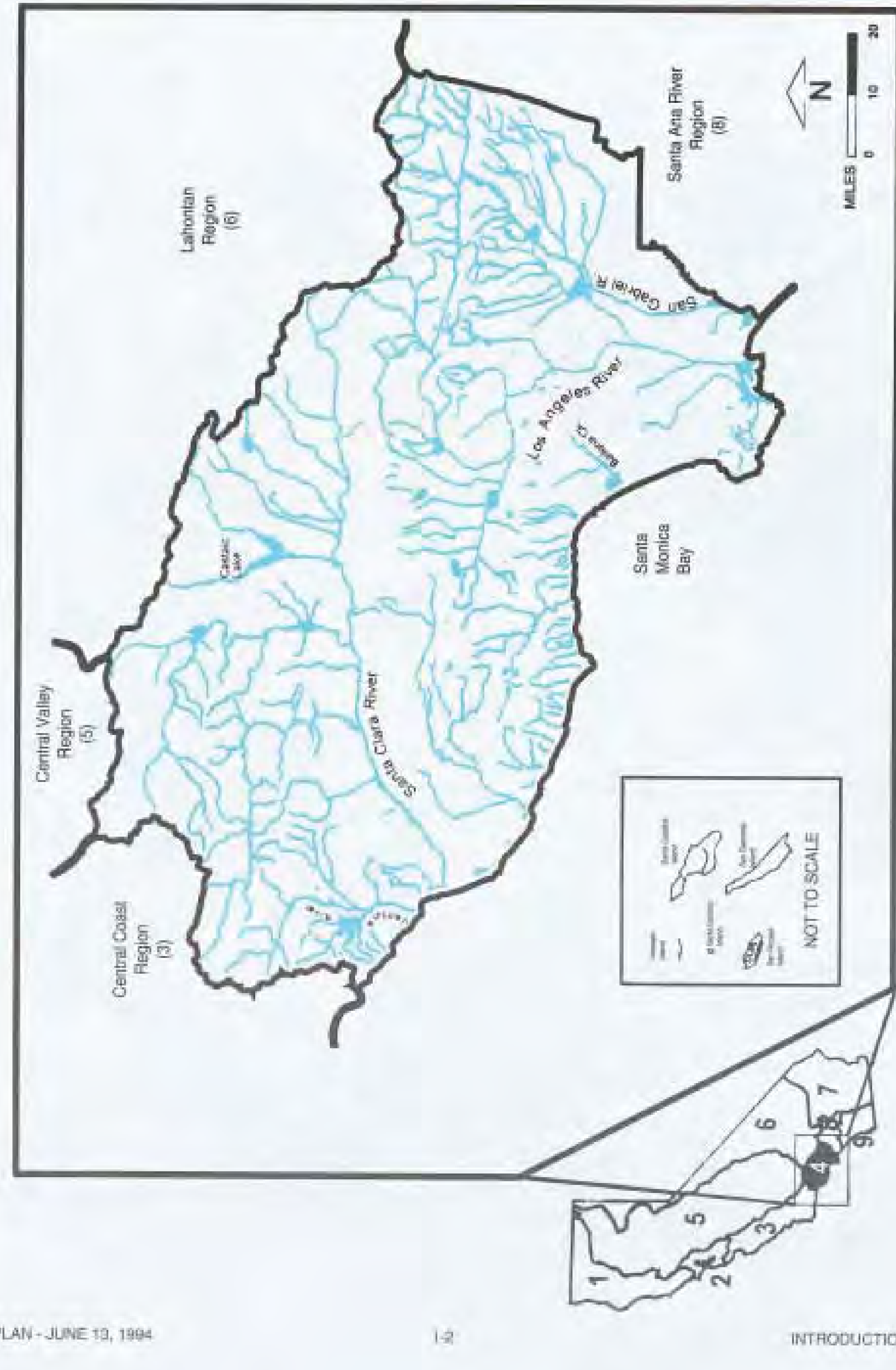


Figure 1-1. Regional Map: Regional Water Quality Control Board, Los Angeles Region.

State Office of Administrative Law (OAL), and the United States Environmental Protection Agency (USEPA).

Legal Basis and Authority

The Basin Plan implements a number of state and federal laws, the most important of which are the California Porter-Cologne Water Quality Control Act (California Water Code, Division 1, Chapter 2, Article 3, et seq., plus others) and the Clean Water Act (PL 92-500, as amended). Other pertinent state laws include: the Hazardous Substances Cleanup Bond Act of 1984 (Health & Safety Code, §25385 et seq.), the Toxic Pits Cleanup Act (Health & Safety Code, §25208 et seq.), and the Toxic Injection Well Control Act (Health & Safety Code, §25159.10 et seq.). Pertinent federal laws include: the Safe Drinking Water Act (42 U.S.C.A., §300F et seq.), the Toxic Substances Control Act (15 U.S.C.A., §2601 et seq.), the Resource Conservation and Recovery Act (RCRA, 42 U.S.C.A., §6 901 et seq.), and the Endangered Species Act (16 U.S.C.A., §1531 et seq.).

The Porter-Cologne Water Quality Control Act (herein after referred to as California Water Code), enacted by the State of California in 1969 and effective January 1, 1970, is considered landmark water quality legislation and has served as a model for subsequent legislation by the federal government and other state governments. This legislation authorizes the State Board to adopt, review, and revise policies for all waters of the state (including both surface and ground waters) and directs the Regional Boards to develop regional Basin Plans. The California Water Code (§13170) also authorizes the State Board to adopt water quality control plans on its own initiative. In the event of inconsistencies among various State and Regional Board plans, the more stringent provisions apply.

The Clean Water Act (CWA), enacted by the federal government in 1972, was designed to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. One of the national goals states that wherever attainable water quality should provide for the protection and propagation of fish, shellfish, and wildlife, and provide for recreation in and on the water (i.e., fishable, swimmable). The CWA (§303[c]) directs states to establish water quality standards for all "waters of the United States" and to review and update such standards on a triennial basis. Other provisions of the CWA related to basin planning include Section 208, which authorizes the preparation of waste treatment management plans, and Section 319 (added by 1987 amendments) which mandates specific actions for the control of pollution from nonpoint sources. The 1987 amendments to the CWA (§307[a]) also mandate that states adopt numerical standards for all priority pollutants.

The USEPA has delegated responsibility for implementation of portions of the CWA to the State and Regional Boards, including water quality planning and control programs such as the National Pollutant Discharge Elimination System (NPDES). The Code of Federal Regulations (Title 40, CFR) and USEPA guidance documents provide direction for implementation of the CWA.

Besides state and federal laws, several court decisions provide guidance for basin planning. For example, the 1983 Mono Lake Decision (National Audubon Society v. Superior Court [1993]) reaffirmed the public trust doctrine, holding that the public trust is "an affirmation of the duty of the state to protect the people's common heritage in streams, lakes, marshlands, and tidelands, surrendering that right of protection only in rare cases when the abandonment of that right is consistent with the purposes of the trust." Public trust encompasses uses of water for commerce, navigation, fisheries, and recreation. In California Trout, Inc. v. State Water Resources Control Board (1989), the courts found that the public trust doctrine also applies to activities that could harm the fisheries in a non-navigable water.

History of Basin Planning in the Los Angeles Region

The Dickey Act, enacted by the State of California in 1949, established nine Regional Water Pollution Control Boards in California. Regional Water Pollution Control Boards were directed to establish water quality objectives in order to protect the quality of receiving waters from adverse impacts of wastewater discharges. During the first few years, the Los Angeles Regional Water Pollution Control Board only established narrative objectives for discharges. By 1952, the Los Angeles Regional Water Pollution Control Board began including numerical limits in requirements for discharges and adopting water quality objectives for receiving waters.

With the enactment of the Porter-Cologne Water Quality Act in 1969, the names of the Regional Water Pollution Control Boards were changed to Regional Water Quality Control Boards, and their authorities were broadened. At this time, the Regional Water Quality Control Boards initiated development of comprehensive regional Basin Plans.

In 1971, the Los Angeles Regional Board adopted an *Interim Water Quality Control Plan* that compiled all of the existing objectives and policies into one document and rescinded all individually-adopted objectives and policies. A more comprehensive planning effort was undertaken when the State Board engaged Daniel, Mann, Johnson, and Mendenhall, Inc., and Koebig and Koebig, Inc. to develop Basin Plans for the Santa Clara River Basin and the Los Angeles River Basin, respectively. This major planning effort culminated in 1975 with the *Water Quality Control Plan for the Santa Clara River Basin (4A)* and the *Water Quality Control Plan for the Los Angeles River Basin (4B)*. These two documents, which together comprised the Basin Plans for the Los Angeles Region, were amended in 1978, 1990, and 1991. These two Basin Plans and amendments are superseded by this single Basin Plan which, for planning purposes, divides the Region into major surface watersheds and groundwater basins.

Since 1975, progress has been made toward the control of a number of water quality problems identified in the 1975 Basin Plans, including the control of point source discharges and the development of new programs to address nonpoint source pollution issues in the Region. At the same time, many new issues and areas of concern have arisen as health scientists have identified increasingly lower concentrations of toxic substances as health risks. Furthermore, advancing analytical technology enables detection of contaminants at increasingly lower concentrations. The State and Regional Board's Continuing Planning Process, based on the latest scientific information, addresses both "old" and "new" water quality issues.

Continuing Planning Process

As part of the State's Continuing Planning Process, components of the Basin Plan are reviewed as new data and information become available or as specific needs arise. Comprehensive updates of the Basin Plan occur in response to state and federal legislative requirements and as funding becomes available. State Board and other governmental entities' (federal, state and local) plans, that can affect water quality, are incorporated into the planning process. In addition, the Basin Plan provides consistent long-term standards and program guidance for the Region.

Triennial Review Process

The California Water Code, (§13240), directs the State and Regional Boards to periodically review and update Basin Plans. Furthermore, the CWA (§303 [c]) directs states to review water quality standards every three years (triennial review) and, as appropriate, modify and adopt new standards.

In the Triennial Review Process, basin planning issues are formally identified and ranked during the public hearing process. These and other modifications to the Basin Plan are implemented through Basin Plan amendments as described below. In addition, the Regional Board can amend the Basin Plan as needed. Such amendments need not coincide with the Triennial Review Process.

Basin Plan Amendments

Amending the Basin Plan involves the preparation of an amendment, an environmental checklist, and a staff report. Public workshops can be held to inform the public about planning issues before formal action is scheduled on the amendments. Following a public review period of at least 30 days, the Regional Board responds to public comments. Subsequently, the Regional Board can take action on the draft amendments at a public hearing.

The California Environmental Quality Act (as codified in the California Public Resources Code, §21080.5[d][2][i]) provides that the Secretary of Resources can exempt regulatory programs of state agencies from the requirements of preparing environmental impact reports, negative declarations, and initial studies should such programs be certified as "functionally equivalent." The Basin Planning process has been so certified. Accordingly, this amendment for the Basin Plan update (and accompanying documentation) is functionally equivalent to an environmental impact report or negative declaration.

Following adoption by the Regional Board, Basin Plan amendments and supporting documents are submitted to the State Board for review and approval. All Basin Plan amendments approved by the State Board after June 1, 1992 must also be reviewed and approved by the State Office of Administrative Law (OAL). All amendments take effect upon approval by the OAL. In addition, the USEPA must review and approve those Basin Plan amendments that involve changes in state standards to ensure such changes do not conflict with federal regulations.

The Region

Regional Setting

The Los Angeles Region (Figure 1-1) encompasses all coastal drainages flowing to the Pacific Ocean between Rincon Point (on the coast of western Ventura County) and the eastern Los Angeles County line, as well as the drainages of five coastal islands (Anacapa, San Nicolas, Santa Barbara, Santa Catalina, and San Clemente). In addition, the Region includes all coastal waters within three miles of the continental and island coastlines.

For planning purposes, the Regional Board uses the classification system developed by the California Department of Water Resources, which divides surface waters into hydrologic units, areas, and subareas (Figure 1-2) and ground waters into major groundwater basins (see ground water section). Figures 1-3 and 1-4 illustrate the major streams and lakes within the Region. As the eastern boundary, formed by the Los Angeles County line, departs somewhat from the hydrologic divide, the Los Angeles and Santa Ana Regions share jurisdiction over watersheds along their common border. The Regional Board is moving towards the use of Watershed Management Areas. Surface water watershed boundaries are illustrated on Figure 1-5.

Descriptions of the major hydrologic units follow:

- Pitas Point Hydrologic Unit, located in western Ventura County, extends from Rincon Point to the Ventura River. Numerous small canyons drain the southern slopes of the coastal hills in this area, which totals about 22 square miles. Limited supplies of ground water are present in alluvium along the bottoms of the canyons.
- Ventura River Hydrologic Unit includes parts of western Ventura County and a small part of eastern Santa Barbara County. The Ventura River drains the northern slopes of Sulphur Mountain and portions of the southern slopes of the Santa Ynez Mountains. The drainage area totals about 300 square miles and, except in coastal areas, land use is predominantly rural and open space. Small alluvial basins along the surface drainage system contain supplies of ground water.
- Santa Clara-Calleguas Hydrologic Unit covers most of Ventura County, part of northern Los Angeles County, and small parts of Santa Barbara and Kern Counties. With a drainage area of 1,760 square miles, it is the largest hydrologic unit in the Region. Most of the upland area is within the Angeles and Los Padres National Forests. While land use in the lower portion of the drainage area – in particular the Oxnard Plain – is predominantly agricultural, urban (primarily residential) land uses are encroaching upon and rapidly replacing these agricultural lands. The Santa Clara River and Calleguas Creek are the major streams in this area, draining the San Gabriel Mountains, Santa Susana Mountains, Oak Ridge, South Mountain, Simi Hills, Sawmill, Liebre and Frazier Mountains. Large reserves of ground water exist in alluvial aquifers underlying the Oxnard Plain and along the valleys of the Santa Clara River and its tributaries.
- Malibu Hydrologic Unit drains the southern slopes of the Santa Monica Mountains in western Los Angeles County and a small area of southeastern Ventura County. The drainage area totals 242 square miles and, except for the coastal area where land use is residential and commercial, most of the area is open space. No one stream dominates this drainage area rather, it is comprised of several small streams, including Topanga Canyon Creek, Malibu Creek, Dume Creek (Zuma Canyon Creek) and Big Sycamore Canyon Creek, which flow southward into the Pacific Ocean. Ground water is present in limited amounts in alluvium along the bottom of canyons and valleys and in fractured volcanic rocks.
- Los Angeles-San Gabriel Hydrologic Unit covers most of Los Angeles County and small areas of southeastern Ventura County. This drainage area totals 1,608 square miles. With most of

Regional Hydrologic Units, Areas and Subareas

401.00	PITAS POINT HYDROLOGIC UNIT
402.00	VENTURA RIVER HYDROLOGIC UNIT
402.10	Lower Ventura River HA
402.20	Upper Ventura River HA
402.30	Ojai HA
2.31	Upper Ojai HSA
2.32	Ojai Valley HSA
403.00	SANTA CLARA-CALLEGUAS HYDROLOGIC UNIT
403.10	Oxnard Plain HA
3.11	Oxnard HSA
3.12	Pleasant Valley HSA
403.20	Santa Paula HA
3.21	Sulfur Springs HSA
3.22	Sisar HSA
403.30	Sespe HA
3.31	Fillmore HSA
3.32	Topa Topa HSA
403.40	Piru HA
3.41	Santa Felicia HSA
3.42	Upper Piru HSA
3.43	Hungry Valley HSA
3.44	Stauffer HSA
403.50	Upper Santa Clara River HA
3.51	Eastern HSA
3.52	Bouquet HSA
3.53	Mint Canyon HSA
3.54	Sierra Pelona HSA
3.55	Acton HSA
403.60	Calleguas-Conejo HA

	SANTA CLARA-CALLEGUAS HU (Continued)
3.61	West Las Posas HSA
3.62	East Las Posas HSA
3.63	Arroyo Santa Rosa HSA
3.64	Conejo Valley HSA
3.65	Tierra Rejada Valley HSA
3.66	Gillibrand HSA
3.67	Simi Valley HSA
3.68	Thousand Oaks HSA
404.00	MALIBU HYDROLOGIC UNIT
404.10	Topanga HA
4.11	Topanga Canyon HSA
4.12	Tuna Canyon HSA
4.13	Pena Canyon HSA
4.14	Piedra Gorda Canyon HSA
4.15	Las Flores Canyon HSA
4.16	Carbon Canyon HSA
404.20	Malibu Creek HA
4.21	Monte Nido HSA
4.22	Las Virgenes Canyon HSA
4.23	Lindero Canyon HSA
4.24	Triunfo Canyon HSA
4.25	Russell Valley HSA
4.26	Sherwood HSA
404.30	Point Dume HA
4.31	Corral Canyon HSA
4.32	Solstice Canyon HSA
4.33	Latigo Canyon HSA
4.34	Escondido Canyon HSA
4.35	Ramirez Canyon HSA

	MALIBU HU (Continued)
4.36	Zuma Canyon HSA
4.37	Trancas Canyon HSA
404.40	Camarillo HA
4.41	Encinal Canyon HSA
4.42	Los Alisos Canyon HSA
4.43	Nicolas Canyon HSA
4.44	Arroyo Sequit HSA
4.45	Little Sycamore HSA
4.46	Deer Canyon HSA
4.47	Big Sycamore Canyon HSA
4.48	La Jolla Valley HSA
405.00	LOS ANGELES-SAN GABRIEL HYDROLOGIC UNIT
405.10	Coastal Plain HA
5.11	Palos Verdes HSA
5.12	West Coast HSA
5.13	Santa Monica HSA
5.14	Hollywood HSA
405.15	Central HSA Split
845.15	Central HSA Split
405.20	San Fernando HA
5.21	Bull Canyon HSA
5.22	Sylmar HSA
5.23	Tujunga HSA
5.24	Verdugo HSA
5.25	Eagle Rock HSA
405.30	Raymond HA
5.31	Pasadena HSA
5.32	Monk Hill HSA

	LOS ANGELES-SAN GABRIEL HU (Continued)
5.33	Santa Anita HSA
405.40	San Gabriel Valley HA
5.41	Main San Gabriel HSA
5.42	Lower Canyon HSA
5.43	Upper Canyon HSA
5.44	Foothill HSA
405.50	Spadra HA
5.51	San Jose HSA
5.52	Pomona HSA
5.53	Live Oak HSA
405.60	Anaheim HA
845.61	Buena Park HSA
405.62	La Habra HSA Split
845.62	La Habra HSA Split
405.63	Yorba Linda HSA Split
845.63	Yorba Linda HSA Split
406.00	SAN PEDRO CHANNEL ISLANDS HYDROLOGIC UNIT
406.10	Anacapa Island HA
406.20	San Nicolas Island HA
406.30	Santa Barbara Island HA
406.40	Santa Catalina Island HA
406.50	San Clemente Island HA
801.00	SANTA ANA RIVER HYDROLOGIC UNIT
801.20	Middle Santa Ana River HA Split
481.20	Chino HSA Split
481.22	Harrison HSA
481.23	Claremont Heights HSA Split

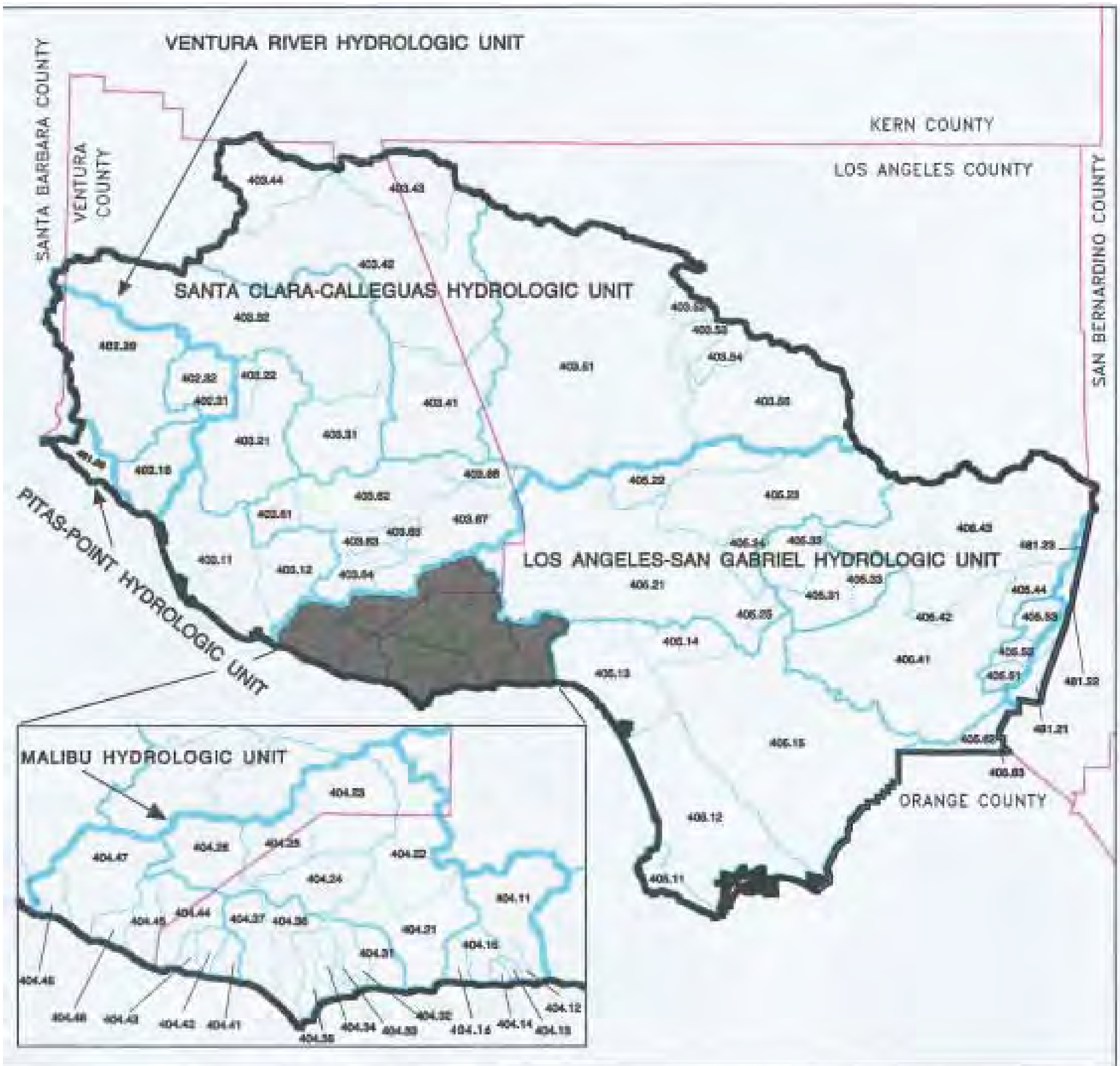


FIGURE 1–2

HYDROLOGIC UNITS

WITH AREAS AND SUBAREAS

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

RWQCB BOUNDARY
HYDROLOGIC UNITS
HYDROLOGIC AREAS
HYDROLOGIC SUBAREAS
COUNTY LINE

N

Miles

0 10 20

FIGURE 1–4

MAJOR RESERVOIRS AND LAKES

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

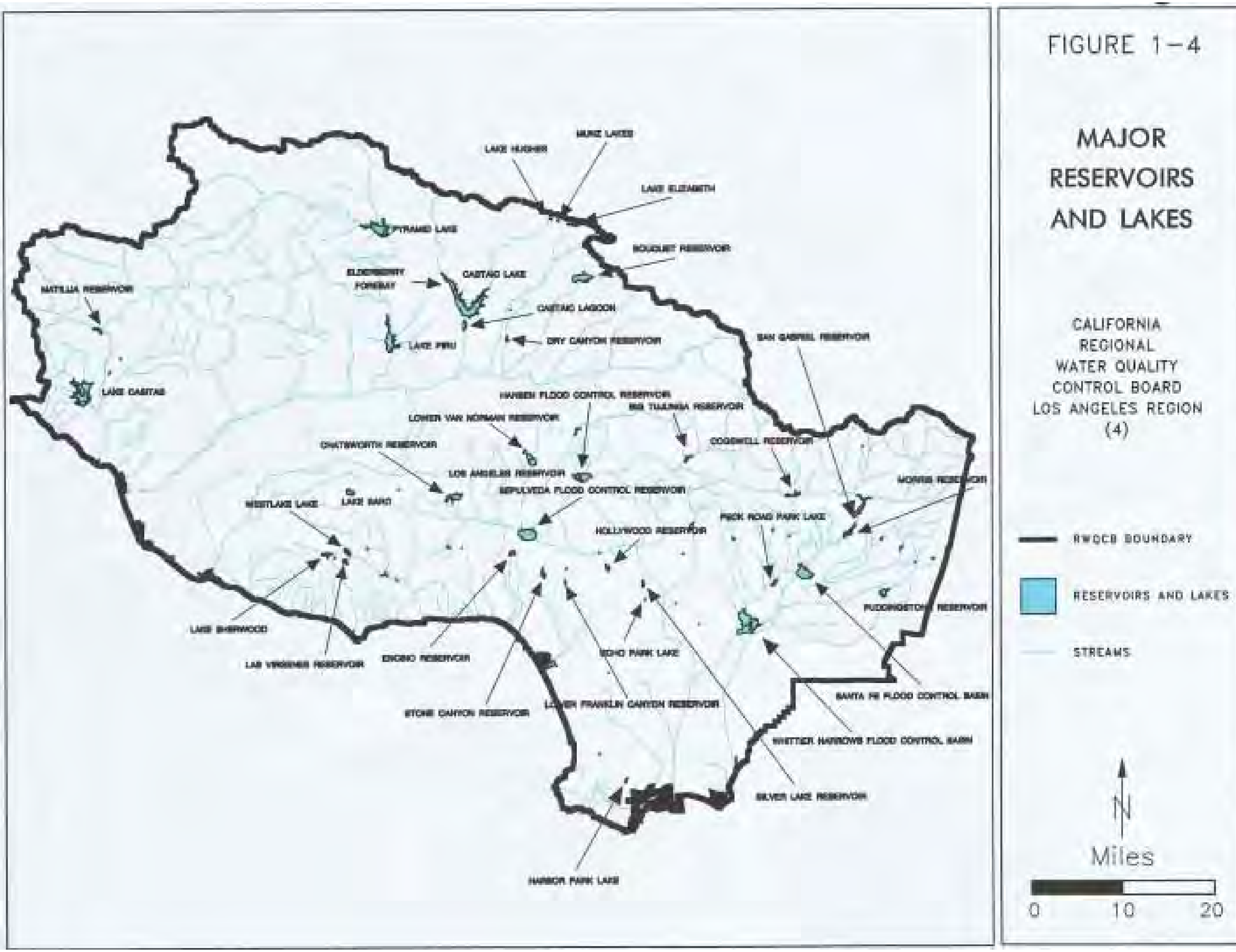
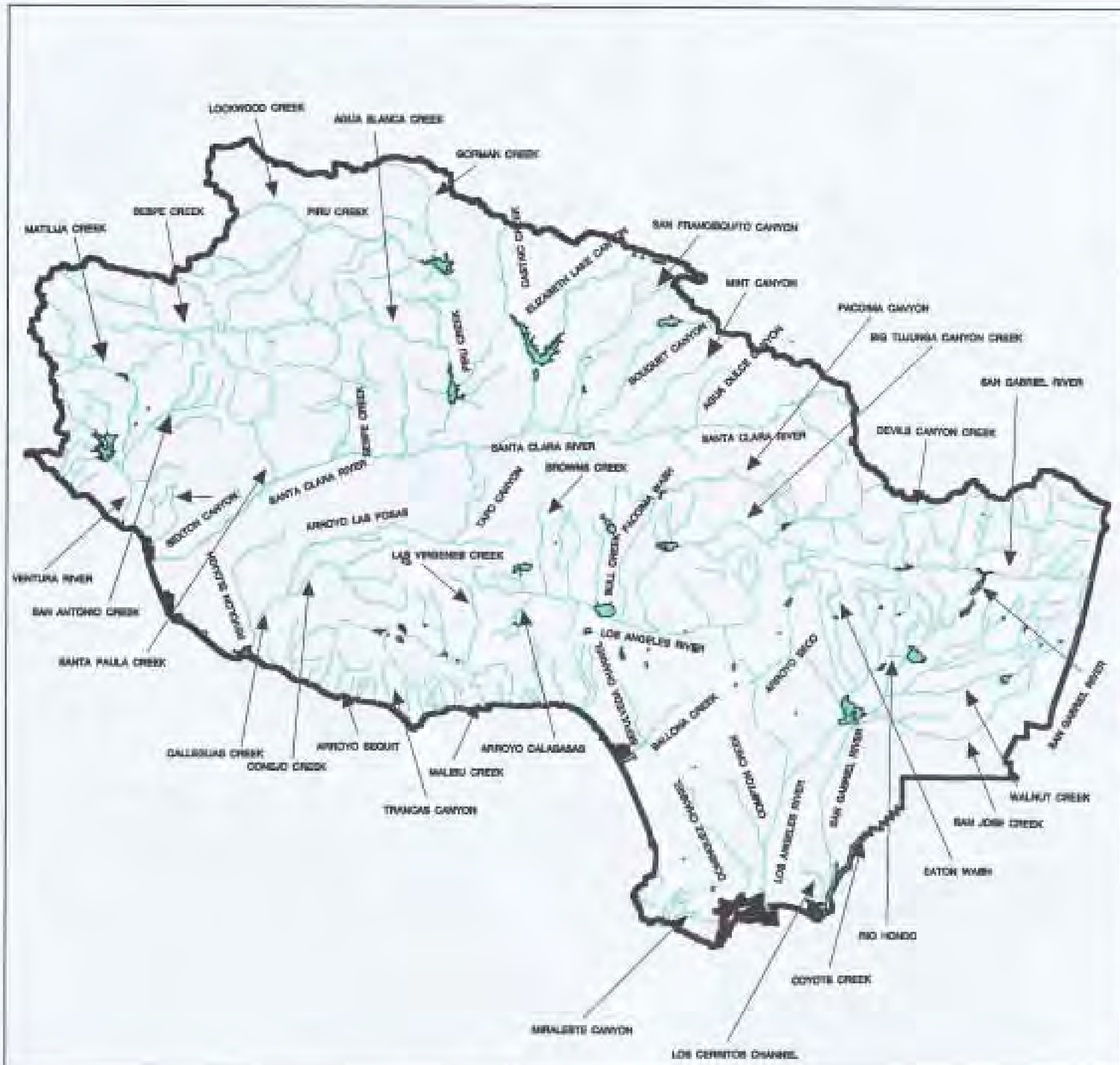


FIGURE 1-3

MAJOR RIVERS AND STREAMS

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)



REGIONAL BOUNDARY

STREAMS

LAKES

N

Miles

0 10 20

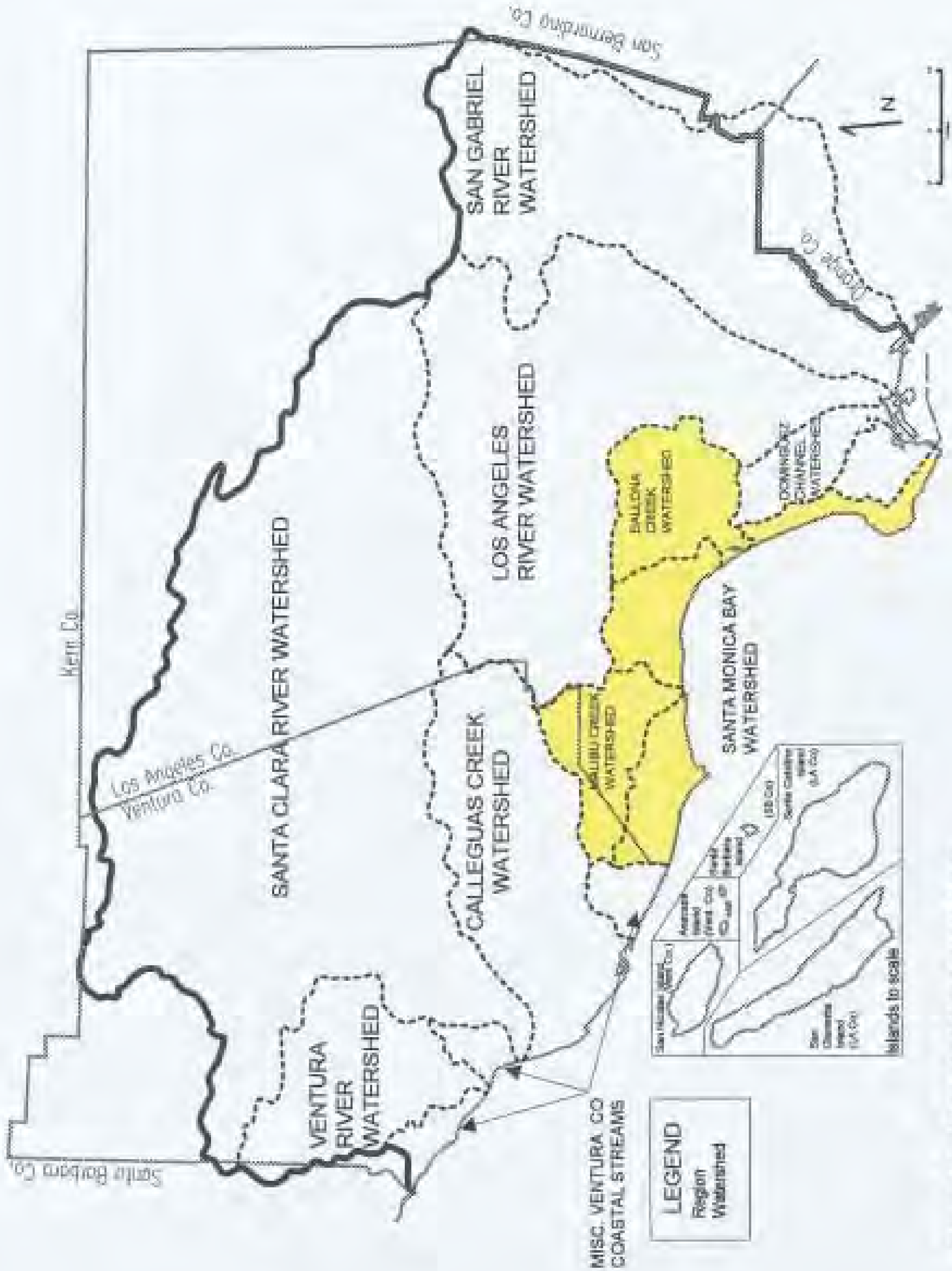


Figure 1-5. Watershed Managment Areas.

the population in the Region located in this hydrologic unit, land use is predominantly residential, commercial, and industrial; much of the area is covered with semi-permeable or non-permeable material (i.e., paved). The Los Angeles River, San Gabriel River, and Ballona Creek, which are the major drainage systems in this area, drain the coastal watersheds of the Transverse Ranges. These surface waters also recharge large reserves of ground water that exist in alluvial aquifers underlying the San Fernando and San Gabriel Valleys and the Los Angeles Coastal Plain.

- San Pedro Channel Islands Hydrologic Unit includes Santa Barbara, Santa Catalina, San Clemente, San Nicolas, and Anacapa Islands and Begg Rock. Except for limited development on Santa Catalina Island, land use of the Channel Islands is predominantly open space. Surface runoff on Santa Barbara Island does not flow in well-defined drainages; rather, surface runoff flows in sheets to the surrounding coastlines. Surface runoff on the other islands drains into intermittently-flowing creeks in small valleys and canyons. Reserves of ground water are limited on all of the islands.

Geology

Most of the Los Angeles Region lies within the western portion of the Transverse Ranges Geomorphic Province. The San Andreas transform fault system, forming the boundary between the North American and Pacific tectonic plates, cuts these western Transverse Ranges. This fault system, which extends northwesterly for over 700 miles from the Salton Sea in southern California to Cape Mendocino in northern California, bends in an east-west direction through the Transverse Ranges. Known as the "Big Bend," this portion of the San Andreas fault system formed from complex movements of the Pacific Plate against the North American Plate. Compression generated by such forces resulted in uplift of the Transverse Ranges, which have a conspicuous east-west trend (unlike other major ranges in the continental United States, which typically have a roughly north-south trend).

Major mountain ranges within the Los Angeles Region include: San Gabriel Mountains, Santa Monica Mountains, Santa Susana Mountains, Simi Hills, and Santa Ynez Mountains (Figure 1-6). The San Gabriel Mountains are the most prominent range in this group. The rock types exposed in the San Gabriel Mountains consist predominantly of Mesozoic granitic rocks (66 to 245 million years old), with minor exposures of Precambrian igneous and metamorphic rocks (prior to 570 million years old), and small stocks of Tertiary plutonic rocks (1.6 to 66 million years old). Cenozoic sedimentary beds (younger than 66 million years) are exposed only at the margins of the San Gabriel Mountains. Reflecting the recent and continuing uplift from plate tectonic activity, the San Gabriels are rugged mountains with deeply dissected canyons. Eroded sediments from these mountains have formed and are continuing to form prominent alluvial fans in the valleys along the flanks of the range.

During the Miocene Epoch (5 million to 23.5 million years ago), the sea advanced to the base of the San Gabriel Mountains, depositing fine-grained marine sediments. As the sea retreated, coarser-grained sediments, eroded from the Transverse Ranges, were deposited as alluvial fans in low-lying areas such as the San Fernando Valley, San Gabriel Valley, Oxnard Plain, and the Los Angeles Coastal Plain (Norris and Webb, 1991). These low-lying areas or basins are filled with layers of sediment. Many of these layers of sediment form aquifers that are important sources of ground water in the Region.

Climate

With prevailing winds from the west and northwest, moist air from the Pacific Ocean is carried inland in the Los Angeles Region until it is forced upward by the mountains. The resulting storms, common from November through March, are followed by dry periods during summer months. Differences in topography are responsible for large variations in temperature, humidity, precipitation, and cloud cover throughout the Region. The coastal plains and islands, with mild rainy winters and warm dry summers, are noted for their subtropical "mediterranean" climate. The inland slopes and basins of the Transverse Ranges, on the other hand, are characterized by more extreme temperatures and little precipitation.

Precipitation in the Region generally occurs as rainfall, although snowfall can occur at high elevations. Most precipitation occurs during just a few major storms. Annual rainfall in Ventura County averages 15.2 inches, although highs of almost 40 inches occur around Cobblestone Mountain and Pine Mountain, and lows of around 14 inches occur on the Oxnard Plain (Ventura County, 1993a).

Figure 1-6. Physiographic features of the Los Angeles Region.

Large variations also exist within Los Angeles County, as indicated by annual highs of around 42 inches at Mount Islip (along the crest of the Angeles National Forest) and annual lows of around 10 inches in the eastern Santa Clara River Valley. While an overall average is not available for Los Angeles County, annual rainfall at the Ducommun Street rain gauge in the City of Los Angeles averages 15.5 inches since measurements began in 1872 (Los Angeles County, 1993).

Land Use/Population

Land use within the Region varies considerably (Figure 1-7). In Ventura County, land uses are changing from agriculture and open space to urban residential and commercial. In southern Los Angeles County, the predominant land uses include urban residential, commercial and industrial. In northern Los Angeles County, open space is rapidly being transformed into residential communities.

The economy in Los Angeles County is primarily industrial, commercial, and service; while in Ventura County the economy is primarily agricultural, service, and commercial.

About 10 million people currently live in the Region. From 1950 to 1990 the population in the Region more than doubled. Figure 1-8 shows the increases in population in the Region since 1950, as well as projected population growth until the year 2015.

Natural Resources

Diversity in topography, soils, and microclimates of the Region supports a corresponding variety of plant and animal communities. Native vegetation in the Region can be categorized into several general plant communities: grasslands, sage-scrub, chaparral, oak woodland, riparian, pinyon-juniper, and timber-conifer. Within these general groups, many mixed subgroups and locally distinct vegetation types can be distinguished: mixed chaparral, semi-desert, and chamise chaparral, are a few examples.

Chaparral is the most common type of native vegetation in the Region. Large expanses of chaparral are found in the Santa Monica Mountains. Inland, coastal sagebrush occurs in the Simi Hills, Santa Susana Knolls, Verdugo Hills, and San Gabriel Mountains. Oak woodland, with the easily identifiable "Valley Oaks", sometimes reaching a height of 20 to 60 feet, is dominant in Thousand Oaks, Lake Casitas, Hidden Valley, Santa Clarita Valley, and elsewhere in the Transverse Mountain Ranges. Grasslands occur in Point Mugu State Park and on hillsides and valleys of northern Los Angeles County.

Riparian vegetation, found along most of the rivers and creeks, consists of sycamores, willows, cottonwoods, and alders. Extensive riparian corridors occur along Piru, Sespe, Santa Paula, Malibu, and Las Virgenes Creeks, Santa Clara, Ventura Rivers, and San Gabriel Rivers, as well as other rivers and creeks of the Los Padres and Angeles National Forests. The riparian vegetation provides essential habitat and transportation corridors for wildlife, supporting a great abundance and diversity of species.

The existence of "ecological islands" as a result of topography and climatic changes has led to the evolution of species, subspecies, and genetic strains of plants and animals in the Region. However, increasing urbanization and development have resulted in the loss of habitat and a decline in biological diversity. As a result, several native flora and fauna species have been listed as rare, endangered or threatened. Representative examples of endangered species include: California condor, American peregrine falcon, California least tern, tidewater goby, unarmored threespine stickleback, Mohave ground squirrel, conejo buckwheat, many-stemmed *Dudleya*, least Bell's vireo, and slender-horned spire flower.

Locally Unique Habitats

Habitats that support rare, threatened, endangered, or other sensitive plant or animal species are unique, not simply because they support these species, but because they are unique habitats in terms of their physical, geographical, and biological characteristics. Both Ventura and Los Angeles Counties have officially designated these unique areas as Significant Biological Resources or Significant Ecological Areas, respectively. These areas are described in detail in the counties' respective General Plans. The following two sections describe some of the more significant ecological areas recognized by Ventura and Los Angeles Counties as unique habitats.

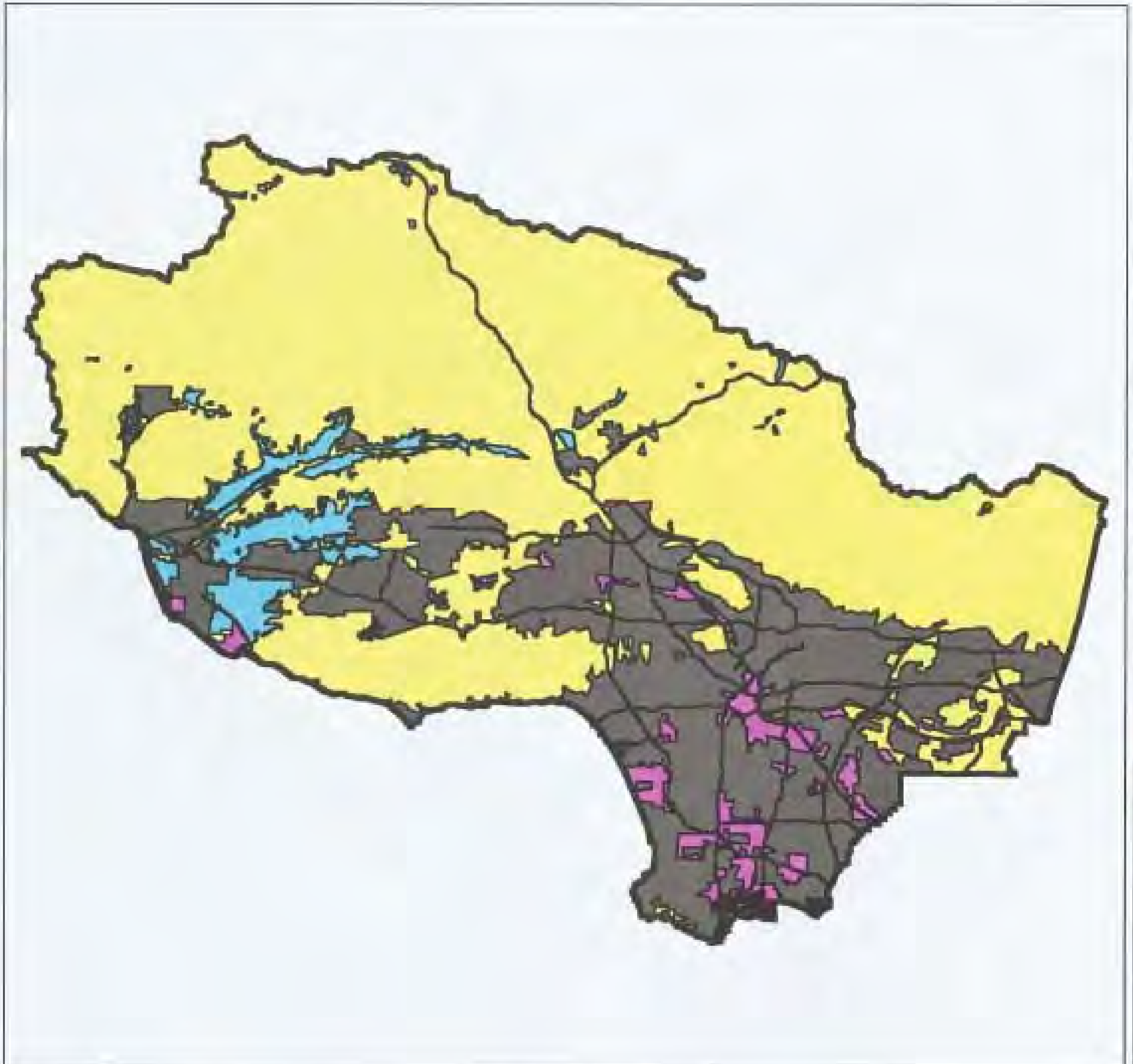
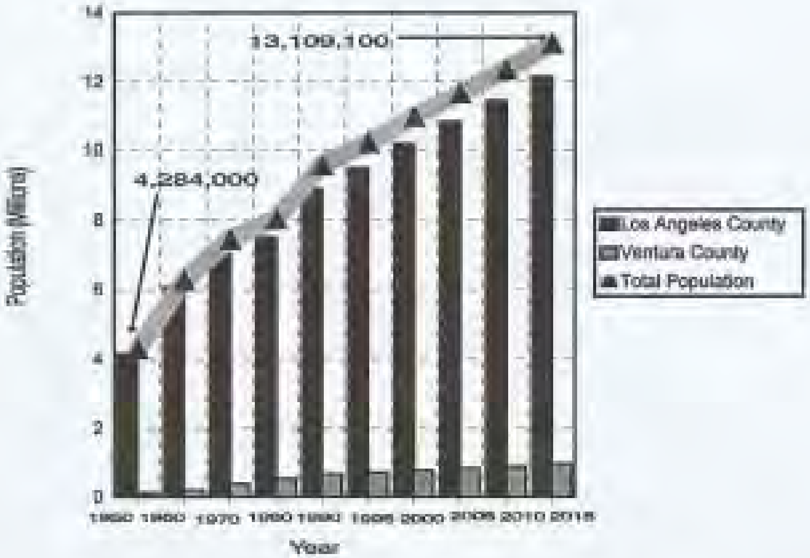


FIGURE 1-7

REGIONAL LAND USE

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)



Year	Los Angeles County	Ventura County	Total
1950	4,168,400	115,600	4,284,000
1960	6,071,900	203,100	6,275,000
1970	7,055,800	381,400	7,437,200
1980	7,500,300	532,200	8,032,500
1990	8,897,500	671,000	9,569,100
1995	9,489,600[p]	725,700[p]	10,215,300[p]
2000	10,180,900[p]	782,700[p]	10,963,600[p]
2005	10,812,900[p]	834,500[p]	11,647,400[p]
2010	11,441,900[p]	905,600[p]	12,347,500[p]
2015	12,137,600[p]	971,500[p]	13,109,100[p]

p = Projected Population

Source: California Department of Finance, June 1994

Figure 1-8. Population Projections in Los Angeles and Ventura Counties.

Ventura County

Many unique habitats, including coastal wetlands and lagoons, are found along the southern coast of Ventura County. These areas provide habitats for many fish, birds, invertebrates, sea lions, and for other marine and estuarine species. Mugu Lagoon is the most extensive wetland in the Region and supports a rich diversity of fish and wildlife (that once inhabited much of southern California's coastal areas). Other wetlands include McGrath Lake, Ormond Beach, and the estuaries at the mouths of the Ventura and Santa Clara Rivers. The "Pothole" in the Devil's Potrero (on Agua Blanca Creek) is an inland freshwater marsh that supports several species of plants unique to freshwater marshes.

One of the largest of Santa Clara River's tributaries, Sespe Creek, contains most of the Santa Clara River's remnant, but restorable, run of the steelhead trout. Sespe Creek is designated as a "Wild Trout Stream" by the State of California and supports significant steelhead spawning and rearing habitat. The steelhead trout is an "anadromous" fish (migrating from the ocean into fresh water for spawning). The federal Los Padres Wilderness Act (1992) permanently set aside portions of Sespe Creek for steelhead trout protection and designated Sespe Creek as a "Wild and Scenic River." Piru and Santa Paula Creeks, two other tributaries of the Santa Clara River, also support good habitats for steelhead. The Pacific lamprey, another anadromous fish, also uses Sespe Creek and the Santa Clara River for spawning. The Santa Clara River also has populations of unarmored three-spine stickleback. In addition, the Santa Clara River serves as an important wildlife corridor.

The Sespe Condor Sanctuary was dedicated in 1947 and consists of 53,000 acres in northern Ventura County. Due to problems with the condor recovery efforts, condors are now being released in Santa Barbara County.

Local populations of steelhead and rainbow trout have nearly been eliminated along the Ventura River. A limited resident population of rainbow trout occurs above Robles Diversion Dam, in San Antonio Creek, and in the lower Ventura River. Migratory steelhead ascend upstream in the Ventura River as far as Robles Diversion Dam and into San Antonio Creek. The California Department of Fish and Game and others, however, have recognized the potential for the restoration of the estuary and enhancement of steelhead populations in the Ventura River (Ventura County, 1991).

Los Angeles County

The County of Los Angeles has designated sixty Significant Ecological Areas (SEAs; Table 1-1) within the County in their general plan (Los Angeles County, 1976). Selected SEAs are described below.

Malibu Lagoon supports two important plant communities, the coastal salt marsh and coastal strand, and is an important refuge for migrating birds (over 200 species of birds have been observed). As Malibu Canyon dissects the Santa Monica Mountains, species normally restricted to the drier interior valleys have extended their range down the canyon. Perennial streams in Malibu Canyon support outstanding oak and riparian woodlands. Malibu Creek is also the southernmost watercourse in California where steelhead trout continue to spawn (for more information about the Malibu Creek watershed see Chapter 4, page 4-54.

The Tujunga Canyon/Hansen Dam area possesses several important features. The floodplain behind the dam supports some of the last examples of the open coastal sage-scrub vegetation in the Los Angeles area. A spreading ground (basin used for groundwater recharge) southwest of the dam has created several freshwater marsh areas that are used by migratory waterfowl and shore birds. The area is also valuable as a wildlife corridor.

The San Gabriel River watershed, totalling more than 136,000 acres, has extensive areas of undisturbed riparian and woodland habitats. The United States Congress has set aside approximately 36,215 acres of the West Fork San Gabriel River watershed as the "San Gabriel Wilderness Area." In addition, about 31,680 acres of the East Fork San Gabriel River watershed have been set aside as the "Sheep Mountain Wilderness Area." This watershed is also valuable to sportsmen, hikers, and picnickers.

San Francisquito Canyon, a tributary of the Santa Clara River, supports populations of Unarmored Three-spine Stickleback, an endangered fish species.

Table 1-1. Significant Ecological Areas (SEAs) in Los Angeles County.[1]

No.	Significant Ecological Area (SEA)	No.	Significant Ecological Area (SEA)
1	Malibu Coastline	33	Terminal Island
2	Point Dume	34	Palos Verdes Peninsula Coastline
3	Zuma Canyon	35	Harbor Lake Regional Park
4	Upper Sierra Canyon	36	Madrona Marsh
5	Malibu Canyon and Lagoon	37	Griffith Park
6	Las Virgenes	38	Baldwin Hills[2]
7	Hepatic Gulch	39	Encino Reservoir
8	Malibu Creek State Park Buffer Area	40	Verdugo Mountains
9	Cold Creek	41	Rio Hondo Spreading Grounds[2]
10	Tuna Canyon	42	Whittier Narrows Dam County Recreation Area
11	Temescal--Rustic--Sullivan Canyons	43	Rio Hondo College Wildlife Sanctuary
12	Palo Comado Canyon	44	Sycamore and Turnbull Canyons
13	Chatsworth Reservoir	45	*Dudleya densiflora* Population
14	Simi Hills	46	Tujunga Spreading Grounds[2]
15	Tonner Canyon/Chino Hills	47*	Edwards Air Force Base
16	Buzzard Peak/San Jose Hills	48*	Big Rock Wash
17	Powder Canyon/Puente Hills	49*	Little Rock Wash
18	Way Hill	50*	Rosamond Lake
19	San Francisquito Canyon	51*	Saddleback Butte State Park
20	Santa Susana Mountains	52*	Alpine Butte
21	Santa Susana Pass	53*	Lovejoy Butte
22	Santa Fe Dam Floodplain	54*	Piute Butte
23	Santa Clara River	55*	Desert-Montane Transect
24	Tujunga Valley/Hansen Dam	56*	Ritter Ridge
25	San Dimas Canyon	57*	Fairmont and Antelope Buttes
26	San Antonio Canyon Mouth	58*	Portal Ridge/Liebre Mountain
27	Portuguese Bend Landslide	59*	Tehachapi Foothills
28	El Segundo Dunes	60*	Joshua Tree Woodland Habitat
29	Ballona Creek	61*	Kentucky Springs[2]
30	Alamitos Bay	62*	Galium grande Population
31	Rolling Hills Canyons	63	Lyon Canyon
32	Agua Amarga Canyon	64	Oak Savannah

1 Descriptions of these areas can be found in the Los Angeles County General Plan (1976)
2 These are also designated as open spaces.
* Outside of the Los Angeles Region

Water Resources/Water Quality Issues

Surface and ground waters within the Los Angeles Region have proven insufficient to support the rapidly growing population in the Los Angeles Region. Water imported from other areas now meets about 50% of fresh water demands in the Region. Restrictions on imported water as well as drought conditions have necessitated water conservation measures which, at present, are voluntary. These conservation measures have slightly lessened the use of potable water in many areas of the Region. In addition, the demand for water is being partially fulfilled by the increasing use of reclaimed water for non-potable purposes such as greenbelt irrigation and industrial processing and servicing.

Surface Waters

Major surface waters of the Los Angeles Region flow from head waters in pristine mountain areas (largely in two National Forests and the Santa Monica Mountains), through urbanized foothill and valley areas, high density residential and industrial coastal areas, and terminate at highly utilized recreational beaches and harbors. Uncontrolled pollutants from nonpoint sources are believed to be the greatest threats to rivers and streams within the Region.

- *Ventura River Watershed:* The Ventura River is the northern-most river system in southern California (south of Point Conception) that supports a large number of sensitive aquatic species, several of which are currently, or proposed to be, endangered or threatened. Water quality in the upper reaches is good but quality in the lower reaches is impacted by a combination of municipal water discharges and agricultural, urban and oil industry nonpoint sources.

- *Santa Clara River Watershed:* The Santa Clara River is the largest river system in southern California that remains in a relatively natural state. Extensive patches of high quality riparian habitat are present along the length of the river and its tributaries. Stream flows are diverted, usually during high flow, for "out-of-stream" beneficial uses. Threats to water quality include increasing development in floodplain areas, necessitating flood control measures such as channelization that results in increased flows, erosion, and loss of habitat.

- *Calleguas Creek Watershed:* Calleguas Creek drains a predominantly agricultural area on the Oxnard Plain and empties into Mugu Lagoon, one of southern California's few remaining large wetlands. While natural flows in the past were intermittent, discharges of municipal, agricultural, and urban wastewaters have increased surface flow in the watershed resulting in increased sedimentation in the lagoon. The general instability of the streambanks, continual destruction of riparian vegetation, and other land use practices have accelerated erosion in this watershed. Erosion problems are intensified in areas where residential development is occurring on steeply sloping upland areas. Should sedimentation continue at the present rate, the lagoon is projected to fill with sediment in about 50 years. Additional problems are produced by irrigation return-flows which add nutrients, pesticides, and other dissolved constituents to the creek and its tributaries.

- *Malibu Creek Watershed:* This watershed has changed rapidly in the last 20 years from a predominantly rural area to a steadily developing area that has doubled in population to nearly 80,000 residents. Increased flows (from imported waters needed to support the growing population base) and channelization of several tributaries to Malibu Creek have caused an imbalance in the natural flow regime in the watershed. Pollutants of concern, many of which are discharged from nonpoint sources, include excess nutrients, sediment, and bacteria.

- *Ballona Creek Watershed:* Pollutants from industrial and municipal effluent as well as urban runoff degrade the quality of Ballona Creek. Specific pollutants include high levels of dissolved solids (chlorides, sulfates, heavy metals) and bacteria. Untreated sewage overflows discharged into Ballona Creek during the rainy season cause beach closures along Santa Monica Bay. In addition, high concentrations of DDT in sediments at the mouth of the creek and in Marina Del Rey provide evidence of past discharges that have resulted in long-term water quality problems.

- *Los Angeles River Watershed:* The Los Angeles River is highly modified, having been lined with concrete along most of its length by the U.S. Army Corps of Engineers from the

1930s to the 1960s. One seven-mile reach in the narrows area (in the middle portion of the river system), where ground water rises into the streambed, is mostly unlined along the stream bottom and provides natural habitat for fish and other wildlife in an otherwise concrete conveyance. The upper reaches of the river carry urban runoff and flood flows from the San Fernando Valley. Below the Sepulveda Basin, flows are dominated by tertiary-treated effluent from several municipal wastewater treatment plants. Because the watershed is highly urbanized, urban runoff and illegal dumping are major contributors to impaired water quality in the Los Angeles River and tributaries.

- *San Gabriel River Watershed:* While the upper San Gabriel River and its tributaries remain in a relatively pristine state, intensive recreational use of this area for picnicking, off road vehicle use, fishing, and hiking threaten water quality and aquatic and riparian habitats. Further problems in the upper San Gabriel River occur as vast amounts of naturally eroding sediment from the rugged San Gabriel Mountains settle into reservoirs behind flood control dams. Improper sediment sluicing operations from these reservoirs can impact aquatic habitats and groundwater recharge areas. In the San Gabriel Valley, the middle reaches of the river have been extensively modified in order to control flood and debris flows and to recharge ground water. Extensive sand and gravel operations are found along these stretches of the river. The lower San Gabriel River (i.e., those stretches flowing through the Los Angeles Coastal Plain) also has been extensively modified and is lined with concrete from approximately Firestone Boulevard to the estuary. Flow in these lower reaches is dominated by effluent from several municipal wastewater treatment facilities and urban runoff. Beneficial uses have been impaired in these lower reaches of the San Gabriel River, as evidenced by ambient toxicity and bioaccumulation of metals in fish tissue.

Other more generalized surface water problems in the Region include:

- Poor mineral quality in some areas due to a variety of reasons including geology, agricultural runoff, discharge of highly mineralized ground water, and poor quality of some imported waters
- Bioaccumulation of toxic compounds in fish and other aquatic life
- Impacts from increased development and recreational uses
- In-stream toxicity from point and nonpoint sources
- Diversion of flows necessary for the propagation of fish and wildlife populations
- Channelization, dredging, and other losses of habitat
- Impacts from transient camps located along creeks and lagoons
- Illegal dumping
- Introduction of non-native plants which are of little value to the biota and clog the streams
- Impacts from sand and gravel mining operations
- Natural oil seeps
- Eutrophication and the accumulation of toxic pollutants in lakes

Ground Waters

Ground water accounts for most of the Region's local (i.e., non-imported) supply of fresh water. Major groundwater basins in the Region are shown in Figure 1-9.

The general quality of ground water in the Region has degraded substantially from background levels. Much of the degradation reflects land uses. For example, fertilizers and pesticides, typically used on agricultural lands, can degrade ground water when irrigation-return waters containing such substances seep into the subsurface. In areas that are unsewered, nitrogen and pathogenic bacteria from overloaded or improperly sited septic tanks can seep into ground water and result in health risks to those who rely on ground water for domestic supply. In areas with industrial or commercial activities, aboveground and underground storage tanks contain vast quantities of hazardous substances. Thousands of these tanks in the Region have leaked or are leaking, discharging petroleum fuels, solvents, and other hazardous substances into the subsurface. These leaks as well as otherdischarges

FIGURE 1–9

REGIONAL GROUNDWATER BASINS

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

— REGIONAL BOUNDARY

NOTE: THIS FIGURE SHOWS ONLY MAJOR GROUNDWATER BASINS IN THE LOS ANGELES REGION. DESIGNATIONS OF BASINS CONFORM TO CA DEPARTMENT OF WATER RESOURCES DESIGNATIONS (1980)

N

Miles

0 10 20

to the subsurface that result from inadequate handling, storage, and disposal practices can seep into the subsurface and pollute ground water.

Compared to surface water pollution, investigations and remediation of polluted ground waters are often difficult, costly, and extremely slow.

Examples of specific groundwater quality problems include:

- San Gabriel Valley and San Fernando Valley Groundwater Basins: Volatile organic compounds from industry, and nitrates from subsurface sewage disposal and past agricultural activities, are the primary pollutants in much of the ground water throughout these basins. These deep alluvial basins do not have continuous effective confining layers above ground water and as a result pollutants have seeped through the upper sediments into the ground water. Approximately 20% of groundwater production capacity for municipal use in the San Gabriel Valley has been shut down due to this pollution.

  In light of the widespread pollution in both the San Gabriel Valley and San Fernando Valley Groundwater Basins, the California Department of Toxic Substances Control has designated large areas of these basins as high priority Hazardous Substances Cleanup sites. Furthermore, the USEPA has designated these areas as Superfund sites. The Regional Board and USEPA are overseeing investigations to further define the extent of pollution, identify the responsible parties, and begin remediation in these areas.

- Central and West Coast Groundwater Basins (Los Angeles Coastal Plain): Seawater intrusion that has occurred in these basins is now under control in most areas through an artificial recharge system consisting of spreading basins and injection wells that form fresh water barriers along the coast. Ground water in the lower aquifers of these basins is generally of good quality, but large plumes of saline water have been trapped behind the barrier of injection wells in the West Coast Basin, degrading significant volumes of ground water with high concentrations of chloride. Furthermore, the quality of ground water in parts of the upper aquifers of both basins is degraded by both organic and inorganic pollutants from a variety of sources, such as leaking tanks, leaking sewer lines, and illegal discharges. As the aquifers and confining layers in these alluvial basins are typically interfingered, the quality of ground water in the deeper production aquifers is threatened by migration of pollutants from the upper aquifers.

- Ventura Central Groundwater Basins: Despite efforts to artificially recharge ground water and to control levels of pumping, ground water in several of the Ventura Central basins has been, and continues to be, overdrafted (particularly in the Oxnard Plain and Pleasant Valley areas). Some of the aquifers in these basins are in hydraulic continuity with seawater; thus seawater is intruding further inland, degrading large volumes of ground water with high concentrations of chloride. In addition, nutrients and other dissolved constituents in irrigation return-flows are seeping into shallow aquifers and degrading ground water in these basins. Furthermore, degradation and cross-contamination are occurring as degraded or contaminated ground water travels between aquifers through abandoned and improperly sealed wells and corroded active wells.

  Unsewered areas of Ventura County, such as the El Rio area (to the northwest of Oxnard), represent another source of pollution to ground water in the Ventura Central Basins. In many wells in the El Rio area, nitrate is present in levels exceeding maximum contaminant levels (MCLs) established by the state and federal government (Ventura County, 1994).

- Acton Valley Groundwater Basin: Ground water is the source of most potable water in this unsewered area. However, increasing concentrations of nitrate are degrading the quality of this water. Investigations are underway to confirm septic tanks as the source of high levels of nitrate in this area.

Coastal Waters

Coastal waters in the Region include bays, harbors, estuaries, beaches, and open ocean. Santa Monica Bay dominates a large portion of the Region's open coastal waters. Deep-draft commercial harbors include the Los Angeles/Long Beach Harbor complex and Port Hueneme. Shallower, small craft harbors, such as Marina del Rey, King Harbor and Ventura Marina, occur at a number of locations.

Important estuaries are represented by coastal lagoons such as Mugu Lagoon and numerous small coastal wetlands such as Ballona Wetlands and Los Cerritos Wetlands. Recreational beaches occur along large stretches of the coastal waters.

These coastal waters are impacted by a variety of activities which include:

- Municipal and industrial wastewater discharges
- Cooling water discharges
- Nonpoint source runoff (urban and agricultural runoff in particular), including leaking septic systems, construction, and recreational activities
- Oil spills
- Vessel wastes
- Dredging
- Increased development and loss of habitat
- Offshore operations
- Illegal dumping
- Natural oil seeps

Imported Waters

Water from other areas has been imported into the Los Angeles Region since 1913, when the Los Angeles Aqueduct started delivering water from the Owens Valley. Since that time, southern California has developed complex systems of aqueducts to import water to support a rapidly growing population and economy. Water imported to the Region presently meets roughly half of the demand for potable water.

The principal systems (Figure 1-9) for importing water are summarized below:

- *The Los Angeles Aqueducts:* The City of Los Angeles, Department of Water and Power, diverts water from the Mono and Owens River Basins and transports this water via the 338-mile long Los Angeles Aqueducts to the City of Los Angeles. The original aqueduct was completed in 1913. A second aqueduct, which parallels the first, was completed in 1970.

Figure 1-10. Sources of Imported Water in the Los Angeles Region (after Los Angeles Department of Water and Power, 1991).

  Releases from the Haiwee Reservoir Complex, at the end of the Owens Valley Basin, supplied over 500,000 acre-feet per year to the City of Los Angeles during the first half of the 1980s. However, releases dropped to 127,012 acre-feet in 1990 as a result of the recent statewide drought, as well as legal restrictions on Mono Basin and Owens Valley water resources. Releases in 1992 totalled 173,945 acre-feet.

- *The California Aqueduct (The State Water Project):* The State of California, Department of Water Resources, transports about 2.4 million acre-feet per year of water, largely from the Feather and the Sacramento Rivers in northern California, to other parts of California via the California Aqueduct. In southern California, the aqueduct splits into east and west branches, terminating at Perris and Castaic Reservoirs, respectively. Approximately 1.4 million acre-feet per year of this water is delivered to four contractors for use within the Los Angeles Region: The Metropolitan Water District of Southern California (MWD), County of Ventura, Castaic Lake Water Agency, and San Gabriel Valley Municipal Water District.
- *The Colorado River Aqueduct:* The MWD imports water from Lake Havasu on the Colorado River through the 242-mile long Colorado River Aqueduct. This water is

transported to Lake Mathews, MWD's terminal reservoir, in Riverside County. While MWD held water rights for over 1.2 million acre-feet per year in the 1930s, MWD's dependable supply of Colorado River water has now been reduced to 450,000 acre-feet per year due to the exercise of water rights by other Colorado River water users. After blending with water delivered through the State Water Project, MWD delivers a portion of this water to its member agencies in the Los Angeles Region; the remaining water is delivered to other areas in southern California.

Water imported from the Owens Valley through the Los Angeles Aqueduct is usually treated for turbidity. Water from the Colorado River typically is harder than local supplies and other imported waters. This hardness is the result of dissolved constituents from soils and rocks in the Colorado River watershed. Water from northern California, while not as hard as Colorado River water, accumulates organic materials as it flows through the fertile Sacramento-San Joaquin Delta. These organic materials when combined with chlorine during typical disinfection treatment processes can result in by-products such as trihalomethanes (THMs). As THMs are linked to cancer, a 100 parts per billion standard has been established that mitigates the occurrence of THMs in drinking water while still allowing for adequate chlorine disinfection.

Water Supply and Drought Issues

During the most recent period of drought, water supplies from northern California often had higher than normal concentrations of chlorides which, in turn, often resulted in waste discharges that exceeded chloride limitations. To provide a measure of relief to dischargers who were unable to meet chloride limitations due to the drought and/or water conservation measures, the Regional Board adopted Resolution No. 90-04, entitled *Effects of Drought Induced Water Supply Changes and Water Conservation Measures on Compliance with Waste Discharge Requirements within the Los Angeles Region.* This policy, which was adopted on March 26, 1990, temporarily raised chloride limitations to match chloride increases in the water supply for a period of three years. Under this policy, chloride limitations were temporarily set at the lesser of (i) 250 mg/L or (ii) the supply concentration plus 85 mg/L.

Although the drought ended in 1993, water supplies in storage still contained higher than normal levels of chlorides. Accordingly, on June 14, 1993 the Regional Board extended these temporary chloride limitations for 18 months.

The Regional Board realizes that there may be a need for a longer term solution to these water supply issues, and will address these issues as part of the next Triennial Review.

Reclaimed Wastewaters

The State and Regional Boards recognize the shortage of fresh water in the Region and the need to conserve water for beneficial uses. Accordingly, reclaimed wastewaters are an increasingly important local resource. The State Board's *Policy with Respect to Water Reclamation in California* (State Board Resolution No. 77-1) is summarized and reprinted in Chapter 5. The importance of water reclamation is also recognized in Porter-Cologne. Sections 13575 to 13577, which were added in 1991 (during the fifth year of the last drought), set reclamation goals of 700,000 acre-feet per year and 1,000,000 acre-feet per year in the years 2000 and 2010, respectively.

The Regional Board supports reclamation projects (i.e., those projects that reuse treated wastewaters, thereby offsetting the use of fresh waters) through the Water Reclamation Requirements program. Under this program, discussed in detail in Chapter 4, treated wastewaters are reused for groundwater recharge, recreational impoundments, industrial processing and supply, and landscape irrigation.

In addition, the State and Regional Boards provide financial assistance to projects that are developing reclamation capabilities.

The Basin Plan

The following chapters designate beneficial uses of the Region's waters, water quality objectives for the protection of these beneficial uses, and a plan of implementation for enhancing or maintaining water quality. This information supersedes that in previously adopted Basin Plans and amendments.

Three overlays are located in appendix two of this Plan (hydrologic units, major freeways and USGS Quad Boundaries). These can be placed over any of the standard regional maps throughout this plan for orientation.

2. BENEFICIAL USES

Table of Contents

Introduction

Beneficial uses form the cornerstone of water quality protection under the Basin Plan. Once beneficial uses are designated, appropriate water quality objectives can be established and programs that maintain or enhance water quality can be implemented to ensure the protection of beneficial uses. The designated beneficial uses, together with water quality objectives (referred to as criteria in federal regulations), form water quality standards. Such standards are mandated for all waterbodies within the state under the California Water Code. In addition, the federal Clean Water Act mandates standards for all surface waters, including wetlands.

Twenty-four beneficial uses in the Region are identified in this Chapter. These beneficial uses and their definitions were developed by the State and Regional Boards for use in the Regional Board Basin Plans. Three beneficial uses were added since the original 1975 Basin Plans. These new beneficial uses are Aquaculture, Estuarine Habitat, and Wetlands Habitat.

Beneficial uses can be designated for a waterbody in a number of ways. Those beneficial uses that have been attained for a waterbody on, or after, November 28, 1975, must be designated as "existing" in the Basin Plans. Other uses can be designated, whether or not they have been attained on a waterbody, in order to implement either federal or state mandates and goals (such as fishable and swimmable) for regional waters. Beneficial uses of streams that have intermittent flows, as is typical of many streams in southern California, are designated as intermittent. During dry periods, however, shallow ground water or small pools of water can support some beneficial uses associated with intermittent streams; accordingly, such beneficial uses (e.g., wildlife habitat) must be protected throughout the year and are designated "existing." In addition, beneficial uses can be designated as "potential" for several reasons, including:

- implementation of the State Board's policy entitled "Sources of Drinking Water Policy" (State Board Resolution No. 88-63, described in Chapter 5),
- plans to put the water to such future use,
- potential to put the water to such future use,
- designation of a use by the Regional Board as a regional water quality goal, or
- public desire to put the water to such future use.

Beneficial Use Definitions

Beneficial uses for waterbodies in the Los Angeles Region are listed and defined below. The uses are listed in no preferential order.

Municipal and Domestic Supply (MUN)
Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

Agricultural Supply (AGR)
Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

Industrial Process Supply (PROC)
Uses of water for industrial activities that depend primarily on water quality.

Industrial Service Supply (IND)
Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.

Ground Water Recharge (GWR)
Uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.

Freshwater Replenishment (FRSH)

Uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).

Navigation (NAV)
Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

Hydropower Generation (POW)
Uses of water for hydropower generation.

Water Contact Recreation (REC-1)
Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

Non-contact Water Recreation (REC-2)
Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Commercial and Sport Fishing (COMM)
Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

Aquaculture (AQUA)
Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.

Warm Freshwater Habitat (WARM)
Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Cold Freshwater Habitat (COLD)
Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Inland Saline Water Habitat (SAL)
Uses of water that support inland saline water ecosystems including, but not limited to, preservation or enhancement of aquatic saline habitats, vegetation, fish, or wildlife, including invertebrates.

Estuarine Habitat (EST)
Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).

Wetland Habitat (WET)
Uses of water that support wetland ecosystems, including, but not limited to, preservation or enhancement of wetland habitats, vegetation, fish, shellfish, or wildlife, and other unique wetland functions which enhance water quality, such as providing flood and erosion control, stream bank stabilization, and filtration and purification of naturally occurring contaminants.

Marine Habitat (MAR)
Uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).

Wildlife Habitat (WILD)
Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

Preservation of Biological Habitats (BIOL)
Uses of water that support designated areas or habitats, such as **Areas of Special Biological Significance (ASBS),** established refuges, parks, sanctuaries, ecological reserves, or other areas where the preservation or enhancement of natural resources requires special protection.

The following coastal waters have been designated as ASBS in the Los Angeles Region. For detailed descriptions of their boundaries, see the Ocean Plan discussion in Chapter 5, Plans and Policies:

- San Nicolas Island and Begg Rock
- Santa Barbara Island and Anacapa Island
- San Clemente Island
- Mugu Lagoon to Latigo Point

- Santa Catalina Island, Subarea One, Isthmus Cove to Catalina Head
- Santa Catalina Island, Subarea Two, North End of Little Harbor to Ben Weston Point
- Santa Catalina Island, Subarea Three, Farnsworth Bank Ecological Reserve
- Santa Catalina Island, Subarea Four, Binnacle Rock to Jewfish Point The following areas are designated Ecological Reserves or Refuges:

- Channel Islands National Marine Sanctuary
- Santa Barbara Island Ecological Reserve
- Anacapa Island Ecological Reserve
- Catalina Marine Science Center Marine Life
- Point Fermin Marine Life Refuge
- Farnsworth Bank Ecological Reserve
- Lowers Cove Reserve
- Abalone Cove Ecological Reserve
- Big Sycamore Canyon Ecological Reserve

Rare, Threatened, or Endangered Species (RARE)
Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.

Migration of Aquatic Organisms (MIGR)
Uses of water that support habitats necessary for migration, acclimatization between fresh and salt water, or other temporary activities by aquatic organisms, such as anadromous fish.

Spawning, Reproduction, and/or Early Development (SPWN)
Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

Shellfish Harvesting (SHELL)
Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sports purposes.

Beneficial Uses for Specific Waterbodies

Tables 2-1 through 2-4 list the major regional waterbodies and their designated beneficial uses. These tables are organized by waterbody type: (i) inland surface waters (rivers, streams, lakes, and inland wetlands), (ii) ground water, (iii) coastal waters (bays, estuaries, lagoons, harbors, beaches, and ocean waters), and (iv) coastal wetlands. Within Table 2-1 waterbodies are organized by major watersheds. Hydrologic unit, area, and subarea numbers are noted in the surface water tables (2-1, 23, and 2-4) as a cross reference to the classification system developed by the California Department of Water Resources. For those surface waterbodies that cross into other hydrologic units, such waterbodies appear more than once in a table. Furthermore, certain coastal waterbodies are duplicated in more than one table for completeness (e.g., many lagoons are listed both in inland surface waters and in coastal features tables). Major groundwater basins are classified in Table 2-2 according to the Department of Water Resources Bulletin No. 118 (1980). A series of maps (Figures 21 to 2-22) illustrates regional surface waters, ground waters, and major harbors.

The Regional Board contracted with the California Department of Water Resources for a study of beneficial uses and objectives for the upper Santa Clara River (DWR, 1989) and for another study of the beneficial uses and objectives the Piru, Sespe, and Santa Paula Hydrologic areas of the Santa Clara River (DWR, 1993). In addition, the Regional Board contracted with Dr. Prem Saint of California State University at Fullerton to survey and research beneficial uses of all waterbodies throughout the Region (Saint, et al., 1993a and 1993b). Information from these studies was used to update this Basin Plan.

State Board Resolution No. 88-63 (Sources of Drinking Water) followed by Regional Board Resolution No. 89-03 (Incorporation of Sources of Drinking Water Policy into the Water Quality Control Plans (Basin Plans)) states that " All surface and ground waters of the State are considered to be suitable, or potentially suitable, for municipal or domestic waters supply and should be so designated by the Regional Boards ... [with certain exceptions which must be adopted by the Regional Board]." In adherence with these policies, all inland surface and ground waters have been designated as MUN - presuming at least a potential suitability for such a designation.

These policies allow for Regional Boards to consider the allowance of certain exceptions according to criteria set forth in SB Resolution No. 88-63. While supporting the protection of all waters that may be used as a municipal water supply in the future, the

Regional Board realizes that there may be exceptions to this policy.

In recognition of this fact, the Regional Board will soon implement a detailed review of criteria in the State Sources of Drinking Water policy and identify those waters in the Region that should be excepted from the MUN designation. Such exceptions will be proposed under a special Basin Plan Amendment and will apply exclusively to those waters designated as MUN under SB Res. No. 88-63 and RB Res. No. 89
03.

In the interim, no new effluent limitations will be placed in Waste Discharge Requirements as a results of these designations until the Regional Board adopts this amendment.

The following sections summarize general information regarding beneficial uses designated for the various waterbody types.

Inland Surface Waters

Inland surface waters consist of rivers, streams, lakes, reservoirs, and inland wetlands. Beneficial uses of these inland surface waters and their tributaries (which are graphically represented on Figures 2-1 to 2-10) are designated on Table 2-1.

Beneficial uses of inland surface waters generally include REC-1 (swimmable) and WARM, COLD, SAL, or COMM (fishable), reflecting the goals of the federal Clean Water Act. In addition, inland waters are usually designated as IND, PRO, REC-2, WILD, and are sometimes designated as BIOL and RARE. In a few cases, such as reservoirs used primarily for drinking water, REC-1 uses can be restricted or prohibited by the entities that manage these waters. Many of these reservoirs, however, are designated as potential for REC-1, again reflecting federal goals. Furthermore, many regional streams are primary sources of replenishment for major groundwater basins that supply water for drinking and other uses, and as such must be protected as GWR. Inland surface waters that meet the criteria mandated by the *Sources of Drinking Water Policy* (which became effective when the State Board adopted Resolution No. 88-63 in 1988) are designated MUN. (This policy is reprinted in Chapter 5, Plans and Policies).

Under federal law, all surface waters must have water quality standards designated in the Basin Plans. Most of the inland surface waters in the Region have beneficial uses specifically designated for them. Those waters not specifically listed (generally smaller tributaries) are designated with the same beneficial uses as the streams, lakes, or reservoirs to which they are tributary. This is commonly referred to as the "tributary rule."

Ground Waters

Beneficial uses for regional groundwater basins (Figure 1-9) are designated on Table 2-2. For reference, Figures 2-11 to 2-18 show enlargements of all of the major basins and sub-basins referred to in the ground water beneficial use table (Table 2-2) and the water quality objective table (Table 3-8) in Chapter
3.

Many groundwater basins are designated MUN, reflecting the importance of ground water as a source of drinking water in the Region and as required by the State Board's *Sources of Drinking Water Policy.* Other beneficial uses for ground water are generally IND, PROC, and AGR. Occasionally, ground water is used for other purposes (e.g., ground water pumped for use in aquaculture operations at the Fillmore Fish Hatchery).

Coastal Waters

Coastal waters in the Region include bays, estuaries, lagoons, harbors, beaches, and ocean waters. Beneficial uses for these coastal waters provide habitat for marine life and are used extensively for recreation, boating, shipping, and commercial and sport fishing, and are accordingly designated in Table 2-3. Figures 2-19 to 2-22 show specific sub-areas of some of these coastal waters.

Wetlands

Wetlands include freshwater, estuarine, and saltwater marshes, swamps, mudflats, and riparian areas. As the California Water Code (§13050[e]) defines "waters of the state" to be "any water, surface or underground, including saline waters, within the boundaries of the state," natural wetlands are therefore entitled to the same level of protection as other waters of the state.

Wetlands also are protected under the Clean Water Act, which was enacted to restore and maintain the physical, chemical, and biological integrity of the nation's waters, including wetlands. Regulations developed under the CWA specifically include wetlands "as waters of the United States" (40 CFR 116.3) and defines them as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Although the definition of wetlands differs widely among federal agencies, both the USEPA and the U.S. Army Corps of Engineers use this definition in administrating the 404 permit program.

Recently, both state and federal wetlands policies have been developed to protect these valuable waters. Executive Order W-59-93 (signed by Governor Pete Wilson on August 23, 1993) established state policy guidelines for wetlands conservation. The primary goal of this policy is to ensure no overall net loss and to achieve a long-term net gain in the quantity, quality, and permanence of wetland acreage in California. The federal wetlands policy, representing a significant advance in wetlands protection, was unveiled by nine federal agencies on August 24, 1993. This policy represents an agreement that is sensitive to the needs of landowners, more efficient, and provides flexibility in the permit process.

The USEPA has requested that states adopt water quality standards (beneficial uses and objectives) for wetlands as part of their overall effort to protect the nation's water resources. The 1975 Basin Plans identified a number of waters which are known to include wetlands; these wetlands, however, were not specifically identified as such. In this Basin Plan, a wetlands beneficial use category has been added to identify inland waters that support wetland habitat as well as a variety of other beneficial uses. The wetlands habitat definition recognizes the uniqueness of these areas and functions they serve in protecting water quality. Table 2-4 identifies and designates beneficial uses for significant coastal wetlands in the Region. These waterbodies are also included on Tables 2-1 and 2-3. Beneficial uses of wetlands include many of the same uses designated for the rivers, lakes, and coastal waters to which they are adjacent, and include REC-1, REC-2, WARM, COLD, EST, MAR, WET, GWR, COMM, SHELL, MIGR, SPWN, WILD and often RARE or BIOL.

As some wetlands can not be easily identified in southern California because of the hydrologic regime, the Regional Board identifies wetlands using indicators such as hydrology, presence of hydrophytic plants (plants adapted for growth in water), and/or hydric soils (soils saturated for a period of time during the growing season). The Regional Board contracted with Dr. Prem Saint, et al. (1993a and 1993b), to inventory and describe major regional wetlands. Information from this study was used to update this Basin Plan.

Water Quality Control Plan Los Angeles Region

Chapter: Beneficial Uses Table 2-1 ~ Table 2-4

Table 2-1. Beneficial Uses of Inland Surface Waters.

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
VENTURA COUNTY COASTAL STREAMS																									
Los Sauces Creek	401.00	P*	I	I	I	I				I	I			I	I				E			I	I		
Poverty Canyon	401.00	P*	I	I	I	I				I	I			I	I				E			I	I		
Madriano Canyon	401.00	P*	I	I	I	I				I	I			I	I				E			I	I		
Javon Canyon	401.00	P*	I	I	I	I				I	I			I	I				E			I	I		E
Padre Juan Canyon	401.00	P*	I	I	I	I				I	I			I	I				E			I	I		
McGrath Lake c	403.11									Ed	Ed	P					E		E		Ee				E
Big Sycamore Canyon Creek	404.47	P*				I				I	I			I	E				E			P	P		E
Little Sycamore Canyon Creek	404.45	P*								I	I			I					E		E		P		
VENTURA RIVER WATERSHED												E													
Ventura River Estuary c	402.10							E		E	E	E		E			E	E	E		Ee	Ef	Ef	E	E
Ventura River	402.10	P*	E		E	E	E			E	E			E	E				E		E	E	E		E
Ventura River	402.20	E	E	E	E	E	E			E	E			E	E				E		Eg	E	E		E
Cañada Larga	402.10	P*		I	I	I	I			I	I			I	I				E			I	I		
Lake Casitas	402.20	E	E	E	E	P	P		P	Ph	E			E	E				E		E				
Lake Casitas tributaries	402.20	E*			P	E				E	E			E	E				E		P	E	E		E
Coyote Creek below dam	402.20	P*				E				P				E	E				E			E	E		E
San Antonio Creek	402.20	E	E	E	E	E				E	E			E	E				E			E	E		E
San Antonio Creek	402.32	E	E	E	E	E	E			E	E			E	E				E			E	E		E
Lion Creek	402.31	I*	I	I	I					I	I			I	I				E						
Reeves Creek	402.32	I*	I	I	I	I				I	I			I	I				E			I	I		
Mirror Lake	402.20	P*				E				P	E			E					P						E
Ojai Wetland	402.20	P*								P	E			E					E						E
Matilija Creek	402.20	P*				E				E	E				E				E			E	E		E
Murietta Canyon Creek	402.20	P*				E				E	E				E				E			E	E		E
North Fork Matilija Creek	402.20	E*	E	E	E	E				E	E			E	E				E		E	E	E		E
Matilija Reservoir	402.20	E			E	E	E			E	E			E	E				E			E	E		E
SANTA CLARA RIVER WATERSHED																									
Santa Clara River Estuary c	403.11							E		E	E	E					E	E	E		Ee	Ef	Ef		E
Santa Clara River	403.11	P*	E	E	E	E	E			E	E			E	E				E		E	E			E
Santa Clara River	403.21	P*	E	E	E	E	E			Ed	E			E					E		E	E			E
Santa Clara River	403.31	P*	E	E	E	E	E			Ed	E			E					E		E	E			E
Santa Clara River	403.41	P*	E	E	E	E	E			E	E			E					E		E	E			E
Santa Clara River	403.51	P*	E	E	E	E	E			E	E			E					E		E				E
Santa Clara River (Soledad Cyn)	403.55	E*	E	E	E	E	E			E	E			E					E		Ei				E
Santa Paula Creek	403.21	P	E	E	E	E	E			E	E			E	E				E		E	E	E		

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required
* Asterixed MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemptions at a later date. (See pages 2-3,4 for more details).

Footnotes are consistent on all beneficial use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4).
d Limited public access precludes full utilization.
e One or more rare species utilize all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.
g Condor refuge.
h Water contact recreational activities prohibited by Casitas MWD.
i Soledad Canyon is the habitat of the Unarmored Three-Spine Stickleback.

Table 2-1. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
SANTA CLARA RIVER WATERSHED (CONT)																									
Sisar Creek	403.21	P	E	P	E	E				E	E			E	E				E		Eg		E		E
Sisar Creek	403.22	P	E	P	E	E				E	E			E	E				E		Eg		E		E
Sespe Creek	403.31	P*	E	E	E	E				E	E			E	E				E	E	E	E	E		E
Sespe Creek	403.32	P	E	P	E	E				E	E			E	E				E	E	Eg	E	E		E
Timber Creek	403.32	P*				E				E	E				E				E	E	E	E	E		E
Bear Canyon	403.32	P*				E				E	E			E	P				E	E	E	E	E		E
Trout Creek	403.32	P*				E				E	E			E	E				E		E	E	E		E
Piedra Blanca Creek	403.32	P*				E				E	E				E				E		E	E	E		E
Lion Canyon	403.32	P*				E				E	E			E	E				E			E	E		E
Rose Valley Creek	403.32	P*				E				E	E			E	E				E				E		E
Howard Creek	403.32	P*				E				E	E				E				E	E	E	E	E		E
Tule Creek	403.32	P*				E				P	E				P				E	E	E	E	E		E
Potrero John Creek	403.32	P*				E				E	E				P				E		E	E	E		E
Hopper Creek	403.41	P*	E		E	E	E			E	E			E	E				E		Eg				E
Piru Creek	403.41	P	E	E	E	E	E			E	E			E	E				E		Eg	E	E		E
Piru Creek	403.42	P	E	E	E	E	E			E	E			E	E				E		Eg		E		E
Lake Piru	403.41	P	E	E	E	E	P			E	E			E	E				E		E		E		
Lake Piru	403.42	P	E	E	E	E	P		P	E	E			E	E				E		E		E		
Pyramid Lake	403.42	E	E	E	E	E	P		E	E	E			E	E				E		E				
Cañada de los Alamos	403.43	I*			I	I	I			I	I			I	I				E		E				
Gorman Creek	403.43	I*			I	I				I	I			I	I				E		P				
Lockwood Creek	403.42	I*			I	I				I	I			I	I				E						
Lockwood Creek	403.44	I*			I	I	I			I	I			I	I				E						
Tapo Canyon	403.41	P*			P					P	E			E					E						
Castaic Creek	403.51	I	I	I	I	I	I			I	E			I					E		E				
Castaic Lagoon	403.51	E*	E	E	E	E	E			E	E			E					E						
Castaic Lake	403.51	E	E	E	E	E	E		E	E	E			E	I				E		E		E		
Elderberry Forebay	403.51	E	E	E	E	E	E		E	Ek	E			E					E		E		E		
Elizabeth Lake Canyon	403.51	I	I	I	I	I	I			I	E			I					E						
San Francisquito Canyon l	403.51	I	I	I	I	I	I			I	I			I					E		E		I		E
South Fork (Santa Clara River)	403.51	I*	I	I	I	I	I			I	I			I					E						
Drinkwater Reservoir	403.51	P*				E				Pk	E			P					E		E				E
Bouquet Canyon	403.51	E I	EI	PI	P I	E	P			Em	E			E	E				E				P		E
Bouquet Canyon	403.52	P	P	P	E	E	P			Em	E			E	E				E		E				E
Dry Canyon Creek	403.51	I	I	I	I	I	I			I	I			I					E						
Dry Canyon Reservoir j	403.51	E	E	E	E	P	P		P	Pk	E			E					E						
Bouquet Reservoir	403.52	E	E	E	E	E	E		P	Pk	E			E					E						

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required
* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemptions at a later date. (See pages 2-3,4 for more details).

Footnotes are consistent on all beneficial use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
g Condor refuge.

j Out of service.
k Public access to reservoir and its surrounding watershed is prohibited by Los Angeles County Department of Public Works.
l The majority of the reach is intermittent, there is a small area of rising ground water creating perennial flow.
m Access prohibited by Los Angeles County Department of Public Works in the concrete-channelized areas.

Table 2-1. Beneficial Uses of Inland Surface Waters (Continued)

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
SANTA CLARA RIVER WATERSHED (CONT)																									
Mint Canyon Creek	403.51	I	I	I	I	I	I			Im	I			I					E						
Mint Canyon Creek	403.53	I*	I	I	I	I	I			Im	I			I					E						
Agua Dulce Canyon Creek	403.54	I*	I	I	I	I	I			I	I			I					E		E				
Agua Dulce Canyon Creek	403.55	I*			I	I	I			I	I			I					E						
Aliso Canyon Creek	403.55	P*			P	E				E	E			E					E						E
Lake Hughes	403.51	P	P	P	P	P	P			E	E			E					E						
Munz Lake	403.51	P*	P	P	P	E	P			E	E			E					E						
Lake Elizabeth	403.51	P	P	P	P	P	P			E	E			E					E		E				
CALLEGUAS-CONEJO CREEK WATERSHED																									
Mugu Lagoon c	403.11							E		Pn	E	Ed					E	E	Eo	E	Ee,p	Ef	Ef	Ed	E
Calleguas Creek Estuary c	403.11							P		Pn	E	E					E		E		Ee,p	Ef	Ef		E
Calleguas Creek	403.11	P*			E	E	E			E	E			E	E				E		Ep				E
Calleguas Creek	403.12	P*	E	E	E	E				Eq	E			E					E						
Revolon Slough	403.11	P*	P		E	E				Eq	E			E					E						E
Beardsley Wash	403.61	P*					E			E	E			E					E						
Conejo Creek	403.12	P*	E	E	E	E				Eq	E			E					E						
Conejo Creek	403.53	P*				I	I			I	I			I					E				E		
Arroyo Conejo	403.64	P*				I	I			I	I			I					E		E				
Arroyo Conejo	403.68	P*				I	I			I	I			I					E						
Arroyo Santa Rosa	403.63	P*				I	I			I	I			I					E						
Arroyo Santa Rosa	403.65	P*				I				I	I			I					E						
North Fork Arroyo Conejo	403.64	P*			E	E				E	E			E					E				E		
Arroyo Las Posas	403.12	P*	P	P	P	E				E	E			E	P				E						
Arroyo Las Posas	403.62	P*	P	P	P	E	E			E	E			E	P				E						
Arroyo Simi	403.62	P*	I			I	I				I			I					E		E				
Arroyo Simi	403.67	I*	I			I	I			I	I			I					E						
Tapo Canyon Creek	403.66	I*		P	P	I				I	I			I					E						
Tapo Canyon Creek	403.67	I*		P	P	I				I	I			I					E						
Gillibrand Canyon Creek	403.68	P*				I	I			I	I			I					E						
Gillibrand Canyon Creek	403.67	P*				I				I	I			I					E						
Lake Bard (Wood Ranch Reservoir)	403.67	E	E	E	E	P				Pr	Er			E					E						
LOS ANGELES COUNTY COASTAL STREAMS																									
Arroyo Sequit	404.44	P*				I				E	E			E	E				E		E	E	E		E
San Nicholas Canyon Creek	404.45	P*								I	I			I					E						

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required
* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemptions at a later date. (See pages 2-3,4 for more details).

Footnotes are consistent on all beneficial use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4).
d Limited public access precludes full utilization.
e One or more rare species utilize all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.
m Access prohibited by Los Angeles County DPW in the concrete-channelized areas.
n Area is currently under control of the Navy: swimming is prohibited.
o Marine habitats of the Channel Islands and Mugu Lagoon serve as pinneped haul-out areas for one or more species (i.e., sea lions).
p Habitat of the Clapper Rail.
q Whenever flow conditions are suitable.
r Public access prohibited by Calleguas MWD.

Table 2-1. Benefical Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
LA COUNTY COASTAL STREAMS (CONT)																									
Los Alisos Canyon Creek	404.42	P*								I	I			I					E		E				
Lachusa Canyon Creek	404.42	P*								I	I			I					E						
Encinal Canyon Creek	404.41	P*								I	I			I					E		E				
Trancas Canyon Creek	404.37	E*								Em	E			E					E		E				
Dume Lagoon c	404.36							E		E	E	E					E		E		Ee	Pf	Pf		E
Dume Creek (Zuma Canyon)	404.36	E*								E	E			E	E				E		E	P	P		
Ramirez Canyon Creek	404.35	I*								I	I			I					E				P		
Escondido Canyon Creek	404.34	I*								I	I			I					E		E				
Latigo Canyon Creek	404.33	I*								I	I			I					E		E				
Solstice Canyon Creek	404.32	E*								E	E			E					E			P	P		
Puerco Canyon Creek	404.31	I*								I	I			I					E						
Corral Canyon Creek	404.31	I*								I	I			I					E						
Carbon Canyon Creek	404.16	P*								I	I			I					E						
Las Flores Canyon Creek	404.15	P*								I	I			I					E						
Piedra Gorda Canyon Creek	404.14	P*								I	I			I					E						
Pena Canyon Creek	404.13	P*								I	I			I	E				E						
Tuna Canyon Creek	404.12	P*								I	I			I					E						
Topanga Lagoon c	404.11							E		E	E	E					E		E		Ee	Ef	Ef		E
Topanga Canyon Creek	404.11	P*								I	I			E	E				E			P	I		
Santa Ynez Canyon	405.13	P*								I	E			I					E		E				
Santa Ynez Lake (Lake Shrine)	405.13	P*								Pk	E			E					E						
Santa Monica Canyon Channel	405.13	P*								Ps	I			P					P						
Rustic Canyon Creek	405.13	P*								I	I			I					E						
Sullivan Canyon Creek	405.13	P*								I	I			I					E						
Mandeville Canyon Creek	405.13	P*								I	I			I					E						
Coastal Streams of Palos Verdes	405.11	P*				I				I	I			I					E		E				
Canyon Streams trib. to Coastal Streams of Palos Verdes	405.12	P*				I				I	I			I					E		Et				
Bixby Slough and Harbor Lake	405.12	P*								E	E			E					E		E				E
Los Cerritos Wetlands c	405.15							E		E	E	E					E		E		Ee	Pf	Pf	E	E
Los Cerritos Channel Estuary c	405.12		E					E		Es	E	E				E	E	E	E		Ee	Ef	Ef	E	
Sims Pond	405.15	P*								P	E			P					E						E
Los Cerritos Channel to Estuary	405.15	P*								P	I			I					E						
Colorado Lagoon	405.12									E	E	E		P					E					E	
[illegible] Marsh	405.12									P	E			P					E						E
Stone Canyon Reservoir	405.13	E*	E	E		P				Pk	E			E					E						
Hollywood Reservoir	405.14	E*	E	E		P				Pk	E			E					E						
Franklin Canyon Reservoir	405.14	E*								Pk,u				Pu											
Upper Franklin Canyon Reservoir	405.14	E*	E	E		P				P	E			P					E						E

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required
* Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemptions at a later date. (See pages 2-3,4 for more details).

Footnotes are consistent on all benefical use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4).
e One or more rare species utilize all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.
k Public access to reservoir and its surrounding watershed is prohibited by the Los Angeles Department of Water and Power.
m Access prohibited by Los Angeles County DPW in the concrete-channelized areas.
s Access prohibited by Los Angeles County DPW.
t Rare applies only to Agua Magna Canyon & Sepulveda Canyon areas.
u These reservoirs are covered and thus inaccessible.

Table 2-1. Benefical Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
MALIBU CREEK WATERSHED																									
Malibu Lagoon c	404.21							E		E	E						E	E	E		Ee	Ef	Ef		E
Malibu Creek	404.21	P*								E	E			E	E				E		E	E	E		E
Cold Creek	404.21	P*								E	E				P				P		E		P		E
Las Virgenes Creek	404.22	P*								Em	E			E	P				E		E	P	P		E
Century Reservoir	404.21	P*								E	E			E					E						E
Malibou Lake	404.24	P*						E		E	E			E					E		E				E
Medea Creek	404.23	P*				E				Im	I			I	P				E		E				E
Medea Creek	404.24	I*				I				Em	E			E					E						E
Lindero Creek	404.23	P*								I	I			I					E						
Triunfo Creek	404.24	P*								Im	I			I					E						
Triunfo Creek	404.25	P*				I				Im	I			I					E		E				
Westlake Lake	404.25	P*						E		E	E			E					E						
Potrero Valley Creek	404.25	P*				I				I	I			P					E						
Lake Eleanor Creek	404.25	P*				I				I	I			I					E						
Lake Eleanor	404.25	P*				E				E	E			E					E		E				E
Las Virgenes (Westlake) Reservoir	404.25	E	E	E	E					Pk,v	E			P					E						
Hidden Valley Creek	404.26	I*				I				I	I			I					E						
Lake Sherwood	404.26	P*				E		E		E	E			E					E						E
BALLONA CREEK WATERSHED																									
Ballona Creek Estuary c,w	405.13							E		E	E	E					E	E	E		Ee	Ef	Ef	E	
Ballona Lagoon/ Venice Canals c	405.13							E		E	E	E					E	E	E		Ee	Ef	Ef	E	E
Ballona Wetlands c	405.13									E	E						E		E		Ee	Ef	Ef		E
Del Rey Lagoon c	405.13							E		E	E	E					E		E		Ee	Ef	Ef		E
Ballona Creek to Estuary	405.13	P*								Ps	E			P					P						
Ballona Creek	405.15	P*								Ps	E			P					E						
DOMINGUEZ CHANNEL WATERSHED																									
Dominguez Channel Estuary c,w	405.12							P		Es	E	E					E	E	E		Ee	Ef	Ef		
Dominguez Channel to Estuary	405.12	P*								Ps	E			P					P		E				
LOS ANGELES RIVER WATERSHED																									
Los Angeles River Estuary c,w	405.12		E					E		E	E	E					E	E	E		Ee	Ef	Ef	P	E
Los Angeles River to Estuary	405.12	P*	P	P		E				Es	E			E				E	E		E	P	P	Ps	
Los Angeles River	405.15	P*	P			E				Es	E			E					P						
Los Angeles River	405.21	P*	P			E				E	E			E					E						E
Compton Creek	405.15	P*				E				Es	E			E					E						E

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Footnotes are consistent on all beneficial use tables.
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b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4).
e One or more rare species utilize all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.

k Public access to reservoir and its surrounding watershed is prohibited by LADWP.
m Access prohibited by Los Angeles County DPW in the concrete-channelized areas.
v Public water supply reservoir. Owner prohibits public entry.
w These areas are engineered channels. All references to Tidal Prisms in Regional Board documents are functionally equivalent to estuaries.
s Access prohibited by Los Angeles County DPW.

Table 2-1. Benefical Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
LA RIVER WATERSHED (CONTINUED)																									
Rio Hondo below Spreading Grounds	405.15	P*				I				Pm	E			P					I						
Rio Hondo to Spreading Grounds	405.15	P*				I				Im	E			P					I						
Rio Hondo	405.41	P*				I				Im	E			P					I		E				E
Alhambra Wash	405.41	P*				I				Pm	I			P					P		E				
Rubio Wash	405.41	P*				I				Im	I			I					E		P				
Rubio Canyon	405.31	P*				E				I	I			I					E		E				E
Eaton Wash	405.41	P*				I				I	I			I					E						
Eaton Wash (below dam)	405.31	P*				I				Im	I			I					E						
Eaton Wash (above dam)	405.31	P*				I				I	I			I					E						
Eaton Dam and Reservoir	405.31	P*				I				P	Id			I					E						
Eaton Canyon Creek	405.31	P*				E				E	E			E					E		E		E		E
Arcadia Wash (lower)	405.41	P*				I				Pm	I			P					P						
Arcadia Wash (upper)	405.33	P*				I				Pm	I			P					P						
Santa Anita Wash (lower)	405.41	P*				I				Pm	E			P					P		E				
Santa Anita Wash (upper)	405.33	P*				E				Em	E			E					E		E				
Little Santa Anita Canyon Creek	405.33	P*				I				I	I			I					E						
Big Santa Anita Reservoir	405.33	P*				E				Px	E			E	E				E						
Santa Anita Canyon Creek	405.33	E*				E				E	E			E	E				E		E		E		E
Winter Creek	405.33	P*				I				I	E			I					E						E
East Fork Santa Anita Canyon	405.33	P*				E				E	E			E	E				E				E		E
Sawpit Wash	405.41	I				I				Im	I			I					E						
Sawpit Canyon Creek	405.41	P*				I				I	I			I					E		E				
Sawpit Dam And Reservoir	405.41	P*				I				Px	I			I					E						
Monrovia Canyon Creek	405.41	I				I				I	I			I					E						E
Arroyo Seco S. Of Devil's Gates. (L)	405.15	P*								I	I			P					P						
Arroyo Seco S. Of Devil's Gates (U)	405.31	P*								Im	I			P					P		E				
Devil's Gate Reservoir (lower)	405.31	P*				I				Im	I			I					P						
Devil's Gate Reservoir (upper)	405.32	I*				I				I	I			I					E						
Arroyo Seco	405.32	E	E	E		E				Em	E			E	E				E						E
Millard Canyon Creek	405.32	E*	E	E		E				E	E			E					E		E				E
El Prieto Canyon Creek	405.32	I	I	I		I				I	I			I					E						
Little Bear Canyon Creek	405.32	P*				I				I	I			I	I				E						E
Verdugo Wash	405.24	P*				I				Pm	I			P					P						
Halls Canyon Channel	405.24	P*	I	I		I				Im	I			I					E						
Snover Canyon	405.32	I	I	I		I				Im	I			I					E						
Pickens Canyon	405.24	I*				I				Im	I			I					E						
Shields Canyon	405.24	I	I	I		I				Im	I			I					E						

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b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
m Access prohibited by Los Angeles County DPW in concrete-channelized areas.
x Owner prohibits entry.

Table 2-1. Benefical Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BICL	RARE	MIGR	SPWN	SHELL	WET[b]
LA RIVER WATERSHED (CONT)																									
Dunsmore Canyon Creek	405.24	I	I	I		I				I	I			I					E						
Burbank Western Channe	405.21	P*								Pm	I			P					P						
La Tuna Canyon Creek	405.21	P*				I				Im	I			I					E						
Tujunga Wash	405.21	P*				I				Pm	I			P	P				P						
Hansen Flood Control Basin & Lakes	405.23	P*				E				E	E			E	E				E		E				
Lopez Canyon Creek	405.21	P*				I				Im	I			I					E						
Little Tujunga Canyon Creek	405.23	P*				I				I	E			I	I				E		E				
Kagel Canyon Creek	405.23	P*				I				Im	I			I					E						
Big Tujunga Canyon Creek	405.23	P*				E				E	E			E	E				E		E		E		E
Upper Big Tujunga Canyon Creek	405.23	P*				E				E	E			I	P				E						E
Haines Canyon Creek	405.23	P*				I				Im	I			I					E		E				
Vasquez Creek	405.23	P*				E				E	E			P	P				E						E
Clear Creek	405.23	P*				E				E	E			E	E				E						E
Big Tujunga Reservoir	405.23	P*				E				Pk	E			E	P				E				E		
Mill Creek	405.23	P*				E				E	E			E	E				E						E
Pacoima Wash	405.21	P*				E				Pm	E			E					E		E				
Pacoima Reservoir	405.22	P*				E				E	E			E					E						
Pacoima Canyon Creek	405.22	P*				E				E	E			E	E				E		E		E		E
Stetson Canyon Creek	405.22	P*				I				Pm	E			P					P						
Wilson Canyon Creek	405.22	P*				I				Em	E			I					E						
May Canyon Creek	405.22	P*				I				I	E			I					E						
Sepulveda Flood Control Basin	405.21	P*				I				E	E			E					E						E
Bull Creek	405.21	P*				I				Im	I			I					E						
Los Angeles Reservoir	405.21	E	E	E		P				Pk	E			E					E		E				
Lower Van Norman Reservoir	405.21	E*	E	E		E				E	E			E					E		E				
Solano Reservoir	405.21	E*								Pk,u				Pu					E						
Caballero Creek	405.21	P*				I				Im	I			I					E						
Aliso Canyon Wash and Creek	405.21	P*				I				Im	I			I					E						
Limekiln Canyon Wash	405.21	P*				I				Im	I			I					E						
Browns Canyon Wash and Creek	405.21	P*				I				Im	I			I					E						
Arroyo Calabasas	405.21	P*								Pm	I			P					P						
McCoy Canyon Creek	405.21	P*				I				I	I			I					E						
Dry Canyon Creek	405.21	P*				I				Im	I			I					E						
Bell Creek	405.21	P*				I				Im	I			I					E						
Chatsworth Reservoir y	405.21	E	E	E						P	E			E					E						
Dayton Canyon Creek	405.21	P*				I				I	I			I					E						

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b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
k Public access to reservoir and its surrounding watershed is prohibited by Los Angeles Department of Water and Power.
m Access prohibited by Los Angeles County DPW in concrete-channelized areas.
u This reservoir is covered and thus inaccessible.
y Currently dry and no plans for restoration.

Table 2-1. Benefical Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
LOS ANGELES RIVER WATERSHED (CONT)																									
ISOLATED LAKES AND RESERVOIRS:																									
Eagle Rock Reservoir	405.25	E*								Pk,u				Pu											
Echo Lake	405.15	P*								P	E			P					E						
El Dorado Lakes	405.15	P*								E	E			P					E						E
Elysian Reservoir	405.15	E*	E	E						Pk	E			P					E						
Encino Reservoir	405.21	E*	E	E						Pk	E			P					E						
Ivanhoe Reservoir	405.15	E*	E	E						Pk	E			P					E						
Lincoln Park Lake	405.15	P*								P	E			P					E						
Silver Lake Reservoir	405.15	E*	E	E						Pk	E			P					E						
Toluca Lake	405.21	P*								Pk	E			P					E						
SAN GABRIEL RIVER WATERSHED																									
San Gabriel River Estuary c,w	405.15		E					E		E	E	E					E	E	E		Ee	Ef	Ef	P	
San Gabriel River: Firestone Blvd-Esutary	405.15	P*								Em	E			P					P						
San Gabriel River: Whittier N-Firestone	405.15	P*	P	P		I				Em	E			I					E		E				
San Gabriel River	405.41	P*				I				Im	I			I					E						
San Gabriel River	405.42	E	E	E	E	E				E	E			E	E				E		E				
San Gabriel River: Main Stem z	405.43	E	E	E	E	E				E	E			E	E				E				E		
North Fork San Gabriel River	405.43	For uses please see UPPER SAN GABRIEL TRIBUTARIES below																							
West Fork San Gabriel River	405.43	For uses please see UPPER SAN GABRIEL TRIBUTARIES below																							
East Fork San Gabriel River	405.43	For uses please see UPPER SAN GABRIEL TRIBUTARIES below																							
Coyote Creek to Estuary	405.15	P*	P	P						Pm	I			P					P		E				
Whittier Narrows Flood Control Basin	405.41	P*				E				E	E			E					E		P				
Legg Lake	405.41	P*				E				E	E			E	E				E						E
San Jose Creek	405.41	P*				I				Pm	I			I					E						
San Jose Creek	405.51	P*				I				Pm	I			I					E						
Puente Creek	405.41	P*				I				P	I			P					P						
Thompson Wash	405.52	P*				I				Im	I			I					E						
Thompson Creek	405.53	P*				I				I	I			I					E		E				
Thompson Creek Dam & Reservoir	405.53	P*				I				Px	I			I					E		E				
Walnut Creek Wash	405.41	P*				I				Im	I			I					E						E
Big Dalton Wash	405.41	P*				I				Pm	I			P					P						
Big Dalton Canyon Creek	405.41	P*				I				I	I			I					E						E
Mystic Canyon	405.41	P*				I				I	I			I					E						
Big Dalton Dam & Reservoir	405.41	P*				E				Px	E			E					E						

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e One or more rare species utilize all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.
k Public access to reservoir and its surrounding watershed is prohibited by the Los Angeles Department of Water and Power.

w These areas are engineered channels. All references to Tidal Prisms in Regional Board documents are functionally equivalent to estuaries.
m Access prohibited by Los Angeles County DPW in concrete-channelized areas.
x Owner prohibits entry.
u This reservoir is covered and thus inaccessible.
z Listed twice in this table (see next page).

Table 2-1. Benefical Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
SAN GABRIEL RIVER WATERSHED (CONT)																									
Bell Canyon Creek	405.41	P*				I				I	I			I					E						
Little Dalton Wash	405.41	P*				I				Pm	I			P					P						
Little Dalton Canyon Creek	405.41	P*				I				I	I			I					E						E
San Dimas Wash (lower)	405.41	P*				I				Im	I			I					E		E				
San Dimas Wash (upper)	405.44	P*				E				Im	I			I					E						
San Dimas Dam and Reservoir	405.44	E*				E				Px	E			E	E				E						
San Dimas Canyon Creek	405.44	E*				E				E	E			E	E				E						E
West Fork San Dimas Canyon	405.44	E*				E				E	E			E	P				E						E
Wolfskill Canyon	405.44	E*				E				E	E			E	P				E		E				E
Puddingstone Dam and Reservoir	405.52	E*			E	E				E	E			E	E				E		E				
Puddingstone Wash	405.51	E*				I				Im	I			I					E						
Marshall Creek and Wash	405.41	E*				I				Im	I			I					E						
Marshall Creek and Wash	405.53	E*				I	I			Im	I			I					E		E				E
Live Oak Wash	405.52	E*				I	I			I	I			I					E						
Live Oak Creek And Wash	405.53	E*				I	I			I	I			I					E						
Live Oak Dam and Reservoir	405.53	E*				E	E			E	E			E					E						
Emerald Creek And Wash	405.53	E*				I	I			Im	I			I					E						
Santa Fe Flood Control Basin	405.41	P*				I				P	I			I					E						E
Bradbury Canyon Creek	405.41	P*				I				I	I			I					E						
Spinks Canyon Creek	405.41	P*				I				I	I			I					E						
Maddock Canyon Creek	405.43	P*				I				I	I			I					E						
Van Tassel Canyon	405.43	P*				I				I	I			I					E		E				
Fish Canyon Creek	405.43	P*	I			E				E	E			E					E		E		E		E
Roberts Canyon Creek	405.43	P*				I				I	I			I					E		E				E
Morris Reservoir	405.43	E	E	E	E	E			E	P	E			E	E				E				E		
San Gabriel Reservoir	405.43	E	E	E	E	E			E	E	E			E	E				E						
UPPER SAN GABRIEL RIVER TRIBUTARIES																									
San Gabriel River: Main Stem z	405.43	E	E	E	E	E				E	E			E	E				E						E
Cattle Canyon Creek	405.43	P*				E				E	E			E	E				E		E		E		E
Coldwater Canyon Creek	405.43	P*				E				E	E			E	E				E		E		E		E
Cow Canyon Creek	405.43	P*				E				E	E			E	E				E		E		E		E
East Fork San Gabriel River	405.43	P*				E				E	E			E	E				E		E		E		E
Allison Gulch	405.43	P*				E				E	E			E	E				E				E		E
Fish Fork	405.43	P*				E				E	E			E	E				E				E		E

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Any regulatory action would require a detailed analysis of the area.
m Access prohibited by Los Angeles County DPW in concrete channelized areas.
x Owner prohibits entry.
z Also listed on previous page.

Table 2-1. Benefical Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
SAN GABRIEL RIVER WATERSHED (CONT)																									
North Fork San Gabriel River	405.43	P*				E				E	E			E	E				E		E		E		E
Bichota Canyon	405.43	P*				E				E	E			E	E				E		P		E		
Coldbrook Creek	405.40	P*				I				I	I			I					E				E		
Cedar Creek	405.43	P*				E				E	E			E	E				E		E		E		E
Crystal Lake	405.43	P*								E	E			E	E				E				E		
Soldier Creek	405.43	P*				I				I	I			I					E				E		
West Fork San Gabriel River	405.43	P*				E				E	E			E	E				E		E		E		E
Bear Creek	405.43	P*				E				E	E			E	E				E		E		E		E
Cogswell Reservoir	405.43	P*				E				E	E			E	E				E				E		
Devils Canyon Creek	405.43	P*				E				E	E			E	E				E				E		E
ISLAND WATERCOURSES																									
Anacapa Island	406.10	P*								P				P					E		E				
San Nicolas Island	406.20	P*								P				P					E		Eaa				
Santa Barbara Island	406.30	P*								E	E			P					E		E				
Santa Catalina Island	406.40	E*				E				E	E			E					E		E				
Middle Ranch System	406.40	P*				E				E	E			E					E		E				
San Clemente Island	406.50	E*				E				E	E			E					E		E				
SAN ANTONIO CREEK WATERSHED ab																									
San Antonio Dam And Reservoir	481.23	E*				E				E	E			E					E						
San Antonio Canyon Creek	481.23	E		E	E	E			E	E	E			E	E				E				E		

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Footnotes are consistent on all benefical use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
aa Habitat of the Channel Island Fox.
ab This watershed is also in Region 8 (801.23).

Table 2-2. Beneficial Uses of Ground Waters.[ac]

DWR Basin No.[ad]	BASIN	MUN	IND	PROC	AGR	AQUA
	PITAS POINT AREA ae	E	E	P	E	
4-1	OJAI VALLEY					
	Upper Ojai Valley					
	West of Sulfur Mountain Road	E	E	E	E	
	Central area	E	E	E	E	
	Sisar area	E	E	E	E	
4-2	Lower Ojai Valley					
	West of San Antonio--Senior Canyon Creeks	E	E	E	E	
	East of San Antonio--Senior Canyon Creeks	E	E	E	E	
4-3	VENTURA RIVER VALLEY					
	Upper Ventura	E	E	E	E	
	San Antonio Creek area	E	E	E	E	
	Lower Ventura	P	E	P	E	
	VENTURA CENTRAL af					
4-4	Santa Clara--Piru Creek area					
	Upper area (above Lake Piru)	P	E	E	E	
	Lower area east of Piru Creek	E	E	E	E	
	Lower area west of Piru Creek	E	E	E	E	
	Santa Clara--Sespe Creek area					
	Topa Topa (upper Sespe) area	P	E	P	E	
	Fillmore area					
	Pole Creek Fan area	E	E	E	E	
	South side of Santa Clara River	E	E	E	E	
	Remaining Fillmore area	E	E	E	E	E
	Santa Clara-Santa Paula area					
	East of Peck Road	E	E	E	E	
	West of Peck Road	E	E	E	E	
	Oxnard Plain					
	Oxnard Forebay	E	E	E	P	
	Confined aquifers	E	E	E	E	
	Unconfined and perched aquifers	E	P		E	

DWR Basin No.[ad]	BASIN	MUN	IND	PROC	AGR	AQUA
	VENTURA CENTRAL (CONT.)					
4-6	Pleasant Valley					
	Confined aquifers	E	E	E	E	
	Unconfined and perched aquifers	P	E	E	E	
4-7	Arroyo Santa Rosa	E	E	E	E	
4-8	Las Posas Valley					
	South Las Posas area					
	NW of Grimes Cyn Rd. and LA Ave. & Somis Rd.	E	E	E	E	
	E of Grimes Cyn Rd. and Hitch Blvd.	E	E	E	E	
	S of LA Ave. between Somis Rd and Hitch Blvd.	E	E	E	E	
	Grimes Canyon Rd. and Broadway area	E	E	E	E	
	North Las Posas area	E	E	E	E	
4-5	UPPER SANTA CLARA					
	Acton Valley	E	E	E	E	
	Sierra Pelona Valley (Agua Dulce)	E	E		E	
	Upper Mint Canyon	E	E	E	E	
	Upper Bouquet Canyon	E	P	P	E	
	Green Valley	E	P	P	E	
	Lake Elizabeth-Lake Hughes area	E	P	P	E	
4-4.07	EASTERN SANTA CLARA					
	Santa Clara-Mint Canyon	E	E	E	E	
	South Fork	E	E	E	E	
	Placerita Canyon	E	E	E	E	
	Santa Clara-Bouquet and San Francisquito Canyons	E	E	E	E	
	Castaic Valley	E	E	E	E	
	Saugus Aquifer	E				
4-9	SIMI VALLEY					
	Simi Valley Basin					
	Confined aquifers	E	E	E	E	
	Unconfined aquifers	E	E	E	P	
	Gillibrand Basin	E	E	P	E	
4-10	CONEJO VALLEY	E	E	E	E	

E: Existing beneficial use
P: Potential beneficial use
See pages 2-1 to 2-3 for descriptions of beneficial uses.

Footnotes are consistent for all beneficial use tables.

ac Beneficial uses for ground waters outside of the major basins listed on this table and outlined in Fig. 1-9 have not been specifically listed. However, ground waters outside of the major basins are, in many cases, significant sources of water. Furthermore, ground waters outside of the major basins are either potential or existing sources of water for downgradient basins, and as such, beneficial uses in the downgradient basins shall apply to these areas.

ad Basins are numbered according to California Department of Water Resources (DWR) Bulletin No. 118-80 (DWR, 1980).

ae Ground waters in the Pitas Point area (between the lower Ventura River and Rincon Point) are not considered to comprise a major basin and, accordingly, have not been designated a basin number by the DWR or outlined on Fig. 1-9.

af The Santa Clara River Valley (4-4), Pleasant Valley (4-6), Arroyo Santa Rosa Valley (4-7), and Las Posas Valley (4-8) Ground Water Basins have been combined and designated as the Ventura Central Basin (DWR, 1980).

Table 2-2. Beneficial Uses of Ground Waters (Continued). ac

DWR Basin No. ad	BASIN	MUN	IND	PROC	AGR	AQUA
4-11	LOS ANGELES COASTAL PLAIN					
	Central Basin	E	E	E	E	
	West Coast Basin	E	E	E	E	
	Hollywood Basin	E	E	E	E	
	Santa Monica Basin	E	E	E	E	
4-12	SAN FERNANDO VALLEY					
	Sylmar Basin	E	E	E	E	
	Verdugo Basin	E	E	E	E	
	San Fernando Basin					
	West of Highway 405	E	E	E	E	
	East of Highway 405 (overall)	E	E	E	E	
	Sunland-Tujunga area ag	Eah	E	E	E	
	Foothill area ag	E	E	E	E	
	Area encompassing RT-Tujunga-Erwin-N. Hollywood-Whitnall-LA/Verdugo-Crystal Springs-Headworks-Glendale/Burbank Well Fields	E	E	E	E	
	Narrows area (below confluence of Verdugo Wash with the Los Angeles River)	E	E	E	E	
	Eagle Rock Basin	E	E	E	E	
4-13	SAN GABRIEL VALLEY					
	Raymond Basin					
	Monk Hill sub-basin	E	E	E	E	
	Santa Anita area	E	E	E	E	
	Pasadena area	E	E	E	E	
	Main San Gabriel Basin					
	Western area ai	E	E	E	E	
	Eastern area ai	E	E	E	E	
	Puente Basin	E	E	E	E	

DWR Basin No. ad	BASIN	MUN	IND	PROC	AGR	AQUA
4-14	UPPER SANTA ANA VALLEY					
8-2aj	Live Oak area	E	E	E	E	
	Claremont Heights area	E	E	E	E	
	Pomona area	E	E	E	E	
	Chino area	E	E	E	E	
	Spadra area	E	E	E	E	
4-15	TIERRA REJADA	E	P	P	E	
4-16	HIDDEN VALLEY	E	P		E	
4-17	LOCKWOOD VALLEY	E	E		E	
4-18	HUNGRY VALLEY AND PEACE VALLEY	E	P	E	E	
4-19	THOUSAND OAKS AREA	E	E	E	E	
4-20	RUSSELL VALLEY					
	Russell Valley	E	P		E	
	Triunfo Canyon area	P	P		E	
	Lindero Canyon area	P	P		E	
	Las Virgenes Canyon area	P	P		E	
4-21	CONEJO-TIERRA REJADA VOLCANIC AREA ak	E			E	
	SANTA MONICA MOUNTAINS-SOUTHERN SLOPES al					
	Camarillo area	E	P		E	
	Point Dume area	E	P		E	
4-22	Malibu Valley	P	P		E	
	Topanga Canyon area	P	P		E	
	SAN PEDRO CHANNEL ISLANDS am					
	Anacapa Island	P	P			
	San Nicolas Island	E	P			
	Santa Catalina Island	E	P		E	
	San Clemente Island	P	P			
	Santa Barbara Island	P	P			

E: Existing beneficial use
P: Potential beneficial use
See pages 2-1 to 2-3 for descriptions of beneficial uses.

Footnotes are consistent for all beneficial use tables.

ac Beneficial uses for ground waters outside of the major basins listed on this table and outlined in Fig. 1-9 have not been specifically listed. However, ground waters outside of the major basins are, in many cases, significant sources of water. Furthermore, ground waters outside of the major basins are either potential or existing sources of water for downgradient basins, and as such, beneficial uses in the downgradient basins shall apply to these areas.

ad Basins are numbered according to DWR Bulletin No. 118-80 (DWR, 1980).

ag The category for the Foothill Wells area in the old Basin Plan incorrectly grouped ground water in the Foothill area with ground water in the Sunland-Tujunga area. Accordingly, the new categories, Foothill area and Sunland-Tujunga area, replace the Foothill Wells area.

ah Nitrate pollution in the groundwater of the Sunland-Tujunga area currently precludes direct MUN uses. Since the ground water in this area can be treated or blended (or both), it retains the MUN designation.

ai All of the ground water in the Main San Gabriel Basin is covered by the beneficial uses listed under Main San Gabriel Basin-eastern area and western area. Walnut Creek, Big Dalton Wash and Little Dalton Wash separate the eastern area from the western area (see dashed line on Fig. 2-17). Any ground water upgradient of these areas is subject to downgradient beneficial uses and objectives, as explained in Footnote ac.

aj The border between Regions 4 and 8 crosses the Upper Santa Ana Valley Ground Water Basin.

ak Ground water in the Conejo-Tierra Rejada Volcanic Area occurs primarily in fractured volcanic rocks in the western Santa Monica Mountains and Conejo Mountain areas. These areas have not been delineated on Fig. 1-9.

al With the exception of ground water in Malibu Valley (DWR Basin No. 4-22), ground waters along the southern slopes of the Santa Monica Mountains are not considered to comprise a major basin and accordingly have not been designated a basin number by DWR or outlined on Fig. 1-9.

am DWR has not designated basins for ground waters on the San Pedro Channel Islands.

Table 2-3. Benefical Uses of Coastal Features.

COASTAL FEATURE [a]	Hydro. Unit No.	MUN	IND	PROC	NAV	POW	REC1	REC2	COMM	WARM	COLD	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET [b]
VENTURA COUNTY COASTAL																				
Nearshore			E		E		E	E	E				E	E	Ean	Ee	Ef	Ef	E	
Offshore Zone					E		E	E	E				E	E		Ee	Ef	Ef	E	
Rincon Beach	401.00				E		E	E	E				E	E			E		E	
Ventura River Estuary c	402.10				E	*	E	E	E	E		E	E	E		Ee	Ef	Ef	E	E
Ventura Keys (Marina)	403.11				E		E	E	E				E	E						
Ventura Marina	403.11		E		E		E	E	E				E	E					E	
Santa Clara River Estuary c	403.11				E		E	E	E			E	E	E		Ee	Ef	Ef		E
Mandalay Beach	403.11				E		E	E	E				E	E		Ee			E	
McGrath Lake c	403.11						Ed	Ed	P			E		E		Ee				E
Edison Canal Estuary	403.11		E				Eao	E					E	E		Ee				
Channel Islands Harbor	403.11		E		E		Eap	E	E				E	E						
Mandalay Bay (Marina)	403.11		E		E		Eaq	E					E	E						
Port Hueneme (Harbor)	403.11			E	E		E	E	E				E	E						
Ormond Beach	403.11		E		E	E	E	E	E				E	E		Ee		P	E	
Ormond Beach Wetlands c	403.11						E	E				E		E		Ee				E
Mugu Lagoon n	403.11				E		Pn	E	Ed			E	E	Eo	E	Ee,p	Ef	Ef	Ed	E
Calleguas Creek Estuary c	403.11				P		Pn	E	E			E		E		Ee,p	Ef	Ef		E
LOS ANGELES COUNTY COASTAL																				
Nearshore Zone +			E		E		E	E	E				E	E	Ean	Ee	Ef	Ef	Ear	
Offshore Zone			E		E		E	E	E				E	E		Ee	Ef	Ef	E	
Nicholas Canyon Beach	404.43				E		E	E	E				E	E				P	E	
Trancas Beach)	404.37				E		E	E	E				E	E				P	E	
Zuma County (Westward)Beach	404.36				E		E	E	E				E	E				P	Ear	
Dume State Beach	404.36				E		E	E	E				E	E				P	E	
Dume Lagoon c	404.36				E		E	E	E			E		E		Ea	Pf	Pf		E
Escondido Beach	404.34				E		E	E	E				E	E				P	E	
Dan Blocker Memorial (Coral) Beach	404.31				E		E	E	E				E	E				P	E	

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required
\+ Nearshore is defined as the zone bounded by the shoreline and a line 1000 feet from the shoreline or the 30-foot depth contours, whichever is further from the shore line. Longshore extent is from Rincon Creek to the San Gabriel River Estuary.

Footnotes are consistent for all beneficial use tables.

a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Inland Surface Waters Table (2-1) or in Wetlands Table (2-4).
d Limited public access precludes full utilization.
e One or more rare species utilize all ocean, bays, esturaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.
n Area is currently under control of the Navy: swimming is prohibited.
o Marine Habitats of the Channel Islands and Mugu Lagoon serve as pinniped haul-out areas for one or more species (i.e., sea lions).
p Habitat of the Clapper Rail.
an Areas of Special Biological Significance (along coast from Latigo Point to Laguna Point) and Big Sycamore Canyon and Abalone Cove Ecological Reserves and Point Fermin Marine Life Refuge.
ao Water contact recreation activities are prohibited by the Southern California Edison Co.
ap Water contact recreational activities are limited to the beach area at the harbor by Marine Authorities.
aq Water contact recreational activities are limited by City of Oxnard to within the easement area of each home.
ar Areas exhibiting large shellfish populations include Malibu, Point Dume, Point Fermin, White Point and Zuma Beach.

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Table 2-3. Benefical Uses of Coastal Features (Continued).

Table Page 2

COASTAL FEATURE [a]	Hydro. Unit No.	MUN	IND	PROC	NAV	POW	REC1	REC2	COMM	WARM	COLD	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET [b]
LOS ANGELES COUNTY COASTAL (CONT)																				
Puerco Beach	404.31				E		E	E	E				E	E				P	E	
Amarillo Beach	404.21				E		E	E	E				E	E				P	E	
Malibu Beach	404.21				E		E	E	E				E	E			E	Eas	Ear	
Malibu Lagoon c	404.21				E		E	E				E	E	E		Ee	Ef	Ef		E
Carbon Beach	404.18				E		E	E	E				E	E				P	E	
La Costa Beach	404.16				E		E	E	E				E	E				P	E	
Las Flores Beach	404.15				E		E	E	E				E	E				P	E	
Las Tunas Beach	404.12				E		E	E	E				E	E				P	E	
Topanga Beach	404.11				E		E	E	E				E	E				P	E	
Topanga Lagoon c	405.11				E		E	E	E			E		E		Ee	Ef	Ef		E
Will Rogers State Beach	405.13				E		E	E	E				E	E				P	E	
Santa Monica Beach	405.13				E		E	E	E				E	E			E	Eas	E	
Venice Beach	405.13				E		E	E	E				E	E		E	E	Eas	E	
Marina Del Rey							E													
Harbor	405.13				E		E	E	E				E	E					E	
Public Beach Areas	405.13				E		E	E	E				E	E		E				
All other Areas	405.13				E		E	E	E				E	E		E			E	
Entrance Channel	405.13				E		E	E	E				E	E		E			E	
Ballona Creek Estuary c,w	405.13				E		E	E	E			E	E	E		Ee	Ef	Ef	E	
Ballona Lagoon/Venice Canals c	405.13				E		E	E	E			E	E	E		Ee	Ef	Ef	E	E
Ballona Wetlands c	405.13						E	E				E		E		Ee	Ef	Ef		E
Del Rey Lagoon c	405.13				E		E	E	E			E		E		Ee	Ef	Ef		E
Dockweiler Beach	405.12		E		E		E	E	E				E	E				P		
Manhattan Beach	405.12				E		E	E	E				E	E				P	E	
Hermosa Beach	405.12				E		E	E	E				E	E				Eas	E	
King Harbor	405.12		E		E		E	E	E				E	E		E				
Redondo Beach	405.12		E		E		E	E	E				E	E		E	E	Eas	E	
Torrance Beach	405.12				E		E	E	E				E	E			E	Eas	E	
Point Vicente Beach	405.11				E		E	E	E				E	E				P	E	
Royal Palms Beach	405.11				E		E	E	E				E	E				P	E	

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required

Footnotes are consistent for all beneficial use tables.

a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.

b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.

c Coastal waterbodies which are also listed in Inland Surface Waters Table (2-1) or in Wetlands Table (2-4).

e One or more rare species utilize all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.

f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.

ar Areas exhibiting large shellfish populations include Malibu, Point Dume, Point Fermin, White Point and Zuma Beach

as Most frequently used grunion spawning beaches. Other beaches may be used as well.

w These areas are engineered channels. All references to Tidal Prisms in Regional Board documents are functionally equivalent to estuaries.

Table 2-3. Benefical Uses of Coastal Features (Continued).

COASTAL FEATURE [a]	Hydro. Unit No.	MUN	IND	PROC	NAV	POW	REC1	REC2	COMM	WARM	COLD	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET [b]
LOS ANGELES COUNTY COASTAL (CONT)																				
Whites Point County Beach	405.11				E		E	E	E				E	E				P	E	
Cabrillo Beach	405.12				E		E	E	E				E	E			E	Eas	E	
Los Angeles-Long Beach Harbor																				
Outer Harbor	405.12				E		E	E	E				E			E			P	
Marinas	405.12		E		E		E	E	E				E			E			P	
Public Beach Areas	405.12				E		E	E	E				E	E		E		P	E	
All Other Inner Areas	405.12		E		E		P	E	E				E			Ee			P	
Dominguez Channel Estuary c,w	405.12				P		E	E	E			E	E	E		Ee	Ef	Ef		
Los Angeles River Estuary c,w	405.12		E		E		E	E	E			E	E	E		Ea	Ef	Ef	P	E
Alamitos Bay	405.12		E		E		E	E	E			E	E	E		E			E	E
Los Cerritos Wetlands c	405.15				E		E	E	E			E		E		Ea	Pf	Pf	E	E
Los Cerritos Channel Estuary c	405.12		E		E		E	E	E			E	E	E		Ea	Ef	Ef	E	
San Gabriel River Estuary c,w	405.15		E		E		E	E	E			E	E	E		Ea	Ef	Ef	P	
Long Beach Marina	405.12						P	E	E				E			E			E	
Public Beach Areas	405.12				E		E	E	E				E			E		P		
All other Areas	405.12						P	E	E				E			E			P	
Marina Stadium	405.12						P	E	E				E			E			E	
Long Beach	405.12				E		E	E	E				E	E			E	Eas	E	
ISLANDS: NEARSHORE ZONES+																				
Anacapa Island	406.10				E		E	E	E				E	Eo	Eat	E		P	E	
San Nicolas Island	406.20				E		E	E	E				E	Eo	Eat	E		P	E	
Begg Rock Nearshore Zone	406.20						E	E	E				E	Eo	Eat	E		P	E	
Santa Barbara Island	406.30				E		E	E	E				E	Eo	Eat	E		P	E	
Santa Catalina Island	406.40	P*			E		E	E	E				E	Eo	Eat	E		P	E	
San Clemente Island	406.50				E		E	E	E				E	Eo	Eat	E		P	E	

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required
* Asterixed MUN designations are designated under SB 88-63 and RB-03. Some designations may be considered for exemptions at a later date (See pages 2-3 and 2-4 for more details).
\+ Nearshore is defined as the zone bounded by the shoreline and a line 1000 feet from the shoreline or the 30-foot depth contours, whichever is further from the shore line.

Footnotes are consistent for all beneficial use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Inland Surface Waters Table (2-1) or in Wetlands Table (2-4).
e One or more rare species utilize all ocean, bays, esturaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.
o Marine Habitats of the Channel Islands and Mugu Lagoon serve as pinniped haul-out areas for one or more species (i.e., sea lions).
w These areas are engineered channels. All references to Tidal Prisms in Regional Board documents are functionally equivalent to estuaries.
as Most frequently used grunion spawning beaches. Other beaches may be used as well.
at Areas of Special Biological Significance or ecological reserves.

Table 2-4. Beneficial Uses of Significant Coastal Wetlands *.

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
Ventura River Estuary c	402.10							E		E	E	E		E			E	E	E		Ee	Ef	Ef	E	E
Santa Clara River Estuary c	403.11							E		E	E	E					E	E	E		Ee	Ef	Ef		E
McGrath Lake c	403.11									Ed	Ed	P					E		E		Ee				E
Ormond Beach Wetlands c	403.11									E	E						E		E		Ee				E
Mugu Lagoon c	403.11							E		Pn	E	Ed					E	E	Eo	E	Ee,p	Ef	Ef	Ed	E
Dume Lagoon c	403.36							E		E	E	E					E		E		Ee	Pf	Pf		E
Malibu Lagoon c	404.21							E		E	E						E	E	E		Ee	Ef	Ef		E
Topanga Lagoon c	404.11							E		E	E	E					E		E		Ee	Ef	Ef		E
Ballona Lagoon/Venice Canals c	405.13							E		E	E	E					E	E	E		Ee	Ef	Ef	E	E
Ballona Wetlands c	405.13									E	E						E		E		Ee	Ef	Ef		E
Del Rey Lagoon c	405.12							E		E	E	E					E		E		Ee	Ef	Ef		E
Los Cerritos Wetlands c	405.15							E		E	E	E					E		E		Ee	Pf	Pf	E	E

* This list may not be all inclusive. More areas may be added as information becomes available.
E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required

Footnotes are consistent for all beneficial use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries.
Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody.
Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Inland Surface Waters Table (2-1) or in Coastal Features Table (2-3).
d Limited public access precludes full utilization.
e One or more rare species utilize all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development.
This may include migration into areas which are heavily influenced by freshwater inputs.
n Area is currently under control of the Navy: swimming is prohibited.
o Marine Habitats of the Channel Islands and Mugu Lagoon
serve as pinniped haul-out areas for one or more species (i.e., sea lions).
p Habitat of the Clapper Rail.

Water Quality Control Plan Los Angeles Region

Chapter 2. Beneficial Uses Figure 2-1 ~ Figure 2-22

Figure 2-1. Miscellaneous streams and coastal features, Ventura County.

Figure 2-2. Major surface waters of the Ventura River watershed.

Figure 2-3. Major surface waters of the Santa Clara River watershed.

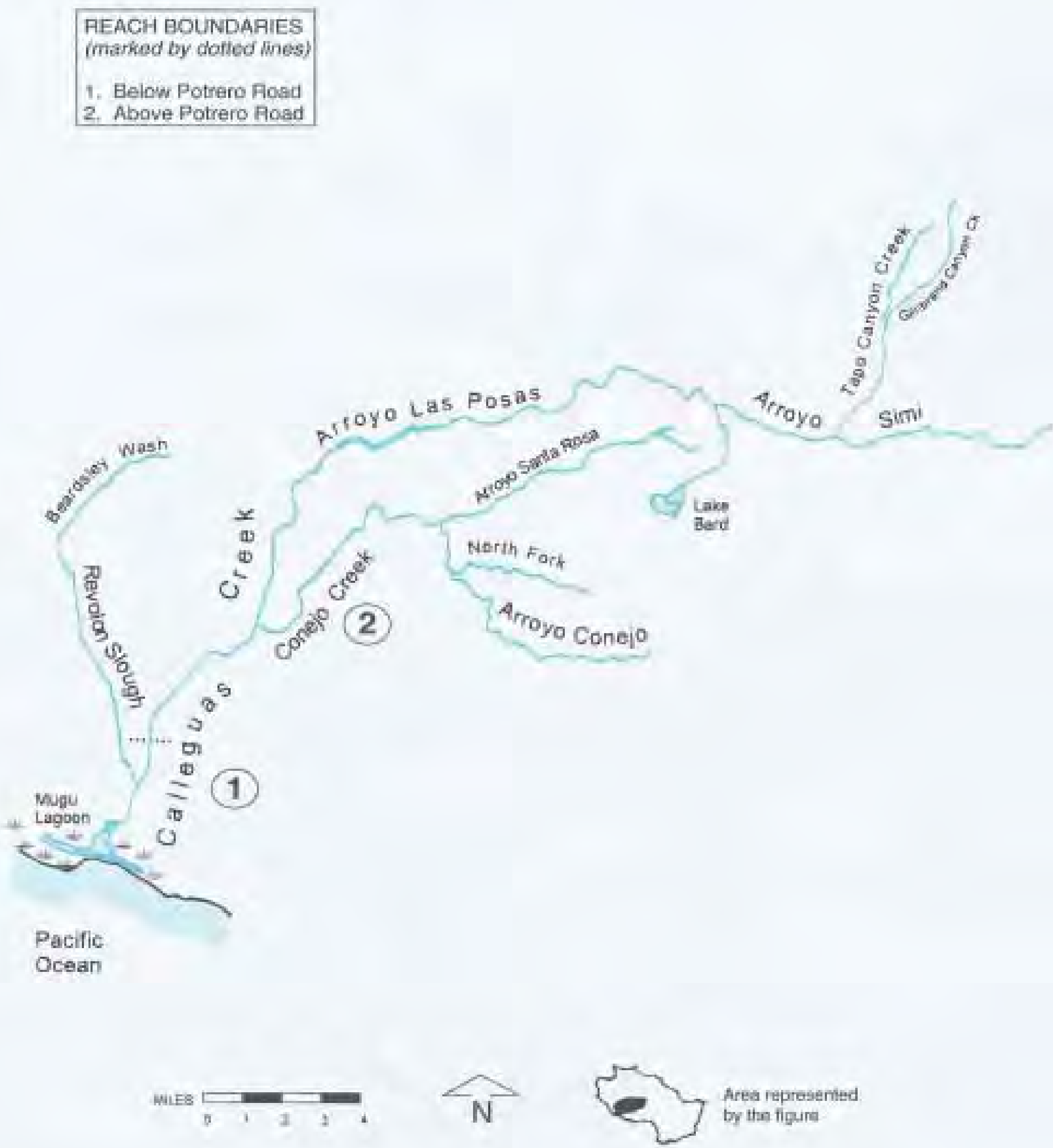


Figure 2-4. Major surface waters of the Calleguas-Conejo Creek watershed.

Figure 2-5. Major surface waters of the Malibu Creek watershed.

* Ballona Creek extends into a complex underground network of stormdrains which reaches to Beverly Hills and West Hollywood, draining 130 square miles.

Figure 2-6. Major surface waters of the Ballona Creek watershed.

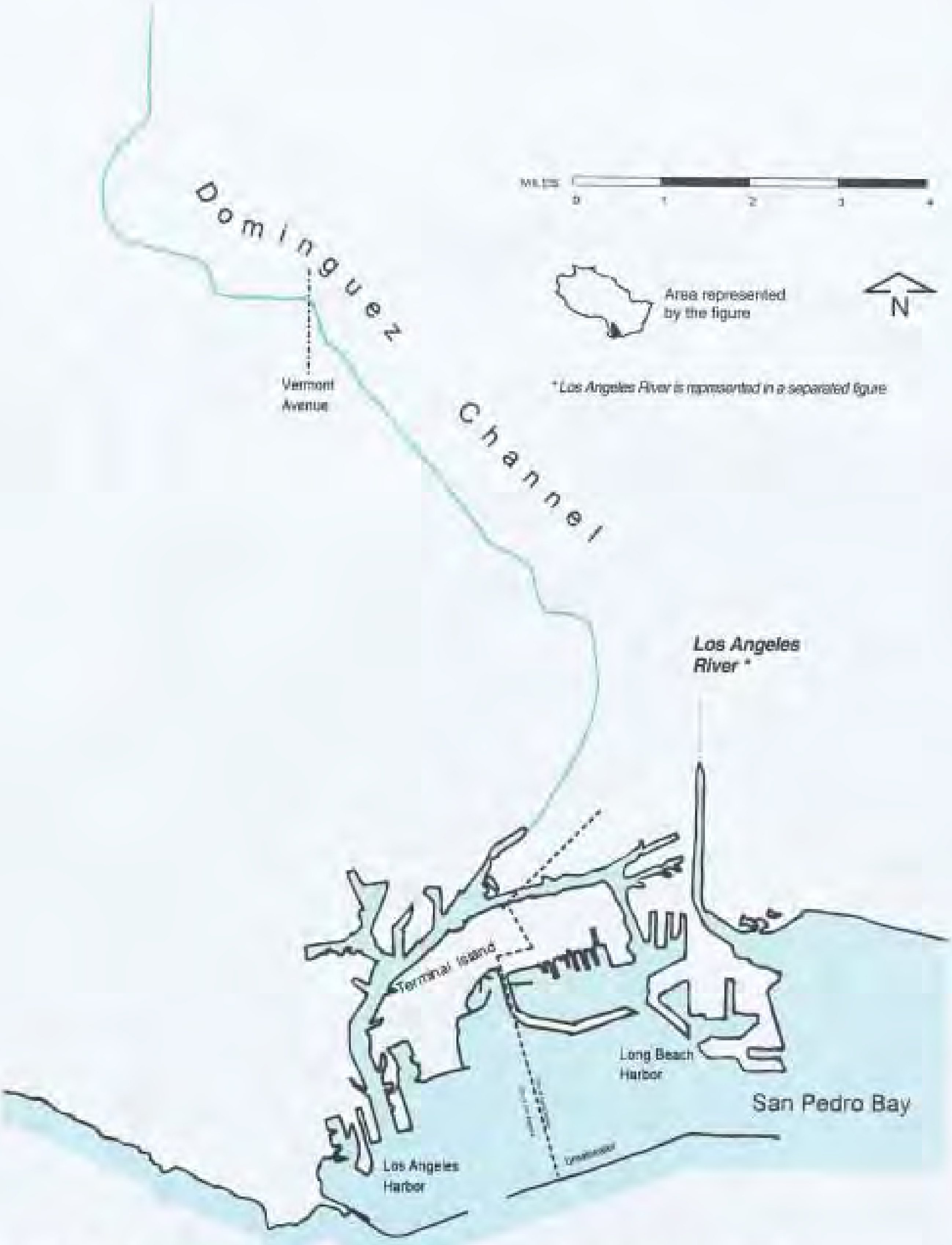
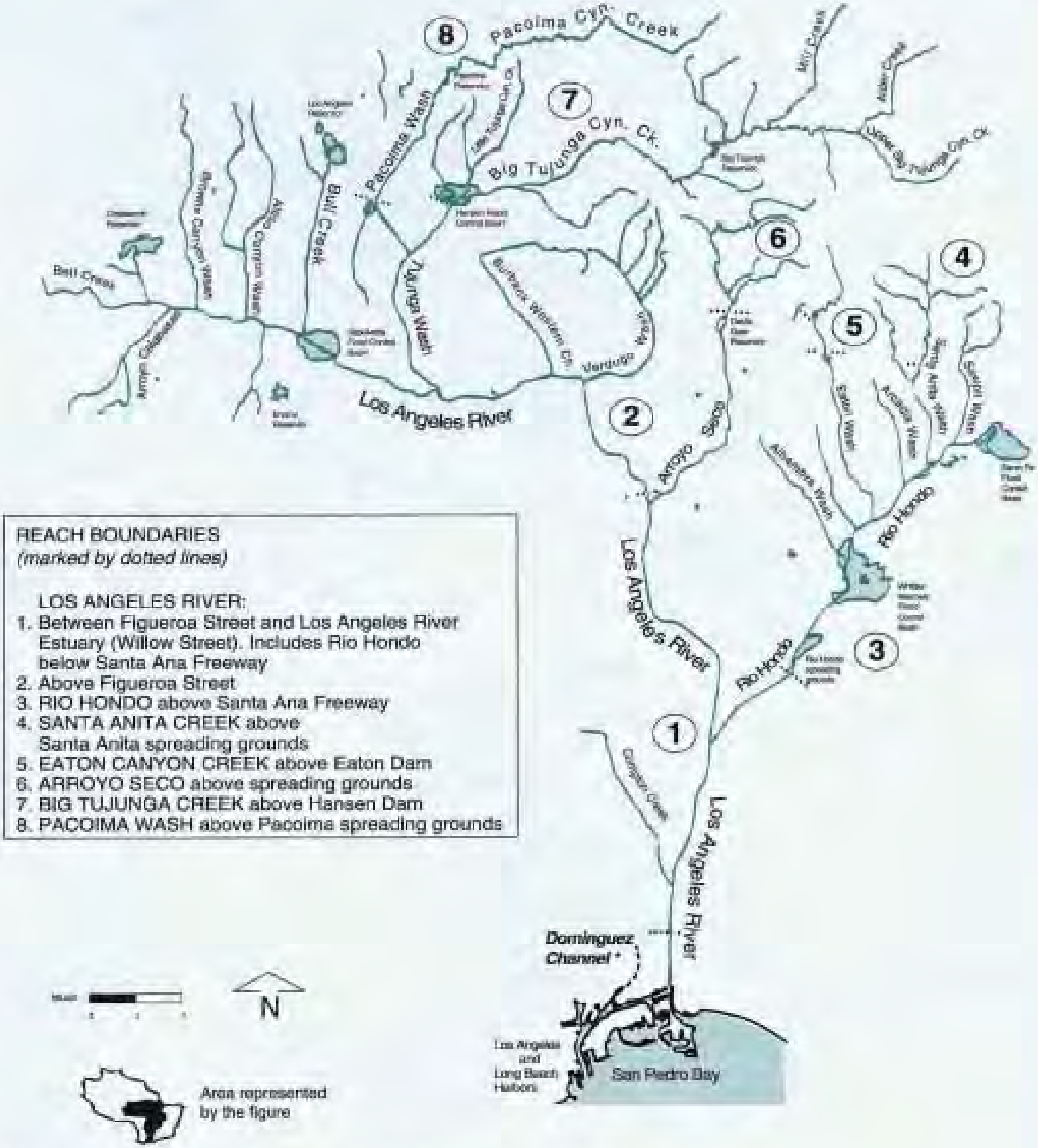


Figure 2-7. Major surface waters of the Dominguez Channel watershed.



** Dominguez Channel is represented in a separated figure*

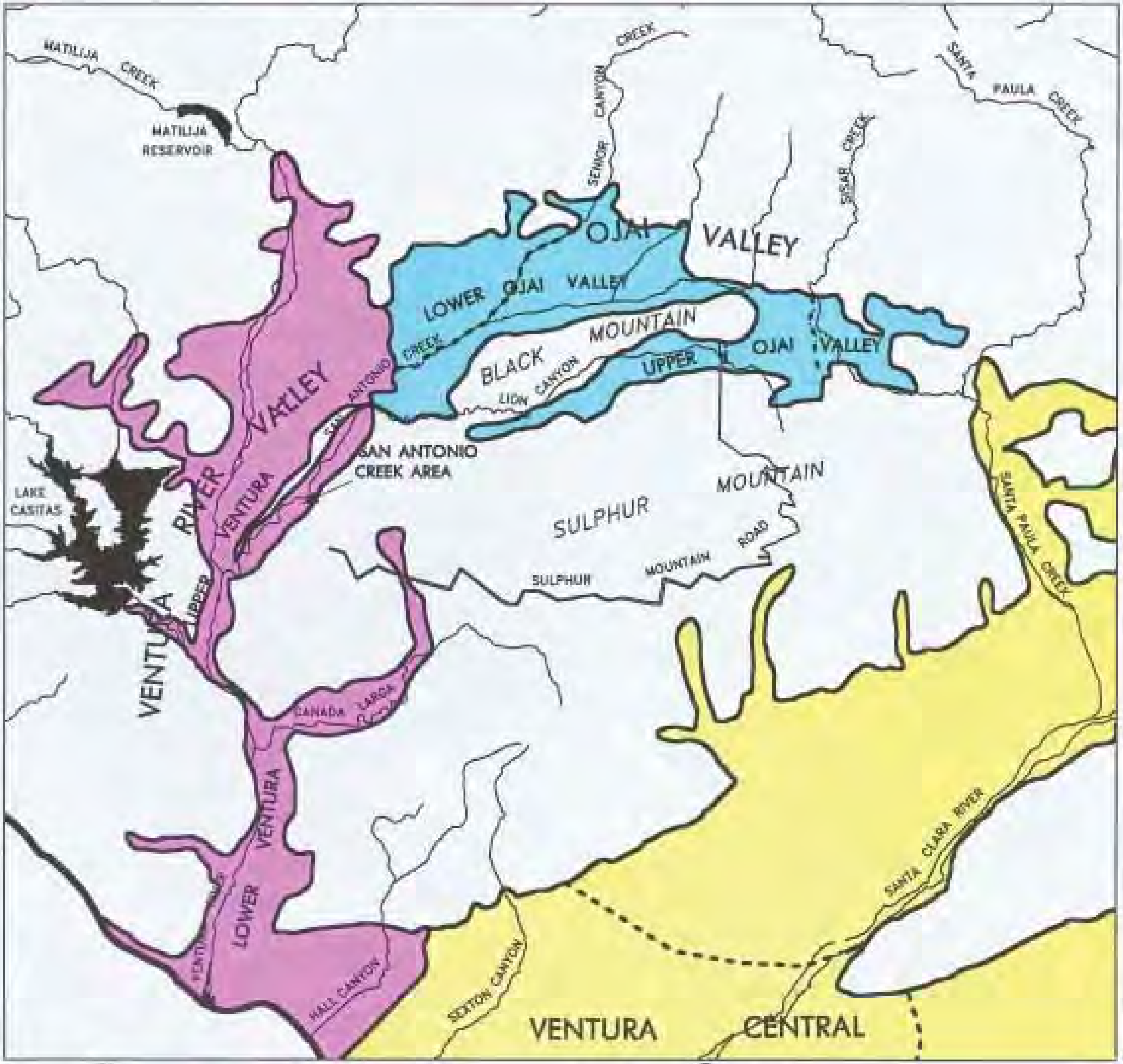
Figure 2-8. Major surface waters of the Los Angeles River watershed.

Figure 2-9. Major surface waters of the San Gabriel River watershed.

Figure 2-10. Miscellaneous streams and coastal features, Los Angeles County.

FIGURE 2-11

OJAI VALLEY AND VENTURA RIVER VALLEY GROUNDWATER BASINS



CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD LOS ANGELES REGION (4)

REGIONAL BOUNDARY

STREAMS

N

Miles

0 2 4

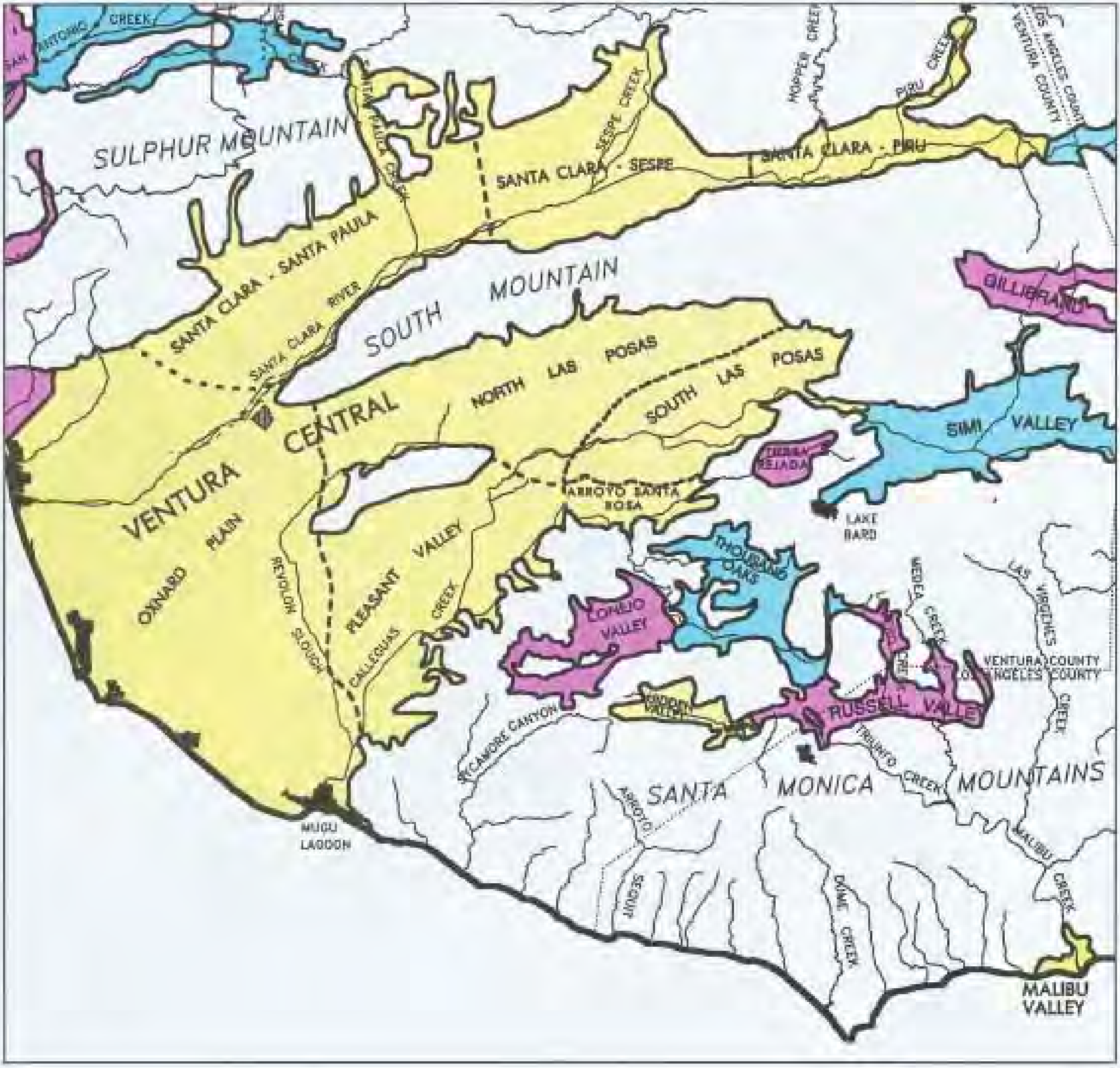


FIGURE 2–12

VENTURA CENTRAL GROUNDWATER BASINS

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

REGIONAL BOUNDARY

STREAMS

COUNTY LINE

SPREADING GROUNDS

N

Miles

0 2 4

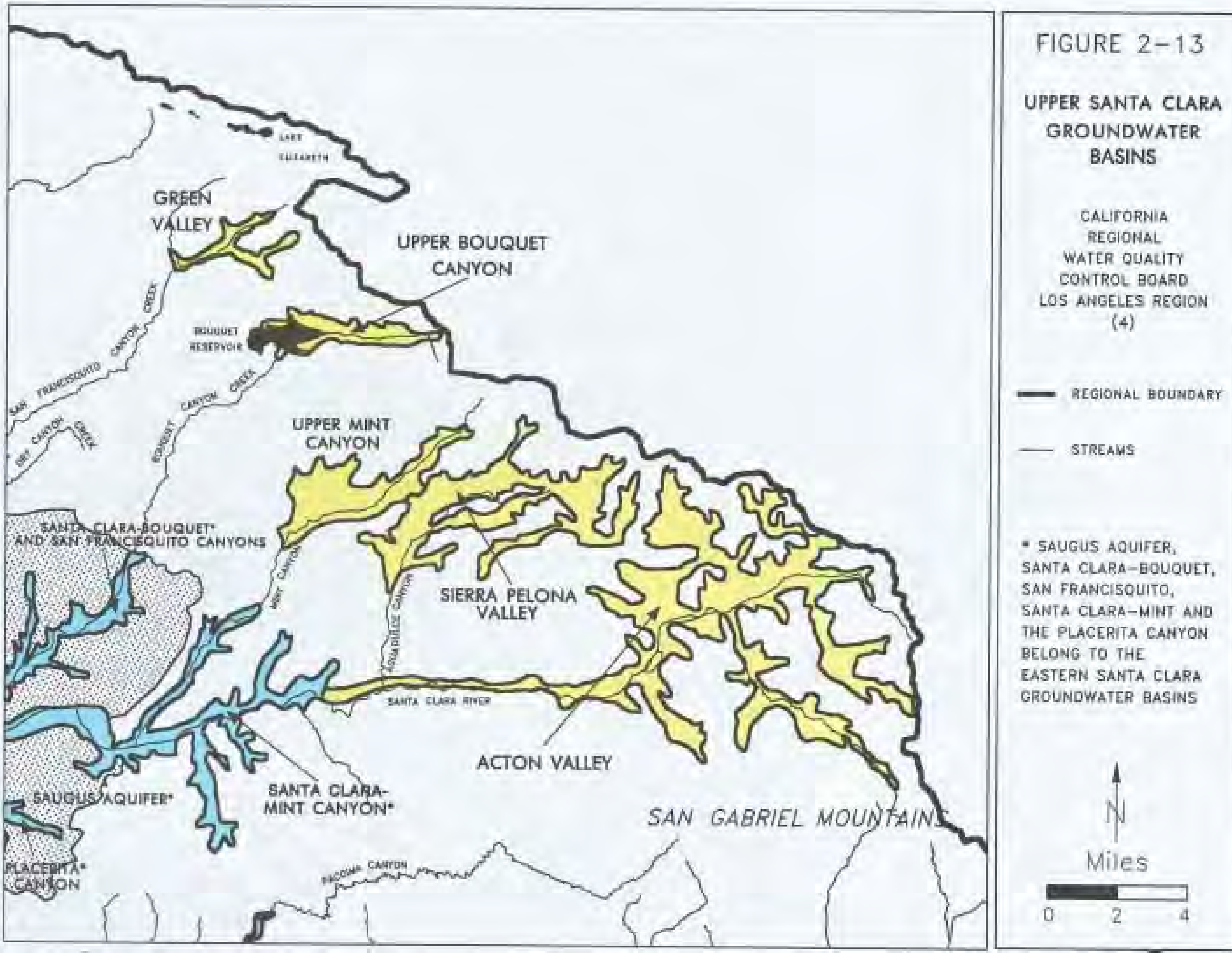


FIGURE 2-13
UPPER SANTA CLARA GROUNDWATER BASINS
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD LOS ANGELES REGION (4)
REGIONAL BOUNDARY
STREAMS
* SAUGUS AQUIFER, SANTA CLARA-BOUQUET, SAN FRANCISQUITO, SANTA CLARA-MINT AND THE PLACERITA CANYON BELONG TO THE EASTERN SANTA CLARA GROUNDWATER BASINS
N
Miles
0 2 4
GREEN VALLEY
UPPER BOUQUET CANYON
BOUQUET RESERVOIR
UPPER MINT CANYON
SIERRA PELONA VALLEY
ACTON VALLEY
SANTA CLARA RIVER
SANTA CLARA-BOUQUET* AND SAN FRANCISQUITO CANYONS
SAUGUS AQUIFER*
SANTA CLARA-MINT CANYON*
PLACERITA* CANYON
SAN GABRIEL MOUNTAINS
SAN FRANCISQUITO CANYON CREEK
BOUQUET CANYON CREEK
MINT CANYON
PACOIMA CANYON

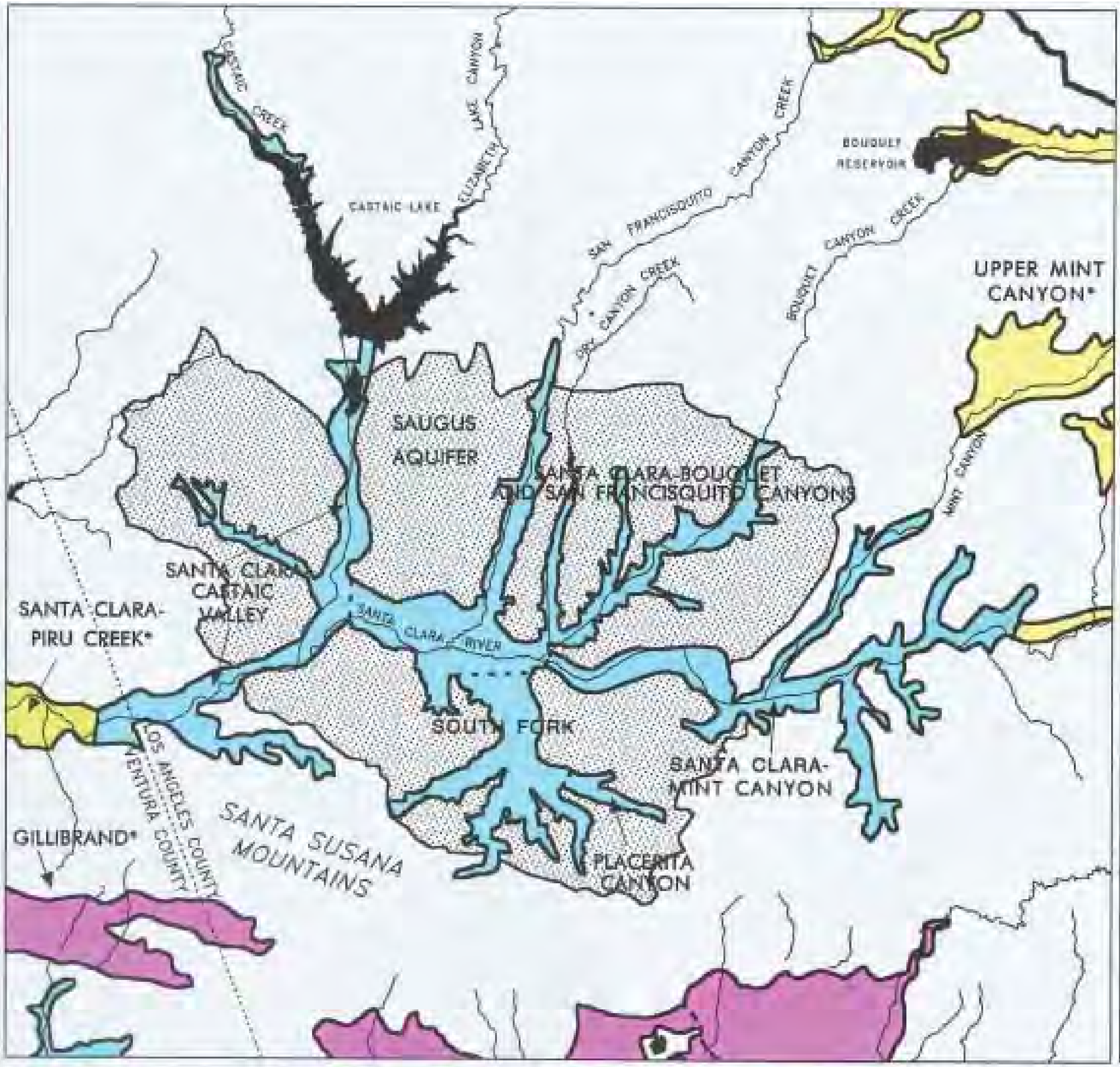


FIGURE 2–14

EASTERN SANTA CLARA GROUNDWATER BASINS

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

REGIONAL BOUNDARY

STREAMS

COUNTY LINE

* UPPER MINT CANYON IS PART OF THE UPPER SANTA CLARA BASINS.

SANTA CLARA–PIRU IS PART OF THE VENTURA CENTRAL BASINS.

GILLIBRAND IS PART OF VENTURA CENTRAL BASINS.

N

Miles

0 2 4

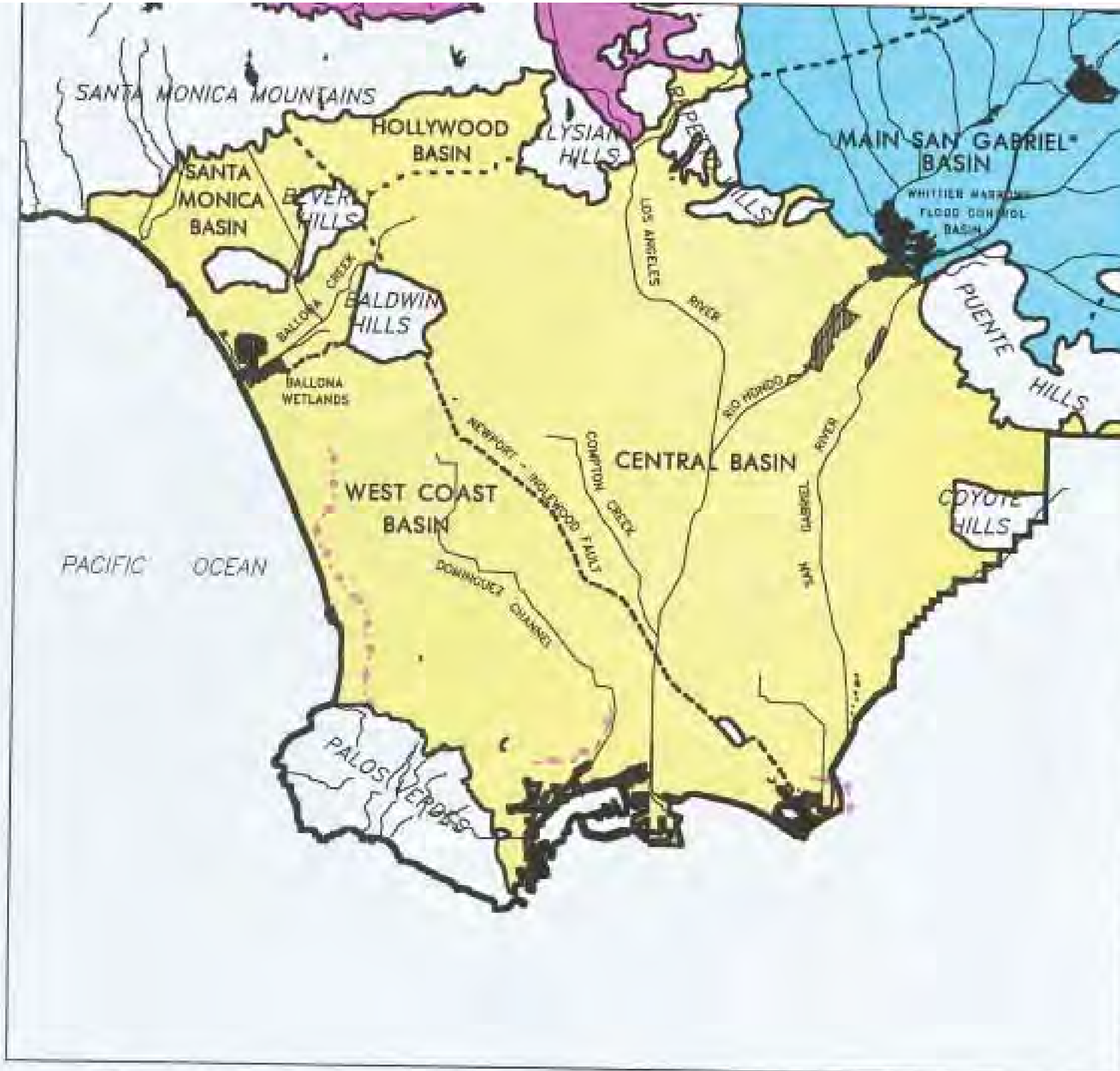


FIGURE 2–15

LOS ANGELES COASTAL GROUNDWATER BASINS

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD LOS ANGELES REGION (4)

*THE MAIN SAN GABRIEL BASIN IS A PART OF THE SAN GABRIEL VALLEY GROUNDWATER BASINS.

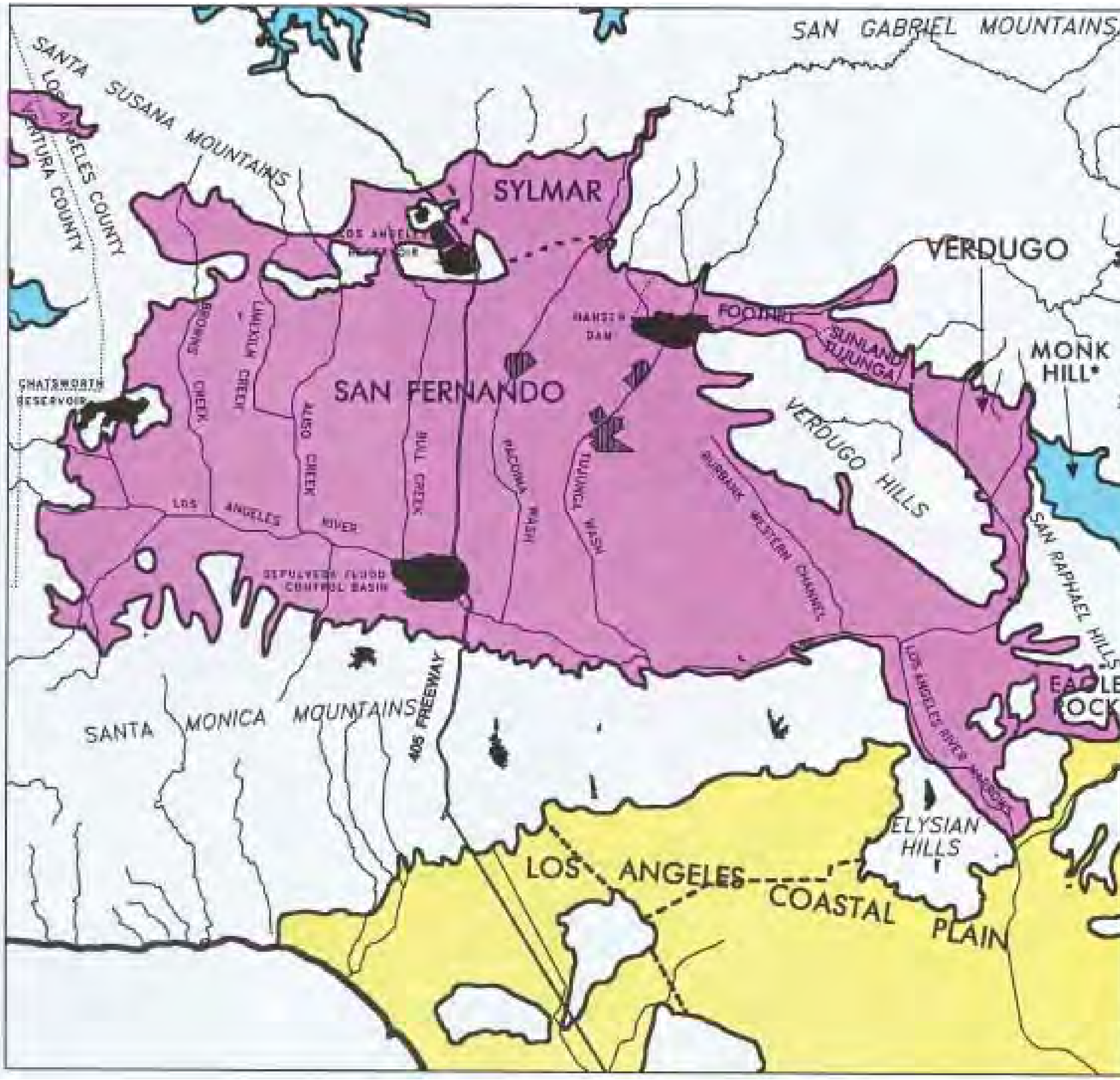


FIGURE 2–16

SAN FERNANDO VALLEY GROUNDWATER BASINS

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

REGIONAL BOUNDARY

STREAMS

COUNTY LINE

SPREADING GROUNDS

* MONK HILL IS A PART OF THE RAYMOND GROUNDWATER BASIN

N

Miles

0 2 4

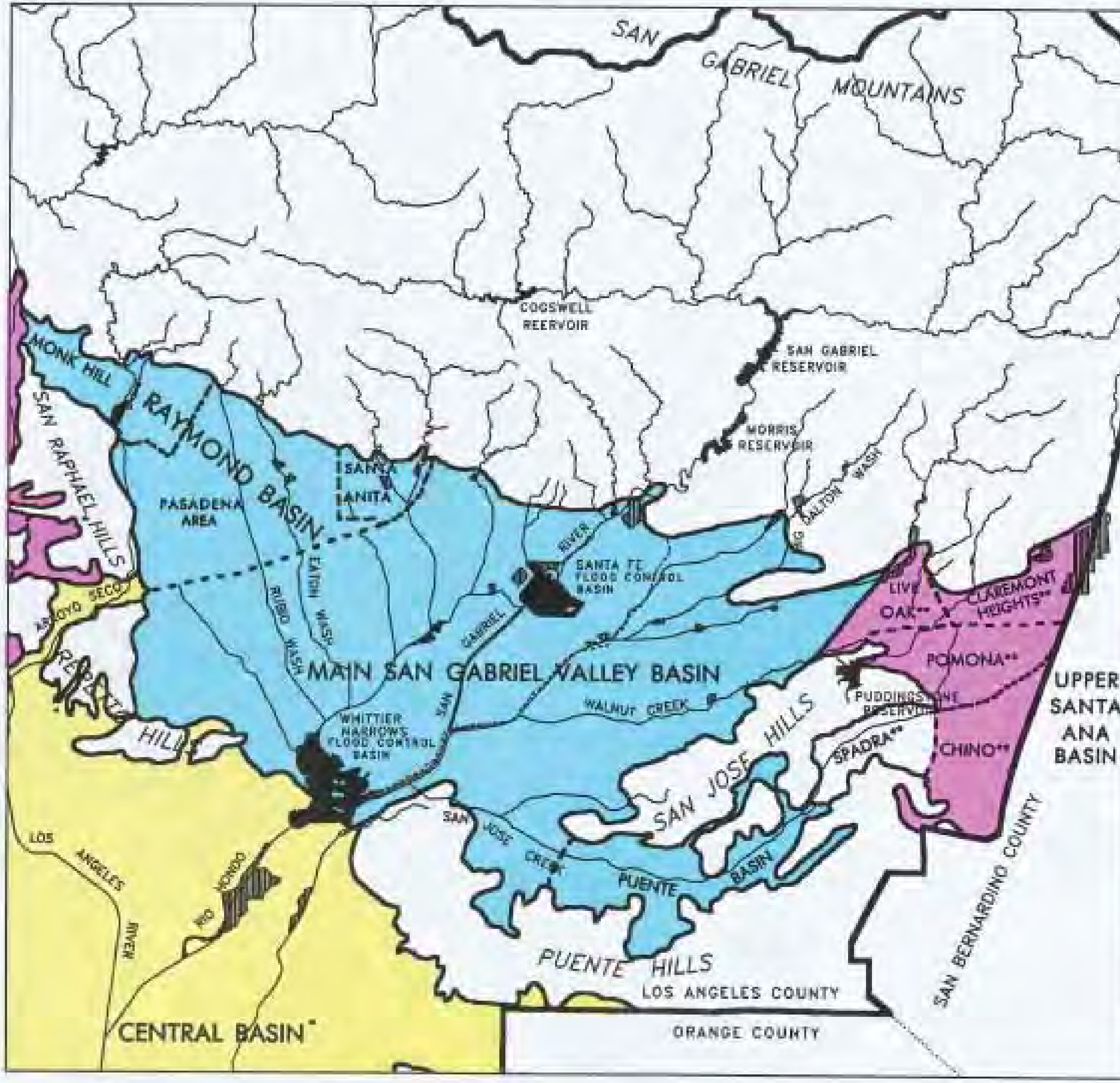


FIGURE 2-17

SAN GABRIEL VALLEY AND UPPER SANTA ANA VALLEY GROUNDWATER BASINS

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

REGIONAL BOUNDARY

STREAMS

SPREADING GROUNDS

* CENTRAL BASIN IS A PART OF THE LA COASTAL PLAIN.

** LIVE OAK, CLAREMONT HEIGHTS POMONA, SPADRA AND CHINO ARE PART OF THE UPPER SANTA ANA VALLEY GROUNDWATER BASIN

N

Miles

0 2 4

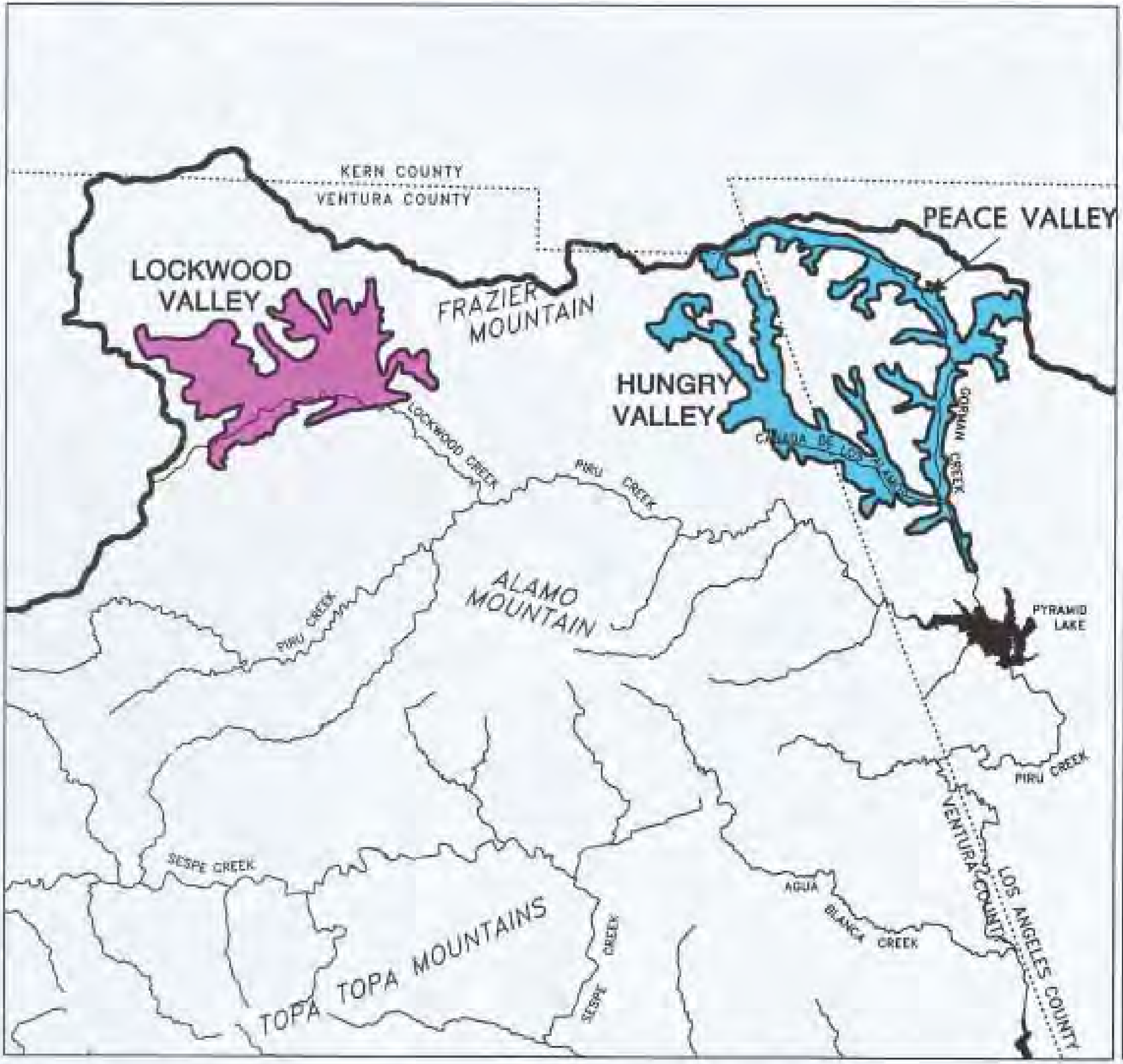


FIGURE 2–18

LOCKWOOD VALLEY
HUNGRY VALLEY
PEACE VALLEY
GROUNDWATER BASINS

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

REGIONAL BOUNDARY

STREAMS

COUNTY LINE

N

Miles

0 2 4

Figure 2-19. Ventura Harbor, Marina, and Keys.

Figure 2-20. Marina Del Rey.

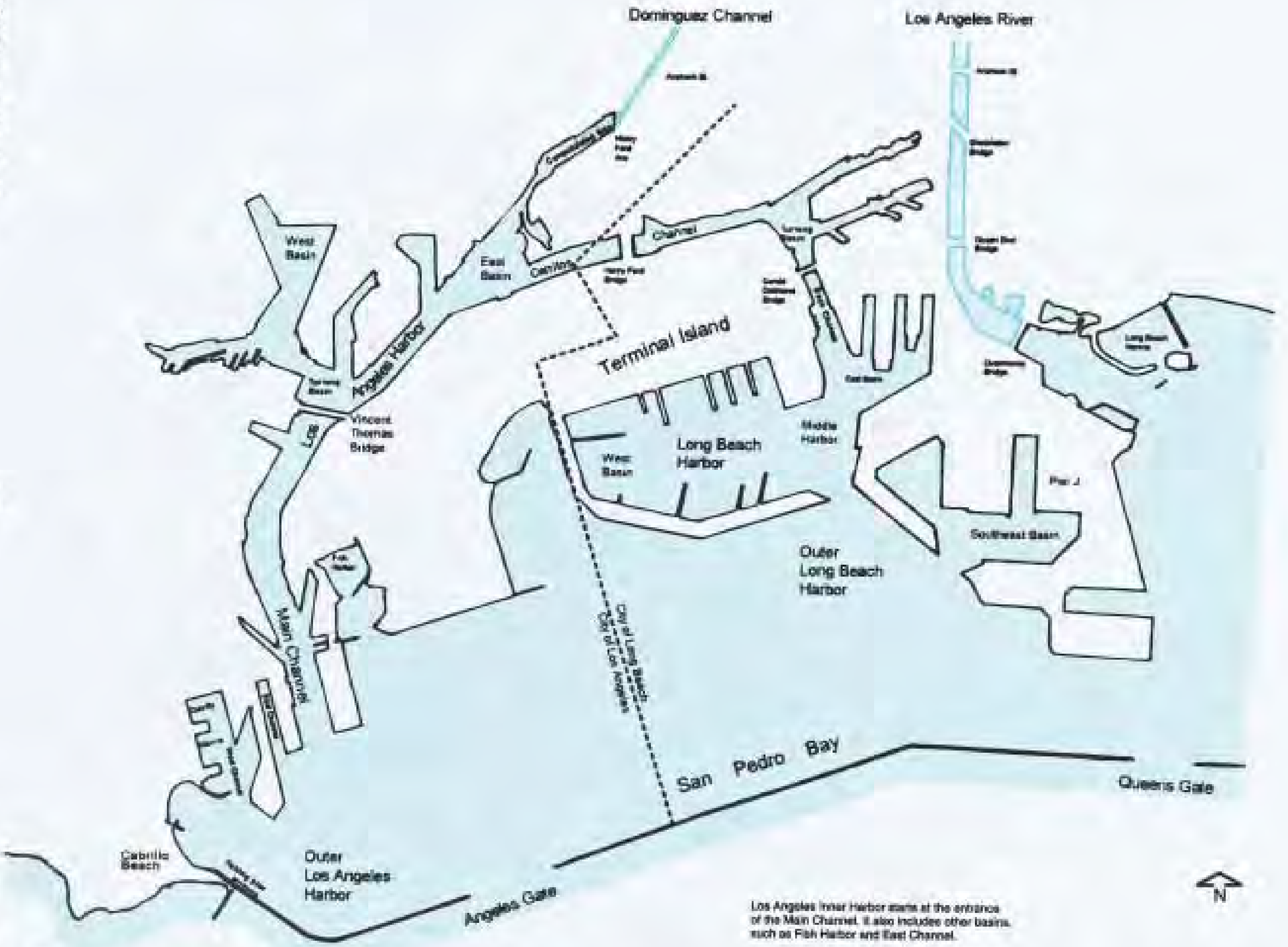


Figure 2-21. Los Angeles Harbor and Long Beach Harbor.

Los Angeles Inner Harbor starts at the entrance of the Main Channel. It also includes other basins, such as Fish Harbor and East Channel.

Long Beach Inner Harbor starts at the entrance of the Middle Harbor. It also includes other basins, such as Southeast Basin.

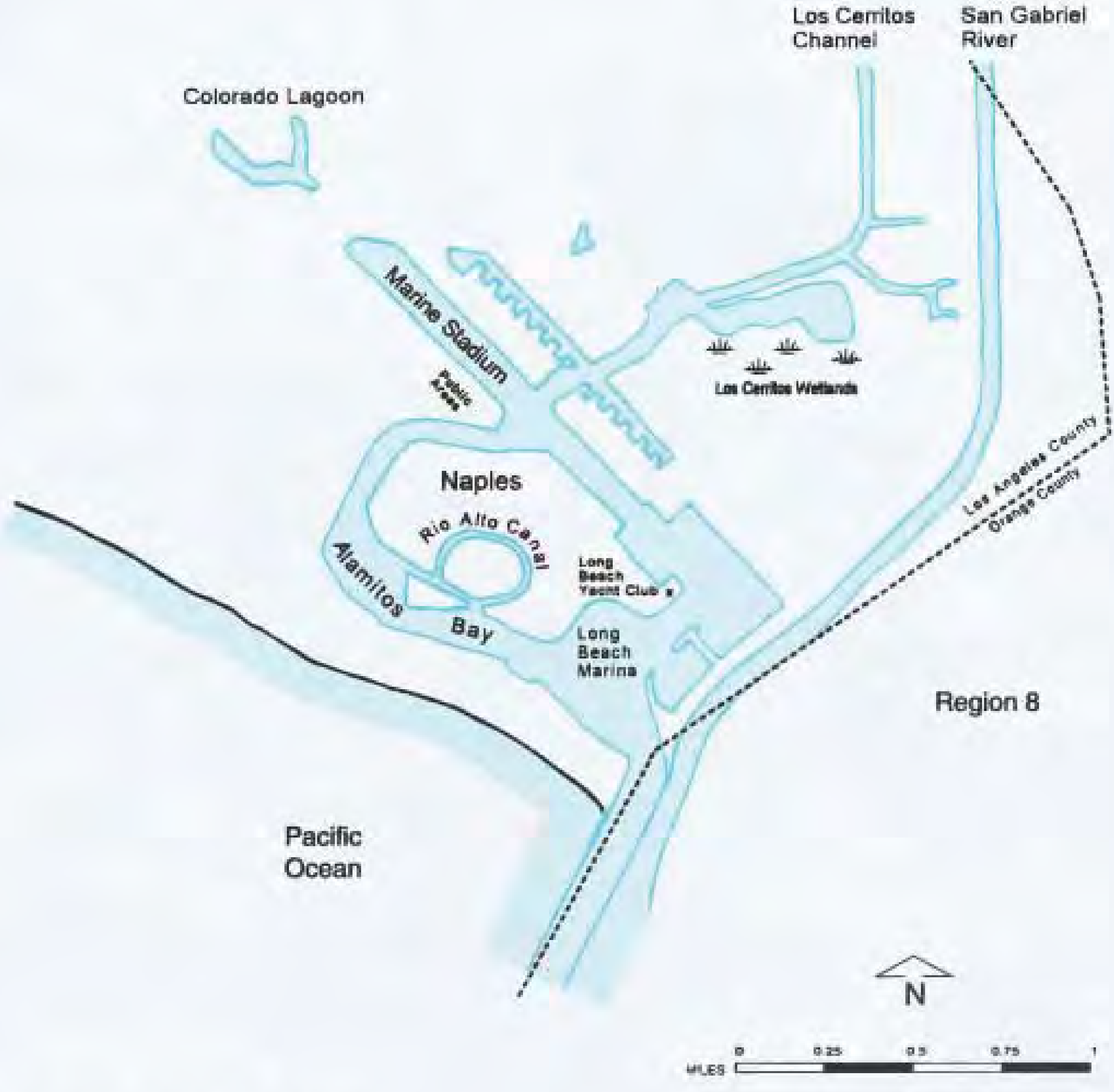


Figure 2-22. Alamitos Bay.

3. WATER QUALITY OBJECTIVES

Table of Contents

Introduction

The Clean Water Act (§303) requires states to develop water quality standards for all waters and to submit to the USEPA for approval all new or revised water quality standards which are established for inland surface and ocean waters. Water quality standards consist of a combination of beneficial uses (designated in Chapter 2) and water quality objectives (contained in this Chapter).

In addition to the federal mandate, the California Water Code (§13241) specifies that each Regional Water Quality Control Board shall establish water quality objectives. The Water Code defines water quality objectives as "the allowable limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area." Thus, water quality objectives are intended (i) to protect the public health and welfare and (ii) to maintain or enhance water quality in relation to the designated existing and potential beneficial uses of the water. Water quality objectives are achieved through Waste Discharge Requirements and other programs outlined in Chapter 4, Strategic Planning and Implementation. These objectives, when compared with future water quality data, also provide the basis for identifying trends toward degradation or enhancement of regional waters.

These water quality objectives supersede those contained in all previous Basin Plans and amendments adopted by the Los Angeles Regional Board. As new information becomes available, the Regional Board will review the objectives contained herein and develop new objectives as necessary. In addition, this Plan will be reviewed every three years (triennial review) to determine the need for modification.

Statement of Policy with Respect to Maintaining High Quality of Waters in California

A key element of California's water quality standards is the state's Antidegradation Policy. This policy, formally referred to as the *Statement of Policy with Respect to Maintaining High Quality Waters in California* (State Board Resolution No. 68-16), restricts degradation of surface or ground waters. In particular, this policy protects waterbodies where existing quality is higher than is necessary for the protection of beneficial uses.

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 68-16

STATEMENT OF POLICY WITH RESPECT TO MAINTAINING HIGH QUALITY OF WATERS IN CALIFORNIA

WHEREAS the California Legislature has declared that it is the policy of the State that the granting of permits and licenses for unappropriated water and the disposal of wastes into the waters of the State shall be so regulated as to achieve highest water quality consistent with maximum benefit to the people of the State and shall be controlled so as to promote the peace, health, safety and welfare of the people of the State; and

WHEREAS water quality control policies have been and are being adopted for waters of the State; and

WHEREAS the quality of some waters of the State is higher than that established by the adopted policies and it is the intent and purpose of this Board that such higher quality shall be maintained to the maximum extent possible consistent with the declaration of the Legislature;

NOW, THEREFORE, BE IT RESOLVED:

1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

2. Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

3. In implementing this policy, the Secretary of the Interior will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act.

BE IT FURTHER RESOLVED that a copy of this resolution be forwarded to the Secretary of the Interior as part of California's water quality control policy submission.

CERTIFICATION

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on October 24, 1968.

Dated: October 28, 1968

Original signed by
Kerry W. Mulligan, Executive Officer
State Water Resources Control Board

Under the Antidegradation Policy, any actions that can adversely affect water quality in all surface and ground waters (i) must be consistent with the maximum benefit to the people of the state, (ii) must not unreasonably affect present and anticipated beneficial use of such water, and (iii) must not result in water quality less than that prescribed in water quality plans and policies. Furthermore, any actions that can adversely affect surface waters are also subject to the federal Antidegradation Policy (40 CFR 131.12), developed under the CWA. The USEPA, Region IX, has also issued detailed guidance for the implementation of federal antidegradation regulations for surface waters within its jurisdiction (USEPA, 1987).

Regional Objectives for Inland Surface Waters

Narrative or numerical water quality objectives have been developed for the following parameters (listed alphabetically) and apply to all inland surface waters and enclosed bays and estuaries (including wetlands) in the Region. *Water quality objectives are in italics.*

Ammonia

The neutral, un-ionized ammonia species (NH_3) is highly toxic to fish and other aquatic life. The ratio of toxic NH_3 to total ammonia ($NH_4^+ + NH_3$) is primarily a function of pH, but is also affected by temperature and other factors. Additional impacts can also occur as the oxidation of ammonia lowers the dissolved oxygen content of the water, further stressing aquatic organisms. Ammonia also combines with chlorine (often both are present) to form chloramines - persistent toxic compounds that extend the effects of ammonia and chlorine downstream.

Oxidation of ammonia to nitrate may lead to groundwater impacts in areas of recharge.

In order to protect aquatic life, ammonia concentrations in receiving waters shall not exceed the values listed for the corresponding instream conditions in Tables 3-1 to 3-4.

Timing of compliance with this objective will be determined on a case-by-case basis. Discharges will have up to 8 years following the adoption of this plan by the Regional Board to (i) make the necessary adjustments/improvements to meet these objectives or (ii) to conduct studies leading to an approved site-specific objective for ammonia. If it is determined that there is an immediate threat or impairment of beneficial uses due to ammonia, the objectives in Tables 3-1 to 3-4 shall apply.

In order to protect underlying groundwater basins, ammonia shall not be present at levels that when oxidized to nitrate, pose a threat to groundwater.

Bacteria, Coliform

Total and fecal coliform bacteria are used to indicate the likelihood of pathogenic bacteria in surface waters. Water quality objectives for total and fecal coliform vary with the beneficial uses of the waterbody and are described below:

In waters designated for water contact recreation (REC-1), the fecal coliform concentration shall not exceed a log mean of 200/100 ml (based on a minimum of not less than four samples for any 30-day period), nor shall more than 10 percent of total samples during any 30-day period exceed 400/100 ml.

In waters designated for non-water contact recreation (REC-2) and not designated for water contact recreation (REC-1), the fecal coliform concentration shall not exceed a log mean of 2000/100 ml (based on a minimum of not less than four samples for any 30-day period), nor shall more than 10 percent of samples collected during any 30-day period exceed 4000/100 ml.

In all waters where shellfish can be harvested for human consumption (SHELL), the median total coliform concentration throughout the water column for any 30-day period shall not exceed 70/100 ml, nor shall more than ten percent of the samples collected during any 30-day period exceed 230/100 ml for a five-tube decimal dilution test or 330/100 ml when a three-tube decimal dilution test is used.

Table 3-1. One-hour Average Concentration for Ammonia[1,2] for Waters Designated as COLD (Salmonids or Other Sensitive Coldwater Species Present).

pH	Temperature, °C						
	0	5	10	15	20	25	30
Un-ionized ammonia (mg/liter NH_3)							
6.50	0.0091	0.0129	0.0182	0.026	0.036	0.036	0.036
6.75	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
7.00	0.023	0.033	0.046	0.066	0.093	0.093	0.093
7.25	0.034	0.048	0.068	0.095	0.135	0.135	0.135
7.50	0.045	0.064	0.091	0.128	0.181	0.181	0.181
7.75	0.056	0.080	0.113	0.159	0.22	0.22	0.22
8.00	0.065	0.092	0.130	0.184	0.26	0.26	0.26
8.25	0.065	0.092	0.130	0.184	0.26	0.26	0.26
8.50	0.065	0.092	0.130	0.184	0.26	0.26	0.26
8.75	0.065	0.092	0.130	0.184	0.26	0.26	0.26
9.00	0.065	0.092	0.130	0.184	0.26	0.26	0.26
Total ammonia (mg/liter NH_3)							
6.50	35	33	31	30	29	20	14.3
6.75	32	30	28	27	27	18.6	13.2
7.00	28	26	25	24	23	16.4	11.6
7.25	23	22	20	19.7	19.2	13.4	9.5
7.50	17.4	16.3	15.5	14.9	14.6	10.2	7.3
7.75	12.2	11.4	10.9	10.5	10.3	7.2	5.2
8.00	8.0	7.5	7.1	6.9	6.8	4.8	3.5
8.25	4.5	4.2	4.1	4.0	3.9	2.8	2.1
8.50	2.6	2.4	2.3	2.3	2.3	1.71	1.28
8.75	1.47	1.40	1.37	1.38	1.42	1.07	0.83
9.00	0.86	0.83	0.83	0.86	0.91	0.72	0.58

1 To convert these values to mg/liter N, multiply by 0.822

2 Source: USEPA, 1986

Table 3-2. One-hour Average Concentration for Ammonia[1,2] for Waters Designated as WARM (Salmonids or Other Sensitive Coldwater Species Absent).

pH	Temperature, °C				
	0	5	10	15	20
Un-ionized ammonia (mg/liter NH_3)					
6.50	0.0091	0.0129	0.0182	0.026	0.036
6.75	0.0149	0.021	0.030	0.042	0.059
7.00	0.023	0.033	0.046	0.066	0.093
7.25	0.034	0.048	0.068	0.095	0.135
7.50	0.045	0.064	0.091	0.128	0.181
7.75	0.056	0.080	0.113	0.159	0.22
8.00	0.065	0.092	0.130	0.184	0.26
8.25	0.065	0.092	0.130	0.184	0.26
8.50	0.065	0.092	0.130	0.184	0.26
8.75	0.065	0.092	0.130	0.184	0.26
9.00	0.065	0.092	0.130	0.184	0.26
Total ammonia (mg/liter NH_3)					
6.50	35	33	31	30	29
6.75	32	30	28	27	27
7.00	28	26	25	24	23
7.25	23	22	20	19.7	19.2
7.50	17.4	16.3	15.5	14.9	14.6
7.75	12.2	11.4	10.9	10.5	10.3
8.00	8.0	7.5	7.1	6.9	6.8
8.25	4.5	4.2	4.1	4.0	3.9
8.50	2.6	2.4	2.3	2.3	2.3
8.75	1.47	1.40	1.37	1.38	1.42
9.00	0.86	0.83	0.83	0.86	0.91

1 To convert these values to mg/liter N, multiply by 0.822

2 Source: USEPA, 1986

Table 3-3. Four-day Average Concentration for Ammonia[1,2] for Waters Designated as COLD (Salmonids or Other Sensitive Coldwater Species Present).

pH	Temperature, °C						
	0	5	10	15	20	25	30
	Un-ionized ammonia (mg/liter NH_3)						
6.50	0.0008	0.0011	0.0016	0.0022	0.0022	0.0022	0.0022
6.75	0.0014	0.0020	0.0028	0.0039	0.0039	0.0039	0.0039
7.00	0.0025	0.0035	0.0049	0.0070	0.0070	0.0070	0.0070
7.25	0.0044	0.0062	0.0088	0.0124	0.0124	0.0124	0.0124
7.50	0.0078	0.0111	0.0156	0.022	0.022	0.022	0.022
7.75	0.0129	0.0182	0.026	0.036	0.036	0.036	0.036
8.00	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
8.25	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
8.50	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
8.75	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
9.00	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
	Total ammonia (mg/liter NH_3)						
6.50	3.0	2.8	2.7	2.5	1.76	1.23	0.87
6.75	3.0	2.8	2.7	2.6	1.76	1.23	0.87
7.00	3.0	2.8	2.7	2.6	1.76	1.23	0.87
7.25	3.0	2.8	2.7	2.6	1.77	1.24	0.88
7.50	3.0	2.8	2.7	2.6	1.78	1.25	0.89
7.75	2.8	2.6	2.5	2.4	1.66	1.17	0.84
8.00	1.82	1.70	1.62	1.57	1.10	0.78	0.56
8.25	1.03	0.97	0.93	0.90	0.64	0.46	0.33
8.50	0.58	0.55	0.53	0.53	0.38	0.28	0.21
8.75	0.34	0.32	0.31	0.31	0.23	0.173	0.135
9.00	0.195	0.189	0.189	0.196	0.148	0.116	0.094

1 To convert these values to mg/liter N, multiply by 0.822.

2 Source: USEPA, 1992

Table 3-4. Four-day Average Concentration for Ammonia[1,2] for Waters Designated as WARM (Salmonids or Other Sensitive Coldwater Species Absent).

pH	Temperature, °C						
	0	5	10	15	20	25	30
	Un-ionized ammonia (mg/liter NH_3)						
6.50	0.0008	0.0011	0.0016	0.0022	0.0031	0.0031	0.0031
6.75	0.0014	0.0020	0.0028	0.0039	0.0055	0.0055	0.0055
7.00	0.0025	0.0035	0.0049	0.0070	0.0099	0.0099	0.0099
7.25	0.0044	0.0062	0.0088	0.0124	0.0175	0.0175	0.0175
7.00	0.0078	0.0111	0.0156	0.022	0.031	0031	0.031
7.75	0.0129	0.0182	0.026	0.036	0.051	0.051	0.051
8.00	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
8.25	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
8.50	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
8.75	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
9.00	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
	Total ammonia (mg/liter NH_3)						
6.50	3.0	2.8	2.7	2.5	2.5	1.73	1.23
6.75	3.0	2.8	2.7	2.6	2.5	1.74	1.23
7.00	3.0	2.8	2.7	2.6	2.5	1.74	1.23
7.25	3.0	2.8	2.7	2.6	2.5	1.75	1.24
7.50	3.0	2.8	2.7	2.6	2.5	1.76	1.25
7.75	2.8	2.6	2.5	2.4	2.3	1.65	1.18
8.00	1.82	1.70	1.62	1.57	1.55	1.10	0.79
8.25	1.03	0.97	0.93	0.90	0.90	0.64	0.47
8.50	0.58	0.55	0.53	0.53	0.53	0.39	0.29
8.75	0.34	0.32	0.31	0.31	0.32	0.24	0.190
9.00	0.195	0.189	0.189	0.195	0.21	0.163	0.133

1 To convert these values to mg/liter N, multiply by 0.822.

2 Source: USEPA, 1992

Bioaccumulation

Many pollutants can bioaccumulate in fish and other aquatic organisms at levels which are harmful for both the organisms as well as organisms that prey upon these species (including humans).

Toxic pollutants shall not be present at levels that will bioaccumulate in aquatic life to levels which are harmful to aquatic life or human health.

Biochemical Oxygen Demand (BOD_5)

The 5-day BOD test indirectly measures the amount of readily degradable organic material in water by measuring the residual dissolved oxygen after a period of incubation (usually 5 days at 20 °C), and is primarily used as an indicator of the efficiency of wastewater treatment processes.

Waters shall be free of substances that result in increases in the BOD which adversely affect beneficial uses.

Biostimulatory Substances

Biostimulatory substances include excess nutrients (nitrogen, phosphorus) and other compounds that stimulate aquatic growth. In addition to being aesthetical unpleasant (causing taste, odor, or color problems), this excessive growth can also cause other water quality problems.

Waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growth causes nuisance or adversely affects beneficial uses.

Chemical Constituents

Chemical constituents in excessive amounts in drinking water are harmful to human health. Maximum levels of chemical constituents in drinking waters are listed in the California Code of Regulations and the relevant limits are described below.

Surface waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use.

Water designated for use as Domestic or Municipal Supply (MUN) shall not contain concentrations of chemical constituents in excess of the limits specified in the following provisions of Title 22 of the California Code of Regulations which are incorporated by reference into this plan: Table 64431-A of Section 64431 (Inorganic Chemicals), Table 64431-B of Section 64431 (Fluoride), and Table 64444-A of Section 64444 (Organic Chemicals). This incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect. (See Tables 3-5, 3-6, and 3-7.)

Table 3-5. The Maximum Contaminant Levels: Inorganic Chemicals (for MUN beneficial use) specified in Table 64431-A of Section 64431 of Title 22 of the California Code of Regulations as of 9-8-94.

Constituent	Maximum Contaminant Level mg/L
Aluminum	1.
Antimony	0.006
Arsenic	0.05
Asbestos	7 MFL*
Barium	1.
Beryllium	0.004
Cadmium	0.005
Chromium	0.05
Cyanide	0.2
Mercury	0.002
Nickel	0.1
Nitrate (as NO_3)	45.
Nitrate + Nitrite (sum as nitrogen)	10.
Nitrite (as nitrogen)	1.
Selenium	0.05
Thallium	0.002

* MFL = million fibers per liter; MCL for fibers exceeding 10 μm in lenght

Table 3-6. The Limiting and Optimum Concentrations for Fluoride (for MUN beneficial use) specified in Table 64431-B of Section 64431 of Title 22 of the California Code of Regulations as of 9-8-94.

Annual Average of Maximum Daily Air Temperature (°F)	Fluoride Concentration (mg/L)			
	Lower	Optimum	Upper	Maximum Concentration Level
53.7 and below	0.9	1.2	1.7	2.4
53.8 to 58.3	0.8	1.1	1.5	2.2
58.4 to 63.8	0.8	1.0	1.3	2.0
63.9 to 70.6	0.7	0.9	1.2	1.8
70.7 to 79.2	0.7	0.8	1.0	1.6
79.3 to 90.5	0.6	0.7	0.8	1.4

Chlorine, Total Residual

Disinfection of wastewaters with chlorine produces a chlorine residual. Chlorine and its reaction products are toxic to aquatic life.

Chlorine residual shall not be present in surface water discharges at concentrations that exceed 0.1 mg/L and shall not persist in receiving waters at any concentration that causes impairment of beneficial uses.

Color

Color in water can result from natural conditions (e.g., from plant material or minerals) or can be introduced from commercial or industrial sources. Color is primarily an aesthetic consideration, although extremely dark colored water can limit light penetration and cause additional water quality problems. Furthermore, color can impact domestic and industrial uses by discoloring clothing or foods. The secondary drinking water standard is 15 color units (DHS, 1992).

Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses.

Exotic Vegetation

Exotic (non-native) vegetation introduced in and around stream courses is often of little value as habitat (food and cover) for aquatic-dependent biota. Exotic plants can quickly out-compete native vegetation and cause other water quality impairments.

Exotic vegetation shall not be introduced around stream courses to the extent that such growth causes nuisance or adversely affects beneficial uses.

Floating Material

Floating materials can be an aesthetic nuisance as well as provide substrate for undesirable bacterial and algal growth and insect vectors.

Waters shall not contain floating materials, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

Table 3-7. The Maximum Contaminant Levels: Organic Chemicals (for MUN beneficial use) specified in Table 64444-A of Section 64444 of Title 22 of the California Code of Regulations as of 9-8-94.

Constituent	Maximum Contaminant Level mg/L
A. Volatile Organic Chemicals (VOCs)	
Benzene	0.001
Carbon Tetrachloride	0.0005
1,2-Dichlorobenzene	0.6
1,4-Dichlorobenzene	0.005
1,1-Dichloroethane	0.005
1,2-Dichloroethane	0.0005
1,1-Dichloroethylene	0.006
cis-1,2-Dichloroethylene	0.006
trans-1,2-Dichloroethylene	0.01
Dichloromethane	0.005
1,2-Dichloropropane	0.005
1,3-Dichloropropene	0.0005
Ethylbenzene	0.7
Monochlorobenzene	0.07
Styrene	0.1
1,1,2,2-Tetrachlorethane	0.001
Tetrachloroethylene	0.005
Toluene	0.15
1,2,4-Trichlorobenzene	0.07
1,1,1-Trichloroethane	0.200
1,1,2-Trichloroethane	0.005
Trichloroethylene	0.005
Trichlorofluoromethane	0.15
1,1,2-Trichloro-1,2,2-Trifluoroethane	1.2
Vinyl Chloride	0.0005
Xylenes (single isomer or sum of isomers)	1.750
B. Non-Volatile Synthetic Organic Chemicals (SOCs)	
Alachlor	0.002
Atrazine	0.003
Bentazon	0.018

Constituent	Maximum Contaminant Level mg/L
Benzo(a)pyrene	0.0002
Carbofuran	0.018
Chlordane	0.0001
2,4-D	0.07
Dalapon	0.2
1,2-Dibromo-3-chloropropane	0.0002
Di(2-ethylhexyl)adipate	0.4
Di(2-ethylhexyl)phthalate	0.004
Dinoseb	0.007
Diquat	0.02
Endothall	0.1
Endrin	0.002
Ethylene Dibromide	0.00005
Glyphosate	0.7
Heptachlor	0.00001
Heptachlor Epoxide	0.00001
Hexachlorobenzene	0.001
Hexachlorocyclopentadiene	0.05
Lindane	0.0002
Methoxychlor	0.04
Molinate	0.02
Oxamyl	0.2
Pentachlorophenol	0.001
Picloram	0.5
Polychlorinated Biphenyls	0.0005
Simazine	0.004
Thiobencarb	0.07
Toxaphene	0.003
2,3,7,8-TCDD (Dioxin)	$3X10^{-8}$
2,4,5-TP (Silvex)	0.05

Methylene Blue Activated Substances (MBAS)

The MBAS procedure tests for the presence of anionic surfactants (detergents) in water. Positive results can indicate the presence of domestic wastewater. This test can be used to indicate impacts from septic systems. Surfactants disturb the surface tension which affects insects and can affect gills in aquatic life. The secondary drinking water standard for MBAS is 0.5 mg/L (DHS, 1992).

Waters shall not have MBAS concentrations greater than 0.5 mg/L in waters designated MUN.

Mineral Quality

Mineral quality in natural waters is largely determined by the mineral assemblage of soils and rocks and faults near the land surface. Point and nonpoint source discharges of poor quality water can degrade the mineral content of natural waters. High levels of dissolved solids renders waters useless for many beneficial uses. Elevated levels of boron affect agricultural use (especially citrus).

Numerical mineral quality objectives for individual inland surface waters are contained in Table 3-8.

Nitrogen (Nitrate, Nitrite)

High nitrate levels in drinking water can cause health problems in humans. Infants are particularly sensitive and can develop methemoglobinemia (blue-baby syndrome). Excess nitrogen in surface waters also leads to excess aquatic growth and can contribute to elevated levels of NO_3 in ground water as well. The primary drinking water standard for nitrate (as NO_3) is 45 mg/L (DHS, 1992).

Waters shall not exceed 10 mg/L nitrogen as nitrate-nitrogen plus nitrite-nitrogen (NO_3-N + NO_2-N), 45 mg/L as nitrate (NO_3), 10 mg/L as nitrate-nitrogen (NO_3-N), or 1 mg/L as nitrite-nitrogen (NO_2-N) or as otherwise designated in Table 3-8.

Oil and Grease

Oil and grease are not readily soluble in water and form a film on the water surface. Oily films can coat birds and aquatic organisms, impacting respiration and thermal regulation, and causing death. Oil and grease can also cause nuisance conditions (odors and taste), are aesthetically unpleasant, and can restrict a wide variety of beneficial uses.

Waters shall not contain oils, greases, waxes or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.

Oxygen, Dissolved (DO)

Adequate dissolved oxygen levels are required to support aquatic life. Depression of dissolved oxygen can lead to anaerobic conditions resulting in odors or, in extreme cases, in fish kills. Dissolved oxygen requirements are dependent on the beneficial uses of the waterbody.

*At a minimum (see specifics below), the **mean** annual dissolved oxygen concentration of **all** waters shall be greater than 7 mg/L, and no single determination shall be less than 5.0 mg/L, except when natural conditions cause lesser concentrations.*

The dissolved oxygen content of all surface waters designated as WARM shall not be depressed below 5 mg/L as a result of waste discharges.

The dissolved oxygen content of all surface waters designated as COLD shall not be depressed below 6 mg/L as a result of waste discharges.

The dissolved oxygen content of all surface waters designated as both COLD and SPWN shall not be depressed below 7 mg/L as a result of waste discharges.

For that area known as the Outer Harbor area of Los Angeles-Long Beach Harbors, the mean annual dissolved oxygen concentrations shall be 6.0 mg/L or greater, provided that no single determination shall be less than 5.0 mg/L.

Table 3-8. Water Quality Objectives for Selected Constituents in Inland Surface Waters[a].

Reaches are in upstream to downstream order.

WATERSHED/STREAM REACH[b]	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Boron[c] (mg/L)	Nitrogen[d] (mg/L)	SAR[e] (mg/L)
Miscellaneous Ventura Coastal Streams	*no waterbody specific objectives* [f]					
Ventura River Watershed:						
Above Camino Cielo Road	700	300	50	1.0	5	5
Between Camino Cielo Road and Casitas Vista Road	800	300	60	1.0	5	5
Between Casitas Vista Road and confluence with Weldon Canyon	1000	300	60	1.0	5	5
Between confluence with Weldon Canyon and Main Street	1500	500	300	1.5	10	5
Between Main St. and Ventura River Estuary	*no waterbody specific objectives* [f]					
Santa Clara River Watershed:						
Above Lang gaging station	500	100	50	0.5	5	5
Between Lang gaging station and Bouquet Canyon Road Bridge	800	150	100	1.0	5	5
Between Bouquet Canyon Road Bridge and West Pier Highway 99	1000	300	100	1.5	10	5
Between West Pier Highway 99 and Blue Cut gaging station	1000	400	100	1.5	5	10
Between Blue Cut gaging station and A Street, Fillmore	1300	600	100	1.5	5	5
Between A Street, Fillmore and Freeman Diversion "Dam" near Saticoy	1300	650	80	1.5	5	5
Between Freeman Diversion "Dam" near Saticoy and Highway 101 Bridge	1200	600	150	1.5	-	-
Between Highway 101 Bridge and Santa Clara River Estuary	*no waterbody specific objectives* [f]					
Santa Paula Creek above Santa Paula Water Works Diversion Dam	600	250	45	1.0	5	5
Sespe Creek above gaging station, 500' downstream from Little Sespe Creek	800	320	60	1.5	5	5
Piru Creek above gaging station below Santa Felicia Dam	800	400	60	1.0	5	5
Calleguas Creek Watershed:						
Above Potrero Road	850	250	150	1.0	10	f
Below Potrero Road	*no waterbody specific objectives* [f]					

Table 3-8. Water Quality Objectives for Selected Constituents in Inland Surface Waters[a] (cont.)

Reaches are in upstream to downstream order.

WATERSHED/STREAM REACH[b]	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Boron[c] (mg/L)	Nitrogen[d] (mg/L)	SAR[e] (mg/L)
Miscellaneous Los Angeles County Coastal Streams	*no waterbody specific objectives* [f]					
Malibu Creek Watershed	*2000*	*500*	*500*	*2.0*	*10*	-
Ballona Creek Watershed	*no waterbody specific objectives* [f]					
Dominguez Channel Watershed	*no waterbody specific objectives* [f]					
Los Angeles River Watershed:						
Above Figueroa Street	950	300	150	g	8	g
Between Figueroa Street and Los Angeles River Estuary (Willow Street). Includes Rio Hondo below Santa Ana Freeway	1500	350	150	g	8	g
Rio Hondo above Santa Ana Freeway [h]	750	300	150	g	8	g
Santa Anita Creek above Santa Anita spreading grounds	250	30	10	g	f	g
Eaton Canyon Creek above Eaton Dam	250	30	10	g	f	g
Arroyo Seco above spreading grounds	300	40	15	g	f	g
Big Tujunga Creek above Hansen Dam	350	50	20	g	f	g
Pacoima Wash above Pacoima spreading grounds	250	30	10	g	f	g
San Gabriel River Watershed:						
Above Morris Dam	250	30	10	0.6	2	2
Between Morris Dam and Ramona Blvd.	*450*	*100*	*100*	*0.5*	8	g
Between Ramona Blvd. and Firestone Blvd.	750	300	150	*1.0*	8	g
Between Firestone Blvd. and San Gabriel River Estuary (downstream from Willow Street) including Coyote Creek	*no waterbody specific objectives* [f]					
All other minor San Gabriel Mountain streams tributary to San Gabriel Valley [i]	300	40	15	g	f	g
Island Watercourses:						
Anacapa Island	*no waterbody specific objectives* [f]					
San Nicolas Island	*no waterbody specific objectives* [f]					
Santa Barbara Island	*no waterbody specific objectives* [f]					
Santa Catalina Island	*no waterbody specific objectives* [f]					
San Clemente Island	*no waterbody specific objectives* [f]					

Table 3-8. Water Quality Objectives for Selected Constituents in Inland Surface Waters[a] (cont.)

Reaches are in upstream to downstream order.

WATERSHED/STREAM REACH[b]	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Boron[c] (mg/L)	Nitrogen[d] (mg/L)	SAR[e] (mg/L)
Other Watercourses:						
San Antonio Creek[i]	225	25	6	–	–	–
Chino Creek[j]	–	–	–	–	–	–

a. As part of the State's continuing planning process, data will continue to be collected to support the development of numerical water quality objectives for waterbodies and constituents where sufficient information is presently unavailable. Any new recommendations for water quality objectives will be brought before the Regional Board in the future.

b. All references to watersheds, streams and reaches include all tributaries. Water quality objectives are applied to all waters tributary to those specifically listed in the table. See Figures 2-1 to 2-10 for locations.

c. Where naturally occurring boron results in concentrations higher than the stated objective, a site-specific objective may be determined on a case-by-case basis.

d. Nitrate-nitrogen plus nitrite-nitrogen (NO3-N + NO2-N). The lack of adequate nitrogen data for all streams precluded the establishment of numerical objectives for all streams.

e. Sodium adsorption ratio (SAR) predicts the degree to which irrigation water tends to enter into cation-exchange reactions in soil.

SAR = Na+/((Ca++ + Mg++)/2)1/2

f. Site-specific objectives have not been determined for these reaches at this time. These areas are often impaired (by high levels of minerals) and there is not sufficient historic data to designate objectives based on natural background conditions. The following table illustrates the mineral or nutrient quality necessary to protect different categories of beneficial uses and will be used as a guideline for establishing effluent limits in these cases. Protection of the most sensitive beneficial use(s) would be the determining criteria for the selection of effluent limits.

Recommended objective (mg/L)	Beneficial Use Categories				
	MUN (Drinking Water Standards)[1]	PROC	AGR	AQ LIFE*(Frshwtr)	GWR
TDS	500 (USEPA secondary MCL)	50-1500[2,7,8]	450-2000[2,3,5]		Limits based on appropriate groundwater basin objectives and/or beneficial uses
Chloride	250 (USEPA secondary MCL)	20-1000[2,8]	100-355[2,3,6]	230 (4 day ave. continuous conc)[4]	
Sulfate	400-500 (USEPA proposed MCL)	20-300[2,8]	350-600[2,5]		
Boron			0.5-4.0[2,5,6]		
Nitrogen	10 (USEPA MCL)				

References: 1) USEPA CFR § 141 et seq., 2) McKee and Wolf, 1963, 3) Ayers and Westcot, 1985, 4) USEPA, 1988, 5) Water Pollution Control Federation, 1989, 6) USEPA, 1973, 7) USEPA 1980, 8) Ayers, 1977.
* Aquatic life includes a variety of Beneficial Uses including WARM, COLD, SPWN, MIGR and RARE.

g. Agricultural supply is not a beneficial use of the surface water in the specified reach.

h. Rio Hondo spreading grounds are located above the Santa Ana Freeway

i. The stated objectives apply to all other surface streams originating within the San Gabriel Mountains and extend from their headwaters to the canyon mouth.

j. These watercourses are primarily located in the Santa Ana Region. The water quality objectives for these streams have been established by Santa Ana Region. Dashed lines indicate that numerical objectives have not been established, however, narrative objectives shall apply. Refer to the Santa Ana Region Basin Plan for more details.

Pesticides

Pesticides are used ubiquitously for a variety of purposes; however, their release into the environment presents a hazard to aquatic organisms and plants not targeted for their use. The extent of risk to aquatic life depends on many factors including the physical and chemical properties of the pesticide. Those of greatest concern are those that persist for long periods and accumulate in aquatic life and sediments.

No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life.

Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of pesticides in excess of the limiting concentrations specified in Table 64444-A of Section 64444 (Organic Chemicals) of Title 22 of the California Code of Regulations which is incorporated by reference into this plan. This incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect. (See Table 3-7.)

pH

The hydrogen ion activity of water (pH) is measured on a logarithmic scale, ranging from 0 to 14. While the pH of "pure" water at 25 °C is 7.0, the pH of natural waters is usually slightly basic due to the solubility of carbon dioxide from the atmosphere. Minor changes from natural conditions can harm aquatic life.

The pH of inland surface waters shall not be depressed below 6.5 or raised above 8.5 as a result of waste discharges. Ambient pH levels shall not be changed more than 0.5 units from natural conditions as a result of waste discharge.

The pH of bays or estuaries shall not be depressed below 6.5 or raised above 8.5 as a result of waste discharges. Ambient pH levels shall not be changed more than 0.2 units from natural conditions as a result of waste discharge.

Polychlorinated Biphenyls (PCBs)

Polychlorinated biphenyls (PCBs) are a highly toxic and persistent group of organic chemicals that have been historically released into the environment. Many historic discharges still exist as sources in the environment.

The purposeful discharge of PCBs (the sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, and Aroclor-1260) to waters of the Region, or at locations where the waste can subsequently reach waters of the Region, is prohibited.

Pass-through or uncontrollable discharges to waters of the Region, or at locations where the waste can subsequently reach water of the Region, are limited to 70 pg/L (30 day average) for protection of human health and 14 ng/L and 30 ng/L (daily average) to protect aquatic life in inland fresh waters and estuarine waters respectively.

Radioactive Substances

Radioactive substances are generally present in natural waters in extremely low concentrations. Mining or industrial activities increase the amount of radioactive substances in waters to levels that are harmful to aquatic life, wildlife or humans.

Radionuclides shall not be present in concentrations that are deleterious to human, plant, animal, or aquatic life or that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal, or aquatic life.

Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of radionuclides in excess of the limits specified in Table 4 of Section 64443 (Radioactivity) of Title 22 of the California Code of Regulations which is incorporated by reference into this plan. This incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect. (See Table 3-9.)

Table 3-9. The Maximum Contaminant Levels: Radioactivity (for MUN beneficial use) specified in Table 4 of Section 64443 of Title 22 of the California Code of Regulations as of 12-22-88.

MCL Radioactivity	Maximum Contaminant Level pCi/L
Combined Radium-226 and Radium-228	5
Gross Alpha particle activity (Including Radium-226 but excluding Radon and Uranium)	15
Tritium	20,000
Strontium-90	8
Gross Beta particle activity	50
Uranium	20

(pCi/L = picocuries = curies x 10^{-12})

Solid, Suspended, or Settleable Materials

Surface waters carry various amounts of suspended and settleable materials from both natural and human sources. Suspended sediments limit the passage of sunlight into waters, which in turn inhibits the growth of aquatic plants. Excessive deposition of sediments can destroy spawning habitat, blanket benthic (bottom dwelling) organisms, and abrade the gills of larval fish.

Waters shall not contain suspended or settleable material in concentrations that cause nuisance or adversely affect beneficial uses.

Taste and Odor

Undesirable tastes and odors in water are an aesthetic nuisance, can impact recreational and other uses, and can indicate the presence of other pollutants.

Waters shall not contain taste or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible aquatic resources, cause nuisance, or adversely affect beneficial uses.

Temperature

Discharges of wastewaters can cause unnatural and/or rapid changes in the temperature of receiving waters which can adversely affect aquatic life.

The natural receiving water temperature of all regional waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses. Alterations that are allowed must meet the requirements below.

For waters designated WARM, water temperature shall not be altered by more than 5 °F above the natural temperature. At no time shall these WARM-designated waters be raised above 80 °F as a result of waste discharges.

For waters designated COLD, water temperature shall not be altered by more than 5 °F above the natural temperature.

Temperature objectives for enclosed bays and estuaries are specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California" (Thermal Plan), including any revisions thereto. See Chapter 5 for a description of the Thermal Plan.

Toxicity

Toxicity is the adverse response of organisms to chemical or physical agents. When the adverse response is mortality, the result is termed acute toxicity. When the adverse response is not mortality but instead reduced growth in larval organisms or reduced reproduction in adult organisms (or other appropriate measurements), a critical life stage effect (chronic toxicity) has occurred. The use of aquatic bioassays (toxicity tests) is widely accepted as a valid approach to evaluating toxicity of waste and receiving waters.

All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in, human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration or other appropriate methods as specified by the State or Regional Board.

The survival of aquatic life in surface waters, subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same waterbody in areas unaffected by the waste discharge or, when necessary, other control water.

There shall be no acute toxicity in ambient waters, including mixing zones. The acute toxicity objective for discharges dictates that the average survival in undiluted effluent for any three consecutive 96-hour static or continuous flow bioassay tests shall be at least 90%, with no single test having less than 70% survival when using an established USEPA, State Board, or other protocol authorized by the Regional Board.

There shall be no chronic toxicity in ambient waters outside mixing zones. To determine compliance with this objective, critical life stage tests for at least three species with approved testing protocols shall be used to screen for the most sensitive species. The test species used for screening shall include a vertebrate, an invertebrate, and an aquatic plant. The most sensitive species shall then be used for routine monitoring. Typical endpoints for chronic toxicity tests include hatchability, gross morphological abnormalities, survival, growth, and reproduction.

Effluent limits for specific toxicants can be established by the Regional Board to control toxicity identified under Toxicity Identification Evaluations (TIEs).

Turbidity

Turbidity is an expression of the optical property that causes light to be scattered in water due to particulate matter such as clay, silt, organic matter, and microscopic organisms. Turbidity can result in a variety of water quality impairments. The secondary drinking water standard for turbidity is 5 NTU (nephelometric turbidity units).

Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in natural turbidity attributable to controllable water quality factors shall not exceed the following limits:

Where natural turbidity is between 0 and 50 NTU, increases shall not exceed 20%.

Where natural turbidity is greater than 50 NTU, increases shall not exceed 10%.

Allowable zones of dilution within which higher concentrations may be tolerated may be defined for each discharge in specific Waste Discharge Requirements.

Regional Narrative Objectives for Wetlands

In addition to the regional objectives for inland surface waters (including wetlands), the following narrative objectives apply for the protection of wetlands in the Region.

Hydrology

Natural hydrologic conditions necessary to support the physical, chemical, and biological characteristics present in wetlands shall be protected to prevent significant adverse effects on:

- *natural temperature, pH, dissolved oxygen, and other natural physical/chemical conditions,*
- *movement of aquatic fauna,*
- *survival and reproduction of aquatic flora and fauna, and*
- *water levels.*

Habitat

Existing habitats and associated populations of wetlands fauna and flora shall be maintained by:

- *maintaining substrate characteristics necessary to support flora and fauna which would be present naturally,*
- *protecting food supplies for fish and wildlife,*
- *protecting reproductive and nursery areas, and*
- *protecting wildlife corridors.*

Regional Objectives for Ground Waters

The following objectives apply to all ground waters of the Region:

Bacteria

Total and fecal coliform bacteria are used to indicate the likelihood of pathogenic bacteria in waters.

In ground waters used for domestic or municipal supply (MUN) the concentration of coliform organisms over any seven day period shall be less than 1.1/100 ml.

Chemical Constituents and Radioactivity

Chemical constituents in excessive amounts in drinking water are harmful to human health. Maximum levels of chemical constituents in drinking waters are listed in the California Code of Regulations and the relevant limits are described below.

Ground waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents and radionuclides in excess of the limits specified in the following provisions of Title 22 of the California Code of Regulations which are incorporated by reference into this plan: Table 64431-A of section 64431 (Inorganic chemicals), Table 64431-B of Section 64431 (Fluoride), Table 64444-A of Section 64444 (Organic Chemicals), and Table 4 of Section 64443 (Radioactivity). This incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect. (See Tables 3-5, 3-6, 3-7, and 3-9.)

Ground waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use.

Mineral Quality

Inorganic constituents in ground waters are largely influenced by thermodynamic reactions that occur as ground water comes into contact with various rock and soil types. For example, ground water that flows through beds of gypsum ($CaSO_4 \cdot 2H_2O$) typically has relatively high levels of calcium cations and sulfate anions. Ground water flowing through limestone ($CaCO_3$) also has relatively high levels of calcium cations, but coupled with bicarbonate anions instead of sulfate. Ground waters with these ions at levels greater than 120 mg/L (expressed as $CaCO_3$) are considered hard waters (Hem, 1989).

Human activities and land use practices can influence inorganic constituents in ground waters. Surface waters carrying abnormally high levels of salts (e.g., irrigation return flows) can degrade the ground waters that they recharge. Abnormally high levels of inorganic constituents can impair and preclude beneficial uses. For example, high levels of boron preclude agricultural use (especially for citrus crops) of ground waters. Hard waters present nuisance problems and may require softening prior to industrial use.

Numerical mineral quality objectives for individual groundwater basins are contained in Table 3-10.

Nitrogen (Nitrate, Nitrite)

High nitrate levels in drinking water can cause health problems in humans. Infants are particularly sensitive and can develop methemoglobinemia (blue-baby syndrome). The primary drinking water standard for nitrate (as NO_3) is 45 mg/L (DHS, 1992).

Human activities and land use practices can also influence nitrogen concentration in ground waters. For example, effluents from wastewater treatment plants, septic tanks and confined animal facilities can add high levels of nitrogen compounds to the ground water that they recharge. Irrigation water containing fertilizers can add high levels of nitrogen to ground water.

Ground waters shall not exceed 10 mg/L nitrogen as nitrate-nitrogen plus nitrite-nitrogen (NO_3-N + NO_2-N), 45 mg/L as nitrate (NO_3), 10 mg/L as nitrate-nitrogen (NO_3-N), or 1 mg/L as nitrite-nitrogen (NO_2-N).

Taste and Odor

Undesirable tastes and odors in water are an aesthetic nuisance and can indicate the presence of other pollutants.

Ground waters shall not contain taste or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses.

Table 3-10. Water Quality Objectives for Selected Constituents in Regional Ground Waters[a].

DWR Basin No.[b]	BASIN	OBJECTIVES (mg/L)			
		TDS	Sulfate	Chloride	Boron
	Pitas Point Area [c]	None specified			
	Ojai Valley				
4-1	Upper Ojai Valley				
	West of Sulfur Mountain Road	1,000	300	200	1.0
	Central area	700	50	100	1.0
	Sisar area	700	250	100	0.5
4-2	Lower Ojai Valley				0.5
	West of San Antonio–Senior Canyon Creeks	1,000	300	200	0.5
	East of San Antonio–Senior Canyon Creeks	700	200	50	
4-3	**Ventura River Valley**				
	Upper Ventura	800	300	100	0.5
	San Antonio Creek area	1,000	300	100	1.0
	Lower Ventura	1,500	500	300	1.5
	Ventura Central [d]				
4-4	Santa Clara–Piru Creek area				
	Upper area (above Lake Piru)	1,100	400	200	2.0
	Lower area east of Piru Creek	2,500	1,200	200	1.5
	Lower area west of Piru Creek	1,200	600	100	1.5
	Santa Clara–Sespe Creek area				
	Topa Topa (upper Sespe) area	900	350	30	2.0
	Fillmore area				
	Pole Creek Fan area	2,000	800	100	1.0
	South side of Santa Clara River	1,500	800	100	1.1
	Remaining Fillmore area	1,000	400	50	0.7
	Santa Clara–Santa Paula area				
	East of Peck Road	1,200	600	100	1.0
	West of Peck Road	2,000	800	110	1.0
	Oxnard Plain				
	Oxnard Forebay	1,200	600	150	1.0
	Confined aquifers	1,200	600	150	1.0
	Unconfined and perched aquifers	3,000	1,000	500	--
4-6	Pleasant Valley				
	Confined aquifers	700	300	150	1.0
	Unconfined and perched aquifers	--	--	--	--
4-7	Arroyo Santa Rosa	900	300	150	1.0
4-8	Las Posas Valley				
	South Las Posas area				
	NW of Grimes Cyn Rd & LA Ave & Somis Rd	700	300	100	0.5
	E of Grimes Cyn Rd and Hitch Blvd	2,500	1,200	400	3.0
	S of LA Ave between Somis Rd & Hitch Blvd	1,500	700	250	1.0
	Grimes Canyon Rd & Broadway area	250	30	30	0.2
	North Las Posas area	500	250	150	1.0
4-5	**Upper Santa Clara**				
	Acton Valley	550	150	100	1.0
	Sierra Pelona Valley (Agua Dulce)	600	100	100	0.5
	Upper Mint Canyon	700	150	100	0.5
	Upper Bouquet Canyon	400	50	30	0.5
	Green Valley	400	50	25	--
	Lake Elizabeth–Lake Hughes area	500	100	50	0.5

Table 3-10. Water Quality Objectives for Selected Constituents in Regional Ground Waters[a] (cont.)

DWR Basin No.[b]	BASIN	OBJECTIVES (mg/L)			
		TDS	Sulfate	Chloride	Boron
4-4.07	**Eastern Santa Clara**				
	Santa Clara--Mint Canyon	800	150	150	1.0
	South Fork	700	200	100	0.5
	Placerita Canyon	700	150	100	0.5
	Santa Clara--Bouquet & San Francisquito Canyons	700	250	100	1.0
	Castaic Valley	1,000	350	150	1.0
	Saugus Aquifer	--	--	--	--
4-9	**Simi Valley**				
	Simi Valley Basin				
	Confined aquifers	1,200	600	150	1.0
	Unconfined aquifers	--	--	--	--
	Gillibrand Basin	900	350	50	1.0
4-10	**Conejo Valley**	800	250	150	1.0
4-11	**Los Angeles Coastal Plain**				
	Central Basin	700	250	150	1.0
	West Coast Basin	800	250	250	1.5
	Hollywood Basin	750	100	100	1.0
	Santa Monica Basin	1,000	250	200	0.5
4-12	**San Fernando Valley**				
	Sylmar Basin	600	150	100	0.5
	Verdugo Basin	600	150	100	0.5
	San Fernando Basin				
	West of Highway 405	800	300	100	1.5
	East of Highway 405 (overall)	700	300	100	1.5
	Sunland-Tugunga area[e]	400	50	50	0.5
	Foothill area[e]	400	100	50	1.0
	Area encompassing RT-Tujunga-Erwin-N. Hollywood-Whithall-LA/Verdugo-Crystal Springs-Headworks-Glendale/Burbank Well Fields	600	250	100	1.5
	Narrows area (below confluence of Verdugo Wash with the LA River)	900	300	150	1.5
	Eagle Rock Basin	800	150	100	0.5
4-13	**San Gabriel Valley**				
	Raymond Basin				
	Monk Hill sub-basin	450	100	100	0.5
	Santa Anita area	450	100	100	0.5
	Pasadena area	450	100	100	0.5
	Main San Gabriel Basin				
	Western area[f]	450	100	100	0.5
	Eastern area[f]	600	100	100	0.5
	Puente Basin	1,000	300	150	1.0
4-14 8-2[g]	**Upper Santa Ana Valley**				
	Live Oak area	450	150	100	0.5
	Claremont Heights area	450	100	50	--
	Pomona area	300	100	50	0.5
	Chino area	450	20	15	--
	Spadra area	550	200	120	1.0
4-15	**Tierra Rejada**	700	250	100	0.5
4-16	**Hidden Valley**	1,000	250	250	1.0
4-17	**Lockwood Valley**	1,000	300	20	2.0
4-18	**Hungry Valley and Peace Valley**	500	150	50	1.0

Table 3-10. Water Quality Objectives for Selected Constituents in Regional Ground Waters[a] (cont.)

DWR Basin No.[b]	BASIN	OBJECTIVES (mg/L)			
		TDS	Sulfate	Chloride	Boron
4-19	Thousand Oaks area	1,400	700	150	1.0
4-20	Russell Valley				
	Russell Valley	1,500	500	250	1.0
	Triunfo Canyon area	2,000	500	500	2.0
	Lindero Canyon area	2,000	500	500	2.0
	Las Virgenes Canyon area	2,000	500	500	2.0
4-21	Conejo-Tierra Rejada Volcanic area[h]	--	--	--	--
	Santa Monica Mountains--southern slopes[i]				
	Camarillo area	1,000	250	250	1.0
	Point Dume area	1,000	250	250	1.0
4-22	Malibu Valley	2,000	500	500	2.0
	Topanga Canyon area	2,000	500	500	2.0
	San Pedro Channel Islands[j]				
	Anacapa Island	--	--	--	--
	San Nicolas Island	1,100	150	350	--
	Santa Catalina Island	1,000	100	250	1.0
	San Clemente Island	--	--	--	--
	Santa Barbara Island	--	--	--	--

a. Objectives for ground waters outside of the major basins listed on this table and outlined in Figure 1-9 have not been specifically listed. However, ground waters outside of the major basins are, in many cases, significant sources of water. Furthermore, ground waters outside of the major basins are either potential or existing sources of water for downgradient basins and, as such, objectives in the downgradient basins shall apply to these areas.

b. Basins are numbered according to Bulletin 118-80 (Department of Water Resources, 1980).

c. Ground waters in the Pitas Point area (between the lower Ventura River and Rincon Point) are not considered to comprise a major basin, and accordingly have not been designated a basin number by the California Department of Water Resources (DWR) or outlined on Figure 1-9.

d. The Santa Clara River Valley (4-4), Pleasant Valley (4-6), Arroyo Santa Rosa Valley (4-7) and Las Posas Valley (4-8) Ground Water Basins have been combined and designated as the Ventura Central Basin (DWR, 1980).

e. The category for the Foothill Wells area in previous Basin Plan incorrectly groups ground water in the Foothill area with ground water in the Sunland-Tujunga area. Accordingly, the new categories, Foothill area and Sunland-Tujunga area, replace the old Foothill Wells area.

f. All of the ground water in the Main San Gabriel Basin is covered by the objectives listed under Main San Gabriel Basin – Eastern area and Western area. Walnut Creek, Big Dalton Wash, and Little Dalton Wash separate the Eastern area from the Western area (see dashed line on Figure 2-17). Any ground water upgradient of these areas is subject to downgradient beneficial uses and objectives, as explained in Footnote a.

g. The border between Regions 4 and 8 crosses the Upper Santa Ana Valley Ground Water Basin.

h. Ground water in the Conejo-Tierra Rejada Volcanic Area occurs primarily in fractured volcanic rocks in the western Santa Monica Mountains and Conejo Mountain areas. These areas have not been delineated on Figure 1-9.

i. With the exception of ground water in Malibu Valley (DWR Basin No. 4-22), ground waters along the southern slopes of the Santa Monica Mountains are not considered to comprise a major basin and accordingly have not been designated a basin number by the California Department of Water Resources (DWR) or outlined on Figure 1-9.

j. DWR has not designated basins for ground waters on the San Pedro Channel Islands.

Statewide Objectives for Ocean Waters

The State Board's *Water Quality Control Plan for Ocean Waters of California* (Ocean Plan) and the *Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California* (Thermal Plan) and any revision thereto, shall also apply to all ocean waters of the Region. These plans are described in Chapter 5, Plans and Policies. Copies of these plans can be obtained at the Office of Legislative and Public Affairs (OLPA) in Sacramento or at the Regional Board office.

Site Specific Objectives

While many pollutants are regulated under federal, state or regionally applied water quality standards, the Regional Board supports the idea of developing site-specific objectives (SSOs) in appropriate circumstances. Site-specific, or reach-specific, objectives are already in place for some parameters (i.e., mineral quality). These were established to protect a specific beneficial use or were based on antidegradation policies. The development of site-specific objectives requires complex and resource intensive studies; resources will limit the number of studies that will be performed in any given year. In addition, a Use Attainability Analysis (UAA) study will be necessary if the attainment of designated aquatic life or recreational beneficial uses is in question. UAAs include waterbody surveys and assessments which define existing uses, determine appropriateness of the existing and designated uses, and project potential uses by examining the waterbody's physical, chemical, and biological characteristics. Under certain conditions, a designated use may be changed if attaining that use would result in substantial and widespread economic and social impacts. Uses that have been attained can not be removed under a UAA analysis. If a UAA study is necessary, that study must be completed before a SSO can be determined. Early planning and coordination with Regional Board staff will be critical to the development of a successful plan for developing SSOs.

Site-specific objectives must be based on sound scientific data in order to assure protection of beneficial uses. There may be several acceptable methods for developing site-specific objectives. A detailed workplan will be developed with Regional Board staff and other agencies (if appropriate) based on the specific pollutant and site involved. State Board staff and the USEPA will participate in the development of the studies so that there is agreement on the process from the beginning of the study.

Although each study will be unique, there are several elements that should be addressed in order to justify the need for a site-specific objective. These may include, but are not limited to:

- Demonstration that the site in question has different beneficial uses (e.g., more or less sensitive species) as demonstrated in a UAA or that the site has physical or chemical characteristics that may alter the biological availability or toxicity of the chemical.
- Provide a thorough review of current technology and technology-based limits which can be achieved at the facility(ies) on the study reach.
- Provide a thorough review of historical limits and compliance with these limits at all facilities in the study reach.
- Conduct a detailed economic analysis of compliance with existing, proposed objectives.
- Conduct an analysis of compliance and consistency with all federal, state, and regional plans and policies.

Once it is agreed that a site-specific objective is needed, the studies are performed, and an objective is developed, the following criteria must be addressed in the proposal for the new objective.

- Assurance that aquatic life and terrestrial predators are not currently threatened or impaired from bioaccumulation of the specific pollutant <u>and</u> that the biota will not be threatened or impaired by the proposed site-specific level of this pollutant. Safe tissue concentrations will be determined from the literature and from consultation with the California Department of Fish and Game and the U.S. Fish and Wildlife Service.

  For terrestrial predators, the presence, absence, or threat of harmful bioaccumulated pollutants will be determined through consultation with the

California Department of Fish and Game and the U.S. Fish and Wildlife Service.

- Assurance that human consumers of fish and shellfish are currently protected from bioaccumulation of the study pollutant, and will not be affected from bioaccumulation of this pollutant under the proposed site-specific objective.

- Assurance that aquatic life is currently, and will be protected from chronic toxicity from the proposed site-specific objective.

- Assurance that the integrity of the aquatic ecosystem will be protected under the proposed site-specific objective.

- Assurance that no other beneficial uses will be threatened or impaired by the proposed site-specific objective.

4. STRATEGIC PLANNING AND IMPLEMENTATION

Table of Contents

Introduction

The Regional Board's mission is to achieve and maintain water quality objectives that are necessary to protect all beneficial uses of the waters in the Region. Depending on the nature of the water quality problem, several different strategies, as outlined below, are employed to accomplish this mission.

- ***Control of Point Source Pollutants:*** Pollutants from point sources are transported to waterbodies in controlled flows at well-defined locations. Examples of point sources include discharges from municipal and industrial wastewater treatment facilities.

  Programs that protect water quality from point source pollutants are primarily regulatory in nature. Permitting programs such as California's Waste Discharge Requirements (established in the 1950s) and the federal National Pollutant Discharge Elimination System (established in the 1970s) are examples of key regulatory programs. Significant progress toward the control of point source pollutants has been made through these permitting programs.

- ***Control of Nonpoint Source Pollutants:*** Pollutants from nonpoint sources are diffuse, both in terms of their origin and mode of transport to surface and ground waters. Unlike pollutants from point sources, pollutants from nonpoint sources often enter waters in sudden pulses and large quantities as rain, irrigation, and other types of runoff that mobilize and transport contaminants into surface and ground waters. Nationwide, pollutants from nonpoint sources represent the greatest threat to water quality. Examples of nonpoint sources in southern California include lawn and garden chemicals that are transported by storm water or water from lawn sprinklers; household and automotive care products that are dumped or drained on streets and into storm drains; fertilizers and pesticides that are washed from agricultural fields by rain or irrigation waters; sediment that erodes from construction sites; and various pollutants deposited by atmospheric deposition.

Nonpoint source pollutants are more difficult to control than point source pollutants, and different control strategies are required. For example, traditional permitting programs are neither a practical nor effective means of protecting water quality from lawn and garden chemicals. Accordingly, the Regional Board is integrating non-regulatory programs with regulatory programs in order to control pollutants from nonpoint sources. Emphasis is placed on pollution prevention through careful management of resources, as opposed to "cleaning up" the waterbody after the fact. Through public outreach – an example of a non-regulatory program – residents are informed of threats to the quality of the waters in their communities and are encouraged to voluntarily implement Best Management Practices (BMPs) that will eliminate or reduce nonpoint sources of pollution. When necessary, local governments are encouraged to develop and implement ordinances that supplement the Regional Board's public outreach efforts. This flexible

Table 4-1. "Threat to Water Quality" and "Complexity" Definitions.

Category	Definition	Example
THREAT TO WATER QUALITY		
Category I (Major threat)	Those discharges which could cause the long-term loss of a designated beneficial use of the receiving water, render unusable a ground water or surface water resource used as a significant drinking water supply, require closure of an area used for contact recreation, result in long-term deleterious effects on shellfish spawning or growth areas of aquatic resources, or directly expose the public to toxic substances.	Loss of a drinking water supply
Category II (Moderate threat)	Those discharges of waste which could impair the designated beneficial uses of the receiving water, cause short-term violations of water quality objective, cause secondary drinking water standards to be violated, or cause a nuisance. The discharge could have a major adverse impact on receiving biota, cause aesthetic impairment to a significant human population, or render unusable a potential domestic or municipal water supply.	Aesthetic impairment from nuisance from a waste treatment facility.
Category III (Minor threat)	Those discharges of waste which could degrade water quality without violating water quality objectives, or cause a minor impairment of designated beneficial uses compared with Category I and Category II.	Small pulses of water from low volume cooling water discharges.
COMPLEXITY		
Category "a"	Any major NPDES discharger; any discharge of toxic wastes; any small volume discharge containing toxic waste or having numerous discharge points or ground water monitoring; any Class I waste management unit.	Small volume complex discharger with numerous discharge points, leak detection systems or ground water monitoring wells.
Category "b"	Any discharger not included above which has a physical, chemical, or biological treatment systems (except for septic systems with subsurface disposal), or any Class II or Class III waste management units.	Marinas with petroleum products, solid wastes or sewage pump-out facilities.
Category "c"	Any discharger for whom waste discharge requirements have been or would be prescribed pursuant to Section 13263 of the Water Code not included as a Category "a" or Category "b" as described above.	Discharges having no waste treatment systems or that must comply with best management practices, discharges having passive treatment and disposal systems, or dischargers having waste storage system with land disposal such as dairy waste ponds.
NPDES Major or Minor		
Major	Publicly owned treatment works with a yearly average flow of over 0.5 million gallons per day (MGD); or an industrial source with a yearly average flow of over 0.1 MGD and those with lesser flows but with acute or potential adverse environmental impacts.	
Minor	All other dischargers that are not categorized as a Major.	

approach can be an effective means of controlling pollutants from many nonpoint sources.

- ***Remediation of Pollution:*** The Regional Board oversees remediation of both ground and surface waters through the investigation of polluted ground water and enforcement of corrective actions needed to restore water quality. These activities are managed through eight programs, namely: Underground Storage Tanks; Well Investigations; Spills, Leaks, Investigations and Cleanups (SLIC); Aboveground Petroleum Storage Tanks; U.S. Department of Defense (DOD) and Department of Energy (DOE) Sites; Resource Conservation and Recovery Act (RCRA); Toxic Pits Cleanup Act; and Bay Protection and Toxic Cleanup.

These programs are designed to return polluted sites to productive use by identifying and eliminating the sources of pollutants, preventing the spread of pollution, and restoring water quality.

Control of Point Source Pollutants

Introduction – General Information about Regional Board Permitting Programs

All wastewater discharges in the Region – whether to surface or ground waters – are subject to Waste Discharge Requirements (WDRs). Likewise, all reuses of treated wastewaters are subject to Water Reclamation Requirements (WRRs). In addition, because the USEPA has delegated responsibility to the State and Regional Boards for implementation of the federal National Pollutant Discharge Elimination System (NPDES) program, WDRs for discharges to surface waters also serve as NPDES permits. These programs are the legal means to regulate controllable discharges. It is illegal to discharge wastes into any waters of the State and to reuse treated wastewaters without obtaining appropriate WDRs, WRRs, or NPDES permits (all of which are hereinafter referred to as Requirements).

Any facility or person who discharges, or proposes to discharge, wastes or makes a material change to the character, location, or volume of waste discharges to waters in the Los Angeles Region (other than into a community sewer system) must describe the quantity and nature of the proposed discharge in a report of waste discharge (ROWD) or an NPDES application. Upon review of the ROWD or NPDES application and all other pertinent information (including comments received at a public hearing), the Regional Board will consider the issuance of Requirements that incorporate appropriate measures and limitations to protect public health and water quality. The basic components of the Requirements include:

- discharge limitations (including, if required, effluent and receiving water limits);
- standard requirements and provisions outlining the discharger's general discharge requirements and monitoring and reporting responsibilities; and
- a monitoring program in which the discharger is required to collect and analyze samples and submit monitoring reports to the Regional Board on a prescribed schedule.

Discharges are categorized according to their threat to water quality and operational complexity (Table 4-1). In addition, discharges to surface waters are categorized as major or minor discharges. Filing and annual fees are based on these categories. WDRs or WRRs usually do not have an expiration date but are reviewed periodically on a schedule based on the level of threat to water quality. NPDES permits are adopted for a five-year period.

Most Requirements are tailored to specific waste discharges. In some cases, however, discharges can be regulated under general Requirements (Table 4-2), which simplify the permit process for certain types of discharges. These general Requirements are issued administratively to the discharger after a completed ROWD or NPDES application has been filed and the Executive Officer has determined that the discharge meets the conditions specified in the general Requirements.

Point source discharges include wastewaters from municipal sewage treatment plants, industrial and manufacturing facilities, shipyards and power generation stations (see examples in Table 4-3). The Regional Board currently administers approximately 1,200 Requirements for these discharges, including 37 sewage treatment facilities with design flows of over 100,000 gallons per day (Table 4-4; Figure 4-1). Major or significant

Table 4-2. Summary of General WDRs* and NPDES Permits Issued by the State Board and the Regional Board.

General WDRs and NPDES Permits	Examples of eligible dischargers
General WDR for land treatment of petroleum hydrocarbon contaminated soil in Los Angeles and Santa Clara River Basins (Order No. 90-148).	Refineries, leaking underground and above ground tanks, and leaking pipelines.
General NPDES permit and WDR for discharges of ground water to surface waters in Los Angeles River and Santa Clara River Basins (Order No. 91-92).	Construction de-watering discharges and well test waters.
General WDR for discharge of non-hazardous contaminated soils and other wastes in Los Angeles River and Santa Clara River Basins (Order No. 91-93).	Petroleum-contaminated soil, excavation soils.
General WDR for private subsurface sewage disposal systems in areas where ground water is used or may be used for domestic purposes (Order No. 91-94).	New residential developments.
General NPDES permit and WDR for discharges of hydrostatic test water to surface waters in Los Angeles River and Santa Clara River Basins (Order No. 91-111).	Waste waters from hydrostatic testing of pipe(s), tanks(s), in any storage vessels.
General NPDES permit and WDR for discharges of storm water associated with industrial activities excluding construction activities (Order No. 91-13-DWQ).**	Surface runoff discharges from industrial sites or facilities.
General NPDES permit and WDR for discharges of storm water runoff associated with construction activity (Order No. 92-08-DWQ).**	Surface runoff from construction sites.
General NPDES permit and WDR for discharge of ground water from investigation and/or clean up of petroleum fuel pollution to surface waters in the Los Angeles and Santa Clara River Basins (Order No. 92-91).	Treated ground water to cleanup waters polluted with petroleum fuel, ground water extracted during pump tests, and well development and purging.
General WDR for specified discharges to ground water in Santa Clara River and Los Angeles River Basins (Order No. 93-10).	Hydrostatic testing of tanks, pipes, and storage vessels; construction dewatering; dust control application; water irrigation storage systems; subterranean seepage dewatering; well development and test pumping; aquifer testing; and monitoring well construction.

* General WDRs can be issued by the Executive Officer without formal Board Action.
** State Board Order.

dischargers of the Region, as of February 1994, fall into the categories shown in Table 4-5.

Waste Discharge Requirements (WDRs)

All discharges, whether to land or water, are subject to the California Water Code (§13263) and will be issued WDRs by the Regional Board. Furthermore, discharges to land are also subject to Title 23, California Code of Regulations, either under Chapter 15 (e.g., mining operations and landfills) or under other chapters (e.g., wastewater treatment, erosion control projects, and certain septic systems).

WDRs usually do not have an expiration date (with the exception of dredging WDRs and some Chapter 15 WDRs).

Land and groundwater-related WDRs (i.e., "Non-NPDES" WDRs) are described in this section. WDRs for discharges to surface waters, that also serve as NPDES permits, are described in the National Pollutant Discharge Elimination System Program section. In general, "Non-NPDES" WDRs regulate discharges of privately or publicly treated domestic wastewater, cooling tower bleed off, process and wash-down wastewater, and oil field brines. These WDRs usually protect the beneficial uses of groundwater basins but some WDRs are

Table 4-3. Examples of Industrial and Municipal Point Source Discharges to Surface Waters.

Discrete Discharge	Examples of pollutants*	Examples of Affected Waterbodies
Oil refinery wastewaters	Oil, chemical additives, dissolved mineral salts, VOCs (BTEX**), BOD, suspended solids, metals, temperature	Santa Monica Bay, Dominguez Channel, Long Beach and Los Angeles Harbors
Oil field drilling brine disposal *Regulated by the California Department of Conservation, Division of Oil and Gas*	BOD, COD, TDS, chloride, settleable solids, suspended solids, oil and grease, sulfur, heavy metals	Re-injection in groundwater basins
Zoo wastewaters	Suspended solids, BOD, bacteria	Los Angeles River
Municipal wastewater treatment plants (See Table 4-4 for more information)	BOD, COD, TDS, chloride, sulfate, nutrients, NH3, residual chlorine, metals, organic chemicals	Most inland waters, Pacific Ocean
Cooling tower water (contact and non-contact), boiler blowdown	Suspended solids, oil and grease, dissolved minerals, settleable solids, chemical additives, temperature	Most inland rivers and streams
Power generation plants	Temperature, chemical additives, minerals	Los Angeles River, Los Cerritos Channel, Santa Monica Bay, Los Angeles Harbor, San Gabriel River Estuary, Pacific Ocean
Ground water from remediation or from construction de-watering	TDS, chloride, sulfate, VOC's, (BTEX), and other petroleum hydrocarbons	Region-wide
Manufacturing (process/wash) waste water	Temperature, residual chlorine	Most inland rivers and streams
Aquaculture wastewater	Suspended solids and nutrients	Pacific Ocean
Shipyard, boatyard wastes	Oil and grease, metals (Pb, Cr), suspended solids, settleable solids, TBT, temperature, chemical additives	Long Beach Harbor, Los Angeles Harbor, Pacific Ocean

* These examples are possible pollutants. Actual presence in all discharges is not implied.
** BTEX is benzene-toluene-ethylbenzene-xylene

issued to protect surface waters in areas where ground water is known to exfiltrate from groundwater basins to surface waters.

Types of waste discharge that require WDRs under these laws and regulations include:

- On-site disposal systems (septic systems)
- Holding/equalization tanks
- Evaporation ponds
- Percolation ponds and leachfields
- Landfills
- Land treatment units (bioremediation)
- Dredging
- Oil field brines

Land Disposal

The Regional Board issues WDRs for wastewaters originating from landfills, surface impoundments, waste piles and land treatment units, mines, and confined animal feedlots. These WDRs can be issued in cooperation with other state agencies (Table 4-6). The Regional Board also administers the Solid Waste Assessment Test (SWAT) Program to identify any landfills that have "leaked" wastes.

The Regional Board can also direct responsible parties to abate any condition of nuisance or pollution from closed, illegal, or abandoned disposal sites.

Table 4-4. Sewage Treatment Facilites with Design Flow Greater than 100,000 Gallons per Day.

Facility Name	1993 Average flow/Peak flow-MGD	Design flow 1993/ Projected 2000-MGD	Receiving waterbody	Reclamation/ percolation ponds	Treatment level	Future plans
Avalon, City of: Avalon Wastewater Treatment Facility	0.65/ 2.00	1.2/ 2.0	Pacific Ocean		Secondary	Plant expansion plan (1994) with biological secondary treatment
Burbank, City of: Burbank Water Reclamation Plant	7.37/ 16.00	9/ 15	Burbank Western Channel	Plans to increase sales for irrigation	Tertiary	Plant expansion plan (1994-1996)
Camarillo Sanitation District: Water Reclamation Plant	3.9/ 7.0	6.75/ same	Conejo Creek	Future plans	Secondary	Plan to construct phase II by 2004 with possible filtration
County Sanitation Districts of Los Angeles County: Joint Water Pollution Control Plant	340/ 460 * (200 secondary)	385 advanced primary (200 secondary)/ same	Pacific Ocean	N/A	Advanced primary/ secondary	Plan for full secondary
County Sanitation Districts of Los Angeles County: La Canada Water Reclamation Plant	0.124/ NA	0.2/ same	none	Irrigation	Secondary	Plan to connect to District's Joint Outfall
County Sanitation Districts of Los Angeles County: Long Beach Water Reclamation Plant	17.3/ 24.9 *	25/ same	Coyote Creek	Plans to increase reclaimed use by ground water injection and other by 1995	Tertiary	Plan to expand capacity by 2010
County Sanitation Districts of Los Angeles County: Los Coyotes Water Reclamation Plant	37.8/ 45.0 *	37.5/ same	San Gabriel River	Reclaimed use	Tertiary	Plan for increased volume
County Sanitation Districts of Los Angeles County: Pomona Water Reclamation Plant	13.2/ 21.3 *	15/ same	San Jose Creek	Industrial, agriculturdal and irrigation use	Tertiary	Plan for increased volume
County Sanitation Districts of Los Angeles County: San Jose Creek Water Reclamation Plant	71.7/ 116.1 *	100/ same	San Gabriel River and San Jose Creek	Groundwater recharge and irrigation	Tertiary	Plan for increased volume
County Sanitation Districts of Los Angeles County: Saugus Water Reclamation Plant	6.3/ 10.5 * (excess is diverted to Valencia)	5.6/ 7.0	Santa Clara River	Plans for reclaimed use	Tertiary	Plan for increased volume
County Sanitation Districts of Los Angeles County: Valencia Water Reclamation Plant	8.8/ 14.6 *	7.5/ 13.5	Santa Clara River	Plans for reclaimed use	Tertiary	Plan for expansion
County Sanitation Districts of Los Angeles County: Whittier Narrows Water Reclamation Plant	12.5/ 18.0 *	15.0/ same	San Gabriel River and Rio Hondo	Groundwater recharge and plans for other reuse	Tertiary	Plan for increased volume

Table 4-4. Sewage Treatment Facilites with Design Flow Greater than 100,000 Gallons per Day (continued).

Facility Name	1993 Average flow/Peak flow-MGD	Design flow 1993/ Projected 2000-MGD	Receiving waterbody	Reclamation/ percolation ponds	Treatment level	Future plans
Las Virgenes Municipal Water District: Tapia Water Reclamation Facility	8/ 13	16/ same	Malibu Creek	Plans increased sales of reclaimed water (Current: 90% of effluent from June-Sept.)	Tertiary	Anaerobic sludge digestion, centrifuge dewatering, in-vessel composting and beneficial reuse
Los Angeles, City of, Department of Public Works: Donald C. Tillman Water Reclamation Plant	75/ 100	80/ same	Los Angeles River	Japanese garden, Wildlife Lake, Lake Balboa. Irrigation. Future groundwater recharge.	Tertiary	Possible increase in capacity
Los Angeles, City of, Department of Public Works: Hyperion Treatment Plant	350/ 476	420/ 450	Santa Monica Bay	West Basin Municipal District plans to reclaim 70 MGD by 1995 at new facility. Other reuse.	Primary/ secondary	Upgrade (1998) to full secondary pure oxygen, two stage anaerobic digestion
Los Angeles, City of, Department of Public Works: Los Angeles-Glendale Water Reclamation Plant	20/ 27	20/ 50	Los Angeles River	Plans to increase reclaimed water sales. Industrial use.	Tertiary	Plan expansion project
Los Angeles, City of, Department of Public Works: Terminal Island Treatment Plant	18/ 28 (dry) 40 (wet)	30/ same	Los Angeles Harbor	Plans for reclaimed use (5 MGD) in 1996	Secondary	Full effluent filtration
Los Angeles, City of, Department of Recreation and Parks: LA Zoo Wastewater Treatment Plant	4.0/ 0.5	2.5/ 8.0	Los Angeles River (over flow) otherwise City sanitary sewer	N/A	Primary/chlorinated	New facility under construction
Los Angeles, County of, Department of Public Works: Malibu Mesa Wastewater Treatment Plant	0.175/ 0.20	0.20/ same	Winter and Marie Canyons	Landscape spray irrigation	Tertiary	No changes anticipated
Los Angeles, County of, Department of Public Works: Trancas Sewage Treatment Plant	0.058/ 0.15	0.12/ same	N/A	Leaching fields	Tertiary	No changes anticipated
Los Angeles, County of, Mech Dept.: Acton Rehabilitation Center	0.026/ ?	0.15/	N/A	N/A	Secondary	No changes anticipated
Ojai Valley Sanitary District: Ojai Valley Wastewater Treatment Plant	2.26/ 3.24	3.0/ same	Ventura River	Plans for reclaimed water	Secondary	New facility plan (1996) for Tertiary treatment
Oxnard, City of, Department of Public Works: Oxnard Wastewater Treatment Plant	18/ 25	37.1/ same	Pacific Ocean	Plans for reclaimed water	Secondary	Plan for tertiary treatment
San Buenaventura, City of: Ventura Water Reclamation Plant	7.6/ 15.0	14/ 16	Santa Clara River Tidal Prism	Plan to increase use of reclaimed water	Tertiary	Plan to update electrical systems.
Simi Valley County Sanitation District: Simi Valley Water Quality Control Plant	9.0/ 22.5	12.5/ same	Arroyo Simi	?	Tertiary	Depends on outcome of study

Table 4-4. Sewage Treatment Facilites with Design Flow Greater than 100,000 Gallons per Day (continued).

Facility Name	1993 Average flow/Peak flow-MGD	Design flow 1993/ Projected 2000-MGD	Receiving waterbody	Reclamation/ percolation ponds	Treatment level	Future plans
Thousand Oaks, City of, Utility Department: Hill Canyon Wastewater Treatment Plant	8.6/ 16.0	10.8/ 14.0	Arroyo Conejo	Future irrigation plans	Tertiary	Advanced treatment using nitrification/denitrification processes
Thousand Oaks, City of, Utility Department: Olsen Road Water Reclamation Plant	0.175/ 0.225	0.75/ same**	Arroyo Conejo	Future irrigation plans	Secondary	Tertiary treatment by filtration
US Navy: NALF San Clemente Island	0.015/ 0.029	0.030/ same	Pacific Ocean	Plan to use reclaimed water for dust control	Secondary	Additional flow equalization capacity, increased drying bed, change to new chemical treatment and aeration
Ventura, County of, Water Works District: Moorpark Wastewater Treatment Plant	1.92/ 2.12	3.0/ 3.5	Calleguas Creek	Reclaimed use and percolation ponds	Tertiary/ Secondary	New tertiary facility. Plans to construct a reclaimed distribution system
Ventura, County of, Water Works District: Nyeland Acres Wastewater Treatment Plant	0.107/ 0.128	0.22/ same	Revolon Slough	no	Secondary	Conversion of STEP system to a gravity collection system
Ventura, County of, Water Works District: Piru Treatment Facility	0.12/ 0.147	0.20/ same	Santa Clara River	Percolation ponds	Secondary	No changes anticipated
Ventura Regional Sanitation District and Camrosa CWD: Camrosa Wastewater Treatment Plant	1.2/ 1.4	1.5/ same	Calleguas Creek	Reclamation reservoir and irrigation	Secondary	Plans to upgrade plant
Ventura Regional Sanitation District: City of Fillmore Wastewater Treatment Plant	1.0/ 1.3	1.3/ 1.6	Santa Clara River	Percolation ponds	Secondary	Currently under expansion
Ventura Regional Sanitation District: Liquid Waste Treatment Fac. #1, sludge treatment	0.04/ 0.06	0.15/ same	N/A	No	Primary	No changes anticipated
Ventura Regional Sanitation District: Montalvo Treatment Plant	0.25/ 0.35	0.36/ same	N/A	Percolation Ponds	Secondary	No changes anticipated
Ventura Regional Sanitation District: Santa Paula Wastewater Treatment Plant	2.04/ 2.6	2.5/ same	Santa Clara River	Groundwater recharge	Tertiary	No changes anticipated
Ventura Regional Sanitation District: Saticoy Sanitation District	0.12/ 0.32	0.30/ same	N/A	Percolation ponds	Primary	No changes anticipated

* Partial 1993 data (first 4 to 6 months).
** The actual flow is not expected to exceed 0.3 MGD

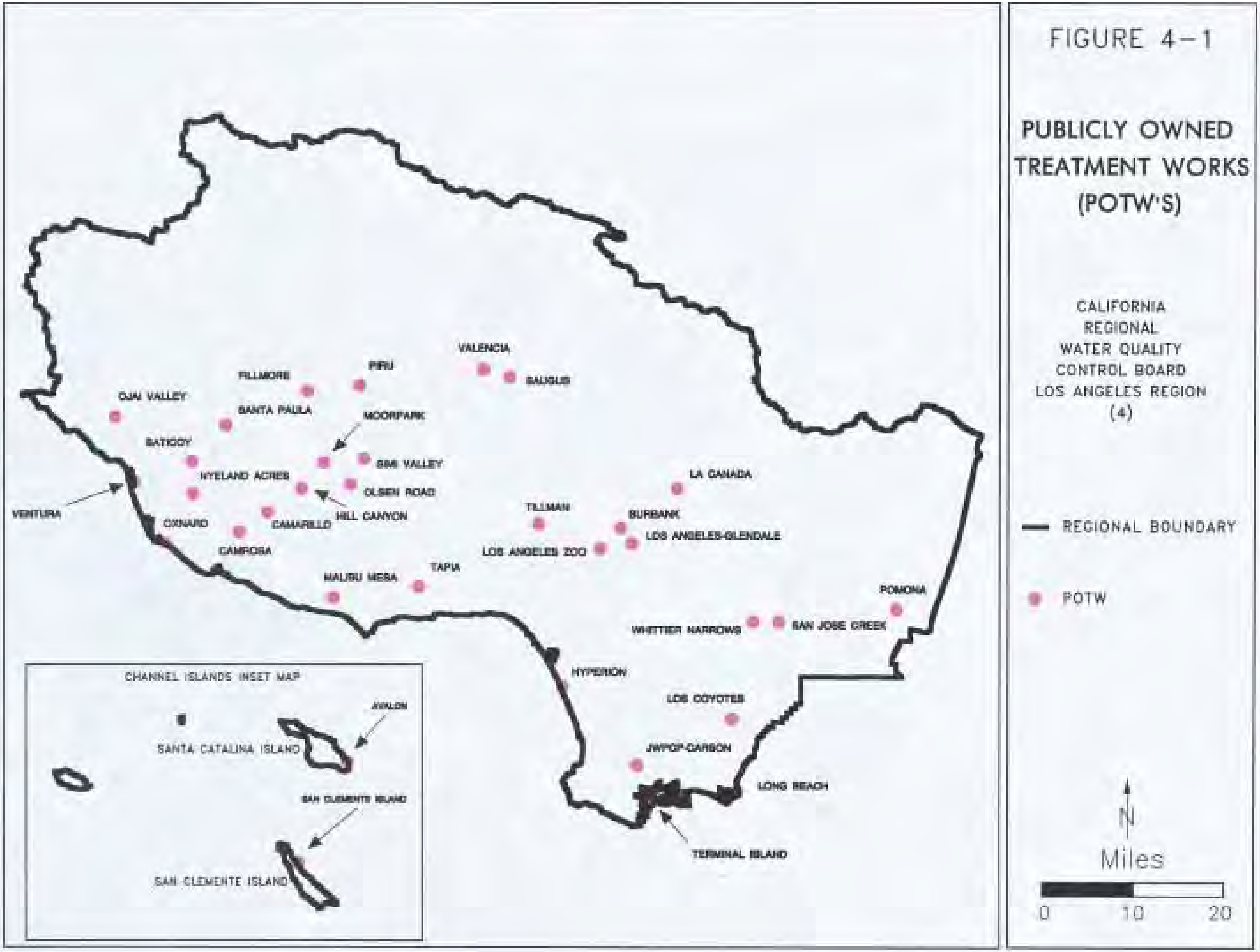


FIGURE 4-1
PUBLICLY OWNED TREATMENT WORKS (POTW'S)
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD LOS ANGELES REGION (4)
REGIONAL BOUNDARY
POTW
N
Miles
0
10
20
OJAI VALLEY
FILLMORE
PIRU
VALENCIA
SAUGUS
SANTA PAULA
MOORPARK
SATICOY
SIMI VALLEY
HYELAND ACRES
OLSEN ROAD
HILL CANYON
VENTURA
OXNARD
CAMARILLO
CAMROSA
MALIBU MESA
TAPIA
TILLMAN
LA CANADA
BURBANK
LOS ANGELES-GLENDALE
LOS ANGELES ZOO
POMONA
WHITTIER NARROWS
SAN JOSE CREEK
HYPERION
LOS COYOTES
JWPCP-CARSON
LONG BEACH
TERMINAL ISLAND
CHANNEL ISLANDS INSET MAP
AVALON
SANTA CATALINA ISLAND
SAN CLEMENTE ISLAND
SAN CLEMENTE ISLAND

Table 4-5. Major or Significant NPDES and WDR Discharge Categories, Numbers of Permits and Total Design Flow#.

Category	Number of permits (Major or Significant Dischargers)	Total design flow from facilities † (MGD approximate)
Domestic sewage	13	35.5
Domestic sewage mixed with industrial waste	26	1255.9
Solid Waste	25	1.0 *
Wash water (industrial/ manufacturing)	1	0.03
Contact & non-contact cooling waters and process waste (industrial/ manufacturing)**	16	6700.4
Storm water runoff ***	14	361
Miscellaneous ****	5	21.1

Numbers as of February 1994.

† Total design flow numbers includes secondary discharges (other categories) from some facilities. The Requirements listed include multiple permits for some major dischargers, particularly municipal sewage treatment plants.

* All landfills are permitted for "no discharge;" not including storm runoff. The 1.0 MGD shown on table is for a sludge farm.

** Includes powerplants.

*** These numbers indicate some process or other wastes.

**** Includes refineries, shipyards, aquaculture, and others.

Landfills

There are over 700 landfills in the Los Angeles Region, of which approximately 30 are active; the remainder are inactive or closed. The Regional Board issues WDRs to landfills that accept at least one of the following types of waste (Table 4-7): hazardous waste (Class I), designated waste (Class II), non-hazardous solid waste (Class III) and inert solid waste (Unclassified). One significant issue in the regulation of solid waste disposal is the definition of designated wastes. Many wastes which are classified as non-hazardous contain constituents of water quality concern that could become soluble in a non-hazardous solid waste landfill. Because of the need for greater containment requirements for this type of designated waste, disposal in a Class III landfill can pose a threat to the beneficial uses of State waters and therefore a more secure site (Class II) is necessary.

Landfill applicants must demonstrate to the Regional Board that the proposed disposal will be in a manner and setting such that wastes will not adversely affect any waters. Criteria for evaluating waste disposal sites include:

- Geologic features of site area
- Liners
- Leachate collection and removal systems
- Subsurface barriers

WDRs for active landfills include mandatory detection and evaluation monitoring programs and prescribed corrective actions for leakages. Landfills that close must be monitored for 30 years (40 CFR Parts 257 and 258) or longer if wastes pose a threat to water quality (Title 23, California Code of Regulations, Chapter 15, §2580).

The Regional Board has regulated landfills since the 1950s. Many of the small older sites have been closed and waste is now being handled at large regional landfills (see Table 4-8 for status of all landfills with ongoing groundwater monitoring programs; Figure 4-2 for locations). The Regional Board reviews and revises WDRs for active Class III sites (there are no active Class I or Class II sites in the Region) to ensure consistency with revised State requirements (Title 23, California Code of Regulations, Chapter 15), requires upgrading of groundwater monitoring systems in order to identify water quality degradation, and reviews and oversees the development and implementation of proper closure plans. Article 5 of Chapter 15, adopted in 1991, specifies new guidelines for the siting of groundwater monitoring wells around all active landfills. In addition, USEPA promulgated regulations (40 CFR Parts 257 and 258, "Subtitle D" [Solid Waste Disposal Facility Criteria]) in 1991, that uniformly apply additional requirements to dischargers of municipal solid waste. The Regional Board adopted Order No. 93-062 (September 27, 1993) which requires that all applicable regional landfills comply with these federal regulations.

Class III landfills in the Los Angeles Region are listed in Table 4-9. Former active Class I landfills include Calabasas, BKK, Palos Verdes, and Simi Valley. There are approximately 15 active inert

Table 4-6. Cooperating Agencies for the Land Disposal Programs.

Waste Disposal Category	Cooperating Agency
Mining Waste (Article 7 of Chapter 15)	California Division of Mines and Geology
Nonhazardous solid waste landfills (also regulated by the Federal Resource Conservation and Recovery Act [RCRA], Subtitle D)	California Integrated Waste Management Board
Hazardous Wastes (also regulated by the Federal Resource Conservation and Recovery Act [RCRA], Subtitle C)	California Department of Toxic Substances Control

Table 4-7. Landfill Classifications.

Disposal Site classification	Definitions of Waste Types (California Code of Regulations, Title 23, Division 3, Chapter 15, Sections 2521 et seq.)	Examples
Class I - Hazardous Waste	a) Hazardous waste is any waste which, under Section 66300 of Title 22, is required to be managed according to Chapter 30 of Division 4 of Title 22. b) Hazardous waste shall be discharged only at Class I waste management units which comply with the applicable provisions unless wastes qualify for a variance under Section 66310 of Title 22. c) Waste which have been designated as restricted wastes by California Department of Health Services (DHS) pursuant to Section 66900, of Title 22 shall not be discharged to waste management units after the restriction dates established by Section 66905 of Title 23 unless: 1) such discharge is for retrievable storage, and 2) DHS has determined that processes to treat or recycle substantially all of the waste are not available, or 3) DHS has granted a variance from restrictions against land disposal of the waste under Section 66930 of Title 22.	Materials that contain high concentrations of pesticides, certain solvents, and PCBs are examples of hazardous wastes.
Class II - Designated Waste	a) Designated waste is defined as: 1) nonhazardous waste which consists of or contains pollutants which, under ambient environmental conditions at the waste management unit, could be released at concentrations in excess of applicable water quality objectives, or which could cause degradation of waters of the State. 2) hazardous waste which has been granted a variance from hazardous waste management requirements pursuant to Section 66310 of Title 22. b) Wastes in this category shall be discharged only at Class I waste management units or at Class II waste management units which comply with the applicable provisions of Chapter 15 and have been approved for containment of the particular kind of waste to be discharged. Decomposable wastes in this category may be discharged to Class I or II land treatment waste management units.	Materials with high concentrations of BOD, hardness, or chloride. Inorganic salts and heavy metals are "manageable" hazardous wastes.
Class III-Nonhazardous Solid Waste	a) Nonhazardous solid waste means all putrescible and nonputrescible solid, semi-solid, and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, manure, vegetable or animal solid and semi-solid wastes and other discarded solid or semi-solid waste; provided that such wastes do not contain wastes which must be managed as hazardous wastes, or wastes which contain soluble pollutants in concentrations which exceed applicable water quality objectives, or could cause degradation of waters of the State (i.e., designated waste). b) Except as provided in Subsection 2520(d) of Chapter 15, nonhazardous solid waste may be discharged at any classified landfill which is authorized to accept such waste, provided that: 1) the discharger shall demonstrate that co-disposal of nonhazardous solid waste with other waste shall not create conditions which could impair the integrity of containment features and shall not render designated waste hazardous (e.g., by mobilizing hazardous constituents); 2) a periodic load-checking program approved by DHS and regional boards shall be implemented to ensure that hazardous materials are not discharged at Class III landfills. c) Dewatered sewage or water treatment sludge may be discharged at a Class III landfill under the following conditions, unless DHS determines that the waste must be managed as hazardous waste: 1) The landfill is equipped with a leachate collection and removal system; 2) The sludge contains at least 20 percent solids by weight if primary sludge, or at least 15 percent solids if secondary sludge, mixtures of primary and secondary sludges, or water treatment sludge, and 3) A minimum solids-to-liquid ratio of 5:1 by weight shall be maintained to ensure that the co-disposal will not exceed the initial moisture-holding capacity of the nonhazardous solid waste. The actual ratio required by the regional board shall be based on site-specific conditions. d) Incinerator ash may be discharged at a Class III landfill unless DHS determines that the waste must be managed as hazardous waste.	Garbage, trash, refuse, paper, demolition and construction wastes, manure, vegetable or animal solid and semisolid wastes.
Unclassified/Inert	a) Inert waste does not contain hazardous waste or soluble pollutants at concentrations in excess of applicable water quality objectives. It does not contain significant quantities of decomposable waste. b) Inert wastes do not need to be discharged to classified management units. c) Regional boards may prescribe individual or general waste discharge requirements for discharges of inert wastes.	Concrete, rock, plaster, brick, uncontaminated soils.

Table 4-8. Status of Landfills (Active and Inactive) in Region that have Ongoing Groundwater Monitoring Programs.

Landfill	Constituents detected in monitoring wells	Current activities
Azusa Landfill (Azusa Land Reclamation Co., Inc.)	Volatile organic compounds (VOCs)	Ongoing continuous detection monitoring includes gas control.
Bailard Landfill (Ventura Regional Sanitation District)	Vinyl chloride	Increased gas extraction wells as well as groundwater extraction wells at Bailard and one well at a coastal site are reducing vinyl chloride exceedances.
BKK Landfill West Covina* (BKK Corporation)	Class I area: VOCs, heavy metals, semi-VOCs, general minerals Class III area: no detectable contaminants	The groundwater monitoring system surrounding the landfill consists of over 200 wells. Offsite well clusters are currently being installed to determine the extent of the contaminant plume from the landfill. Corrective action program ongoing.
Bradley Landfill (Valley Reclamation Co.)	VOCs	Site undergoing evaluation monitoring.
Brand Park Disposal Site (City of Glendale)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Calabasas Landfill* (Sanitation Districts of Los Angeles County)	Heavy metals, VOCs, semi-VOCs	Site undergoing evaluation monitoring.
Calmat Sun Valley (Calmat Properties Co.)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Chandler Sand and Gravel (Chandler's Sand and Gravel)	General minerals	Inert landfill. Site undergoing detection monitoring.
Chiquita Canyon Landfill (Laidlaw Waste System Chiquita)	VOCs, inorganic compounds	Corrective action program will be implemented.
Coastal Landfill (Ventura Regional Sanitation District) [closed]	VOCs	Increased gas extraction wells as well as groundwater extraction wells at Bailard and one well at coastal site are reducing VOCs exceedances.
Getty Oil Site (Texaco Producing, Inc.)	No detected contamination	Site undergoing detection monitoring.
Irwindale Dike Build-up (Livingston-Graham Inc.)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Lopez Canyon Landfill (City of Los Angeles Department of Public Works)	No detected contamination	Additional up and down gradient wells installed as part of required program. Site undergoing detection monitoring.
Manning Pit South [Former] (Los Angeles County DPW WMD)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Manning Pit North (City of Irwindale)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Montebello Land and Water (Montebello Land and Water Co.)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Nu-Way Owl Rock Landfill	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Nu-Way Industries Landfill [closed]	Detectable VOCs up- and down-gradient	No statistically significant exceedences.

Table 4-8. Status of Landfills (Active and Inactive) in Region that have Ongoing Groundwater Monitoring Programs (continued).

Landfill	Constituents detected in monitoring wells	Current activities
Operating Industries Landfill*** (Operating Industries, Inc.) [closed-Superfund site]	VOCs, semi-VOCs, metals, inorganic compounds	A leachate treatment plant has been constructed for on-site treatment, with a remedial investigation ongoing.
Owl Rock Quarry Site (Nu-Way Industries, Inc.)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Palos Verdes** (Sanitation Districts of Los Angeles County) [closed]	VOCs	Department of Toxic Substances Control is lead agency. Districts have submitted remedial investigation report.
Puente Hills Landfill (Sanitation Districts of Los Angeles County)	VOCs, metals	In August 1993, the Districts installed a replacement barrier and additional gas wells to control landfill gas, the probable source of the VOC's. Site undergoing detection monitoring.
San Marino City Dump (City of San Marino)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Santa Clara Disposal Site, Oxnard (Ventura Regional Sanitation District) [closed]	VOCs	Increased gas extraction wells and groundwater extraction wells at Bailard and one well at a coastal site are reducing VOCs exceedances.
Savage Canyon Disposal Site (City of Whittier)	No detected contamination	Site undergoing detection monitoring.
Scholl Canyon Landfill (Sanitation Districts of Los Angeles County)	VOCs, chloride	Site undergoing evaluation monitoring.
Simi Valley Landfill* (Waste Management of California)	VOCs	Site undergoing evaluation monitoring.
Spadra Landfill (Sanitation Districts of Los Angeles County)	VOCs	An evaluation monitoring program will be implemented.
Stough Park Landfill (City of Burbank)	VOCs	An evaluation monitoring program will be implemented.
Strathern (LA By-Products Co.)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Sunshine Canyon Landfill - City of Los Angeles portion (Browning-Ferris Industries, Inc.) [closed]	Chloride above Water Quality Protection Standard	The operator has been asked to do additional background/site characterization to determine sources of elevated chloride levels downgradient of the landfill.
Toland Road Disposal Site (Ventura Regional Sanitation District)	No detected contamination	Additional downgradient well to be installed. Site undergoing detection monitoring.
Toyon Canyon Landfill (City of Los Angeles Department of Public Works) [closed]	Organic and inorganic constituents	A monitoring and reporting program was revised in December 1991. An evaluation monitoring program has also been submitted.

* Former Class I landfill that is now an operating Class III landfill and has an ongoing ground water monitoring program.
** Former Class I landfill that is now closed and has an ongoing ground water monitoring program.
*** Former Class II landfill that is now closed but has an ongoing ground water monitoring program.

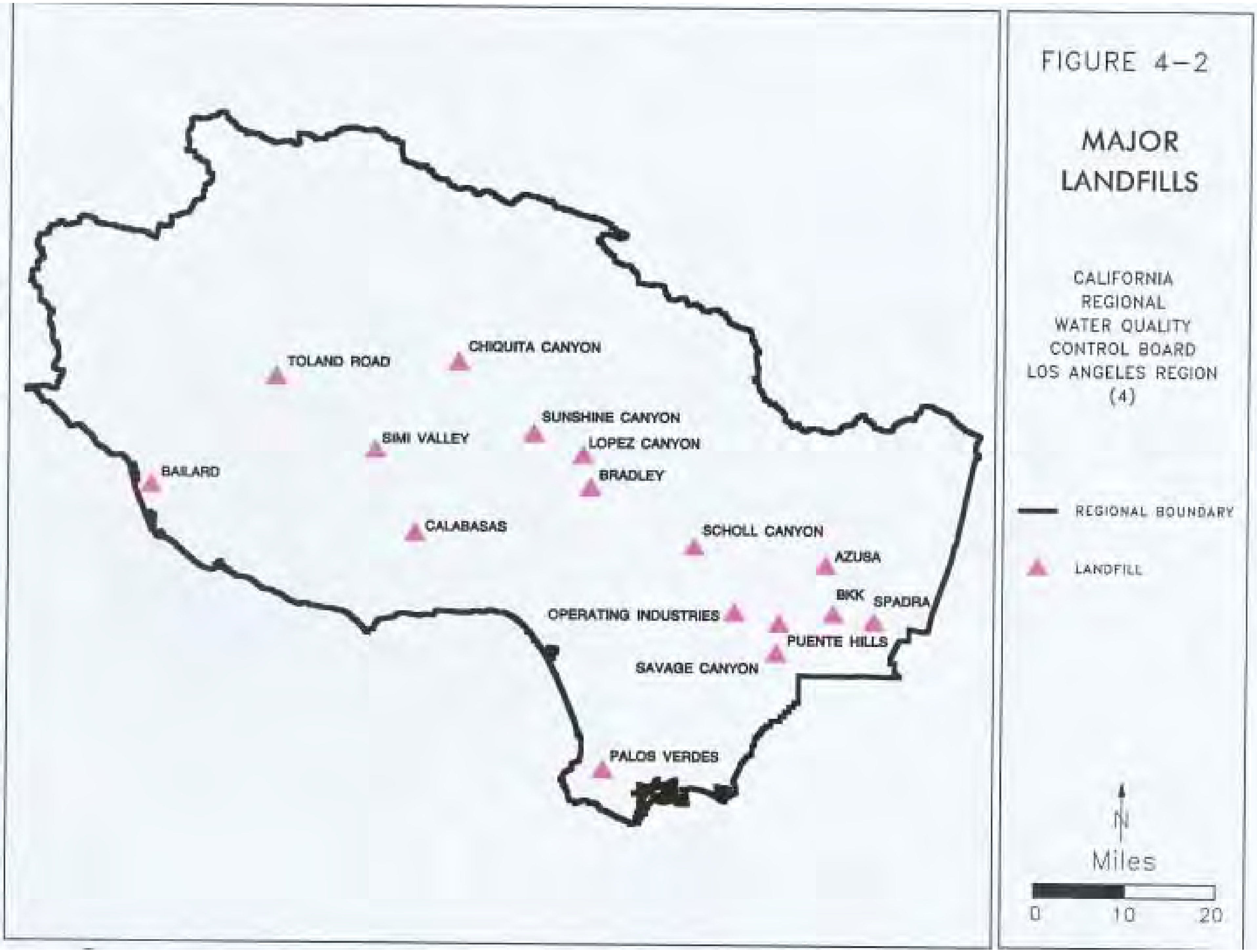

TOLAND ROAD
CHIQUITA CANYON
SUNSHINE CANYON
SIMI VALLEY
LOPEZ CANYON
BAILARD
BRADLEY
CALABASAS
SCHOLL CANYON
AZUSA
BKK
SPADRA
OPERATING INDUSTRIES
PUENTE HILLS
SAVAGE CANYON
PALOS VERDES
FIGURE 4-2
MAJOR
LANDFILLS
CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)
REGIONAL BOUNDARY
LANDFILL
N
Miles
0
10
20

Table 4-9. Active Regional Class III Landfills.

County	Agency/Owner	Landfills
Ventura County	Ventura Regional Sanitation District	Bailard Toland Road
	Waste Management Disposal Services of California, Inc.	Simi Valley
Los Angeles County	Azusa Land Reclamation/BFI *	Azusa
	BFI	Sunshine Canyon
	BKK	BKK-West Covina
	City of Burbank	Stough Park
	Laidlaw Waste System	Chiquita Canyon
	City of Los Angeles Department of Public Works	Lopez Canyon
	Sanitation Districts of Los Angeles County	Calabasas Puente Hills Scholl Canyon Spadra
	Valley Reclamation Company/Waste Management Disposal Services of California, Inc.	Bradley
	City of Whittier	Savage Canyon
	Consolidated Disposal	Pebbly Beach
	Doug Bombard Enterprises	Two Harbors

* The Azusa Landfill Reclamation site is currently accepting inert wastes. A ruling from State Board will determine whether the original 80-acre portion of the site will continue to operate as a Class III landfill pursuant to Regional Board Order WQ 86-59 and State Board Order 91-01.

landfills; see Table 4-10 for Regional Board procedures for siting inert landfills. In addition, there are several hundred inactive landfills in the Region, for which information about the nature of wastes and possible impacts to ground water are unknown at this time.

The Regional Board also administers the Solid Waste Water Quality Assessment Test (SWAT) Program in the Region, pursuant to the California Water Code (§13273). Section 13273, added in 1985, requires owners of active or inactive non-hazardous landfills to evaluate the possible migration of hazardous wastes or leachate from their landfill.

In addition to requiring site evaluations, the SWAT Program also:

- provides deadlines for implementation of water quality monitoring systems at active solid waste disposal sites;
- requires water quality monitoring systems at many closed solid waste disposal sites which previously had none; and
- requires identification of leaking solid waste disposal sites for verification monitoring and/or remedial actions to be taken under the Chapter 15 Program.

In 1986, the Regional Board began to require that landfill operator/owners prepare SWAT proposals to show how they would meet the requirements of Section 13273. Upon approval of proposals by the Regional Board, the operators must collect groundwater monitoring data during four consecutive quarters and submit the combined data in a SWAT report. To date, the Regional Board has received approximately 75 reports. Several of the landfills that detected problems underwent, or are undergoing, verification monitoring. SWAT reports submitted by owner/operators must include an analysis of the surface and ground water on, under, and within one mile of the solid waste disposal site in order to provide a reliable indication of whether there is any leakage of hazardous waste. Reports must also contain a chemical characterization of the soil-pore liquid of those areas which are likely to be affected if the solid waste disposal site is leaking and compare that area to geologically similar areas near the solid waste disposal site which have not been affected by the leakage of waste.

Table 4-10. Procedures for Siting Inert Landfills.

Regional Board procedures for siting inert landfills
A monitoring program approved by the Executive Officer must be in place and operating prior to disposal of any inert waste. This will include ground water monitoring and waste disposal reporting. In the event that possible leakage from the landfill is observed during routine detection monitoring, an evaluation monitoring, and if necessary, a corrective action program similar to those included in Chapter 15 will be implemented.
Disposal must be restricted to inert wastes. Organic material is allowed only in insignificant quantities, with the exception of a maximum of 5% by volume of organic material from debris basins. Friable asbestos, asphaltic material*, and rubber tires are specifically prohibited unless allowed by Waste Discharge Requirements from the Regional Water Quality Control Board.
A waste load checking program similar to those approved for Class III landfills must be carried out.
Installation of precipitation and drainage controls is required to accommodate runon and runoff.
Inspection of facility by Regional Board staff should be conducted at least once per year.
Submittal of a closure plan is required for review and approval by the Executive Officer. Such plan to include ground water monitoring for a minimum period of five years.

* Asphaltic material that contains less than 50% solids is not allowed (i.e., asphalt). Asphaltic concrete (as defined by the Joint Cooperative Committee of the Southern California Chapter, American Public Works Association, and Southern California Districts, and Associated General contractors: *Standard Specifications for Public Works Construction*) is allowed.

Under Public Resources Code Section 45700, the State Board is required to rank all solid waste facilities throughout the State based on the threat to water quality. Other State Board reports prepared under this section detail the extent of hazardous waste at each solid waste disposal site, the potential effects these hazardous wastes can have upon the quality of waters of the State, and recommended actions needed to protect the quality of water.

Sludge Use and Disposal

Biosolids, or sludge, are residual byproducts of sewage treatment, water treatment, and certain industrial processes. Heavy metals and volatile organic chemicals tend to concentrate in sludge. For this reason, USEPA and the Regional Board do not allow the direct discharge of sludge to the ocean or any other surface waters. Discharge to land must be carefully controlled because of potential impacts on ground and surface water quality. If sludge is disposed at a landfill, it must be non-hazardous, and meet the moisture and liquid-solid ratio requirements of the receiving landfill.

Under the NPDES program, sludge disposal is regulated (40 CFR Part 503) as a self-implementing program enforced by USEPA; the state does not have delegated authority for implementing the sludge program. Sludge reporting requirements (i.e., haulage information) for sewage treatment plants are included in their NPDES permits and WDRs.

The Regional Board encourages the use of sludge or by-products thereof. Some ways that sludge can be disposed include the following:

- dehydrated sludge as fuel in gas boilers to generate electricity (ash can be recovered for use as a fluxing agent in copper smelting or in cement production);
- sludge digester methane gas as fuel in gas boilers to generate electricity;
- chemically fixated sludge as landfill daily cover: adding chemical additives which fix heavy metals, reduce pathogens, and reduce free water to form a clay-like soil for use as daily landfill cover;
- sludge as a soil amendment: composting dewatered sludge (pathogens are killed at composting temperatures);
- sludge as a nutrient source for non-edible crops: direct application to agricultural crops not meant for direct human consumption (mixing, tilling, or injecting sludge into soil);
- sludge disposal directly in certain landfills; and
- sludge disposal in-situ.

Soil and Hazardous Waste Disposal

Contaminated soil and other material must be treated or properly disposed in order to minimize threat to the quality of surface or ground waters. Dischargers are required to submit an initial analysis of the material by a State-certified laboratory. If the material is deemed hazardous, the discharger is referred to the California Department of Toxic Substances Control. For non-hazardous materials, general WDRs can be issued on a case-by-case basis. All permitted treatment or disposal includes monitoring and reporting requirements.

General WDRs (Table 4-2) for discharge of non-hazardous contaminated soils or other wastes (good for 90 days) are issued for disposal of up to 100,000 cubic yards of contaminated material. If the material contains acceptable levels of total petroleum hydrocarbons (TPH) or other contaminants, then it can be disposed in a Class III landfill at the discretion of the site operator. For discharges over 100,000 cubic yards, individual WDRs are required.

General WDRs (Table 4-2) for in-situ treatment are issued for materials that meet guidelines for land treatment of petroleum hydrocarbon-contaminated soils. Up to 100,000 cubic yards of contaminated soil can be remediated, by land treatment, to acceptable levels usually not exceeding 1000 mg/kg total petroleum hydrocarbons, within one year. For discharges over 100,000 cubic yards, individual WDRs are necessary.

Remediation treatment includes biodegradation (by a land treatment process) for hydrocarbon contaminated soil found on site and a fixation process for metals contaminated soils. In-situ disposal (without treatment) can be allowed, on a case-by-case basis, for material that is not considered to be a threat to surface or ground water.

Dredging Requirements

The Regional Board issues WDRs for dredging projects to control potential water quality impacts associated with removal and disposal of bottom sediments. In the Los Angeles Region, most dredging activities take place within the Ports of Los Angeles and Long Beach to maintain navigation channels at the proper depth or to accommodate new development. Dredging projects periodically occur in other partially or fully enclosed water bodies (e.g., marinas and lagoons), ocean waters, and inland lakes and reservoirs. Applicants must demonstrate that dredging activities will not cause adverse water quality impacts and that disposal will be managed such that beneficial uses will not be affected. Dredging requirements usually have an expiration date.

Septic Systems

The California Water Code, Chapter 4, Article 5, sets forth criteria for regulating individual disposal systems (i.e., residential septic tanks). In the past, the Regional Board placed certain types of septic tank systems under individual WDRs. The Regional Board has delegated local health or public works departments jurisdiction to permit and regulate most single-family dwellings septic tank disposal systems. However, the Regional Board retains jurisdiction over multiple-dwelling units, some non-domestic septic tank systems, and large developments in certain problem areas, as well as in any situation where septic systems are creating or have the potential to create a water quality problem.

The Regional Board has adopted general WDRs (Table 4-2) for certain private residential subsurface sewage disposal systems in areas where ground water is an important source of drinking water. These general WDRs apply to areas greater than 1 acre and less than five acres in size and in general require either a hydrogeologic study or mitigation measures. WDRs are not issued for lots less than 1 acre in size and are not required for lot sizes greater than five acres.

Waivers from WDRs

The Regional Board can waive WDRs pursuant to the California Water Code (§13269) provided that such action is not against the public interest. Discharges eligible for such waivers (see Table 4-11 for examples) must comply with all applicable Water Quality Control Plans, and:

- have minimal adverse water quality impact;
- be adequately regulated by another State or local agency; or
- be a category of discharge covered by State or Regional Board regulations, guidelines, or Best Management Practices where the Regional Board has obtained voluntary compliance.

Table 4-11. Waiver Conditions from WDRs.

Regional Board waivers
Single family dwelling subsurface sewage disposal systems which are installed and operated in compliance with local ordinances *(as modified by General Permit Order No. 91-94).*
Single family dwelling swimming pool waste disposal installations which are constructed and operated in compliance with local ordinances (Resolution No. 53-5).
The on-site disposal of uncontaminated and unpolluted rotary mud resulting from the drilling of one oil well in such a manner that it will not be dumped or allowed to drain into any waters of the State.
State Board Waivers
Temporary construction dewatering discharge when end-of-pipe treatment is not feasible and the quality of the discharge is acceptable.
Discharges from private and public recreational impoundments caused by: a) continuous addition of domestic water and no additives are used to maintain the lake quality b) wet weather conditions and herbicides are used on a seasonal basis for maintenance of the aesthetic conditions in the impoundment c) water spilled from an impoundment through the addition of new water, wind action, or rainfall, or over a spillway.

Waivers of WDRs are conditional and can be terminated at any time by the Regional Board. NPDES permits, described below, can not be waived.

Water Reclamation Requirements (WRRs)

The State and Regional Board adopted the *Policy With Respect to Water Reclamation in California.* This policy, summarized and reprinted in Chapter 5, directs the Regional Boards to encourage reclamation of wastewaters and to promote water reclamation projects that preserve, restore, or enhance in-stream beneficial uses. The Regional Board waives fees for WRRs.

Projects that reuse treated wastewaters and thereby lessen the demand for higher quality fresh waters are subject to Water Reclamation Requirements (WRRs). Title 22, California Code of Regulations, Division 4, Chapter 3, describes the applicable reclamation criteria (Table 4-12). Requirements from the California Department of Health Services are incorporated into WRRs. Treated wastewaters subject to WRRs in the Los Angeles Region are used for landscape irrigation, recreational impoundments, and to recharge ground water. WRRs are not needed for process waters that are completely recycled during plant operations.

National Pollutant Discharge Elimination System Program (NPDES)

The CWA authorized the USEPA to regulate point source pollutants to the waters of the United States under the NPDES permitting program. The goal of this program was to eliminate all discharges of pollutants to surface waters by 1985. In 1974, California became a "delegated state" for issuing NPDES permits. As noted above, the state issues NPDES permits as WDRs in accordance with a Memorandum of Agreement (MOA) between the USEPA and the State Board, and as codified in the California Water Code, Chapter 5.

A standard NPDES permit generally includes the following components:

- Findings: *official description of the facility, processes, type and quantity of wastes, existing requirements, enforcement actions, public notice and applicable Water Quality Control Plans.*
- Effluent limitations: *narrative and numerical limits for effluent; discharge prohibitions.*
- Receiving water limitations: *narrative and numerical objectives for the receiving waters.*
- Provisions: *standard provisions required by the Regional Board and by Federal law; expiration date of permit.*
- Compliance/task schedules: *time schedules and interim reporting deadlines for compliance.*
- Pretreatment requirements: *standard pretreatment requirements for municipal facilities (see below).*

Table 4-12. Reclaimed Water: Uses and California Title 22 Health Requirements.

Permitted use of reclaimed water	Summary of Title 22 (Sections 60303 et. seq.) Health Requirements
Spray irrigation of food crops	Reclaimed water used for spray irrigation of food crops shall be at all times adequately disinfected, oxidized, coagulated, clarified, filtered wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process, the median number of coliform organisms does not exceed 2.2 per 100 ml and the number of coliform organisms does not exceed 23 per 100 ml in more than one sample within any 30-day period. The median value shall be determined from the bacteriological results of the last 7 days for which analyses have been completed.
Surface irrigation of food crops	Reclaimed water used for surface irrigation of food crops shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process, the median number of coliform organisms does not exceed 2.2 per 100 ml as determined from the bacteriological results of the last 7 days for which analyses have been completed. Orchards and vineyards may be surface irrigated with reclaimed water that has the quality at least equivalent to that of primary effluent provided that no fruit is harvested that has come in contact with the irrigating water or the ground. Exceptions to the quality requirements for reclaimed water used for irrigation of food crops may be considered by the State Department of Health on an individual basis where the reclaimed water is to be used to irrigate a food crop which must undergo extensive commercial, physical or chemical processing sufficient to destroy pathogenic agents before it is suitable for human consumption.
Irrigation of fodder, fiber and seed crops	Reclaimed water used for the surface or spray irrigation of fodder, fiber, and seed crops shall have a level of quality no less than that of primary effluent.
Irrigation of pasture for milking animals	Reclaimed water used for the irrigation of pasture to which milking cows or goats have access shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 23 per 100 ml, as determined from the bacteriological results of the last 7 days for which analyses have been completed.
Landscape irrigation of golf courses, cemeteries, freeway landscapes and similar areas	Reclaimed water used for the irrigation of golf courses, cemeteries, freeway landscapes, and landscapes in other areas where the public has similar access or exposure shall be at all times an adequately disinfected oxidized wastewater. The wastewater shall be considered adequately disinfected if the median number of coliform organisms in the effluent does not exceed 23 per 100 ml as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of coliform organisms does not exceed 240 per 100 ml in any two consecutive samples.

Table 4-12. Reclaimed Water: Uses and California Title 22 Health Requirements (continued).

Permitted use of reclaimed water	Summary of Title 22 (Sections 60303 et. seq.) Health Requirements
Irrigation of parks, playgrounds, schoolyards and similar areas	Reclaimed water used for the irrigation of parks, playgrounds, schoolyards, and other areas where the public has similar access or exposure shall be at all times an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater or a wastewater treated by sequence of unit processes that will assure an equivalent degree of treatment and reliability. The wastewater shall be considered adequately disinfected if the medium number of coliform organisms in the effluent does not exceed 2.2 per 100 ml, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of coliform organisms does not exceed 23 per 100 ml in any sample.
Nonrestricted recreational impoundment (no limitations are imposed on body-contact sport activities)	Reclaimed water used as a source of supply in a nonrestricted recreational impoundment shall be at all times adequately disinfected, oxidized, coagulated, clarified, filtered wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process, the median number of coliform organisms does not exceed 2.2 per 100 ml and the number of coliform organisms does not exceed 23 per 100 ml in more than one sample within any 30-day period. The median value shall be determined from the bacteriological results of the last 7 days for which analyses have been completed.
Restricted recreation impoundment (recreation is limited to fishing, boating, and other non-body-contact water recreation activities)	Reclaimed water used as a source of supply in a restricted recreational impoundment shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 ml, as determined from the bacteriological results of the last 7 days for which analyses have been completed.
Landscape impoundment (aesthetic enjoyment or other function but no body-contact is allowed)	Reclaimed water used as a source of supply in a landscape impoundment shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 23 per 100 ml, as determined from the bacteriological results of the last 7 days for which analyses have been completed.
Groundwater recharge of domestic water supply aquifers	Recharge water requirements are made on a case-by-case basis to ensure that the water is of such quality that fully protects public health at all times. Factors considered include treatment provided, effluent quality and quantity, spreading operations, soil characteristics, hydrogeology, residence time, receiving water quality and distance to withdrawal.
Other uses (toilet flush, industrial cooling water, process water, seawater intrusion barrier)	User must demonstrate that methods of treatment and reliability features will assure an equal degree of treatment and reliability.

- Sludge requirements: *sludge monitoring and control requirements, if necessary and not regulated under separate WDRs.*

- Monitoring program: *specific locations of monitoring stations and sampling frequency for all parameters limited in permit, including flow.*

Pretreatment

The 1972 amendments to the CWA established a separate regulatory program, called the National Pretreatment Program, that requires removal of toxic and other non-conventional pollutants at their sources before the wastewater enters publicly-owned treatment works (POTWs). The USEPA has developed pretreatment regulations for certain industries.

In addition, agencies operating one or more POTWs with a total design flow greater than five-million gallons per day are required to implement pretreatment programs. Smaller POTWs that have significant industrial influent, treatment process problems, or violations of effluent limitations, also can be required to pretreat influent. The pretreatment programs are designed to reduce pollutants that: interfere with biological treatment processes, contaminate sludge, and violate water quality objectives of receiving waters. POTWs are responsible for implementing and enforcing their own pretreatment programs, but are subject to USEPA and Regional Board approval and oversight.

Storm Water Permits

Storm water runoff is runoff from land surfaces that flows into storm drains or directly into natural waterbodies during rainfall. Storm water discharges include flow through pipes and channels or sheet flow over a surface. Storm water runoff was not regulated by the NPDES program until after the 1987 amendments to the CWA. Historically, many large manufacturers or industrial operators collected runoff (non-process wastewater) within their properties and discharged it to storm drains or sent it to a sewage treatment plant. However, most small industries and construction sites did not collect or monitor their runoff. The NPDES program now requires that this runoff be eliminated or regulated under a storm water permit. For more information about storm water, see the Urban Runoff in the Nonpoint Source section of this Chapter.

Table 4-13. Storm Water General NPDES Categories (General Permit Major Categories are Italic).

Industrial Facility Categories
i. Facilities subject to storm water effluent limitations guidelines, new source performance standards, or toxic pollutant effluent standards (40 CFR subchapter N)
ii. Certain manufacturing facilities
iii. Oil and Gas/Mining facilities
iv. Hazardous waste treatment, storage, or disposal facility
v. Landfills, land application sites, and open dumps that receive or have received any industrial wastes from facilities listed herein
vi. Recycling facilities, including metal scrap yards, battery reclaimers, salvage yards, and automobile junkyards
vii. Steam electric power generating facilities
viii. Transportation facilities which have vehicle maintenance shops, equipment cleaning operations, or airport deicing operations
ix. Sewage or Wastewater treatment facilities with design flows greater than 1.0 mgd or plants required to have pretreatment program
xi. Other manufacturing facilities where materials, machinery, or products are exposed to storm water
Construction Activities of five acres or more, including clearing, grading and excavation. Construction which results in soil disturbances of less than 5 acres requires a permit if the construction activity is part of a larger common plan of development.

In November 1990, USEPA published initial permit application requirements for certain categories of storm water discharges associated with industrial activity and for discharges from separate municipal storm sewer systems located in municipalities with populations of 100,000 or more (55 FR 47990). These NPDES storm water discharge permits provide a mechanism for monitoring the discharge of pollutants to "waters of the United States" and for establishing appropriate controls to the maximum extent practicable.

In cases where there are existing NPDES permits for wastewater discharges, the Regional Board incorporates storm water discharge provisions into the same permit. Currently two types of NPDES storm water permits have been promulgated by the State and Regional Boards:

- Municipal permits for separate storm sewer systems located in urban areas with populations of 100,000 or more.
- Statewide general permits (Table 4-2):
  - (i) for *industrial activities*, excluding construction. This permit covers 10 of the 11 industrial classifications described in the federal storm water regulations (Table 4-13); and
  - (ii) for all *construction projects* impacting five acres or more, or smaller areas that are part of a larger common plan, including excavation, demolition, grading and clearing. (USEPA is considering making this permit applicable to all construction sites as part of Phase 2 of the storm water program).

Municipal storm water runoff is covered under municipal permits for a single city, county, or groups of cities and counties. The County of Los Angeles requested and received an "early" permit in 1990, prior to the promulgation of the USEPA storm water regulations. This permit covers the drainage basins contained within Los Angeles County with cities being brought into compliance under the program in three phases (Table 4-14; Figure 4-3). The Regional Board is currently developing a similar municipal permit that will cover most of Ventura County (Table 4-15), including the cities of Oxnard, Simi Valley and Thousand Oaks which have populations of greater than 100,000. The City of Thousand Oaks will be issued a separate storm water NPDES permit for drainage areas tributary to Santa Monica Bay. Each phase of the storm water program in Los Angeles County is being implemented over three years:

Table 4-14. Drainage Areas and Associated Co-permittees of Los Angeles County Municipal Storm Water NPDES Permit

Phase or Drainage Area 1: Santa Monica Bay Drainage Basin
Agoura Hills, Beverly Hills, Calabasas, Caltrans, Culver City, El Segundo, Hermosa Beach, Inglewood, Los Angeles (City and County), Malibu, Manhattan Beach, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Santa Monica, Torrance, Ventura County (portions of Ventura County are included within the Los Angeles permit area), West Hollywood, Westlake Village
Phase or Drainage Area 2: Upper Los Angeles River and Upper San Gabriel River Drainage Basins
Alhambra, Arcadia, Azusa, Baldwin Park, Bradbury, Burbank, Calabasas, Caltrans, Claremont, Covina, Diamond Bar, Duarte, El Monte, Glendale, Glendora, Hidden Hills, Industry, Irwindale, La Cañada Flintridge, La Habra Heights, La Puente, La Verne, Los Angeles (City and County), Monrovia, Montebello, Monterey Park, Pasadena, Pomona, Rosemead, San Dimas, San Fernando, San Gabriel, San Marino, Sierra Madre, South El Monte, South Pasadena, Temple City, Walnut, West Covina
Phase or Drainage Area 3: Lower Los Angeles River, Lower San Gabriel River and Santa Clara River Drainage Basins
Alhambra, Artesia, Bell, Bellflower, Bell Gardens, Caltrans, Carson, Cerritos, Commerce, Compton, Cudahy, Downey, El Segundo, Gardena, Glendale, Hawaiian Gardens, Hawthorne, Huntington Park, Inglewood, La Cañada Flintridge, La Habra Heights, Lakewood, La Mirada, Lawndale, Lomita, Long Beach, Los Angeles (City and County), Lynwood, Maywood, Montebello, Norwalk, Palos Verdes Estates, Paramount, Pasadena, Pico Rivera, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Santa Clarita, Santa Fe Springs, Signal Hill, South Gale, South Pasadena, Torrance, Vernon, Whittier

- Year I: compilation of existing data on the storm drain system and identification of existing Best Management Practices.
- Year II: implementation of early action Best Management Practices for cities, and regional

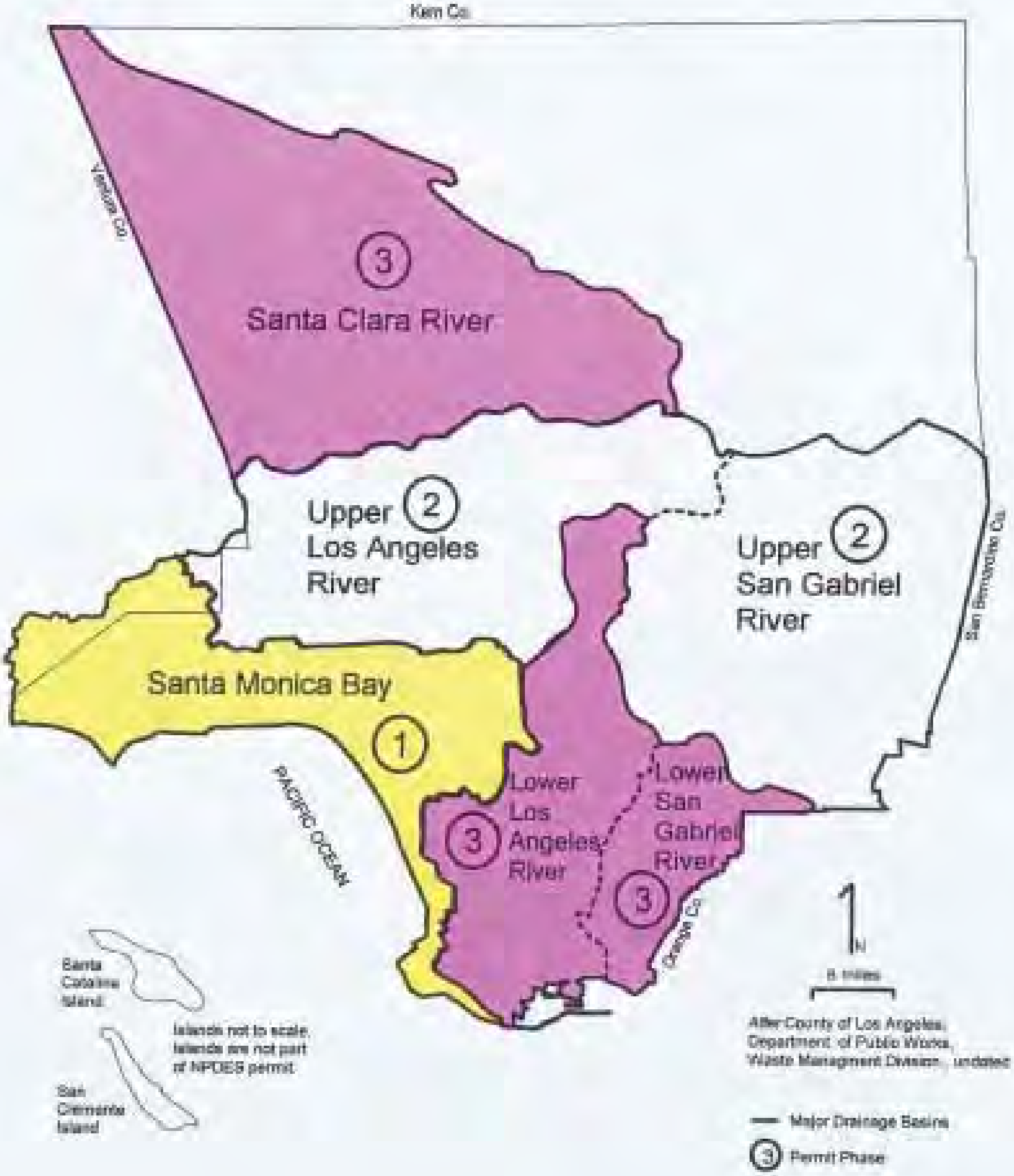


Figure 4-3. Drainage basins and phases of the Los Angeles County Municipal storm water NPDES permit.

monitoring programs for nonpoint source pollutants.

- Year III: implementation of additional Best Management Practices that are city-specific based on existing land use patterns and local concerns.

Industrial general storm water NPDES permits require that any owner/operator of a site that falls into one of the regulated categories and that discharges storm water to waters of the United States file a Notice of Intent (NOI) with the State Board. As detailed in the general permit, these dischargers are required to eliminate most non-storm water discharges, including illicit connections, to storm water drainage systems.

An industrial owner/operator must prepare a *Storm Water Pollution Prevention Plan* and a *Monitoring and Reporting Program* if storm water leaves, or has the potential to leave, an industrial site. Industries can monitor individually, or apply for a "group monitoring" program for like industries. Group monitoring is based on the assumption that similar industries have similar types of discharges. Industries under this program must sample a minimum of 20% or a minimum number of four, whichever is higher, of the facilities covered under an approved group program.

Table 4-15. Drainage Areas and Co-permittee Cities and Agencies of the Ventura County Municipal Storm Water NPDES Permit.

Drainage Area 1: Ventura River Drainage Basin
Ojai, San Buenaventura, Unincorporated Ventura County
Drainage Area 2: Santa Clara River Drainage Basin
Fillmore, Oxnard, San Buena Ventura, Santa Paula, Unincorporated Ventura County
Drainage Area 3: Calleguas Creek Drainage Basin
Camarillo, Moorpark, Simi Valley, Thousand Oaks, Unincorporated Ventura County
Drainage Area 4: Malibu Creek
Thousand Oaks, Unincorporated Ventura County
Drainage Area 5: Bays/Estuaries
Oxnard, Port Hueneme, San Buenaventura

The Regional Board's permitting strategy for industrial facilities is based on four-tiers of priorities: baseline permitting, watershed permitting, industry-specific permitting and facility-specific permitting (Table 4-16). General permits for industrial facilities will not be less stringent than individual permits. Rather, the use of general permits is intended to alleviate the administrative burden of issuing storm water permits to all industrial facilities. All permits, whether general or individual, will also require compliance with all local agency requirements. In addition, industrial facilities must eliminate all non-storm water discharges from storm drain systems unless they are authorized by an NPDES permit or determined not to be a source of pollutants and thus do not need an NPDES permit for discharge. General permits for other classes of non-storm water discharges will be considered as the need arises. Other industrial facilities not regulated at this time are expected to identify "hot areas" at their facilities where runoff can contact pollutants or activities can release pollutants to runoff. Examples of potential "hot areas" are storage areas for raw materials, sites used for the storage and maintenance of equipment, and shipping and receiving areas. In addition, industrial facilities are expected to segregate storm water discharges from these "hot areas;" and identify and implement control measures in these and other areas at the facility consistent with local agency comprehensive storm water control programs.

Dischargers are required to control pollutant discharges through use of best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT) to reduce pollutants and to use more stringent controls, if necessary, to meet water quality standards. To date, the USEPA has established technology-based numerical effluent limitations for storm water discharges from ten industrial activities (40 CFR Subchapter N, examples in Table 4-17).

For construction activities, landowners are required to develop and implement a *Storm Water Pollution Prevention Plan* and assess the effectiveness of their pollution prevention measures (control practices). The NPDES permit establishes requirements for the Notice of Intent (NOI) and the

Table 4-16. Four-tier Priority Strategy for Permitting Industrial Storm Water Dischargers.

Tier 1 - Baseline Permitting: The State Board issued a general permit in November 1991 for storm water discharges associated with industrial activities. The majority of storm water discharges associated with industrial activities in the Region will be allowed coverage under this State Board general permit. Requirements for the Notification of Intent to be covered under the general permit and the schedule for submittal and compliance are established in the permit.
Tier II - Watershed Permitting: Facilities within watersheds determined to be affected by industrial storm water discharges will be targeted for individual or watershed-specific general permits. The Regional Board will consider watershed-specific permits, on an as needed basis, for high resource or water-quality impaired watersheds in the Region.
Tier III - Industry-Specific Permitting: Specific industrial categories will be targeted for individual or industry-specific general permits. Storm water discharges from primary-metal industries, automobile salvage yards, boat yards, U.S. Department of Defense facilities in the Region may be significant sources of pollutants, and as such, the Regional Board will consider issuing general permit(s) or individual permit(s) specific to these facilities.
Tier IV - Facility-Specific Permitting: The targeting of individual facilities for facility-specific permitting will be dependent on several factors including special characteristics, complexity of operations, pollution threat, and others. Such facilities will also include those that have been found to be unsuitable for the other three tiers of permitting. In general, facility-specific permits are intended to be more restrictive than other tiers of permitting.

schedule for submittal and compliance. Discharges addressed by the permit include (i) pollutant discharges that occur during construction activities, (ii) discharges of construction waste material, and (iii) pollutant discharges in runoff after construction is completed. Permit conditions must be consistent with local agency ordinances and regulatory programs; the intent of the permit is not to supersede local programs, but rather to complement them. Under the municipal permits described above, local agencies are required to effectively address construction activities through their early planning and CEQA processes, as well as implement and develop control measures as part of their comprehensive control programs.

Criteria for WDRs, WRRs, and NPDES Permit Limit and Provisions

The Regional Board refers to several guidance documents or policies in developing effluent limits, including: USEPA's *Quality Criteria for Water* (USEPA, 1986) and a series of industry-specific USEPA Effluent Guideline Volumes (*Development Documents for Effluent Limitations Guidelines and Standards*). Site-specific effluent and receiving water limits are developed to comply with narrative and numerical objectives in the *California Ocean Plan* (1990), the *California Thermal Plan* (1975), the objectives and beneficial uses in this *Regional Water Quality Control Plan*, and other State and Regional Board plans and policies. Other nearby waste discharges, and the need to prevent nuisance, are also considered. In addition, all discharges must comply with Federal and State anti-degradation (see Chapters 3 and 5) and anti-backsliding (CWA §404) policies.

Municipal Effluent Limits (NPDES)

Effluent limitations for municipal NPDES permits require (i) at least secondary treatment, (ii) non-ocean disposal or recycling of sludge, (iii) compliance with health standards for coliform and fecal bacteria, and (iv) conformance with water contact or fish habitat standards, if necessary. Since 1977, all ocean dischargers have been required by USEPA to have secondary treatment. Some dischargers are not yet fully in compliance with this requirement; however, USEPA has denied all applications from POTWs in the Los Angeles Region for federal 301(h) waivers which would allow modified water quality criteria for ocean discharges. Those POTWs that submitted applications are now in the process of constructing secondary treatment facilities.

Specific Criteria for Site-specific Determination of Effluent Limits

The Regional Board prescribes effluent limits after assessing the nature of the waste, treatment level,

Table 4-17. Selected Point Source Categories Subject to Storm Water Effluent Limitation Guidelines (see 40 CFR 411-443).

BAT is Best Available Technology Economically Achievable.
BPT is Best Practicable Control Technology Currently Available.

Category	Legal Standard	Design storm	Parameter	Concentration (mg/L unless noted) Max for any 1 day	Concentration (mg/L unless noted) 30-day average
Cement manufacturing	BPT	10 yr. 24 hr.	TSS pH	< 50 6.0-9.0	
Feedlots (all subcategories except ducks)	BPT	10 yr. 24 hr.		No discharge of process wastewater pollutants	
	BAT	25 yr. 24 hr.		No discharge	
Feedlots (Ducks)	BPT	*	BOD5	1.66	0.91
			fecal coliform (kg/1000 ducks)	< 400/100 mpn/ml	
Fertilizer Manufacturing (Phosphate)	BPT	*	Total phosphorus Fluoride	105 75	35 25
Fertilizer Manufacturing (Ammonia)	BPT	*	Ammonia	0.1875	0.0625
			pH (kg/1000kg of product)	6.0-9.0	
Fertilizer Manufacturing (Ammonium sulfate production)	BPT	*		No discharge	
Fertilizer Manufacturing (Urea produced as a solution)	BPT	*	Ammonia Organic Nitrogen (kg/1000kg of product)	0.95 0.61	0.40 0.33
	BAT	*	Ammonia Organic Nitrogen (kg/1000kg of product)	0.53 0.45	0.27 0.24
Fertilizer Manufacturing (Urea grilled or granulated)	BPT	*	Ammonia Organic Nitrogen (kg/1000kg of product)	1.18 1.48	0.59 0.80
	BAT	*	Ammonia Organic Nitrogen (kg/1000kg of product)	0.53 0.86	0.27 0.46
Fertilizer Manufacturing (Ammonium Nitrate)	BPT	*	Ammonia Nitrate (kg/1000kg of product)	0.73 0.67	0.39 0.37
	BAT	*	Ammonia Nitrate (kg/1000kg of product)	0.08 0.12	0.04 0.07
Petroleum Refining (For discharges composed entirely of contaminated runoff)	BPT	*	Oil and Grease TOC	15 110	

Table 4-17. Selected Point Source Categories Subject to Storm Water Effluent Limitation Guidelines (see 40 CFR 411-443) (continued).

BAT is Best Available Technology Economically Achievable.
BPT is Best Practicable Control Technology Currently Available.

Category	Legal Standard	Design storm	Parameter	Concentration (mg/L unless noted)	
				Max for any 1 day	30-day average
Petroleum Refining (For discharges of a] contaminated runoff that is commingled or treated with process wastewater or b] wastewater consisting solely of contaminated runoff which exceeds 15 mg/L oil and grease or 110 mg/L TOC and is not commingled or treated with any other type of wastewater) *Multiply the flow of contaminated runoff (as determined by the permit writer) by the concentrations listed.*	BPT	*	BOD5 TSS COD Oil & grease Phenolic compounds (4AAP) Total chromium Hexavalent chromium	48 33 360 15 0.35 0.73 0.062	26 21 180 8 0.17 0.43 0.028
			pH (kg/1000m³ of flow)	6.0-9.5	
	BAT	*	Phenolic compounds (4AAP) Total chromium Hexavalent chromium COD (kg/1000m³ of flow)	0.35 0.60 0.062 360	0.17 0.21 0.028 180
Phosphate Manufacturing (Defluorinated phosphate rock and defluorinated phosphoric acid)	BPT	*	Total phosphorus Fluoride	105 75	35 25
			pH	6.0 -9.5	
Phosphate Manufacturing (Sodium phosphates)	BPT	*	TSS Total phosphorus Fluoride	0.50 0.80 0.30	0.25 0.40 0.15
			pH (kg/1000kg of product)	6.0-9.5	
Steam Electric Power Generating (Runoff from coal piles)	BPT	10 yr. 24 hr.	TSS pH PCBs	50 (max at any time) 6.0-9.0 No discharge	
Mineral Mining (Crushed stone and construction sand and gravel)	BPT	10 yr. 24 hr.	pH	6.0-9.0***	
Mineral Mining (Industrial sand: Discharge of process-generated wastewater from facilities that recycle waste except from those employing HF flotation)	BPT	10 yr. 24 hr.	TSS	45	25
			pH	6.0-9.0***	
Mineral Mining (Industrial sand: Discharges of process generated wastewater from facilities that recycle wastewater and employ HF flotation)	BPT	10 yr. 24 hr.	TSS Total fluoride	0.046 0.006	0.023 0.003
			pH (kg/1000kg final product)	6.0-9.0***	
Mineral Mining (Industrial sand: All other discharges of process generated wastewater)	BPT	10 yr. 24 hr.		No discharge	

Table 4-17. Selected Point Source Categories Subject to Storm Water Effluent Limitation Guidelines (see 40 CFR 411-443) (continued).

BAT is Best Available Technology Economically Achievable.
BPT is Best Practicable Control Technology Currently Available.

Category	Legal Standard	Design storm	Parameter	Concentration (mg/L unless noted) Max for any 1 day	Concentration (mg/L unless noted) 30-day average
Mineral Mining (Industrial sand: Mine dewatering discharges)	BPT	10 yr. 24 hr.	TSS	45	25
			pH	6.0-9.0***	
Mineral Mining (Gypsum, asphaltic mineral, asbestos and wollastonite, borax, potash, sodium sulfate, frasch sulfur, magnesite, diatomite, jade, novaculite, barite, fluorspar, salines from brine lakes, bentonite, and tripoli)	BPT	10 yr. 24 hr.		No discharge	
Ore mining and dressing (Iron ore: runoff from the drainage area of facility)	BPT	10 yr. 24 hr.	TSS Iron (dissolved)	30 2.0	20 1.0
			pH	6.0-9.0	
Ore Mining and Dressing (Copper, lead, zinc, gold, silver, and molybdenum ores: runoff from the drainage area of facility)	BPT	10 yr. 24 hr.	TSS Copper Zinc Lead Mercury	30 0.30 1.5 0.6 0.002	20 0.15 0.75 0.3 0.001
			pH	6.0-9.0	
	BAT	10 yr. 24 hr.	Copper Zinc Lead Mercury Cadmium	0.30 1.5 0.6 0.002 0.10	0.15 0.75 0.3 0.001 0.05
Ore Mining and Dressing (Gold placer mine: surface runoff which has commingled with mine drainage or waters resulting from the beneficiation process)	BPT	10 yr. 24 hr.	Settleable solids	0.2 ml/L (instantaneous max)	
Ore Mining and Dressing (Titanium ore: surface water incorporated into mine drainage)	BPT	10 yr. 24 hr.	All mine drainages: TSS Iron	30 2.0	20 1.0
			pH	6.0-9.0	
			Discharges from Mills: TSS Zinc Nickel	30 1.0 0.2	20 0.5 0.1
			pH	6.0-9.0	

Table 4-17. Selected Point Source Categories Subject to Storm Water Effluent Limitation Guidelines (see 40 CFR 411-443) (continued).

BAT is Best Available Technology Economically Achievable.
BPT is Best Practicable Control Technology Currently Available.

Category	Legal Standard	Design storm	Parameter	Concentration (mg/L unless noted)	
				Max for any 1 day	30-day average
Ore Mining and Dressing (Tungsten, Nickel and Vanadium ores: surface runoff incorporated into mine drainage)	BPT	10 yr. 24 hr.	Mines producing ≥ 5000 metric tons:		
			TSS	30	20
			Cadmium	0.10	0.05
			Copper	0.3	0.15
			Zinc	1.0	0.5
			Lead	0.6	0.3
			Arsenic	1.0	0.5
			pH	6.0-9.0	
			Mills producing ≥5000 metric tons:		
			TSS	30	20
			Cadmium	0.10	0.05
			Copper	0.3	0.15
			Zinc	1.0	0.5
			Arsenic	1.0	0.5
			pH	6.0-9.0	
			Mines and Mills producing < 5000 metric tons:		
			TSS	50	30
			pH	6.0-9.0	
Paving and Roofing Materials (Asphalt emulsion)	BPT	*	Oil and grease	0.020	0.015
			pH (kg/m³ of runoff)	6.0-9.0	
	BAT	*	TSS	0.023	0.015
			oil and grease	0.015	0.010
			pH (kg/m³ of runoff)	6.0-9.0	
Paving and Roofing Materials** (Asphalt concrete)	BPT	*		No discharge	
Paving and Roofing Materials** (Asphalt roofing)	BPT	*	TSS	0.056	0.038
			pH (kg/1000kg of product)	6.0-9.0	
	BAT	*	TSS	0.028	0.019
			pH (kg/1000kg of product)	6.0-9.0	

Table 4-17. Selected Point Source Categories Subject to Storm Water Effluent Limitation Guidelines (see 40 CFR 411-443) (continued).

BAT is Best Available Technology Economically Achievable.
BPT is Best Practicable Control Technology Currently Available.

Category	Legal Standard	Design storm	Parameter	Concentration (mg/L unless noted)	
				Max for any 1 day	30-day average
Paving and Roofing Materials ** (Linoleum and printed asphalt felt)	BPT	*	TSS	0.038	0.02 5
			pH (kg/1000kg of product)	6.0-9.0	
	BAT	*	TSS	0.019	0.013
			pH (kg/1000kg of product)	6.0-9.0	

* not specified

** Any water which comes into direct contact with any raw material, intermediate product, by product, or product used in or resulting from production.

*** or lower but not less than 6.0 if water quality standards authorize lower pH; and if discharge, unaltered by human activity, would have a pH lower than 6.0.

dilution or mixing zone, other discharges in the area, beneficial uses and objectives for the receiving waters, and relevant State and Federal guidelines and regulations.

On a case-by-case basis, the Regional Board can allow a mixing zone for compliance with receiving water objectives. In rivers and streams an approved mixing zone can not extend more than 250 feet from the point of discharge or be located less than 500 feet from an adjacent mixing zone. Since many of the streams in the Region have minimal upstream flows, mixing zones are usually not appropriate. In lakes or reservoirs, it may not extend 25 feet in any direction from the discharge point, and the sum of mixing zones may not be more than 5% of the volume of the waterbody. As detailed in the States' *Ocean Plan*, ocean dilution zones are determined using standard models.

Water quality-based effluent limitations for discharges to inland surface waters (SWRCB, 1991a and SWRCB, 1991b) are developed in a number of ways including:

- assignment of a portion of the loading capacity of the receiving water to each of the sources of waste, point and nonpoint;
- determination of limitations based on a formula that considers the water quality objective and ambient background concentrations of each substance and allowed dilution ratio;
- determination of limitations using statistically-based calculations and information about the effluent and receiving water, where sufficient information exists to adequately characterize effluent and receiving water;
- using discharge prohibitions to implement water quality objectives for a particular area; or
- for power plant discharges, determination of limitations based on a formula that incorporates cooling water flow and combined in-plant waste streams.

Effluent limits for ocean discharges are based on objectives in the *Ocean Plan*.

Standard Provisions in WDRs and NPDES Permits

Standard provisions are included in most Non-Chapter 15 WDRs and in all NPDES permits and outline specific restrictions and requirements imposed by the Regional Board. Selected provisions which relate to prohibited discharges are listed below. A full copy of the standard provisions for either WDRs or NPDES permits can be obtained at the Regional Board office. NPDES standard provisions are different from WDRs standard provisions.

Selected Standard Provisions Applicable to Non-Chapter 15 Waste Discharge Requirements

General Prohibition: Neither the treatment nor the discharge of waste shall create pollution, contamination, or nuisance, as defined by Section 13050 of the California Water Code.

Hazardous Releases: Except for a discharge which is in compliance with waste discharge requirements, any person who, without regard to intent or negligence, causes or permits any hazardous substance or sewage to be discharged in or on any waters of the State, or discharged or deposited where it is, or probably will be, discharged in or on any waters of the State, shall, as soon as (i) that person has knowledge of the discharge, (ii) notification is possible, and (iii) notification can be provided without substantially impeding cleanup or other emergency measures, immediately notify the Office of Emergency Services of the discharge in accordance with the spill reporting provision of the State Toxic Disaster Contingency Plan adopted pursuant to Article 3.7 of Chapter 7 of Division 1 of Title 2 of the Government Code, and immediately notify the State Board or the appropriate Regional Board of the discharge. This provision does not require reporting of any discharge of less than a reportable quantity as provided for under Subdivisions (f) and (g) of Section 13271 of the Water Code unless the discharger is in violation of a prohibition in the applicable Water Quality Control Plan.

Petroleum Releases: Except for a discharge which is in compliance with waste discharge requirements, any person who without regard to intent or negligence, causes or permits any oil or petroleum product to be discharged in or on any waters of the State, or discharged or deposited where it is, or probably will be, discharged in or on any waters of the State, shall, as soon as (i) such person has knowledge of the discharge, (ii) notification is possible, and (iii) notification can be provided without substantially impeding cleanup or other emergency measures, immediately notify the Office of Emergency Services of the discharge in accordance with the spill reporting provision of the State Oil Spill Contingency Plan adopted pursuant to Article 3.5 (commencing with Section 8574.1) of Chapter 7 of Division 1 of Title 2 of the Government Code. This provision does not require reporting of any discharge of less than 42 gallons unless the discharge is also required to be reported pursuant to Section 311 of the Clean Water Act or the discharge is in violation of a prohibition in the applicable Water Quality Control Plan.

Selected General Requirements and Standard Provisions Applicable for NPDES Permits

- Neither the disposal nor any handling of wastes shall cause pollution or nuisance.
- Wastes discharged shall not contain any substances in concentrations toxic to human, animal, plant or aquatic life.
- Wastes discharged shall not contain visible oil or grease, and shall not cause the appearance of grease, oil or oily slick, or persistent foam in the receiving waters or on channel banks, wall, inverts or other structures.
- Wastes discharged shall not increase the natural turbidity of the receiving waters at the time of discharge.
- Wastes discharged shall not damage flood control structures or facilities.
- The temperature of wastes discharged shall not exceed 100 °F.
- The discharge of any radiological, chemical, or biological warfare agent or high level radiological waste is prohibited.
- Bypass (the intentional diversion of waste streams from any portion of a treatment facility) is prohibited (with certain exceptions).

Self Monitoring, Compliance Monitoring and Inspections

Permits and requirements issued by the Regional Board are generally self-monitored by each individual discharger, with oversight by the Regional Board. The Regional Board conducts periodic inspections and compliance monitoring and, as necessary, will take enforcement actions to ensure compliance.

Self Monitoring Program: Dischargers are required to regularly collect samples of their waste stream(s) and, in some cases, receiving waters and submit results to the Regional Board. If the discharger discovers that they are not in compliance with their Requirements, they are required to take measures, including change of operations, in order to come into compliance. The monitoring and reporting schedule is determined for each discharger on a case-by-case basis.

Compliance Monitoring and Inspections: Regional Board staff conduct unannounced inspections (including collection of samples) to determine the status of compliance with Requirements. All major dischargers are inspected at least once a year.

Enforcement

Regional Boards are authorized to implement a variety of enforcement actions to obtain compliance with Requirements. Enforcement procedures can be informal, such as a letter informing the discharger of non-compliance and requesting the discharger to comply with terms of its Requirements, or they can be more formal, such as an order prescribing needed changes and a time schedule. Generally, instances of noncompliance are first addressed by discussions at the site, via telephone, or by letter with a request to correct the problem within a given period of time.

The California Water Code (§13267) authorizes the Regional Board to require any discharger to submit technical or monitoring reports. Failure to supply the required reports is a misdemeanor. Section 13268 permits the Regional Board to levy administrative civil liabilities (e.g., fine) not exceeding five thousand dollars ($5,000) for each day that the discharger fails to comply with the Section 13267 request. Civil liability may also be imposed by the superior court in an amount that shall not exceed twenty-five thousand dollars ($25,000) for each day in which the violation occurs. If warranted, the Executive Officer will issue a *Notice of Violation* that is sent to the discharger for failure to comply with a predetermined compliance action/schedule.

Under the California Water Code, the Regional Board has several enforcement options available to compel compliance with a Board order. The following is a brief overview of the enforcement actions available to the Regional Board (statutory references are to the California Water Code).

***Time Schedule Orders** (§13300):* Dischargers operating under Regional Board orders who are not able to meet requirements, or whose actions threaten to violate requirements prescribed by the Regional Board, can be administratively issued (by the Executive Officer) an order specifying a time schedule for the discharger to take specific actions which will correct or prevent the violation. The time schedule order may also include interim limits with which the discharger must comply during the time schedule until full compliance is achieved.

***Cease and Desist Orders** (§13301):* The Regional Board may issue a Cease and Desist Order when a discharger:

- fails to comply with requirements or discharge prohibitions contained in an NPDES permit or in WDRs/WRRs;
- fails to comply with a time schedule set by the Board in a time schedule order; or
- fails to take preventive or remedial action in the event of a threatened violation of a Board order.

The order requires the discharger to comply with established requirements or prohibitions, to comply with a time schedule, or, if the violation is threatening, to take appropriate remedial or preventative action. The order may also restrict or prohibit the discharge of new sources of waste to a community sewer system.

***Cleanup and Abatement Orders** (§13304):* The Regional Board may issue a cleanup and abatement order to any discharger who has discharged wastes without a valid Board order or who has caused, or threatens to cause, a condition of pollution. The order requires the discharger to clean up waste or abate its effects or, in the case of a threatened pollution or discharge, take other necessary remedial or preventive actions. If the discharger fails to take action, the State Attorney General, at the request of the Board, may file a petition for issuance of an injunction requiring compliance. Alternatively, the Executive Officer is authorized to issue a Cleanup and Abatement Order administratively.

Administrative Civil Liability: A Civil Liability (e.g., fine) may be administratively imposed by the Regional Board against dischargers who violate §13350 or §13385 or any other Regional Board order.

Assessments imposed for §13350 violations shall not exceed five thousand dollars ($5,000), but shall not be less than five hundred dollars ($500), for each day the discharger is deemed to be in violation. Section 13350 violations include:

- failure to comply with a Cleanup and Abatement Order or a Cease and Desist Order;
- violation of any Requirements which creates a nuisance or causes pollution; and
- deposition of oil or petroleum residue in or on any State waters.

The Regional Board can impose sanctions up to ten thousand dollars ($10,000) for each day in which the discharger violates §13385. Section 13385 violations include:

- failure to furnish a report, filing a false report of waste discharge or a false technical report, or failure to pay a fee when so requested;
- discharging warfare (radiological, chemical or biological) agents into State waters;
- violating dredge and fill material permits; and
- refusing to provide technical or monitoring reports as requested by the Regional Board.

The Executive Officer is authorized to impose an Administrative Civil Liability administratively. If the discharger so requests, a hearing will be held by the Regional Board on the violation and the amount of the civil liability. Funds collected from civil penalties go directly to the State Water Pollution Cleanup and Abatement Account which is administered by the State Board. In lieu of a civil liability payment, the Regional Board may require that the violator fund a cleanup or enhancement activity within the area of the discharge violation or for other environmentally beneficial projects in the Region.

Judicial Civil Liability: The State Attorney General, upon a request from the Regional Board, may petition the superior court to seek penalties in excess of the fines that the Regional Board is authorized to impose. For §13350 violations (see criteria listed in Administrative Civil Liabilities section above), the court may impose civil liabilities up to fifteen thousand dollars ($15,000) for each day. For §13385 violations, the court-imposed fines cannot exceed twenty-five thousand dollars ($25,000) for each day of violation.

Injunctive Relief: The State Attorney General or the appropriate county or District Attorney or City Attorney may, at the request of the Regional Board, petition the Superior Court for injunctive relief for any person not complying with submittal of required reports and fees (§13360) or discharging wastes in violation of the California Water Code (§13386), or where there is evidence of irreparable damage (§13361).

Control of Nonpoint Source Pollutants

Introduction

Despite California's significant achievements in controlling point source discharges from municipal sewage treatment plants and industrial facilities, pollutants from nonpoint sources continue to degrade many of our water resources. Approximately two-thirds of California's waterbodies assessed in the State's *Water Quality Assessment Report* (1992) are threatened or impaired by nonpoint sources of pollution.

Nonpoint source (NPS) pollution, as opposed to "point source" pollution (a discharge at a specific location or pipe with the exception of irrigation return flows), generally consists of diffuse runoff of pollutant-laden water from adjacent land. These pollutants are transported to waters by precipitation, irrigation, and atmospheric deposition. Nonpoint sources have been grouped by the USEPA into categories that include agriculture, urban runoff, construction, hydromodification, resource extraction, silviculture, and land disposal. These categories, however, are not exclusive. For example, agricultural operations contain both point (concentrated animals) and nonpoint source (irrigation return flow) categories.

Nonpoint source pollution has been studied for several decades. Many of the earlier nonpoint source planning efforts generated excellent studies and reports; unfortunately, many of the recommendations have yet to be implemented. Due to new requirements mandated as a result of the 1987 amendments to the CWA, a more focused, results-oriented approach is being implemented nationwide.

Early Nonpoint Source Pollution Planning Efforts

The CWA (§208) required State and local agencies to identify water quality problems from both point and nonpoint sources as part of their water quality planning efforts. From 1974 to 1981, federal grants under this program provided funds to states and local agencies for identification of nonpoint source problems and development of control strategies. Although many of these plans were never implemented, this early work helped establish the framework for existing state nonpoint source programs currently being implemented under the CWA (§319).

Recognizing the need to assess the water quality effects of storm water runoff, the USEPA initiated the Nationwide Urban Runoff Program (NURP) in 1978. This five-year program collected data on the quality of urban runoff and its impact on receiving waters. Objectives of NURP included the development of a national database and analytical methodologies to examine the quality characteristics of urban runoff, a determination of the extent to which urban runoff contributes to water quality problems, and an evaluation of best management practices to control pollutants from urban runoff. Data from 28 projects around the country confirmed that significant levels of pollutants such as nutrients, heavy metals, and bacteria result from urban runoff. These studies also showed that the most significant effects of urban storm water runoff on aquatic life were due to hydrologic changes related to urbanization and construction activities.

Development of the State Nonpoint Source Program

The CWA (§101(a)(7)) states:

"it is the national policy that programs for the control of nonpoint sources of pollution be developed and implemented in an expeditious manner so as to enable the goals of this Act to be met through the control of both point and nonpoint sources of pollution."

With the addition of specific nonpoint source language in the 1987 amendments to the CWA (particularly §319), new direction focusing on implementation of state nonpoint source management programs have been authorized.

Section 319 requires that states complete two documents by August 4, 1988, in order to be eligible for federal nonpoint source funding: an Assessment Report describing the state's nonpoint source water quality problems and a Management Plan describing plans to address the state's nonpoint source problems.

The State Board is responsible for implementing the requirements of §319 and reporting to the USEPA. In addition to authority under the CWA, the State Board has independent authority to implement requirements of §319 by means of Division 7 of the California Water Code, commencing with §13000.

The State Water Resources Control Board completed its *Nonpoint Source Assessment Report* and *Nonpoint Source Management Plan* in 1988. The *Assessment Report* summarizes water quality impairments due to nonpoint source and describes regional, State, and Federal programs in California that addressed nonpoint source pollution. The *Management Plan* outlines the legal and institutional framework, objectives, and implementation plan for the State's program.

The State's *Nonpoint Source Management Plan* describes a three-tiered management approach to address nonpoint source problems. Each Regional Board will decide which management option(s) will be required for individual situations. Generally, the least stringent option (in terms of regulation) that will protect or restore water quality will be employed, followed by more formal regulatory measures if timely improvements in water quality are not achieved. Regional Boards usually will not impose effluent limits on nonpoint source dischargers who are implementing Best Management Practices in accordance with a State or Regional Board formal action. The three tiers (in order of increasing regulatory control) are outlined below:

(i) Voluntary implementation of Best Management Practices

Land managers or property owners voluntarily or cooperatively implement Best Management Practices.

(ii) Regulatory-based enforcement of Best Management Practices

The Regional Board can encourage the use of Best Management Practices by waiving WDRs on the condition that the dischargers implement effective Best Management Practices .

The Regional Board can enforce Best Management Practices indirectly by entering into Management Agency Agreements (MAAs) with other agencies that have the authority to enforce Best Management Practices .

(iii) Effluent limitations

The Regional Board can adopt and enforce WDRs on any proposed or existing waste discharge, including discharges from nonpoint sources.

Following the adoption of the *Nonpoint Source Management Plan*, the State and Regional Boards have focused on the following objectives in developing the program elements:

- Initiate and institutionalize activities for the control of nonpoint source pollution from urban runoff, agriculture, silviculture, mining, construction, hydromodification, grazing, and septic tanks.
- Encourage, develop, and manage contracts for projects funded under CWA (§319) funding.
- Develop a program to implement the requirements of the 1990 re-authorization of the Coastal Zone Management Act (CZMA) which requires the State Board and the Coastal Commission to develop and implement an enforceable nonpoint source program in the coastal zone.
- Initiate pilot watershed programs across the State.
- Implement a public outreach and educational program.

During the preparation of the California *Nonpoint Source Management Plan*, the State Board formed an Interagency Advisory Committee (IAC). IAC meetings are held quarterly and serve as a forum for discussion of Nonpoint Source Program development and direction, funding, and the exchange of new ideas in nonpoint source related activities implemented by the various agencies.

The IAC consists of State and Regional Board staff, other State agencies, the California Association of Resource Conservation Districts, federal agencies, and other interested parties. Active member agencies of the IAC are listed below:

State Agencies:

Coastal Commission
Department of Conservation
Department of Fish and Game
Department of Food and Agriculture
Department of Pesticide Regulation
Department of Transportation
Department of Water Resources
Association of Resource Conservation Districts
Water Resources Control Board
Regional Water Quality Control Boards

Federal Agencies:

Agricultural Stabilization and Conservation Service
Army Corps of Engineers
Bureau of Land Management
Bureau of Reclamation
Environmental Protection Agency
Forest Service
Fish and Wildlife Service
Soil Conservation Service

The State Board has entered into agreements with other agencies (Table 4-18) which have the authority to implement, or require the implementation of, Best Management Practices under the State's Nonpoint Source Program. These agreements capitalize on the expertise and authorities of other agencies with responsibilities related directly or indirectly to water quality. Memorandums of Understanding (MOUs) and Management Agency Agreements (MAAs) are the two types of agreements used for this purpose. The format and end-result of both agreements are

Table 4-18. Nonpoint Source-related Memorandums of Understanding (MOUs) and Management Agency Agreements (MAAs) between the State Water Resources Control Board and Other Agencies.

Effective Date	Title of Agreement
May 26, 1981	Management Agency Agreement between the State Water Resources Control Board and the Forest Service, United States Department of Agriculture.
February 3, 1988	Management Agency Agreement between the State Water Resources Control Board, the State Board of Forestry, and the State Department of Forestry and Fire Protection.
July 30, 1990	Memorandum of Understanding between the State Water Resources Control Board, the Soil Conservation Service, and U.S. Department of Agriculture for Planning and Technical Assistance Related to Water Quality Policies and Activities.
December 23, 1991	Memorandum of Understanding between the State Water Resources Control Board and the California Department of Pesticide Regulation for the Protection of Water Quality (Surface and Ground Water) from Potentially Adverse Effects of Pesticides.
February 3, 1993	Memorandum of Understanding between the California State Water Resources Control Board, the Bureau of Land Management, and U.S. Department of the Interior for Planning and Coordination of Nonpoint Source Water Quality Policies and Activities.

basically the same. These agreements outline the responsibilities of one agency, then the other, followed by the joint responsibilities of both agencies.

Nonpoint Source Funding

Because the Nonpoint Source Program is different from most other water quality programs, innovative ways of financing and implementing nonpoint source projects have been developed. Prior to the CWA 1987 amendments, states used §106 and §205(j) monies (as described below) to fund limited nonpoint source activities. The primary federal funding for current nonpoint source program development and implementation includes §205(j)(5), §319(h), §201(g)(1)(b), §603(c)(2), and §604(b) monies as described below.

Section 205(j)(5): Section 205(j)(5) established a set-aside of construction grant funds for the purposes of carrying out activities under Section 319, including program development and the preparation of state Assessment Reports and Management Plans. These funds were used for assessment and development activities for California's program through fiscal year 1989.

Section 319(h): Grant funds authorized by Section 319(h) can be used for the implementation of nonpoint source management programs but cannot be used for assessment activities. States must have a USEPA-approved Assessment and Management Plan before qualifying for these monies. This grant program funds both State and Regional Board programs and provides competitive grants for other agencies to use in implementing nonpoint source measures around the State. These grants include a "non-federal" match of 40%, illustrating the intent of Congress and USEPA to encourage states to make a substantial financial commitment to implement nonpoint source programs.

Section 201(g)(1)(b): The CWA 1987 amendments added subsection 210(g)(1)(b) that expanded the use of 201 funds to "...any purpose for which a grant can be made under Section 319(h) and (i)." These funds can be used for either nonpoint source development or implementation projects. The Regional Board has recently received funding under this program to provide resources to coordinate a multi-agency study in the Malibu Creek Watershed (see description in the Future Direction section for more detail).

Section 603(c)(2): The CWA 1987 amendments added Title VI establishing a State Water Pollution Control Revolving Fund Program (SRF). This program provides funding in the form of loans, refinancing, and bond insurance which can be used for (i) construction of publicly owned treatment works, (ii) the implementation of state nonpoint source management programs, and (iii) the development and implementation of state estuary conservation and management plans. The State and Regional Boards encourage local agencies to apply for these low-interest loans to implement nonpoint source demonstration projects and programs in the Region.

Section 604(b): States must set aside one percent of their Title VI allotments or $100,000, whichever is greater, to carry out planning programs under 205(j) and 303(e) of the CWA. These funds can be used under 205(j) planning for nonpoint source related activities. This can become an important source of funding for nonpoint source planning and assessment tasks since these types of activities cannot be carried out under Section 319.

Nonpoint Source Categories

The following sections describe the major sources of nonpoint pollution, the extent of the problem in the Region, and the main regulatory and non-regulatory approaches available to control runoff from these nonpoint sources of pollution.

Agriculture

Agriculture is a major industry in California and will continue to be important to the State's economy. Agricultural activities, however, can generate pollutants such as sediment, pesticides, nutrients, and oxygen-demanding organic matter. Upon discharge to a receiving water, these pollutants can degrade water quality and impair beneficial uses, as explained below.

Sediment: Eroded soil materials, along with other chemicals (nutrients, pesticides, and other organic chemicals) that adsorb to the sediment particles, are transported from land surfaces into adjacent waterbodies. Excess sediment can interfere with photosynthesis by reducing light penetration, smother benthic organisms, destroy important spawning habitats, and fill in waterways hindering navigation or groundwater percolation and increasing flooding.

Pesticides: Nationwide, pesticide use has changed in recent years. Although there is now a greater number of pesticides available for use, the current trend seems to be toward a decreased use of chemicals. There is also a dramatic decrease in the use of persistent (long-lived) pesticides, many of which were banned in the late 1970s. Many currently-used chemicals, however short-lived, can be highly toxic to fish and other aquatic life (especially at critical life stages), so that even very low levels of these pesticides in runoff can be a significant environmental concern.

Nutrients: In general, runoff from agricultural lands has significantly higher nutrient concentrations than drainage waters from forested or other "covered" lands. These increased nutrient levels result from fertilizer application and animal waste. Eutrophication of lakes, streams, and coastal waters, as well as groundwater degradation, are often attributed to runoff from agricultural lands. Nutrients are necessary for plant growth in a waterbody, but excess nutrients can lead to excessive algal growth, an imbalance in natural nutrient cycles, changes in water quality (such as demand for dissolved oxygen), and a decline in the number of fish species.

Organic Material: Crop debris and animal wastes are major sources of organic matter which can be transported into streams from agricultural lands. As these materials decompose, they tend to deplete dissolved oxygen in receiving waters. Fish and other aquatic life cannot survive in waters with low levels of oxygen.

Agriculture in the Los Angeles Region is concentrated in Ventura County, which has over 95,000 acres under cultivation (Figure 4-4). Agriculture is Ventura County's largest industry and accounts for 11% of total employment in the county. Approximately 70% of the farms are between 40 and 50 acres in size, and only about 5% of the farms are greater than 500 acres. Major crops in Ventura County include fruit, nuts, vegetables, nursery stock, Christmas trees, and sod (Ventura County, 1990).

While rich soils and a mild climate have contributed to the success of Ventura County's agricultural industry, water supplies are limited. The agricultural community pumps over 270,000 acre-feet of ground water per year. This accounts for 86% of water consumption in the County (Ventura County, 1993). With groundwater pumping rates far exceeding recharge rates, some groundwater basins have been, and continue to be, overdrafted. These overdraft conditions accelerate the existing seawater intrusion problem, as discussed in the Seawater Intrusion Section below.

FIGURE 4-4

Los Angeles County
Ventura County
1990 Land Use
Agriculture

The State and Regional Boards have the authority to regulate any discharge, including agriculture. Such a regulatory program could supplement the Department of Pesticide Regulation's pesticide regulatory program. To date, however, the State and Regional Boards have not chosen to control pollutants from agricultural sources through regulations such as WDRs. Rather, the Boards expect that significant improvement to water quality can be achieved through voluntary implementation of management measures (i.e., Best Management Practices) that reduce or eliminate pollutants from agricultural sources. The U.S. Department of Agriculture, Soil Conservation Service and the Resource Conservation Districts provide information on, and assistance in, implementing these types of management measures.

In addition to encouraging the implementation of Best Management Practices identified in the USEPA's *Guidance Specifying Management Measures For Sources of Nonpoint Pollution in Coastal Waters* (known as the *(g) guidance*), the Regional Board and USEPA have undertaken outreach programs. One such example is a 319(h) grant made to the Ventura County Resource Conservation District (RCD) in 1992 to fund a project that will demonstrate improved irrigation techniques to growers on the Oxnard Plain. These irrigation techniques will reduce runoff and deep percolation of pesticides, sediment, and nutrients, thereby improving water quality. Through the RCD's efforts, the Regional Board and USEPA hope to encourage other growers on the Oxnard Plain to switch to irrigation technologies and practices that will both improve water quality and conserve water.

The Regional Board is also an active participant on the Mugu Lagoon Task Force, which is comprised of local, regional, and State agencies, as well as U.S. Navy (which occupies land surrounding Mugu Lagoon). The objective of this Task Force is to foster cooperation between agencies in developing a comprehensive plan that will improve water quality in Calleguas Creek, Revolon Slough, and Mugu Lagoon, which is one of the Region's few remaining wetlands. The Task Force is focusing, in particular, on ways in which to reduce sources of sediment and pesticides.

Confined Animal Operations

Confined animals are those that are raised or sheltered in high densities. Examples of confined animal operations include kennels, horse stables, poultry ranches, dairies, stockyards, and feedlots. Wastes from such facilities can contain significant amounts of pathogens, oxygen-depleting organic matter, nitrogen compounds, and other suspended and dissolved solids. As a result, runoff of storm or wash waters from confined animal areas can degrade receiving surface waters. Furthermore, percolation of storm or wash waters into ground water can degrade the water quality. The risk of degradation increases during the rainy season when animal waste containment and treatment ponds are often overloaded.

Minimum design and management standards for the protection of water quality from confined animals are promulgated in the Title 23, California Code of Regulations, Chapter 15, Article 6. These regulations prohibit the discharge of facility wash water, animal wastes, and storm water runoff from animal confinement areas, into the waters of the State, and specify minimum design and waste management standards such as: the collection of all wastewaters; the retention of wastewaters and storm waters in manured areas during a 25-year, 24-hour storm; the use of paving or impermeable soils at manure storage areas; and the application of manures and wastewaters on land at reasonable rates for minimal percolation. The Regional Board has the authority to enforce these regulations through WDRs, described in the section of this chapter entitled Control of Point Source Contamination. In addition to the State's Title 23 regulations, many local agencies have enacted ordinances and zoning restrictions that require additional waste management practices.

While large confined animal facilities (e.g., dairies and poultry farms) sometimes threaten water quality in other Regions of the State, large confined animal facilities do not constitute a widespread threat to water quality in the Los Angeles Region, since there are only a few of such facilities in the Region. However, localized threats can result from smaller facilities, such as horse stables where runoff from manured areas can degrade the quality of receiving waterbodies. In such cases, the Regional Board has the authority to protect water quality through WDRs.

Urban Runoff

Urbanization disturbs natural land cover, alters natural drainage patterns, and increases impervious areas (e.g., rooftops, streets, parking lots) where water can not infiltrate into the ground. While concerns about urban runoff were focussed primarily on flood control in the past, urban runoff has now been proven to be a significant source of pollutants that degrade regional waters. Pollutants in urban runoff include urban debris, suspended solids, bacteria, viruses, heavy metals, pesticides, petroleum hydrocarbons, and other organic compounds. These pollutants threaten the quality of receiving waters in numerous and varied ways. Suspended solids (such as soil particles) can, upon settling, destroy spawning grounds and other habitats. Urban debris is unsightly and can present health risks such as cuts, punctures, and disease. High levels of bacteria occasionally necessitate beach closures. Heavy metals and organic compounds contaminate sediment near harbors and other recreational areas and can bioaccumulate in aquatic organisms.

More than 1,000 miles of storm drains beneath the streets of Los Angeles collect runoff from city streets, eventually dumping this flow into streams and coastal waters. High concentrations of pollutants that have accumulated on streets and other impervious surfaces during southern California's long dry summers are flushed into the storm drains and into surface waters during major storms that typically occur in winter.

The Southern California Coastal Water Research Project (SCCWRP), the Santa Monica Bay Restoration Project (SMBRP), and the University of Southern California (USC) Institute for Ocean and Coastal Studies have evaluated the characteristics of urban runoff, including pollutant loads, impacts, and toxicity, to coastal waters. The pollutant load and toxicity of urban runoff in the Region were found to be comparable to that of sewage effluent. The USEPA performed a nationwide evaluation of the environmental hazards posed by priority pollutants in urban runoff and found that cadmium, copper, lead, and zinc exceeded freshwater acute aquatic criteria in up to 50% of the samples analyzed (USEPA, 1983). In addition, these pollutants, along with cyanide, mercury, and silver, exceeded freshwater chronic criteria in at least 10% of the samples.

The Regional Board's urban runoff management program (through both the Storm Water and nonpoint source programs) continues to assess specific urban runoff problems and control strategies to remediate those problems. Program elements include:

- Supporting research by SCCWRP, SMBRP, USC, USEPA, and others to better define regional impacts of urban runoff discharges.

- Developing cooperative investigation and control strategies utilizing the expertise and resources of point source dischargers in receiving water segments.

- Organizing local ad hoc task forces for hydrologic watersheds/sub-watersheds with representation from point source discharges, local industries, local agencies, public interest groups, the Regional Board, and the USEPA to facilitate investigations and the development of control strategies.

- Participation on the State Board Coordinating Committee and Technical Advisory Committees formed to address urban runoff management measures developed under mandates of the Coastal Zone Management Act Re-authorization Amendments (CZARA) of 1990.

- Participating on the State Board Storm Water Quality Task Force in the development and implementation of statewide urban storm water management guidance and strategies.

- Working with other agencies such as the South Coast Air Quality Management District, Southern California Association of Governments, and the Metropolitan Transit Authority to ensure that transportation related strategies and plans will reduce the impact on receiving waters from transportation system runoff discharges.

Progress to date in this program includes a survey of basic information from flood control districts, Caltrans and local agencies which own or have maintenance responsibility for storm drain systems. The survey indicated that, with few exceptions, agencies have little information on the storm drain systems that they own or manage. Flow and water quality data describing discharges from storm drain systems are very limited. Few programs existed to control urban runoff from a water quality perspective. Existing maintenance programs include cleaning storm drainage inlets, catch basins, and storm drainage lines on an annual, or as-needed basis for flood control purposes only, not for water quality improvement.

The USEPA promulgated regulations (40 CFR Parts 122, 123, and 124) for storm water discharges in

November 1990. The regulations list the types of storm water discharges for which NPDES permits are required. These include discharges from separate municipal storm drain systems serving populations of 100,000 or more, discharges associated with industrial activities, discharges from construction activities, and discharges that contribute to violations of water quality standards or are significant contributors of pollutants to the receiving waters. The regulations authorize the issuance of system-wide or jurisdiction-wide permits and effectively prohibit non-storm water discharges to storm drains. They also require designated municipalities to implement control measures to reduce pollutants to the maximum extent practicable. Industrial storm water discharges are subject to standards based on best available technology (BAT) which is economically achievable. The Regional Board can, where necessary, require storm water discharge permits for dischargers not specifically cited in the regulations but who are a significant contributor of pollutants to waters of the Region (See Point Source section above for more details about the Storm Water Regulatory Program).

Local municipalities and the County of Los Angeles are working together to implement an Urban Runoff and Storm Water Management Program. The Regional Board issued a municipal storm water NPDES permit to Los Angeles County and co-permittees (cities and agencies) in June 1990. The permit implements a program which includes the development, assignment, and implementation of control strategies to reduce pollutants in urban runoff discharges in Los Angeles County. Table 4-19 lists the minimum required Best Management Practices (BMPs) to be implemented county-wide. The County of Ventura and local municipalities in Ventura County have joined together to develop and implement a Ventura County Storm Water Management Program, and the Regional Board is considering issuance of an NPDES storm water permit to Ventura County and associated cities. The County will then be required to implement a storm water management program that will include the development and implementation of urban runoff control strategies and county-wide storm water monitoring. The program will include the cities of Oxnard, Simi Valley and Thousand Oaks which have populations greater than 100,000 and are federally mandated to implement strategies to control pollutants in urban runoff. The city of Thousand Oaks, for areas that drain into Los Angeles County, will be regulated under a separate storm water NPDES permit.

The Regional Board conducts surveillance activities and provides overall direction to oversee, verify, and ensure implementation of urban runoff control programs. Technical guidance for prevention activities, as well as the identification, assignment, and implementation of control measures, and monitoring will be developed. Numerical limitations for selected pollutants, or pollutant indicator parameters, for urban runoff discharges in high resource watersheds, or impaired stream segments, will be developed in consultation with the USEPA and the State Board.

The Regional Board's continuing strategy for urban runoff management will include: (i) a comprehensive control program, (ii) a highway runoff control program, (iii) an industrial activity control program, and (iv) a construction activity control program. These programs are described below.

Comprehensive Control Program

All cities and counties in the Region are required to develop and implement comprehensive urban runoff control programs which focus on the prevention of future water quality problems and remediation of existing problems. The requirements of the municipal control program are intended to be consistent with NPDES regulations for municipal storm water discharges. In addition to baseline elements such as implementation of Best Management Practices (Table 4-19) and monitoring of runoff, these programs will include pilot projects or other investigations which will:

- implement measures to reduce pollutants in runoff to the maximum extent practicable from commercial, residential, industrial, and roadway areas;
- implement measures to identify and eliminate illicit connections and illegal dumping into storm drain systems;
- implement measures for operating and maintaining public highways to reduce pollutants in runoff; and
- implement measures to reduce pollutants in discharges associated with the application of pesticides, herbicides, and fertilizer. These will include, as appropriate, controls such as educational activities and other measures for commercial applicators and distributors, and

Table 4-19. Los Angeles County Municipal Storm Water Permit: Minimum Required Best Management Practices (BMPs) to be Implemented County-wide.

Establish or improve an area-wide catch basin stenciling program with a universal stencil to discourage dumping, discarding, and/or discharge of pollutants, carriers, and/or debris into storm drainage systems county-wide.
Develop programs to promote, publicize and facilitate public reporting of illegal discharges and/or dumping.
Adopt a runoff control ordinance requiring the use of BMPs during and after construction and at selected commercial and industrial establishments.
Augment public education and outreach programs with regard to catch basins and storm drainage systems and their intended purpose.
Provide regular catch basin cleaning when and where needed.
Increase cleaning frequency of and number of roadside trash receptacles in areas where needed.
Increase street sweeping in areas where needed.
Discourage the improper disposal of litter, lawn/garden clippings, and pet feces into the street or area where runoff may carry these pollutants to the storm drainage system.
Implement facility inspections of auto repair shops, auto body shops, auto parts and accessory shops, gasoline stations, and restaurants as the accumulation of pollutants, garbage, and /or debris tends to concentrate in these areas.
Encourage owners and persons in control of homes or businesses to remove dirt, rubbish, and debris from their sidewalks and alleys which may contribute pollutants to urban runoff.
Encourage recycling of oil, glass, plastic, and other materials to prevent their improper disposal into the storm drainage system.
Encourage the proper disposal of Household Hazardous Wastes to prevent the improper disposal of such materials to the storm drainage system.
Encourage the proper use and conservation of water.

controls for application in public right-of-ways and at municipal facilities.

On an annual basis, each city or county is required to conduct an evaluation of the effectiveness of its Comprehensive Control Program.

Highway Runoff Control Program

An essential component of a municipal comprehensive control program is the implementation of practices for maintaining public highways that reduce impacts on receiving waters from highway runoff. However, cities and counties (permittees) do not have jurisdiction over public highways controlled by the California Department of Transportation (Caltrans). In order to ensure the effectiveness of the comprehensive control programs, Caltrans must either actively participate as an entity in the County Storm Water Program, or will be required to obtain a separate NPDES permit for storm water discharges for highways under its jurisdiction. Such a program for Caltrans shall include a *Storm Water Management Plan* which addresses the design, construction, and maintenance of highway facilities relative to reducing pollutants in highway discharges to the maximum extent practicable. The Plan shall include:

- a characterization of Caltrans highway systems, including pollutants, highway layout, and drainage control system in the area;
- a description of existing highway runoff control measures;
- a description of additional highway runoff control measures to enhance pollutant removal; and

- a plan for monitoring the effectiveness of control measures and highway runoff water quality and pollutant loads.

The Highway Runoff Management Plan shall specifically address litter control, proper pesticide/herbicide management, reduction of direct discharges, reduction of runoff velocity, landscape over-watering, use of grassed channels, curb elimination, catch basin maintenance, appropriate street cleaning, establishing and maintaining vegetation, infiltration practices, and detention/retention practices. Caltrans shall coordinate its urban runoff program with local agencies and existing programs related to the reduction of pollutants in highway runoff.

Industrial Activity Control Program

The Regional Board will require, pursuant to NPDES storm water regulations, an NPDES permit for the discharge of storm water from specified facilities associated with industrial activities. The industrial activity control program applies to any discharge from specified conveyance or engineered surface which is used for concentrating, collecting, and conveying storm water and which is directly related to manufacturing, processing, or raw material storage areas at an industrial facility. The program applies to all facilities identified by 40 CFR Part 122.26(b)(14) and include both privately and publicly (federal, state, and municipal) owned facilities (see Tables 4-13, 4-16 and 4-17).

The Regional Board considers storm water discharges from automotive operations, including gas stations, auto repair shops, auto body shops, dealerships, battery shops, wrecking yards, radiator shops and mobile car washing businesses, significant sources of pollutants in the Region. It is intended that these discharges and similar discharges from commercial establishments be addressed initially at the local level through ordinances and industrial waste inspections as part of the municipal comprehensive control program. The Regional Board will assess the success of these local programs before including such discharges in the NPDES permit program.

Construction Activity Control Program

Major construction activities include the development, or redevelopment, of residential, commercial, and industrial areas, as well as transportation facilities. The major pollutant associated with construction activities is sediment. Additional pollutants include fuel, oil, paints, glues, pesticides, fertilizers, metals, and sanitary and solid wastes. The impact of these pollutants is dependant on the activities on site, as well as the duration of construction, rainfall, topography, soil characteristics, distance to the receiving waterbody, and Best Management Practices used on the site.

The Regional Board requires, pursuant to NPDES storm water regulations, an NPDES permit for the discharge of storm water from all construction activities, including demolition, clearing and excavation, and grading. The State Board issued a general permit (Table 4-2) in August 1992, for construction activity discharges. The majority of construction activity discharges in the Los Angeles Region will be covered under the State Board general permit. This program regulates construction sites that are five acres or more; USEPA, however, is considering making this program applicable to all construction sites as part of phase two of the Storm Water Program.

Hydrologic Modification

In light of the extensive development that has occurred on many of the floodplains throughout the Region, flood control in the Los Angeles Region is accomplished primarily through hydrologic modification.

Hydrologic modifications are activities that are designed to control natural streamflow. These include bank stabilization, channelization, in-stream construction, dredging, dams, levees, spillways, drop structures, weirs, and impoundments. Activities such as straightening, widening, deepening, or relocating existing stream channels, and clearing or snagging operations also fall into this category. Some specific examples of hydrologic modifications are described below.

Channelization: Channelization usually involves the straightening of channels and hardening of banks (e.g. concrete and rip-rap) along waterways undertaken for the purpose of flood control, navigation, and/or drainage improvement. These hydrologic modifications can disturb vegetative cover, increase scour as a result of increased velocities, and increase water temperatures when overhanging or streamside vegetation is removed. Channel modification activities can also deprive wetlands and estuarine shorelines of enriching sediments, change the ability of natural systems to both absorb hydraulic energy and filter pollutants from surface waters, and cause interruptions of critical life stages of aquatic organisms. Hardening of banks along waterways results in permanent elimination of habitat, decreased quantities of organic matter entering aquatic systems and increased movement of nonpoint source pollutants from the upper reaches of watersheds into coastal waters. Channel modification projects undertaken in streams or rivers usually require regularly-scheduled maintenance activities to preserve and maintain completed projects. These frequently result in a continual disturbance of in-stream and riparian habitats.

Dredging: Dredging is the removal of sediment buildup from stream channels or other waterbodies. Dredging is often needed to remove excess silt and coarse sediments which diminish some recreational and other beneficial uses. This can result in improved circulation and long-term improvements; however, many short-term impacts occur during and after dredging occurs. Dredging destroys aquatic habitats and associated organisms. Dredging can also introduce pollutant loadings to the waterbody by disturbing sediments that have accumulated contaminants over an extended period of time. This disturbance often re-suspends and redissolves pollutants back into the aquatic environment.

Impoundments and Reservoirs: Impoundments range from small dams constructed for soil and water conservation purposes to large drinking water reservoirs with volumes in excess of several hundred thousand acre feet. Impoundments cause problems during and after the construction phase. Some of the impacts during construction include high erosion rates, washings from the preparation of the dam structure, and clearing operations of the area to be inundated. Long-term problems due to the impoundment itself can affect habitats in the reservoir and impact downstream river quality by diverting waters needed in downstream areas to support the localized aquatic life. Periodic maintenance of sediment buildup in reservoirs (which involves draining, dredging, or sluicing), termed "cleanout," has the potential to degrade downstream water quality and limits groundwater recharge capabilities. Sediment removal in reservoirs must be carefully managed so as not to transport sediment loads downstream which can impair beneficial uses (i.e., sealing spreading grounds and smothering aquatic habitat and organisms). The Regional Board strongly opposes sluicing of sediment from reservoirs for maintenance purposes when this activity has the potential to impair downstream uses. Cleanout is currently a controversial issue with respect to the reservoirs in the Upper San Gabriel River watershed.

The Los Angeles County Department of Public Works maintains a series of debris basins in canyon mouths and upstream stabilization structures in selected watersheds to trap debris flows from canyons. There are currently 114 debris basins in the watershed of the Los Angeles and San Gabriel River systems. In addition, the County maintains 225 stabilization structures in 47 major watersheds, which serve as erosion control structures.

The Los Angeles County Department of Public Works also operates 14 dams as part of their Flood Control Program (refer to Figure 1-3 for the locations of major lakes and reservoirs). Table 4-20 lists the major reservoirs in the Region, their function and capacity, and the agencies that operate and maintain them.

401 Certification Program

The most effective tool the State has for regulating hydrologic modification projects is the 401 Certification Program.

The CWA (§401(a)(1)) gives states the authority to issue, deny, or waive water quality 401 certifications to applicants applying for federal permits or licenses for activities that can result in discharge to any water of the United States. The issuance of a 401 certification ensures that the project will comply with the State's Water Quality Standards as designated in the Basin Plan. The 401 certification process is commonly used by the Regional Board when reviewing projects from applicants who are requesting a Section 404 permit from the U.S. Army Corps of Engineers. The State Board can provide 401 certification upon the recommendation of the Regional Board and Executive Officer.

The CWA (§404) establishes a permit program, administered by the Secretary of the Army, acting through the Corps of Engineers, to regulate the discharge of fill or dredged material into the watersof the United States. Section 404(c) gives the Administrator of the USEPA further authority to restrict or prohibit the discharge of any dredged or fill material that can cause an unacceptable adverse effect on municipal water supplies, shellfish beds, fisheries, wildlife, or recreational areas.

Table 4-20. Selected Reservoirs in the Region: Ownership, Capacity and Function.

Name of Dam/Reservoir	Function	Capacity (acre-feet)	Ownership & Maintenance
Bard	CONS	10,500†	CAMWD
Big Dalton	FC, CONS	938*	LACDPW
Big Tujunga	FC, CONS	5,319*	LACDPW
Bouquet	CONS	36,505†	CITY of LA
Castaic	CONS, REC	323,702†	DWR
Casitas	CONS, REC	254,000†	USBR/CASITAS MWD
Chatsworth	CONS	9,886†	CITY OF LA
Cogswell	FC, CONS, REC	8,871*	LACDPW
Devil's Gate	FC, CONS	2,817*	LACDPW
Eagle Rock	CONS	254†	CITY OF LA
Eaton Wash	DS, CONS	852*	LACDPW
Hollywood/Mulholland Dam	CONS	4,036†	CITY OF LA
Los Angeles	CONS	10,000†	CITY OF LA
Live Oak	FC, CONS	2,600†	MWD
Live Oak	FC, CONS	230†	LACDPW
Matilija	CONS	1800†	VCFCD
Morris	FC, CONS	21,343*	MWD/LACDPW
Pacoima	FC, CONS	3,383*	LACDPW
Piru/Santa Felicia Dam	CONS, REC	88,300†	UWCD
Puddingstone	FC, REC	16,342*	LACDPW
Puddingstone Diversion	FC, DIV, CONS	205*	LACDPW
Pyramid	CONS, REC	171,200†	DWR
San Dimas	FC, CONS	1,058*	LACDPW
San Gabriel	FC, CONS	45,883*	LACDPW
Santa Anita	FC, CONS	905*	LACDPW
Santa Fe	FC, CONS	32,109†	COE/LACFCD
Sawpit	FC, CONS	408*	LACDPW
Silver Lake	CONS	2,020†	CITY OF LA
Stone Canyon	CONS	10,372†	CITY OF LA
Thompson Creek	FC, CONS	533*	LACDPW
Whittier Narrows	FC, CONS	67,060†	COE/LACDPW

CONS	Conservation (domestic water supply)
DIV	Diversion
DS	Debris Storage
FC	Flood Control
REC	Recreation

CAMWD	Calleguas Municipal Water District
COE	United States Army Corps. of Engineers
DWR	Department of Water Resources (State of California)
LACDPW	Los Angeles County Department of Public Works
MWD	Metropolitan Water District of Southern California
USBR	United States Bureau of Reclamation
UWCD	United Water Conservation District
VCFCD	Ventura County Flood Control District

† 1994 Capacity
* 1993 Capacity

Streambed Alteration Agreements

In addition to the CWA (§401 and §404), Sections 1601-1605 of the Fish and Game Code (Chapter 6, Fish and Wildlife Protection and Conservation) apply to any governmental agency, state or local, or any public utility that proposes to divert, obstruct or change the natural flow or bed, channel or bank of any river, stream, or lake. It is unlawful for any person to engage in such a project or activity without first notifying the California Department of Fish and Game of such activity, and one can not commence such operations until the Department has found such operations will not substantially adversely affect existing fish or wildlife resources. Agencies must submit proposed plans to the Department of Fish and Game. The Department will then review the proposal, conduct field investigations, if warranted, and notify the Agency of any potentially adverse impacts to the existing fish and wildlife resource due to the proposed activity. The Department of Fish and Game can propose mitigation measures necessary to protect the fish and wildlife.

Recreational Impacts

Water contact and non-contact recreational activities range from swimming, surfing, and sunbathing at coastal beaches to hiking along some of the pristine stretches of streams in the canyons of the Transverse Mountain Ranges. With the intense residential, commercial, and industrial development throughout much of the Region, however, relatively few natural environments remain for the enjoyment of urban residents. Many of those environments that do remain are threatened by overuse as well as disregard for the sensitivity of natural ecosystems. Many of the streams and banks in the parks and campgrounds of the Region are littered with trash and debris.

Water quality impacts from recreational use are not restricted to litter. Other ways in which water quality is affected include discharges from overloaded sewage containment and septic systems and erosion of dunes and stream banks from trampling and off-road vehicles. In addition to degrading riparian, estuarine, and coastal habitats, these impacts leave sites in unsightly and unhealthy conditions, limiting future recreational opportunities. Golf courses are kept green by applications of pesticides and fertilizers. Over watering allows these chemicals to runoff into surface waters. In some cases, the extra irrigation water itself causes a disruption of the hydrologic balance of surface waters.

The Regional Board encourages mitigation of recreational impacts through planning efforts at a local level. Planning efforts should address maintenance of parks, campgrounds, beaches, and other open spaces. Public outreach and education measures, while long term, are nonetheless considered to be the most effective way of controlling this type of pollution and maintaining these resources.

Septic Systems

Many areas in the Region rely on septic systems for disposal of domestic household waste. Septic systems "treat" household wastes by first removing organic solids through settling and decomposition in the tank portion of the system. Further treatment of organic chemicals, nutrients, and bacteria occurs as the effluent released from the tank percolates through the soil. Proper construction of septic systems is imperative. Poorly designed and constructed systems will not function properly and can result in pollution of surface and/or ground waters (Figure 4-5). Septic systems used in undersized lots or unsuitable soils are also subject to malfunction and can lead to untreated or poorly treated sewage seeping into yards, roadside ditches, streams, lagoons, or into ground water – creating a public nuisance and health hazard. Even well-functioning septic systems can pollute ground water under adverse conditions (e.g., unsuitable sites.)

Nitrogen compounds, which are typically present in effluent from septic systems, are highly soluble and stable in aqueous environments. When not denitrified by bacteria or assimilated into organic growth (plants) in the unsaturated zone, these nitrogen compounds are easily transported to ground water. Examples of this problem occur in developed areas along the coast and in rural areas undergoing rapid urbanization (such as Ventura County or northern Los Angeles County).

Although there is controversy about the possible health effects of nitrate on adults, it has been shown that high levels of nitrate cause methemoglobinemia (blue-baby syndrome) in infants. The federal drinking water standard of 10 mg/L nitrate plus nitrite (expressed as nitrogen) is based on this relationship. Furthermore, high levels of nitrates have economic impacts on supplies of potable water, requiring well closure and relocation, well deepening, wellhead treatment, or blending. In addition, new developments may be restricted due to the presence of water supply with nitrogen concentrations that exceed drinking water standards.

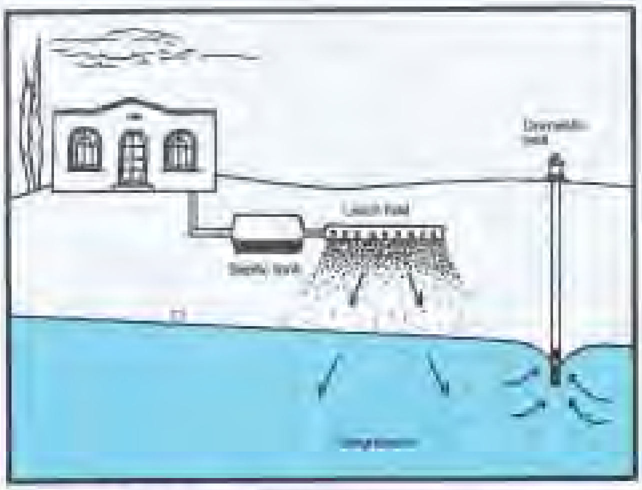


Figure 4-5. Septic System. In a properly designed septic system, pollutants in the septic tank effluent are naturally degraded in the leach field before reaching the water table. This diagram, however, illustrates how pollution of ground water can result from a septic system that is not properly located or maintained.

The Regional Board discourages the prolonged use of septic systems, except in isolated areas where connection to a wastewater collection system is not feasible and there is no threat to groundwater quality. Septic systems are not acceptable in areas where there are unsuitable soils, inadequate lot sizes, or other factors that can lead to contamination of either surface or ground water. In assessing areas of concern, high priority is given to rapidly developing areas where local ground water is the sole or primary source of drinking water. One such area is the Aqua Dulce area of the Sierra Pelona Valley in northern Los Angeles County. Ground water is the primary source of drinking water for residents in this unsewered area. High concentrations of nitrate, however, have been found in some of the wells in the area. In response, the Regional Board has contracted with the University of California at Riverside to use isotope techniques to trace the source (or sources) of nitrogen in ground water in the area.

In addition, in response to other concerns that ground water was not sufficiently protected from the effects of new developments that rely on septic systems, the Regional Board developed an Interim Policy for septic systems in areas that rely on ground water for domestic purposes. Under this Interim Policy, the Regional Board adopted *General Waste Discharge Requirements for Residential Subsurface Sewage Disposal Systems in Areas Where Ground Water is Used For Domestic Purposes* (Order No. 91-94, adopted July 22, 1991). These requirements are intended to simplify and expedite the application process and processing of requests for use of septic systems in residential areas while assuring the protection of water quality. As part of the requirements, the Regional Board requires either a hydrogeologic study or certain mitigation measures.

Recommendations for future steps for control of problems from septic systems include:

- evaluate the adequacy of existing local regulations for installation and maintenance of septic systems;
- continue to discourage or limit the use of septic systems in new developments;
- encourage alternative waste treatment systems; and
- encourage and support funding for wastewater treatment plants in outlying areas where water quality problems and/or population density require wastewater collection and treatment.

Seawater Intrusion

Ground water supplied most of the water in the Region until the 1940s. By World War II, however, increasing demands for ground water escalated to such an extent that groundwater pumping far exceeded freshwater recharge (i.e., replenishment) in many aquifers (Fossette, 1986). As a result, degradation of ground water occurred as seawater seeped inland to replace ground water in freshwater aquifers that had been overpumped. Referred to as seawater intrusion, this condition is accelerated when coastal aquifers are overdrafted (i.e., when groundwater pumping exceeds recharge).

Seawater intrusion can be controlled through pumping restrictions and artificial recharge of aquifers. Artificial recharge is especially important in urban areas where paved surfaces and buildings have eliminated natural recharge areas and drastically reduced recharge rates. Figure 4-6 illustrates two forms of artificial recharge used to combat seawater intrusion: spreading basins and injection wells. Spreading basins are constructed in permeable zones where water can seep into the subsurface. Spreading basins in the Los Angeles Region typically were created by modifying existing terrain with dikes or low head dams within, or adjacent to, stream channels. Such devices divert excess supplies of surface waters into spreading basins, thus recharging aquifers and creating a seaward gradient that will help prevent seawater intrusion. Injection wells along coastal areas create a freshwater barrier that can halt seawater intrusion, recharge aquifers, and allow groundwater pumping from elevations below sea level. In addition, artificial recharge is often supplemented through in-lieu recharge programs, wherein excess supplies of surface water (when available) are discounted and sold to groundwater pumpers. In exchange for this discounted surface water, groundwater pumpers agree that they will not exercise pumping rights on an equivalent amount of ground water.

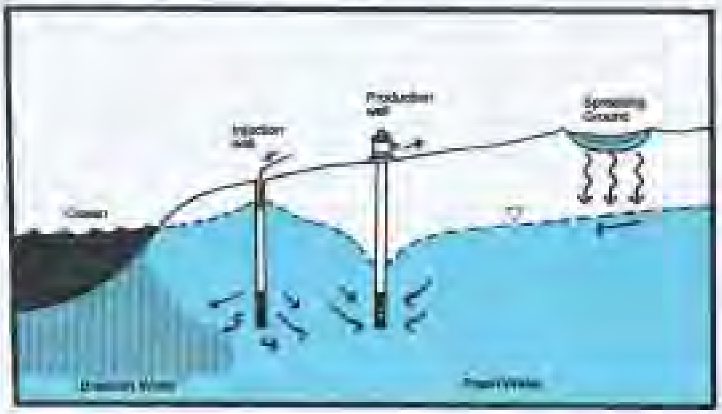


Figure 4-6. Artificial recharge through spreading grounds and injection wells. Use of artificial recharge in this coastal aquifer helps to (i) maintain groundwater levels through use of spreading grounds and (ii) prevent saltwater intrusion using injection wells. Arrows in figure indicate direction of groundwater flow. (Hatched lines indicate the water table.)

On the Los Angeles Coastal Plain, three rows of injection wells (the Alamitos Barrier along the Central Basin, and the Dominguez Gap and West Coast Barriers along the West Coast Basin) protect aquifers from seawater intrusion. In addition, spreading grounds along the San Gabriel and Rio Hondo Rivers in the northern part of the Central Basin provide further recharge of the coastal aquifers under the Los Angeles Coastal Plain. These artificial recharge projects are supplemented by an aggressive in-lieu recharge program. Finally, enforcement of adjudicated groundwater rights in these basins ensures that groundwater production will not exceed recharge.

While groundwater overdraft and seawater intrusion are under control on the Los Angeles Coastal Plain, they continue to be serious problems within the Oxnard Plain portion of the Ventura Central Groundwater Basin. Aquifers underlying the Oxnard Plain are the primary source of agricultural supply water. Although spreading grounds along the lower Santa Clara River and an in-lieu recharge program have somewhat lessened overdraft conditions, groundwater pumping continues to greatly exceed freshwater recharge.

Ground water in the San Gabriel and San Fernando Valley Basins is also artificially recharged through spreading basins. While these inland basins are not intruded by seawater, they have been overdrafted in the past. Recharge through spreading basins, coupled with court enforcement of adjudicated water rights, protects these inland basins from overdraft.

The Regional Board supports artificial recharge projects through regulatory and financial assistance programs. Water Reclamation Requirements (WRRs) – in lieu of WDRs – regulate groundwater recharge with treated wastewaters.

Resource Extraction

Resource extraction includes mining, drilling, and pumping for mineral petroleum products. Impacts to water quality can be significant, even for small operations. Surface mining operations alter the natural landscape, resulting in accelerated erosion and sedimentation. In addition, high concentrations of chemicals that are leached from exposed soils, ores, and waste rocks can pollute ground or surface waters. Oil production activities also disturb surrounding lands; brines and drilling fluids from drilling operations have a potential for degrading the environment if spilled. Water quality impacts from resource extraction are not limited to operating mines and petroleum wells (Ventura County, 1990). Water quality can be threatened by abandoned mining operations (and associated tailings) and petroleum drilling sites if not properly reclaimed.

Mines

Most active mines in the Los Angeles Region are sand and gravel operations located along the San Gabriel and Santa Clara Rivers. Gypsum, borax, and titanium (and associated heavy minerals) mines operate in the area along with small-scale gold prospecting. In 1988-89, the number of mines in Los Angeles and Ventura Counties totaled 53, as shown below and as shown on Figure 4-7 (DMG, 1990):

Sand and gravel	41
Clay	3
Stone (including dimension, decorative)	8
Tungsten	1

There are three types of sand and gravel operations: in-stream, wet, and dry. Discharges of washwaters from all types of sand and gravel operations contain suspended sediments that can degrade downstream waters. In-stream operations divert the sand and gravel load of a stream, thereby altering natural rates of sedimentation in downstream areas. Modification of stream channels during in-stream operations results in excessive scouring and increased sedimentation during floods, possible loss of riparian vegetation due to lowering of the water table and potential loss of aquifer storage capacity. In addition, oil, grease, and turbidity from in-stream operations degrade the quality of surface waters; off channel diversion helps to minimize these problems. Wet operations, which occur below the seasonal high water table, can directly pollute ground water and otherwise degrade water quality by evaporative loss, and silting. Approximately 10% of the operations in the Region are wet. Dry sand and gravel operations, on the other hand, are conducted entirely above the water table and result in less severe impacts to water quality. Suspended sediments in runoff from dry operations, however, can degrade water quality, especially during wet weather (Division of Oil, Gas & Geothermal Resources, 1989).

Ore mining operations often generate acidic runoff (i.e., water with a pH below 6) and dissolved metals that are toxic to aquatic life in downstream surface waters. In addition, this contaminated runoff can seep into ground water. Contaminated runoff often can be neutralized with chemicals, or reduced to acceptable levels with Best Management Practices (BMPs).

Surface mining and subsequent reclamation are governed by California's Surface Mining and Reclamation Act (SMARA) of 1975 and the federal Surface Mining Control and Reclamation Act (SMCRA) of 1977 which require operations to minimize erosion and sedimentation (some operations are specifically exempted). In addition, any chemicals used in the operations must meet current discharge requirements from both their operations and stock piles. Federal mining law controls mining on Department of Defense lands, Native-American lands, Bureau of Land Management lands and Forest Service lands.

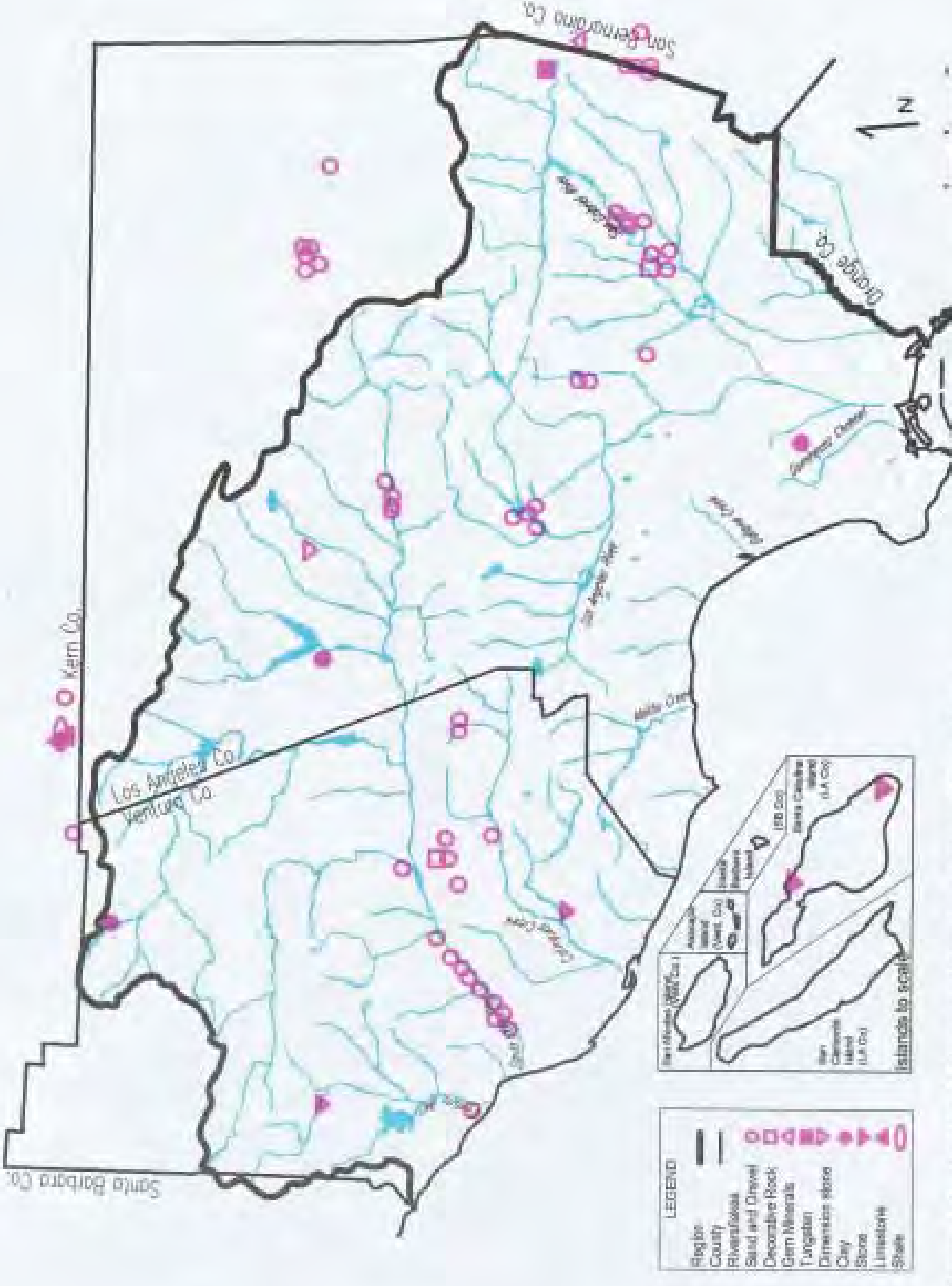
The Regional Board issues WDRs for mining operations on a case-by-case basis. Under the California Water Code (§13263.1) the Regional Board must "determine that the proposed mining waste is consistent with a waste management strategy that prevents the pollution or contamination of the waters of the State, particularly after closure of any waste management unit for mining waste." California Code of Regulations, Title 23, Chapter 15, Article 7 also applies to mining wastes. In addition, industrial storm water runoff (NPDES) permits are required for each site.

Ventura and Los Angeles Counties impose restrictions on mining operations that are consistent with Regional, State, and Federal laws. In Ventura County, stringent conditions are placed on mining operations in order to protect water quality and associated resources, preserve wildlife habitat, and enhance reclamation and aesthetics (Ventura County General Plan, 1990). In Los Angeles County, surface mining operators (including oil and gas production) are required to control slope excavations, erosion and sedimentation, runoff and flooding, etc.

Oil and Gas Extraction

Southern California has a large number of oil and gas fields (Figure 4-8). District 1 of the California Division of Oil, Gas & Geothermal Resources (DOG&G) includes Los Angeles, San Bernardino, Orange, Riverside, San Diego, and Imperial Counties; District 2 covers Ventura County. In 1991, oil production in District 1 and District 2 included 46.6 (48 active fields) and 15.8 (52 active fields) million barrels respectively. Gas production was 15.8 and 18.4 billion cubic feet, respectively. The primary method of enhanced oil recovery is waterflooding in which water is injected into oil reservoirs through injection wells. In both Districts, 102 wells had active water disposal programs totalling 20.3 million barrels of produced water (DOG&G, 1991).

While many of the discharges associated with oil and gas production (such as disposal of produced



After California Division of Mines and Geology, 1990

Figure 4-7. Regional Mines and Sand and Gravel Operations.

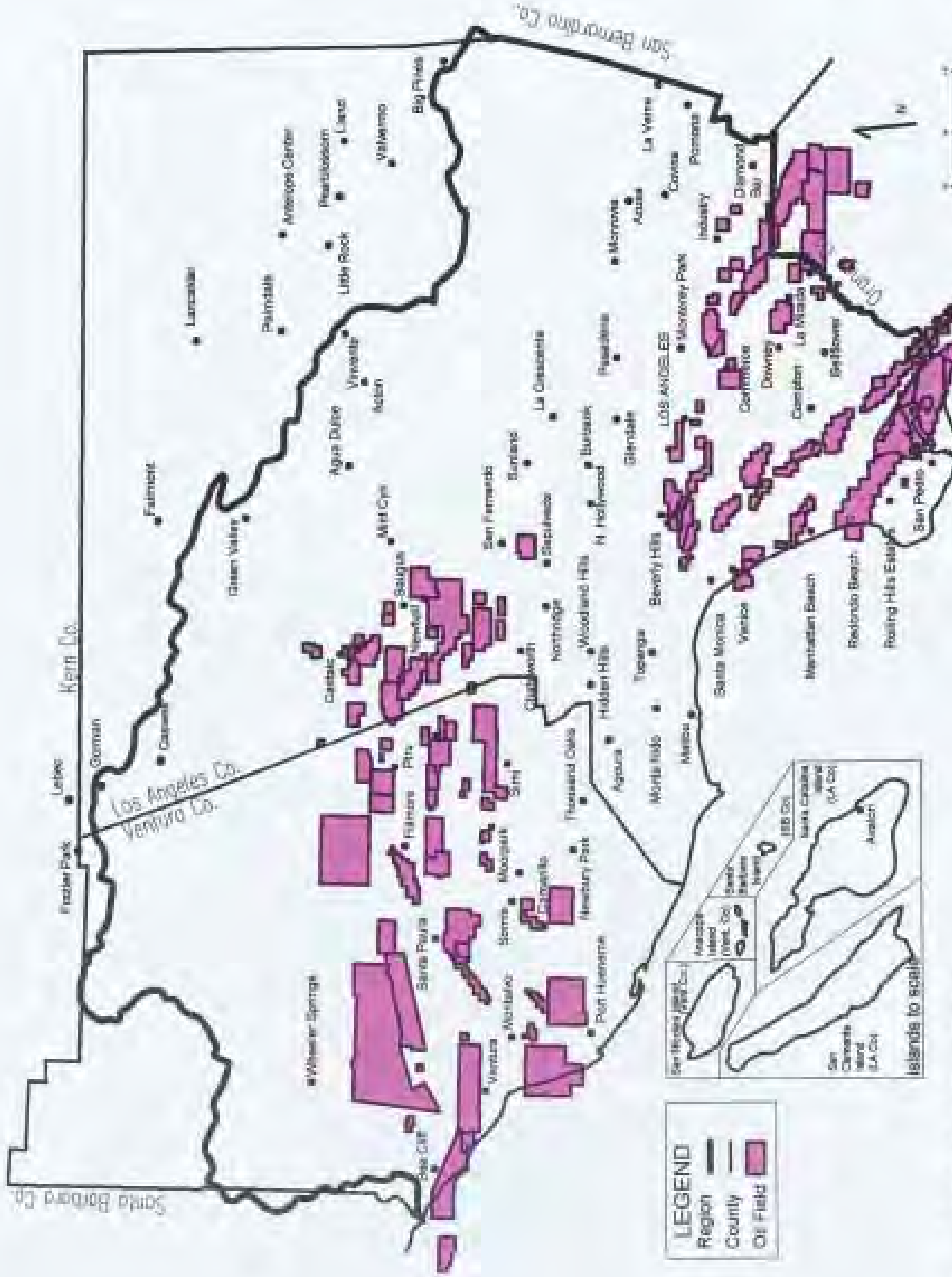


Figure 4-8. Oil Field Boundaries.

Oil field boundaries after Department of Oil and Gas, 1992 (Districts 1 and 2) water and cuttings) are considered point sources, pollutants from nonpoint sources are also significant threats to water quality. Such nonpoint sources can include seeping and overflowing reserve pits containing drilling fluids and production pits containing hydrocarbons and radium, polluted storm water runoff from drilling and production sites, and spills during transportation. Water associated with oil, gas, or geothermal resource extraction frequently contains high levels of sodium, calcium, chloride, sulfate, carbonate, boron, and iodine, as well as trace metals and hydrocarbons. There also are significant sources of pollutants from natural oil seeps in the Region, which often surface on the ocean floor, along streams such as Santa Paula, Tapo, and Sisar Creeks in Ventura County, and in the vicinity of the La Brea Tarpits in Los Angeles County.

Oil production on federal lands, including National Forest lands, is regulated by the U.S. Bureau of Land Management. Offshore production within three miles of the coast is under state jurisdiction, while that beyond three miles is under federal jurisdiction. The California Division of Oil, Gas & Geothermal Resources conducts environmental inspections of active and inactive off shore and on shore wells, including injection wells for re-injection of produced water associated with oil wells. The Department of Toxic Substances Control regulates hazardous wastes stored, used, or generated on-site. As a result of a Memorandum of Understanding between the State Board and the Division of Oil, Gas & Geothermal Resources, the Regional Board no longer issues WDRs for brine injection wells but does issue WDRs for land disposal at oil and gas sites, including landfills and spreading operations. The USEPA issues permits for injection wells (40 CFR Chapter 1, Subchapter D); DOG&G regulates Class II brine injection wells.

The Regional Board requires NPDES storm water permits for oil production facilities.

Silviculture

Silviculture is the process of managing trees in a forest and includes activities such as site preparation, cultivation, timber harvest, and transport. Such activities are significant sources of nonpoint pollutants unless properly managed. The major type of pollution associated with silvicultural operations is increased sedimentation from the erosion of harvest sites, log landings, logging and skid trails. Other pollutants include pesticides, fertilizers, fire-retardant chemicals, organic matter, woody debris, and increased water temperature along streams where trees have been removed. Logging roads on forest lands, which normally provide access for timber management, recreation, fire protection and other activities, can impact wildlife habitat by increasing erosion and sedimentation in streams and thus destroying aquatic habitats.

In 1897, the federal Organic Administration Act first addressed the management of National Forests. In 1905, Congress transferred all forest reserves to the U.S. Department of Agriculture from the U.S. Department of Interior. This established the U.S. Forest Service as the land management agency in charge of National Forests. The National Environmental Policy Act (NEPA) of 1969 required evaluation of potential impacts on the environment before activities such as timber harvesting could occur on federal lands.

In 1973, mounting concern over forest management and its impacts led to the Z'berg-Nejedley Forest Practice Act. This Act regulates forest practices on state, county, and private lands. It encourages timber production but requires consideration of fish, wildlife and other forest resources. Similar concerns for other federally-owned lands led to the National Forest Management Act of 1976, which outlines even more precise management guidelines requiring long-range planning process and encouraging public participation.

Best Management Practices in Forest Management: The U.S. Forest Service water quality maintenance and improvement measures, or Best Management Practices (BMPs), were developed in compliance with CWA (§208). Practices developed by the Forest Service were certified by the State Water Resources Control Board and approved by the USEPA in 1979. The signing of the 1981 Management Agency Agreement (MAA) between the U.S. Forest Service and the State Board resulted in the formal designation of the Forest Service as a water quality management agency. BMPs are the measures both the State and Federal water quality regulatory agencies expect the Forest Service to implement in order to meet water quality objectives and to maintain and improve water quality. There are currently 98 certified practices being implemented. These 98 practices have been identified under 8 different resource categories (Table 4-21). Twenty-seven of the 98 practices are specifically related to

Table 4-21. Best Management Practices in Forest Management – Angeles and Los Padres National Forests.

Resource Category	Practice *
Timber	Protection of Unstable Areas
	Streamcourse Protection
	Erosion Control on Skid Trails
Road and Building Site Construction	Road Slope Stabilization
	Controlling In-channel excavation
	Water Source Development Consistent with Water Quality Protection
Mining	Administering U.S. Mining Laws
Recreation	Documentation of Water Quality Data
	Protection of Water Quality within Developed and Dispersed Recreation Areas
Vegetative Manipulation	Pesticide Application Monitoring and Evaluation
	Untreated Buffer Strips for Riparian Area and Streamside Management
Fire Suppression & Fuels Management	Protecting of Water Quality from Prescribed Burning Effects
	Repair or Stabilization of fire Suppression Related Watershed Damage
Watershed Management	Watershed Restoration
	Water Quality Monitoring
Grazing	Controlling Livestock Numbers and Season of Use
	Rangeland Improvements

* This list is not complete, but illustrates examples for each of the 8 Resource Categories.

Source: United States Department of Agriculture, 1987 and 1991

silvicultural activities. The most current reference for BMPs is a Soil and Water Conservation Handbook titled *Water Quality Management for National Forest System Lands in California* (USFS, 1986). In addition to the 98 certified practices, two additional practices are currently being reviewed prior to state and federal certification (USFS, 1987).

Within the Region, water quality management is administered in both the Angeles National Forest and the Los Padres National Forest through the continued implementation of the BMPs and through the guidance of the 1981 Management Agency Agreement between the State Board and the U.S. Forest Service. In both the Angeles and the Los Padres National Forests, management activities are limited to a broad-based "selection management," where selective cutting leads to, or maintains, a small even-aged groups of trees similar to those that occur under natural conditions.

Within the forest, wildfire poses one of the greatest threats to water quality. This is especially true of the Los Padres National Forest. Between 1912 and 1985, wildfires burned 1,844,150 acres of the forest, making it one of the most fire-prone in the National Forest System. Wildfires in the Angeles National Forest burn an average of 18,500 acres annually. In addition to the ash and debris resulting from wildfires, destruction of vegetation results in elevated levels of erosion and sedimentation in streams and increased levels of nutrients in the aquatic systems. Removal of streamside cover results in increased water temperature and reduced dissolved oxygen levels. In addition, flooding results in stream bank erosion and loss of riparian habitat.

Current vegetative management practices focus on fire prevention, suppression, and a program of fuel management. The U.S. Forest Service thins overstocked chaparral stands each year. This thinning is accomplished by hand or mechanical methods, use of silvicides, or by low-intensity prescribed burning. This greatly reduces the potential for wildfire by limiting exposure of residual stands to potential wildfires.

In the Angeles National forest, there are approximately 240 miles of perennial rivers and streams, numerous miles of intermittent streams, five natural lakes, and 14 reservoirs. The net yield in this forest is approximately 226,000 acre-feet of water. The Los Padres National Forest has 37 reservoirs and provides about 715,000 acre-feet net yield of water (USFS, 1987).

The major water quality problem in the forest lands is sedimentation and its effect on aquatic habitat and reservoir storage life. As an example, about six million tons of sediment are estimated to be produced on the Los Padres Forest each year; roughly 50% of this sedimentation results from erosion and flooding after wildfires (USFS,1987).

Coastal Nonpoint Source Pollution Program

The Coastal Zone Act Re-authorization Amendments (CZARA) of 1990 include Section 6217, "Protecting Coastal Waters," and requires states with approved coastal zone management programs to develop a Coastal Nonpoint Pollution Control Program (CNPCP). This program will be implemented through existing State coastal zone management programs (California Coastal Commission) and nonpoint source management programs (State Water Resources Control Board). At the federal level, the USEPA and the National Oceanic and Atmospheric Administration (NOAA) will jointly administer the new requirements.

The *Program Development and Approval Guidance* was released by USEPA and NOAA in January, 1993. States have 30 months (by July, 1995) to submit their Coastal Nonpoint Pollution Control Program for approval. Once the plan is approved, states have three years (until January, 1999) to implement the technology-based management measures. USEPA and NOAA will then have a two-year monitoring period (until January, 2001) to assess the effectiveness of the measures. States will then have an additional three years (until January, 2004) to implement any additional measure necessary to attain water quality standards.

Future nonpoint source funding allocations are contingent upon the completion of an approvable program. If the state does not submit an approvable program, financial penalties will be assessed in the form of progressively decreasing Section 319 grants to the state.

The *Guidance Specifying Management Measures For Sources of Nonpoint Pollution in Coastal Waters* (commonly called the *(g) guidance*) was released by the USEPA in January, 1993. This *(g) Guidance* contains management measures for five major categories of nonpoint source pollution: agriculture, forestry, urban (including septic tanks), marinas and recreational boating, and hydromodification (Table 4-22). States will be expected to implement all of the measures specified in the *(g) Guidance* with some limited exceptions. These exceptions include (i) sources that are not present, nor reasonably anticipated in an area; or (ii) sources that do not individually or cumulatively present significant adverse effects to living resources or human health. States will also have some flexibility in adopting the exact measures specified in the *(g) Guidance* or alternative measures which are demonstrated to be as effective as USEPA measures in controlling nonpoint source pollution.

The State Board and Coastal Commission have assembled a Coordinating Committee and several Technical Advisory Committees to review the *(g) Guidance* management measures and develop strategies to implement them in California. A key feature of this program is that the State must develop *enforceable* management measures. This differs from most of the State's existing nonpoint source efforts which for the most part are voluntary. There are also some components of the program that the Regional and State Boards do not usually regulate, such as issues relating to land use. Therefore, it will be critical to coordinate State and Regional Boards programs with those of the Coastal Commission and appropriate local agencies in order to develop a successful coastal nonpoint source program. This program will be closely integrated with the Regional Board's storm water permitting program and others, such as the Santa Monica Bay Restoration Project.

Future Direction: Watershed-Based Water Quality Control

The concept of comprehensive watershed level management of water resources is currently being incorporated into various elements of the State's Nonpoint Source Management Program. The watershed protection approach is an integrated strategy for more effectively protecting and restoring beneficial uses of State waters. By looking at an entire watershed, one can more clearly identify critical areas and practices which need to be targeted for pollution prevention and corrective actions. This approach not only addresses the waterbody itself, but the geographic area which drains to the watercourse. This strategy also

Table 4-22. Management Measures in the *Guidance Specifying Management Measures For Sources of Nonpoint Pollution in Coastal Waters* ["(g) Guidance"].

Categories	Subcategories
Agriculture	Erosion and sediment control Confined animal facility control Nutrient management Pesticide management Livestock grazing Irrigation water management
Forestry	Pre-harvest planning Streamside management areas Road construction/reconstruction Road management Timber harvesting Site preparation and forest regeneration Fire managment Revegetation of disturbed areas Forest chemical managment Wetlands forest managment
Urban	New development management Watershed protection/site development Construction erosion and sediment control Construction site chemical control Existing development managment New and operating onsite disposal systems (septic tanks) managment
Marinas	Siting and design Marina flushing managment Water quality assessment Habitat assessment Shoreline stabilization management Storm water runoff management Fueling station design management Sewage facility managment Marina and boat Operation and Maintenance Solid waste management Fish waste managment Liquid material managment Petroleum control managment Boat cleaning management Public education managment Maintenance of sewage facilities management Boat operation management
Hydromodification	Channelization and channel modification Physical and chemical characteristics of surface waters Instream and riparian habitat restoration management Dams Erosion and sediment control Chemical and pollutant control Protection of surface water quality and instream and riparian habitat Stream bank and shoreline erosion management
Wetlands	Protection of wetlands and riparian areas Restoration of wetlands and riparian areas Vegetated treatment systems

integrates both surface and ground waters, inland and coastal waters, and point and nonpoint sources of pollution. Point sources have received most of the regulatory attention in the past, however, significant improvements in point sources, coupled with continued water quality impairments, have necessitated the water resources community to look at a more integrated approach which considers impacts from both point and nonpoint sources of pollutants.

The Watershed Protection Approach is built on three main principles. *First*, targeted watersheds should be those where pollution poses the greatest risk to human health, ecological resources, other beneficial uses of the water, or combinations of these. *Second*, all parties with a stake in the specific local situation should participate in the analysis of the problems and the creation of solutions. *Third*, the actions undertaken should draw on the full range of methods and tools available, integrating them into a coordinated, multi-organizational effort to solve the identified problems.

Many agencies and organizations concerned with water resources have come to recognize that this type of approach can be very effective in realistically assessing cumulative impacts and formulating workable mitigation strategies. The Coastal Zone Management Act Re-authorization Amendments, USEPA guidance, and various legislative proposals clearly state the need to consider the implications of land use on water quality. The USEPA and State Board encourage the Watershed Protection Approach at all levels of government. USEPA program managers are re-thinking their approach to the allocation of resources (especially within the Nonpoint Source Program) and will be primarily funding studies that are part of a watershed planning and implementation effort. Recently, the State Board has formed a work group to investigate options for watershed management in California. The Water Quality Task Force, created by the Los Angeles Regional Water Quality Control Board in December, 1992, included a watershed management issue in the list of recommended actions to be implemented at the regional level.

The traditional approach to managing pollutant discharges into streams, lakes, and the ocean has evolved over time – often with separate programs to address various aspects of an overall water quality problem. Some of these programs can have different, overlapping, or conflicting priorities. A transition to watershed-based management can require some programs to be reoriented and integrated. Other programs can not be amenable to the watershed approach. However, this new perspective, even with a limited application, could produce more benefits than a strict program-based approach and provide improved communication and

Malibu Creek Watershed Nonpoint Source Pilot Project

The Malibu Creek watershed, a drainage area of approximately 105 square miles, has changed rapidly in recent years from a predominantly rural area to a steadily developing area. Impacts from human activities are degrading beneficial uses and potentially contributing to long-term environmental problems. The Malibu Lagoon is listed as an impaired waterbody, and sections of the Malibu Creek are listed as threatened waterbodies (WQA, 1992). For these reasons, the Malibu Creek watershed has been chosen by the Regional Board for a pilot watershed nonpoint source project which is funded by USEPA Title II grant monies. This project is being undertaken in cooperation with the United States Soil Conservation Service, the California Coastal Conservancy, the California Department of Fish and Game, the California Department of Parks and Recreation, and others.

Watershed stakeholders, including local activists, politicians, agency representatives, local residents and members of the regulated community, participated in a series of discussion and consensus building groups, dating back to 1991, that resulted in the identification of several areas of environmental concern. Pollutants of concern, many of which are contributed by nonpoint sources, include excess nutrients, sediment, and disease-causing organisms. Increased flows, due to imported water to support the growing population base, as well as channelization and urbanization, have caused an imbalance in the natural regime of dry weather low-flows in the summer.

A comprehensive management plan is being developed to restore biological and recreational resources and to prevent further environmental degradation. The Regional Board has taken the lead in coordinating a comprehensive approach to controlling the nonpoint source pollution aspects of the effort. The Regional Board provides technical assistance including:

- coordination of and participation in watershed-wide water quality monitoring efforts;
- development of a model to determine waste loads into the creek and lagoon system to determine where reductions are needed;
- development of a plan to minimize water quality impacts on Malibu Lagoon from surface discharge of current and future groundwater pollution abatement programs;
- assistance in the implementation of Best Management Practices for the Municipal Storm water NPDES permit; and
- initiation of a nonpoint source public education campaign.

coordination among all levels of government, private organizations, and citizens.

The Region has been divided into six watershed management areas (see Figure 1-5) for planning purposes.

Projects in the Los Angeles Region which are already successfully utilizing the watershed approach include the Malibu Creek Watershed Study (see description on previous page) and the Santa Monica Bay Restoration Project. Regional Board staff are also participating on the Santa Clara River Project Steering Committee and the Los Angeles River Master Plan Environmental Quality Subcommittee, both of which are developing flood plain or watershed plans for these rivers.

The Regional Board plans to implement more watershed-based projects in the future. These will increase the coordination of planning, monitoring, assessment, permitting, and enforcement elements of the various surface and groundwater programs with activities/jurisdiction in each watershed.

Remediation of Pollution

The Regional Board allocates substantial resources to the investigation of polluted waters and enforcement of corrective actions needed to restore water quality. Specific remediation programs include:

- Underground Storage Tanks
- Well Investigations
- Spills, Leaks, Investigations and Cleanups (SLIC)
- Aboveground Petroleum Storage Tanks
- U.S. Department of Defense (DOD) and Department of Energy (DOE) Sites
- Resource Conservation and Recovery Act (RCRA)
- Toxic Pits Cleanup Act
- Bay Protection and Toxic Cleanup

The relatively recent discovery of pollutants in ground water has jeopardized an important source of water for municipal, agricultural, industrial process, and industrial supply uses in the Los Angeles Region. As a result, reliance on imported supplies of water to this semiarid region has increased.

The Regional Board sets cleanup goals based on the State's *Antidegradation Policy* as set forth in State Board Resolution No. 68-16. Under the *Antidegradation Policy*, whenever the existing quality of water is better than that needed to protect present and potential beneficial uses, such existing quality will be maintained (see Chapter 5, Plans and Policies). Accordingly, the Regional Board prescribes cleanup goals that are based upon background concentrations. For those cases wherein dischargers have demonstrated that cleanup goals based on background concentrations cannot be attained due to technological and economic limitations, State Board Resolution No. 92-49 sets forth policy for cleanup and abatement based on the protection of beneficial uses. Under this policy, the Regional Board can – on a case-by-case basis – set cleanup levels as close to background as technologically and economically feasible. Such levels must, at a minimum, consider all beneficial uses of the waters. Furthermore, cleanup levels must be established in a manner consistent with California Code of Regulations, Title 23, Chapter 15, Article 5; cannot result in water quality less than that prescribed in the Basin Plans and policies adopted by the State and Regional Board; and must be consistent with maximum benefit to the people of the State.

The amended State Board Resolution No. 92-49 has been adopted by the State Board. Upon approval from the Office of Administrative Law (OAL), the amended policy will become effective.

Underground Storage Tanks

Approximately 18,000 underground storage tanks have been identified in the Region, accounting for 15% of the 120,000 underground storage tanks that have been identified throughout the State. Most of these tanks contain, or contained, gasoline and diesel fuel products. Over 4,500 sites in the Los Angeles Region are known to have leaking tanks. These leaks can result in pollution of soil, ground water, surface water, and air, and can also constitute fire or explosion hazards (Figure 4-9).

To protect ground and surface waters from petroleum hydrocarbons from leaking underground storage tanks, the State of California enacted legislation in 1983 (Health and Safety Code, Division 20, Chapter 6.7). Underground tank regulations promulgated under this legislation are designed to (i) ensure the integrity of all underground storage tanks, and (ii) detect any leaks. These regulations can be found in Title 23, California Code of Regulations, Division 3, Chapter 16.

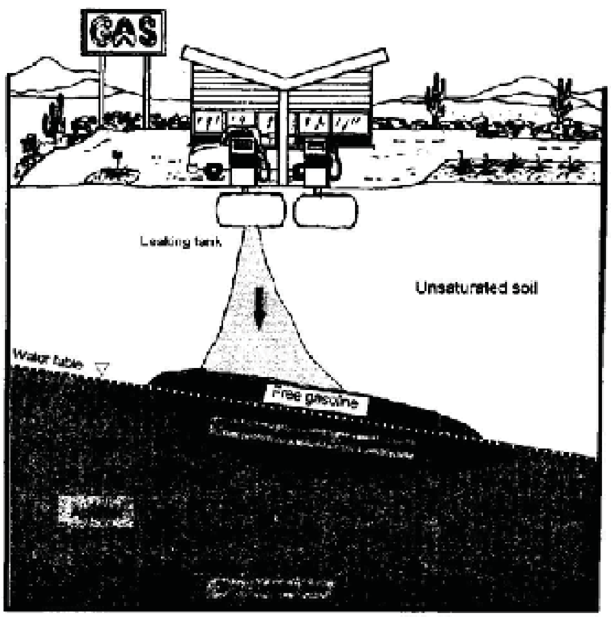


Figure 4-9. Leaking underground storage tank. This diagram illustrates how contamination of the vadose zone and pollution of ground water can result from leaks of gasoline from an underground storage tank (Adapted from Fetter, 1988).

To ensure the integrity of all underground storage tanks, the State's regulations require all counties in California to implement an underground tank permitting program. The counties have the flexibility to shift responsibility to local governments (known as Local Implementing Agencies), provided that the Local Implementing Agencies (LIAs) adopted appropriate ordinances before July, 1990 for implementing underground tank permitting programs that are at least as stringent as the Chapter 16 regulations. Under the permitting programs, a tank owner or operator must obtain an operating permit from the county or LIA in which the tank is located. Permit conditions include tank construction standards, monitoring requirements, unauthorized release reporting, initial abatement procedures, and closure requirements. Furthermore, permitting procedures undertaken by LIAs include initial assessments of sites where pollution can have occurred. LIAs within the Los Angeles Region include: the Counties of Ventura and Los Angeles, and the Cities of Burbank, Glendale, Long Beach, Los Angeles (including the City of San Fernando), Pasadena, Santa Monica, San Buenaventura, Torrance, and Vernon.

Responsibility for overseeing investigations of groundwater pollution and corrective actions rests with the Regional Board. However, given the magnitude of the problems from leaking underground storage tanks in the Los Angeles Region, the Counties of Los Angeles and Ventura joined the State Board's Local Oversight Program (LOP), through which they share regulatory responsibility with the State. (Note that, in addition to their role in the LOP program, the Counties of Los Angeles and Ventura are also LIAs.) In order to provide practical guidance to regulatory agencies overseeing site investigations and corrective actions, the State Board has issued the *Leaking Underground Fuel Tank (LUFT) Field Manual*. This manual is not a policy or regulation; rather, it establishes procedures for verifying the occurrence of a leak from an underground fuel storage tank and for assessing the impact to soil and ground water.

To expedite the permitting process for sites requiring groundwater remediation, the Regional Board has adopted a general permit for the discharge of treated ground water, *Discharge of Ground Water from Investigation and/or Cleanup of Petroleum Fuel Pollution to Surface Waters* (Table 4-2). This general permit regulates the discharge of treated ground water, from petroleum fuel contamination sites, to surface waters, provided that the discharge meets the limitations and conditions of the general permit and does not exceed water quality objectives or impair beneficial uses of the receiving waters.

Leaks from underground storage tanks are not limited to petroleum fuels. Other hazardous substances, such as solvents, also leak and pollute ground and surface waters. Although remediation of such pollution is a high priority, limited funding is available for the investigation and cleanup of such sites. Accordingly, the current scope of the Underground Storage Tank Program is somewhat restricted to pollution from petroleum fuels.

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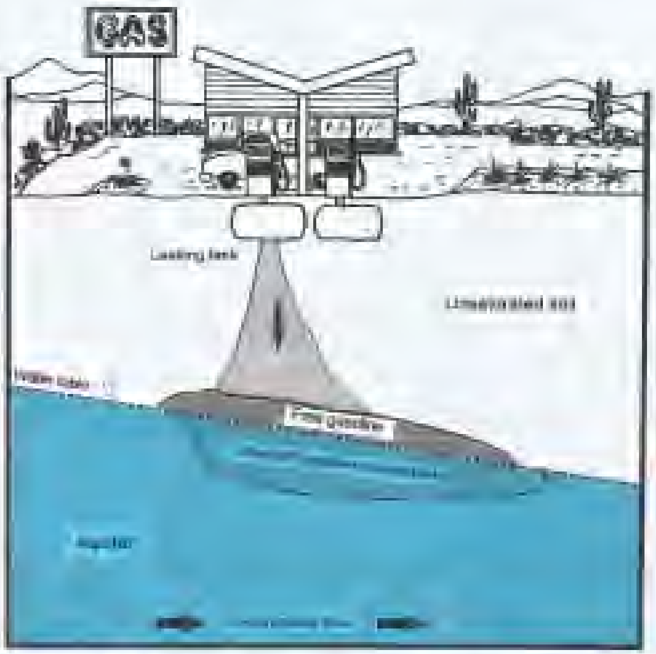

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Well Investigations

By 1980, volatile organic compounds (VOCs) had been discovered in a number of public water supply wells in the San Gabriel Valley and San Fernando Valley Groundwater Basins. These discoveries, along with the discovery of dibromochloropropane (DBCP) in several hundred wells in the San Joaquin Valley and in the Riverside-San Bernardino area, prompted passage of legislation (Assembly Bill 1803) in 1983 which mandated statewide sampling for contamination in public water systems. This legislation is codified in the California Health and Safety Code, Section 4026.3.

The California Department of Health Services and county Health Departments completed sampling of public wells in 1985. Organic pollution was detected in over 640 public water supply wells in the Los Angeles Region. The Regional Board, under authority of the California Water Code (§13304) locates and abates the sources of pollutants affecting these wells and oversees the remediation of the pollution. These investigations, conducted through the Well Investigation Program (WIP), are designed to:

- identify and eliminate sources of pollutants in public water supply wells;
- identify dischargers, by establishing a cause-and-effect relationship between the discharge of a pollutant and a polluted well. When necessary, take enforcement action against dischargers in order to force them to undertake site investigations and corrective actions; and
- oversee remediation of soils and ground waters.

All WIP activities are directed to pollution of ground water in the San Gabriel Valley and San Fernando Valley Groundwater Basins. These valleys are synclinal basins at the base of the San Gabriel Mountains. The two basins, which are separated by the San Raphael Hills, are largely filled with alluvial sediments eroded from the surrounding mountains and hills. Large volumes of groundwater flow through these alluvial sediments, and both basins are important sources of water for more than one million people. In addition to meeting a large part of the demand for potable water, the San Gabriel and San Fernando Valley Groundwater Basins store large volumes of ground water that can be pumped during droughts and recharged during years of surplus surface water supplies. The discovery of significant pollution in these basins, however, has significantly reduced groundwater production as well as the potential for conjunctive use, thereby increasing dependence on imported supplies of water.

Groundwater pollution can often be traced to historic and current land uses. Primary organic pollutants in public water supply wells in the San Gabriel and San Fernando Valley Basins include tetrachloroethylene (PCE) and trichloroethylene (TCE). These compounds, both of which are volatile organic compounds (VOCs), have been widely used as solvents in manufacturing and dry cleaning processes. Soil pollution and subsequent groundwater pollution can result from inadequate handling, storage, and disposal practices of such substances at industrial facilities. In addition to volatile organic compounds, high concentrations of nitrates in the upper 160 feet of the San Fernando Valley Basin have polluted many wells. Nitrates often originate in agricultural areas where fertilizers have been excessively applied to crops, in stockyards and feedlots where nitrates from manure leaches into ground water, and in unsewered areas where nitrates from septic tank systems leach into ground water. With few continuous confining layers of less permeable sediments, groundwater recharge – and the infiltration of pollutants – can occur throughout much of the San Gabriel and San Fernando Valleys.

The Regional Board identifies sources of pollutants by inspecting facilities to check their chemical handling, storage, and disposal practices. Information from these inspections assists in identifying those responsible for releases of pollutants. Under the direction of the Regional Board, parties thus identified are required to conduct subsurface investigations of soil and ground water to confirm the presence or absence of pollutants, quantify the extent of pollution, and plan corrective actions. The Regional Board is committed to working closely with those responsible for releases of pollutants to find cost effective ways in which to investigate and remediate pollution in a timely manner. Whenever appropriate, the Regional Board promotes innovative remediation options and encourages phased, cooperative remediation plans involving multiple sites.

Additionally, in order to minimize the spread of pollution caused by groundwater pumping and recharge activities, the Regional Board oversees a comprehensive groundwater quantity and quality management program in the San Gabriel Valley. This management program, implemented by the Main San Gabriel Basin Watermaster and about 45 private and municipal water purveyors, has the following objectives:

- Prevent public exposure to contamination.
- Maintain adequate water supply.
- Protect natural resources.
- Control the migration of pollutants.
- Remove polluted ground water.

Oversight of this management program is authorized by Regional Board Resolution No. 91-6, entitled *Amendment to the Water Quality Control Plan for the Los Angeles River Basin and Implementation Plan Concerning the Extraction of Ground Water Within the San Gabriel Valley Basin.* In the San Fernando Valley Groundwater Basin, the Watermaster for the Upper Los Angeles River Area (i.e., the San Fernando Valley Groundwater Basin) cooperates with the Regional Board to achieve similar objectives (Upper Los Angeles River Area Watermaster, 1993c).

In light of the extent of pollution in the San Gabriel Valley and San Fernando Valley Groundwater Basins (Figures 4-10 and 4-11) and the dependence on this important source of ground water, the State of California designated large areas of these basins as high priority Hazardous Substances Cleanup sites. The USEPA also designated these same areas as sites eligible for funding under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) legislation (i.e., as Superfund sites). The USEPA, as lead agency for enforcement in these areas, is responsible for strategy, case development, determination of responsible parties, and settlement negotiations. The Regional Board, on behalf of the USEPA, identifies dischargers as described above.

Spills, Leaks, Investigation and Cleanup (SLIC)

With a skilled work force, well-developed infrastructure and large-scale production capacity, the Los Angeles Region is an important industrial and manufacturing center. With 20 major refineries and hundreds of smaller facilities, the Region has the greatest concentration of petroleum production and storage facilities along the West Coast. Although these activities are an important part of the Region's economic base, they have often severely degraded the environment.

Reports of unauthorized discharges, such as spills and leaks from above-ground storage tanks, are investigated through the Regional Board's Spills, Leaks, Investigation and Cleanup (SLIC) Program. This program is not restricted to particular pollutants or environments; rather, the program covers all types of pollutants (such as solvents, petroleum fuels, and heavy metals) and all environments (including surface and water, ground water, and the vadose zone). Upon confirming that an unauthorized discharge is polluting or threatens to pollute regional waterbodies, the Regional Board oversees site investigation and corrective action. Statutory authority for the program is derived from the California Water Code, Division 7, Section 13304. Guidelines for site investigation and remediation are promulgated in State Board Resolution No. 92-49 entitled *Policies and Procedures For Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304*, described at the beginning this Chapter, in section entitled Remediation of Pollution. Pollutants in the SLIC Program are typically petroleum fuel products which, in addition to existing in liquid form as pure compounds (i.e., "free product"), can dissolve in water, adsorb to soils, and vaporize. Site investigations to delineate the extent of pollution caused by such substances are therefore very complex. Cases range from small leaks of fuel products stored in metal drums to large spills at tank farms and refineries, where tens of millions of gallons of free product are floating on the surface of ground waters in important aquifers. Over 350 cases of pollution have been investigated since 1986. Approximately 50 of these sites have been remediated and closed. State of the art remediation techniques, such as bioremediation of soils, have successfully been employed to remediate pollution. Approximately 100 cases are presently undergoing investigation or corrective action. New cases of pollution are reported at a rate of about 2 to 3 per month.

Department of Defense and Department of Energy

Decades of defense and energy activities have degraded water quality on and around federally-owned facilities. Working with other agencies, the Regional Board is involved with remedial investigation and clean up action on over 16 U.S.

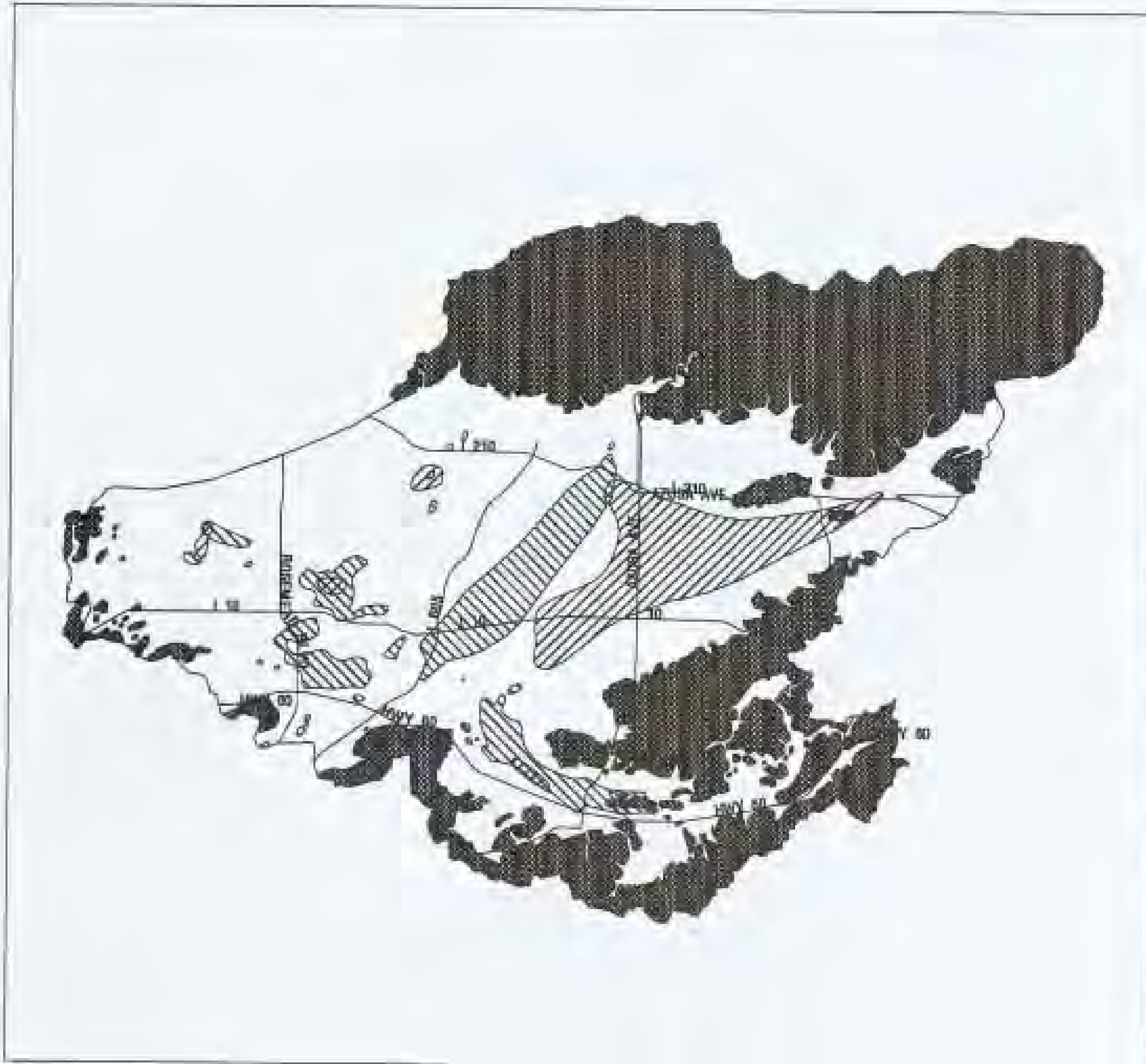

FIGURE 4-10

SAN GABRIEL VALLEY
GROUNDWATER BASIN
CONTAMINATION PLUMES

CALIFORNIA REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

VOC'S ABOVE MCL
NITRATES ABOVE MCL
BEDROCK OUTCROP

MILES
0 1 2 3 4

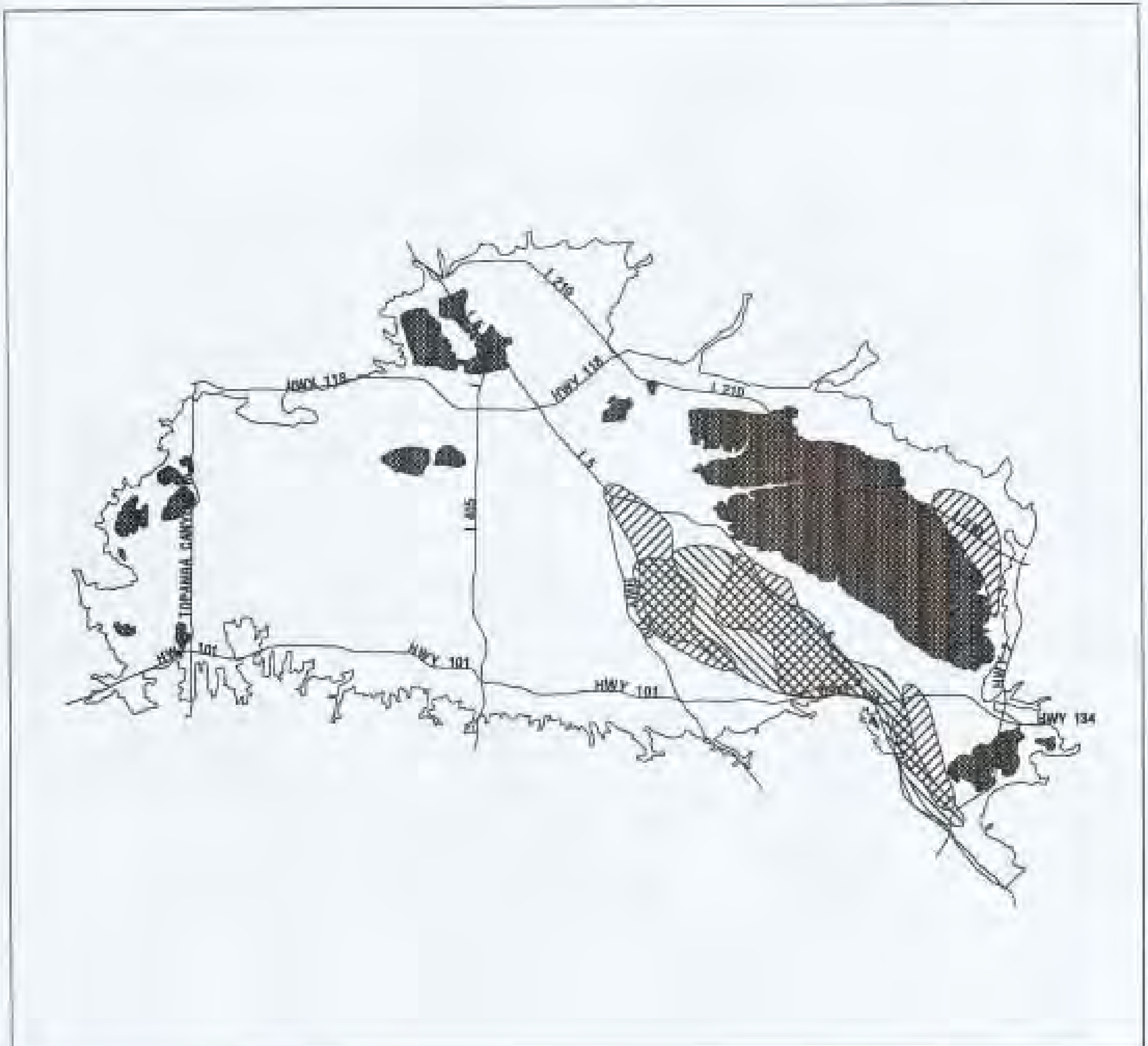

FIGURE 4-11

SAN FERNANDO VALLEY

GROUNDWATER BASIN

CONTAMINATION PLUMES

CALIFORNIA REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

VOC'S ABOVE MCL

NITRATES ABOVE MCL

BEDROCK OUTCROP

MILES

0 1 2 3 4

Department of Defense (DOD) sites and one U.S. Department of Energy (DOE) site. Agreements with the DOD and DOE provide for accelerated cleanups at military bases and other Defense sites that are scheduled for closing. Site investigation and clean up procedures are consistent with State laws and regulations as well as applicable provisions of CERCLA.

Aboveground Petroleum Storage Tanks

In order to prevent unauthorized discharges from aboveground petroleum storage tanks, the State of California has enacted legislation designed to lower the risk of spills and leaks. The California Health & Safety Code (§25270 et seq.) requires owners or operators of above-ground petroleum storage tanks to file a storage statement with the State Board and implement spill prevention measures. Examples of such measures include daily visual inspections of any storage crude oil or its fractions, the installation of secondary containment for all tanks with sufficient capacity to hold the content of the largest tank at the facility plus sufficient volume for rainfall to avoid overflow, and development of a *Spill Prevention Control and Countermeasure Plan*. In the event of an unauthorized release, the owner or operator must notify State officials and undertake appropriate monitoring and corrective action. In addition, annual fees are levied on tank owners. The Regional Board uses these fees to fund aboveground petroleum tank inspections and enforcement. There are over 10,000 aboveground petroleum storage tanks in the Los Angeles Region.

Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) is federal legislation (42 U.S.C.A. 6901 et seq.) designed to ensure that hazardous substances are managed in an environmentally-sound manner. Regulations promulgated under this legislation are in 40 CFR 264 and Title 22 of the California Code of Regulations and include comprehensive requirements for hazardous waste generators, transporters, and facilities that treat, store and dispose of hazardous wastes.

The State of California Department of Toxic Substances Control (DTSC) administers the RCRA Program in California. When requested, the Regional Board reviews on water-quality issues related to RCRA sites.

Toxic Pits Cleanup Act

The State's Toxic Pits Cleanup Act of 1984 (TPCA) regulates impoundments containing liquid hazardous wastes. Regulations promulgated under the TPCA legislation are in the Health & Safety Code, Division 20, Chapter 6.5, Article 9, and are administered by the State and Regional Boards. Major provisions in these regulations include:

- Requirements that all impoundments containing liquid hazardous wastes be retrofitted with liners and laced collection systems, and performance standards for these systems.
- Groundwater monitoring in accordance with the federal Resource Conservation and Recovery Act.
- A prohibition on the discharge of liquid hazardous wastes within 1/2 mile upgradient of a drinking water well.
- A Hydrogeologic Assessment Report.

Seventeen known impoundments containing liquid hazardous waste were operating in the Los Angeles Region when TPCA legislation was enacted. The Regional Board has overseen closure of all of these impoundments.

Bay Protection and Toxic Cleanup Program

In 1989, State legislation added Sections 13390 through 13396 to the California Water Code which established the Bay Protection and Toxic Cleanup Program (BPTCP). The program has four main goals: (i) to provide protection of existing and future beneficial uses of bays and estuarine waters, (ii) to identify and characterize toxic hot spots, (iii) to plan for the cleanup or other remedial or mitigating actions, and (iv) to contribute to the development of effective strategies to control toxic pollutants and prevent creation of new hot spots or the perpetuation of existing hot spots.

The Water Code requires that each Regional Board complete a toxic hot spot cleanup plan and that the State Board prepare a consolidated cleanup plan for submittal to the Legislature. Each cleanup plan must include a description of each toxic hot spot with its priority listing, an assessment of the most likely source(s) of pollutants, an estimate of the total costs to implement the cleanup plan, an estimate of costs which can be recoverable from responsible parties, a preliminary assessment of the actions required to remedy or restore a toxic hot spot, and a two-year expenditure schedule identifying State funds needed to implement the plan. It is required that a State-wide consolidated cleanup plan will be completed by June 30, 1999.

The Santa Monica Bay Restoration Project

Introduction

In recognition of the need to protect the Bay and associated watersheds, in May 1988, the State of California and the U.S. Environmental Protection Agency nominated and included Santa Monica Bay in the National Estuary Program (NEP). Established under the Water Quality Act of 1987 and managed by the U.S. EPA, the NEP currently includes 21 significant estuaries and coastal water bodies nationwide. The NEP was created to pioneer a broader focus for coastal protection, and to demonstrate practical, innovative approaches for protecting coastal areas and their living resources.

As an NEP, the Santa Monica Bay Restoration Project (SMBRP) is charged with assessing the Bay's pollution and degradation problems and producing a Bay Restoration Plan (BRP) to serve as a blueprint for the Bay's recovery. To fulfill its responsibility, the SMBRP convened a Management Conference. Organized into three groups (the Management, Technical Advisory, and Public Advisory Committees), the Management Conference is a unique and diverse coalition of government, environmentalists, scientists, industry, and the public committed to restoring the Bay. Over the last five years, this coalition has been successfully breaking many interagency barriers, and building consensus to solve problems.

For the purposes of the NEP, the borders of Santa Monica Bay are defined as reaching from the Ventura County line to Point Fermin on the south end of the Palos Verdes Peninsula.

Assessment of Problems in Santa Monica Bay

Santa Monica Bay is an important natural resource which provides significant environmental, recreational and economic benefits for Southern California. However, the Bay's living resources, water quality, and natural beauty have been affected by years of development and other human uses.

The creation of the SMBRP in 1988 has brought about much progress in understanding the problems facing the Bay. Above all, the SMBRP Management Conference has focused on assessing problems associated with four fundamental issues: swimming safety, seafood safety, fisheries and living resources protection, and ecosystem health.

Environmental Issues

Public concern about the safety of *swimming* in, and consuming *seafood* from Santa Monica Bay has been high for the past decade. Studies have shown that some local seafood species contain elevated concentrations of potentially toxic chemicals, primarily DDT and PCBs. As a result, responsible State agencies have published advisories to anglers regarding consumption of these species. With regard to the safety of swimming in Bay waters, some Santa Monica Bay beaches are occasionally closed due to storm water contaminated with minimally-treated sewage overflows. Studies have also found evidence of human fecal waste in dry-weather urban runoff. As a result, warning signs have been posted near outlets of flowing storm drains on beaches to discourage swimming near storm drains.

Despite the relative abundance of aquatic and terrestrial life in and around Santa Monica Bay (including several endangered species), the Bay's *habitats* have been significantly altered and degraded. For example, only about 5% of the area's historical wetlands acreage still exists. Pollution of coastal waters has led to a decline in species and a commercial fishing ban on white croaker in certain areas. In addition, although the use of DDT was banned in 1971, residues of this pesticide still bio-accumulate in the tissues of invertebrates, fish, birds, and marine mammals.

Pollutant loading has been identified as the most important contributor to the problems associated with beneficial use impairment in the Bay. The

SMBRP identified 19 pollutants of concern based on the serious impacts they have had or may have on the Bay. These 19 pollutants of concerns are: DDT, PCBs, PAHs, chlordane, TBT, cadmium, chromium, copper, lead, nickel, silver, zinc, pathogenic bacteria and viruses, total suspended solids, nutrients, trash and debris, chlorine, oxygen demands, and oil and grease.

Pollutants of concern reach Santa Monica Bay through a number of routes. Major pathways include wastewater carried by the region's sewage system and released into the Bay after treatment; urban runoff/storm water carried into the Bay through the region's storm drain system; treated wastewater directly discharged into the Bay from industrial facilities; oil and hazardous waste spilled directly into the Bay or into the storm drain system, and resuspension of contaminated sediments. Overall, sewer systems are the largest source of pollutant loading to the Bay. However, as the quality of sewage discharges from treatment plants has improved, the relative contribution of storm water and urban runoff to the total pollutant load to the Bay has increased.

The condition of the Bay and its watershed, with an emphasis on the effects of pollution on human health and the marine environment is documented in detail in the Santa Monica Bay Characterization Report published by the SMBRP in April 1993.

Management Issues

The Santa Monica Bay "watershed" is bordered on the north by the Santa Monica Mountains divide, on the east by Griffith Park, on the south by Point Fermin, and on the west by the eastern portion of Ventura County. Hydrologically, the Bay watershed is divided into 28 drainage basins, each of which has unique topographical and land use characteristics. The northern portion of the Bay watershed has steep topography and contains large undeveloped areas. The central and southern portions have a mixture of residential and industrial/commercial land use. The Palos Verdes Peninsula segment of the watershed contains residential development along with open space and a rocky shoreline.

Management of water pollution and habitat protection in Santa Monica Bay is currently based on jurisdictional rather than hydrologic or watershed boundaries. There are more than 50 Federal, State, and local agencies or jurisdictions whose management decisions directly or indirectly affect water quality, natural resources, and recreational activities in the Santa Monica Bay watershed and the near-coastal area. To make planning, forecasting, and implementation of actions more cost effective and successful, they should be coordinated on a watershed basis.

Historically, water quality management in the Santa Monica Bay area targeted the most visible pollution problems such as individual municipal and industrial "point" sources of pollution. This approach has solved the worst pollution problems, but it may have neglected the less obvious, but potentially more damaging impact of "nonpoint" pollution such as storm water/urban runoff and atmospheric deposition. There is an urgent need to address all these pathways/sources in a coordinated rather than a fragmented manner.

Currently, most of these pollutants are primarily managed by applying concentration-based water quality standards. However, such an approach may not always be appropriate to protect against impacts that result from long-term accumulation of these pollutants in marine environments. A new mass emissions approach is being considered. Under this approach, an allowable "no impact" cumulative loading of a pollutant would be determined on a watershed basis, coupled with a set of useful "end points" by which to measure the adequacy of management actions.

Recommended Actions

Supported by extensive problem research and assessment, the Bay Restoration Plan sets forth actions that need to be taken to achieve a clean and healthy Bay. The BRP not only identifies actions, but also implementors, timelines, and potential funding sources.

Described below are some of the high priority actions presented in the Draft BRP which the Los Angeles Regional Water Quality Control Board has been designated to serve as either the lead, regulatory lead, or as an important participant in their implementation.

- Improve management framework for water quality regulation and enforcement

  Specific actions to be led by the Regional Board include revising and incorporating new program elements into the NPDES permits, especially storm water NPDES permits, as needed; ensuring adequate staffing, resources, and legal support at the Regional Board for storm water NPDES permits, other NPDES permits, and pretreatment permit compliance and enforcement; and developing new, effective enforcement tools, if necessary.

Led by EPA and the post-SMBRP organization, and with the involvement of the Regional Board, specific actions are also recommended to investigate the necessity for and feasibility of developing numeric effluent limits for storm water runoff.

- Coordinate Bay water pollution management on a watershed basis

  A key action under the leadership of the Regional Board is to develop tools for coordinating all components of the NPDES program (urban, municipal, industrial and cooling water discharges) with other permitting and regulatory functions on a watershed/sub-watershed basis. One recommended mechanism for management on a watershed basis is the adoption of a mass emissions approach, with the Regional Board serving as the lead in overseeing its development and implementation.

  In order to carry out the watershed management approach, the BRP prescribes a Malibu Creek Pilot Watershed Management Plan. It is recommended that the post-SMBRP organization, with participation of the Regional Board, use applicable elements of the Malibu Creek Pilot Plan to develop management plans for other priority watersheds.

- Implement control measures for pollutants associated with storm water/urban runoff

  Specific actions include ensuring adequate staff and training in local municipalities and agencies for storm water/urban runoff management; evaluating and developing effective processes to address small discharges of non-storm or contaminated storm runoff; developing and implementing land use tools for storm water/urban runoff management; developing and enforcing land use ordinances; developing and implementing a five-year urban runoff education strategy; implementing a set of mandatory short-term Best Management Practices (BMPs); conducting pilot projects for medium and long term BMP implementation; and promoting implementation of general good housekeeping practices by commercial and industrial facilities and construction activities.

  It is recommended that most actions in this category be implemented by co-permittees of the municipal storm water NPDES permit, led by the Los Angeles County Department of Public Works, and that the Regional Board act as regulatory lead.

- Upgrade all direct municipal discharges to Santa Monica bay to secondary treatment levels

  Two specific actions are included: (i) the City of Los Angeles should complete construction of full secondary facilities at the Hyperion treatment plant and remedy storm-related sewage overflow problems; (ii) the County of Los Angeles should install full secondary treatment facilities at the Joint Water Pollution Control Plant. It is recommended that Regional Board act as regulatory lead for implementation of these actions.

- Control pathogens in surfzone to ensure the safety of swimmers

  Specific actions include developing and conducting a sanitary survey; conducting on-site inspections and repairing malfunctioning septic tanks; developing inspection systems; conducting focused inspection of illegal and illicit sewage connections to storm drains; inspecting and correcting leaks from sewer lines and sewage treatment plants; treating and/or diverting dry-weather urban runoff if feasible

  Implementation of these actions will be carried out by various agencies/organizations including Los Angeles County Department of Public Works, Los Angeles County Department of Health Services, POTWs, and local cities, as well as the SMBRP. The Regional Board is recommended to serve as regulatory lead for implementation of these actions.

- Assess health risks associated with swimming and revise water quality standards

  The key action is to conduct an epidemiological study to assess the possible health risks of recreational exposure to storm drain runoff in

Santa Monica Bay. It is recommended that this action be led by the State Water Resources Control Board with the participation of the Regional Board and other State and local health service agencies.

- Develop and implement comprehensive monitoring program

It is recommended that NPDES permittees as well as the Regional Board participate in a "retooled" Santa Monica Bay and watershed monitoring program focusing on compliance monitoring aspects. As part of the monitoring program, a user-friendly SMB data management system would be designed and maintained by the post-SMBRP organization with the participation of the Regional Board.

The Santa Monica Bay Restoration Plan was presented to the public in April 28, 1994. Its implementation is slated to begin in January, 1995.

5. PLANS AND POLICIES

Table of Contents

Introduction

The State Water Resources Control Board has adopted several statewide Water Quality Control Plans that are part of the Regional Board Basin Plans. In addition, both the State and Regional Boards have adopted policies, separate from the plans, that provide detailed direction on the implementation of certain plan provisions. In the event that inconsistencies exist among various plans and policies, the more stringent provisions apply.

This update of the Los Angeles Region's Basin Plans has been prepared to be consistent with all State and Regional Board plans and policies adopted to date. Following are summaries of the most frequently referenced plans and policies affecting the Los Angeles Region. These plans and policies can be revised periodically.

State Board Plans

Ocean Plan

The State Board adopted the *Water Quality Control Plan for Ocean Waters of California* (State Board Resolution No. 74-57) in 1974 and amended this plan in 1988 (State Board Resolution No. 88-111) and 1990 (State Board Resolution No. 90-27). This amended plan, which is referred to as the *Ocean Plan*, establishes beneficial uses and water quality objectives for waters of the Pacific Ocean adjacent to the California coast outside of enclosed bays, estuaries, and coastal lagoons. The Ocean Plan also prescribes effluent quality requirements and management principles for waste discharges and specifies certain waste discharge prohibitions. Prohibitions include discharges of specific hazardous substances and sludge, bypases of untreated waste, and discharges that impact Areas of Special Biological Significance (ASBS).

The Ocean Plan authorizes the State Board to designate ASBS and requires that wastes be discharged a sufficient distance away from these areas to protect natural water quality conditions. Waste discharges to ASBS are prohibited unless the State Board finds that there would be no adverse impact to beneficial uses. The following areas have been designated as ASBS in this Region (Figures 5-1 and 5-2):

- San Nicolas Island and Begg Rock: Waters surrounding San Nicolas Island and Begg Rock to a distance of one nautical mile offshore or to the 300-foot isobath, whichever is greater.

- Santa Barbara Island and Anacapa Island: Waters surrounding Santa Barbara Island and Anacapa Islands to a distance of one nautical mile offshore or to the 300-foot isobath, whichever is greater.

- San Clemente Island: Waters surrounding San Clemente Island to a distance of one nautical mile offshore or to the 300-foot isobath, whichever is greater.

- Mugu Lagoon to Latigo Point: Ocean water within a line originating from Laguna Point at

Figure 5-1. General Location of Areas of Special Biological Significance in Los Angeles Region.

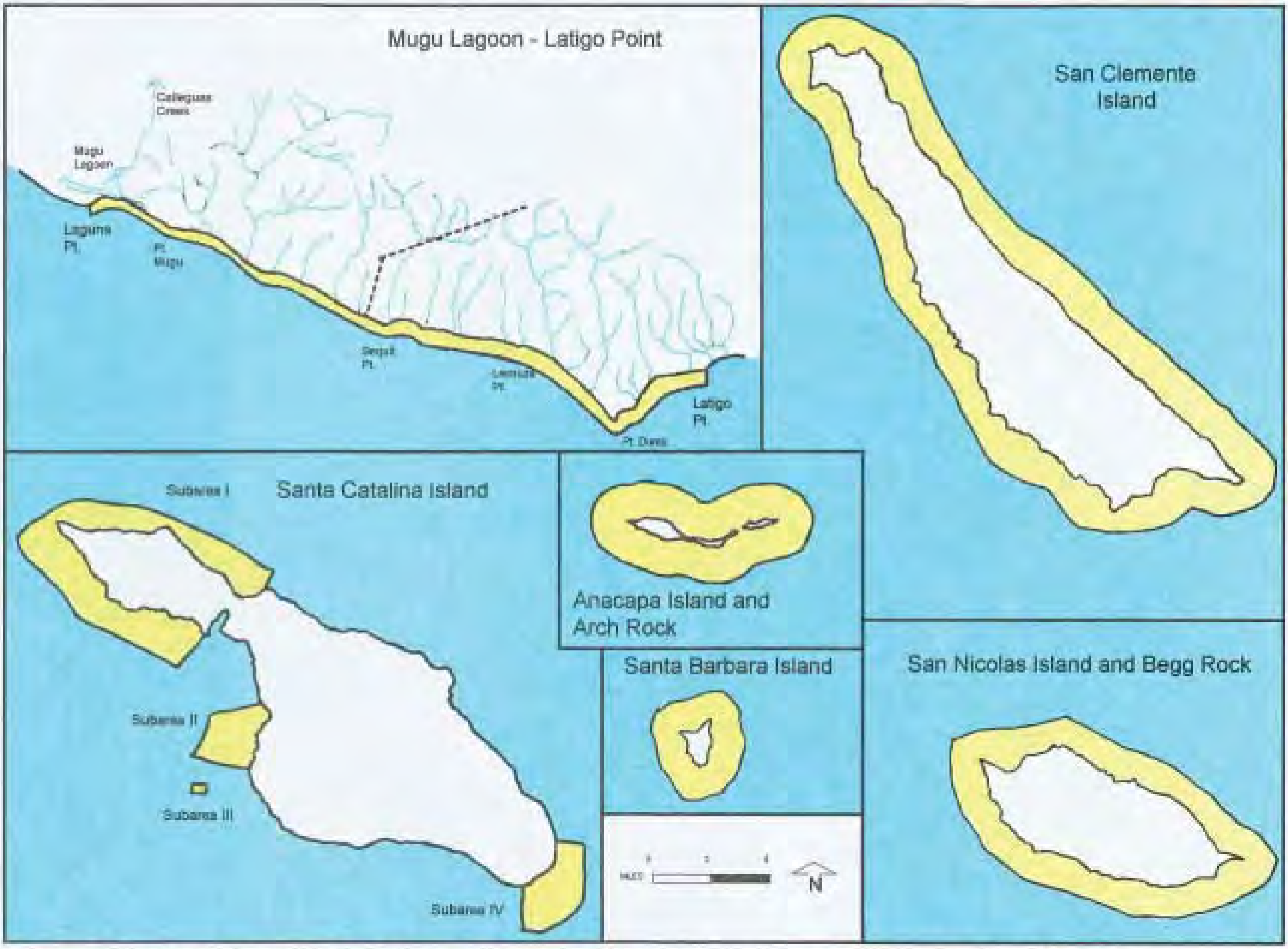

Figure 5-2. Detailed locations of Areas of Special Biological Significance in Los Angeles Region.

34° 5' 40" north, 119° 6' 30" west, thence southeasterly following the mean high tide line to a point at Latigo Point defined by the intersection of the mean high tide line and a line extending due south of Bench Mark 24; thence due south to a distance of 1000 feet offshore or to the 100-foot isobath, whichever distance is greater; thence northwesterly following the 100-foot isobath or maintaining a 1,000-foot distance from shore, whichever maintains the greater distance from shore, to a point lying due south of Laguna Point, thence due north to Laguna Point.

- Santa Catalina Island, Subarea One, Isthmus Cove to Catalina Head: From Point 1 determined by the intersection of the mean high tide line and a line extending due west from USGS Triangulation Station "Channel" on Blue Cavern Point; thence due north to the 300-foot isobath or to one nautical mile offshore, whichever distance is greater; thence northerly and westerly, following the 300-foot isobath or maintaining a distance of one nautical mile offshore, whichever is the greater distance, around the northwestern tip of the island and then southerly and easterly, maintaining the distance offshore described above, to a point due south of USGS Triangulation Station "Cone" on Catalina Head; thence due north to the intersection of the mean high tide line and a line extending due south from USGS Triangulation Station "Cone", thence returning around the northwestern tip of the Island following the mean high tide line to Point 1.

- Santa Catalina Island, Subarea Two, North End of Little Harbor to Ben Weston Point: From Point 1 determined by the intersection of the mean high tide line extending due south from USGS Triangulation Station "White Bluff"; thence due west to the 300-foot isobath or to one nautical mile offshore, whichever distance is greater; thence southerly on a meander line following the 300-foot isobath or maintaining a distance of one nautical mile offshore, whichever distance offshore is greater, to a point due west of USGS Triangulation on Station "Slip" on Ben Weston Point; thence due east to the intersection of the mean high tide line and a line extending due west from USGS Triangulation Station "Slip"; thence northerly following the mean high tide line to Point 1.

- Santa Catalina Island, Subarea Three, Farnsworth Bank Ecological Reserve: Waters within the Farnsworth Bank Ecological Reserve, which are located 1.6 nautical miles southwest of Ben Weston Point, Catalina Island, on a bearing of 240° true. The Bank is composed of sheer rocky pinnacles rising from the sandy ocean floor 250 feet deep to within 50 feet of the surface. The Bank occupies an area approximately 575 yards long by 200 yards wide.

- Santa Catalina Island, Subarea Four, Binnacle Rock to Jewfish Point: From Point 1 determined by the intersection of the mean high tide line and a line extending due north from the highest point of Binnacle Rock; thence due south to a point one nautical mile offshore or to the 300-foot isobath, whichever distance is greater; thence easterly and northerly, maintaining a distance of one nautical mile or to the 300-foot isobath, whichever distance is greater, to a point due east of the eastern-most extension of the mean high tide line at Jewfish Point; thence due west to the eastern-most extension of the mean high tide line at Jewfish Point; thence southerly and westerly following the mean high tide line to Point 1.

The State Board shall periodically revise the Ocean Plan to reflect water quality objectives that are necessary to protect beneficial uses of ocean waters and to be consistent with current technology.

Thermal Plan

The State Board adopted the *Water Quality Control Plan for the Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries in California* in May 1972, and amended this plan (State Board Resolution No. 75-89) in September 1975. This plan, which is referred to as the "Thermal Plan," was developed in order to minimize the effects of wastes on the temperature of receiving waters. The plan specifies temperature objectives, effluent limits, and discharge prohibitions related to thermal characteristics of interstate waters, enclosed bays, and estuaries.

Nonpoint Source Management Plan

The State Board adopted the *Nonpoint Source Management Plan* (State Board Resolution No. 88-123) in November 1988, pursuant to Section 319 of the CWA. This plan outlines the state's Nonpoint Source Control Program objectives, framework, and implementation program. The plan emphasizes voluntary Best Management Practices (BMPs) and the need for cooperation with local governments and other agencies to implement the BMPs.

State Board Policies

Significant State Board policies that are applicable to the Los Angeles Region are summarized below.

The State Policy for Water Quality Control

The State Board adopted the *State Policy for Water Quality Control* in July 1972. This policy, which serves as a basis for subsequent water quality policies, sets forth general principles (outlined below) that are necessary for implementation of programs that protect the quality of the waters throughout the state.

- Water rights and water quality control decisions must ensure protection of available fresh water and marine resources for maximum beneficial use.
- Municipal, agricultural, industrial wastewaters must be considered as a potential integral part of the total fresh water resource.
- Coordinated management of water supplies and wastewaters on a regional basis must be promoted to achieve efficient utilization of water.
- Efficient wastewater management is dependent upon a balanced program of source control of environmentally hazardous substances, treatment of wastewaters, reuse of reclaimed water, and proper disposal of effluent and residuals.
- Substances not amenable to removal by treatment systems presently available or planned for the immediate future must be prevented from entering sewer systems in quantities which would be harmful to the aquatic environment, adversely affect beneficial uses of water, or affect treatment plant operation. Persons responsible for the management of waste collection, treatment, and disposal systems must actively pursue the implementation of their objective of source control for environmentally hazardous substances. Such substances must be disposed of such that environmental damage does not result.
- Wastewater treatment systems must provide sufficient removal of environmentally hazardous substances which cannot be controlled at the source to ensure against adverse effects on beneficial uses and aquatic communities.
- Wastewater collection and treatment facilities must be consolidated in all cases where feasible and desirable to implement sound water quality management programs based on long-range economic and water quality benefits to an entire basin.
- Institutional and financial programs for implementation of consolidated wastewater management systems must be tailored to serve each particular area in an equitable manner.
- Wastewater reclamation and reuse systems which ensure maximum benefit from available fresh water resources shall be encouraged. Reclamation systems must be an appropriate integral part of the long-range solution to the water resources needs of an area and incorporate provisions for salinity control and disposal of non-reclaimable residues.
- Wastewater management systems must be designed and operated to achieve maximum long-term benefit from the funds expended.
- Water quality control must be based upon the latest scientific findings. Criteria must be continually refined as additional knowledge becomes available.
- Monitoring programs must be provided to determine the effects of discharges on all beneficial water uses including effects on aquatic life and its diversity and seasonal fluctuations.

Statement of Policy with Respect to Maintaining High Quality Water in California (Antidegradation Policy)

The State Board adopted the *Statement of Policy with Respect to Maintaining High Quality Water in*

California (State Board Resolution No. 68-16) on October 28, 1968. This policy, which is referred to as the "Antidegradation Policy," protects surface and ground waters from degradation. In particular, this policy protects waterbodies where existing quality is higher than that necessary for the protection of beneficial uses.

Under California's Antidegradation Policy, any actions that can adversely affect water quality in all surface and ground waters must be consistent with the maximum benefit to the people of the state, must not unreasonably affect present and anticipated beneficial use of such water, and must not result in water quality less than that prescribed in water quality plans and policies. Furthermore, any actions that can adversely affect surface waters are also subject to the federal Antidegradation Policy (40 CFR 131.12), developed under the CWA. The USEPA, Region IX, has also issued detailed guidance for the implementation of federal antidegradation regulations for surface waters within its jurisdiction (USEPA, 1987).

This resolution has been reprinted in Chapter 3.

Water Quality Control Policy for the Enclosed Bays and Estuaries of California

The State Board adopted the *Water Quality Control Policy for the Enclosed Bays and Estuaries of California* (State Board Resolution No. 74-43) in May 1974. This policy is designed to prevent water quality degradation and protect beneficial uses in enclosed bays and estuaries. In addition, the policy outlines water quality principles and guidelines to achieve these objectives. Decisions by the Regional Board must be consistent with the provisions designed to prevent water quality degradation.

The policy lists principles of management that include the State Board's desire to phase out all discharges (exclusive of cooling waters) to enclosed bays and estuaries as soon as practicable. Discharge prohibitions are placed on:

- new dischargers of municipal wastewaters and industrial process waters (exclusive of cooling water discharges) which are not consistently treated and discharged in a manner that would enhance the quality of the receiving waters;
- municipal and industrial waste sludge and untreated sludge digester supernatant, centrate, or filtrate;
- rubbish or refuse into surface waters or at any place where they would be eventually transported to enclosed bays and estuaries;
- silt, sand, soil, clay, or other earthen materials from onshore operations including mining, construction, and lumbering in quantities which unreasonably affect or threaten to affect beneficial uses;
- materials of petroleum origin in sufficient quantities to be visible or in violation of waste discharge requirements (except for scientific purposes);
- radiological, chemical, or biological warfare agent or high-level radioactive waste; and
- discharge or by-pass of untreated waste.

Water Quality Control Policy on the Use and Disposal of Inland Water Used for Powerplant Cooling

The State Board adopted the *Water Quality Control Policy on the Use and Disposal of Inland Water Used for Powerplant Cooling* (State Board Resolution No. 75-58) in June 1975. This policy outlines the State Board's positions on powerplant cooling, specifying that fresh waters should be used for cooling only when other alternatives are not feasible. The Regional Boards are responsible for enforcement of this policy.

Policy with Respect to Water Reclamation in California

The State Board adopted the *Policy with Respect to Water Reclamation in California* (State Board Resolution No. 77-1) on January 6, 1977. This resolution recognizes the shortage of water in many areas of the state and the need to conserve water for beneficial uses. In addition, the policy outlines the State and Regional Boards' support for and encouragement of water reclamation while also acknowledging the need to protect public health. As per this resolution, the State and Regional Boards encourage reclamation projects for which:

- beneficial use will be made of wastewaters that would otherwise be discharged to marine or brackish receiving waters or evaporation ponds;
- reclaimed water will replace or supplement the use of fresh water or better quality water; or
- reclaimed water will be used to preserve, restore, or enhance instream beneficial uses which include, but are not limited to, fish, wildlife, recreation and aesthetics associated with any surface water or wetlands.

This resolution has been reprinted at the end of this Chapter.

Policy on the Disposal of Shredder Waste

The State Board adopted the *Policy on the Disposal of Shredder Waste* (State Board Resolution No. 87-22) on March 19, 1987. This policy permits the disposal of wastes produced by the mechanical destruction of car bodies, old appliances, and similar castoffs into certain landfills under specific conditions designated and enforced by the Regional Boards.

Sources of Drinking Water Policy

The State Board adopted the *Sources of Drinking Water Policy* (State Board Resolution No. 88-63) on May 19, 1988. This policy declares that all waters of the state, with certain exceptions, are to be protected as existing or potential sources of municipal and domestic supply. Exceptions include waters with existing high dissolved solids (i.e., waters with dissolved solids greater than 3,000 mg/L), low sustainable yield (less than 200 gallons per day for a single well), waters with contamination that cannot be treated for domestic use using best management practices or best economically achievable treatment practices, waters within particular municipal, industrial, and agricultural wastewater conveyance and holding facilities, and regulated geothermal ground waters. Where the Regional Water Board finds that one of these exceptions applies, it can remove the municipal and domestic supply beneficial use designation for the particular waterbody through a Basin Plan amendment. Basin Plan amendments are subject to approval by the State Board, the State Office of Administrative Law, and the USEPA.

This resolution has been reprinted at the end of this Chapter.

Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304

State Board Resolution No. 92-49, entitled *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304* (the Policy) promotes attainment of the best quality of water that is reasonable.

The amended Policy establishes cleanup and abatement policies and procedures for those cases of pollution wherein it is not reasonable to restore water quality to background levels. Under this Policy, case-by-case cleanup levels for the restoration of water quality must, at minimum:

- consider all beneficial uses of the waters;
- not result in water quality less than that prescribed by in the Basin Plan and policies adopted by the State and Regional Boards;
- be consistent with maximum benefit to the people of the state; and
- be established in a manner consistent with California Code of Regulations, Title 23, Chapter 15, Article 5 (Water Quality Monitoring and Response Programs for Waste Management Units).

Regional Water Quality Advisory Task Force

In December 1992, the Regional Board created a Water Quality Task Force. The eleven member task force included representatives of governmental agencies, businesses, and environmental groups and was co-chaired by Regional Board members: Michael Keston and Larry Zarian. The goals of the group included identification of ways to reduce the costs of complying with water quality regulations without compromising water quality and public health.

Following two workshops, the Task Force developed a series of 16 recommendations (*Working Together for an Affordable Clean Water Environment,* September 30, 1993) to be submitted to the Regional Board, State Board, Cal-EPA and the State Legislature, seeking their support, as appropriate. Regional Board staff have begun implementing many of these recommendations, and the Regional Board will submit progress reports to the Task Force on a semi-annual basis. These recommendations for the Regional Board are briefly summarized below:

- Create a Technical Review Committee to serve as a public forum to discuss existing and proposed Regional Board programs, policies and procedures.
- Prepare a Site Assessment and Clean-up Guidebook.
- Provide "trigger language" to expedite insurance claims and loan requests.
- Establish a set of clear standards for site-cleanup that are consistent across all Regional Board programs.
- Create a Business Assistance Unit.
- Review monitoring and reporting requirements and eliminate those that are unnecessary.
- Establish a "self-directed" cleanup program.
- Adopt NPDES permit process improvements including establishing a surface water quality technical review committee, assign experienced staff to all major NPDES permits and their renewals, conduct more thorough reviews of annual reports, and provide more feedback to permittees.
- Consider setting performance-based numeric goals, where appropriate, for constituents for which permit limits are more stringent than statewide Water Quality Plans.
- Take into account the mineral content of an area's water supply when setting wastewater discharge limits.
- Facilitate development and adoption of site specific objectives based upon actual or reasonably foreseeable beneficial uses.
- Incorporate a watershed management approach into the Basin Plan. Coordinate key elements of the Coastal Zone Act Re-Authorization Amendments, the Storm Water Permit Program, and other related programs.

Regional Board Resolutions

The Los Angeles Regional Board has adopted many resolutions over the years. The following are summaries of the resolutions that are most important to the Regional Board's implementation of the Basin Plan and are herein incorporated by reference:

Resolution No. 93-006. Adopted November 1, 1993.
"Accepting the Final Report of the Water Quality Advisory Task Force."

Resolution No. 92-09. Adopted October 19, 1992
"Designation of Regional Category "A" Waterbodies under the California Inland Surface Waters Plan."
The Regional Board chose not to adopt Category "A" waterbodies for the Region. The need for site-specific objectives will be determined on a case-by-case basis as each NPDES permit is renewed.

Resolution No. 92-08. Adopted June 22, 1992
"Amendment to the Water Quality Control Plans to Prohibit New or Lateral Expansion of Existing Nonhazardous Solid Waste Landfills in Sand and Gravel Mining Pits within the Los Angeles Region."
This resolution was adopted by the Regional Board but not by the State Board. The State Board will consider this issue during the next Chapter 15 review and update. This resolution, thus, is not in effect.

Resolution No. 92-06. Adopted March 9, 1992
"Approval of Regional Water Quality Assessment."
Update to include the following previous excluded waterbodies: Upper Los Angeles River, Lower Los Angeles River, Lower San Gabriel River, Lower Santa Clara River Valley, Inner Los Angeles Harbor, Inner Long Beach Harbor, Ventura Harbor, Santa Monica Bay, San Pedro Bay, Ballona Creek.

Resolution No. 92- 05 . Adopted January 27, 1992
"Approval of Regional Water Quality Assessment."
Under this resolution the Regional Board partialy adopted the 1991 Water Qualilty Assessment Report of the Los Angeles Region.

Resolution No. 91-06. Adopted June 3, 1991
"Amendment to the Water Quality Control Plan for the Los Angeles River Basin and Implementation Plan Concerning the Extraction of Ground Water Within the San Gabriel Valley Basin."
Under this amendment, the Regional Board oversees a comprehensive groundwater quantity and quality program in the San Gabriel Valley Groundwater Basin, designed to ensure that the extraction of ground water is conducted in a manner that will meet water supply needs and improve and protect water quality.

Resolution No. 90-11. Adopted October 22, 1990
"Adoption of Revised Water Quality Objectives and Beneficial Uses for Piru, Sespe, and Santa Paula Hydrologic Areas - Santa Clara River Basin (4A)."

Resolution No. 90-10. Adopted August 20, 1990
"Resolution of Recommendation to State Water Resources Control Board to Grant an Exception to the Ocean Plan Prohibition for Waste Discharge to an Area of Special Biological Significance - San Nicolas Island."

Resolution No. 90-08. Adopted May 21, 1990
"Requesting the State Water Resources Control Board to Accept Grant Funds from the U. S. Environmental Protection Agency (USEPA) for the Santa Monica Bay Restoration Project as Part of a Continuing Cooperative Agreement."

Resolution No. 90-07. Adopted April 23, 1990
"Requesting the State Water Resources Control Board to Apply for a Continuance of the Cooperative Agreement with the U. S. Environmental Protection Agency to Accelerate Source Investigation Activities in the San Fernando Valley."

Resolution No. 90-06. Adopted April 23, 1990
"Requesting the State Water Resources Control Board to Apply for a Continuance of the Cooperative Agreement with the U. S. Environmental Protection Agency to Accelerate Source Investigation Activities in the San Gabriel Valley."

Resolution No. 90-04. Adopted March 26, 1990
"Effects of Drought Induced Water Supply Changes and Water Conservation Measures on Compliance With Waste Discharge Requirements Within the Los Angeles Region." This policy temporarily raised chloride limitations in Waste Discharge Requirements to match chloride increases in the water supply for a period of 3 years. Specifically, chloride limitations were temporarily set at the lesser of (i) 250 mg/L or (ii) the supply concentration plus 85 mg/L.

Resolution No. 90-02. Adopted February 26, 1990
"Acceptance of the Southern California Association of Governments' Final Report on the State of Santa Monica Bay."

Resolution No. 89-10. Adopted December 4, 1989
"Adoption of Regional Water Quality Assessment Report."

Resolution No. 89-08. Adopted December 4, 1989
"Requesting the State Water Resources Control Board to Accept Grant Funds from the U. S. Environmental Protection Agency (USEPA) for the Santa Monica Bay Restoration Project as Part of a Continuing Cooperative Agreement and to Accept Action Plan Demonstration Project Funds for Early Implementation of Management Recommendations."

Resolution No. 89-03. Adopted March 27, 1989
"Incorporation of Sources of Drinking Water Policy into the Water Quality Control Plans (Basin Plans) - Santa Clara River Basin (4A)/Los Angeles River Basin (4B)."

Resolution No. 89-02. Adopted February 27, 1989
"Regional Board Acceptance of Storm Runoff Report."

Resolution No. 88-12. Adopted September 26, 1988
"Supporting Beneficial Use of Available Reclaimed Water in Lieu of Potable Water for the Same Purpose."

Resolution No. 88-11. Adopted August 22, 1988
"Directing Staff to Apply for a Cooperative Agreement With the U. S. Environmental Protection Agency to Accelerate Source Investigation Activities in the San Gabriel Valley."

Resolution No. 88-10. Adopted July 25, 1988
"Completion of the Triennial Review Public Hearing and the 1988 Triennial Review Process for the Water Quality Control Plans (Basin Plans) - Santa Clara River Basin (4A)/Los Angeles River Basin (4B)."

Resolution No. 85-09. Adopted November 25, 1985
"Designation of Class III Landfill Within the Los Angeles Region to Accept Shredder Wastes as Required by Senate Bill No. 976."

Resolution No. 85-04. Adopted March 25, 1985
"Regional Board Acceptance of Ocean Dumping Report."

Resolution No. 85-03. Adopted March 25, 1985
Rescinding Resolution No. 56-45, *"Adopting an Operating Procedure for Simplifying Filing of Reports on Disposal of Rotary Mud Resulting from Oil Well Drilling Operations."*

Resolution No. 84-05. Adopted June 25, 1984
"Triennial Review of Water Quality Control Plans - Santa Clara River Basin (4A)/Los Angeles River Basin (4B)."

Resolution No. 83-03. Adopted October 24, 1983
"Implementation of Those Elements of the Amendment to the Areawide Waste Treatment Management Plan Appropriate to its Jurisdiction."

Resolution No. 82-06. Adopted September 27, 1982
"Lowering of Lake Sherwood, Ventura County."

Resolution No. 78-13. Adopted November 27, 1978
"Revisions to Water Quality Control Plan for Los Angeles River Basin (4B)."

Resolution No. 78-12. Adopted August 28, 1978
"Regional Board Consideration of the 208 Areawide Waste Treatment Management Plan for Ventura County Adopted by the Board of Directors of the Ventura Regional County Sanitation District on June 22, 1978."

Resolution No. 78-10. Adopted July 24, 1978
"A Resolution Requesting the State Water Resources Control Board to Seek Exemption from U. S. Coast Guard Regulations for Avalon Bay Relative to Vessel Waste Discharges."

Resolution No. 78-09. Adopted July 24, 1978
"A Resolution Requesting the State Board to Seek Exemption from U. S. Coast Guard Regulations for Channel Islands Harbor Relative to Vessel Waste Discharges."

Resolution No. 78-07. Adopted June 26, 1978
"Resolution of Intent Regarding Compliance Date for Trace Element Limits in the Ocean Plan."

Resolution No. 78-02. Adopted March 27, 1978
"Revisions to Water Quality Control Plan for Santa Clara River Basin (4A)."

Resolution No. 78-01. Adopted February 27, 1978
"Supporting Adoption of the Clean Water and Water Conservation Bond Law of 1978."

Resolution No. 77-06. Adopted September 26, 1977
"Guidance for Persons Wishing to Use Reclaimed Wastewater During the Drought."

Resolution No. 77-02. Adopted April 25, 1977
"Urging Continued Irrigation of State Park Lands by Las Virgenes Municipal Water District."

Resolution No. 76-06. Adopted April 26, 1976
"Revisions to Water Quality Control Plan for Los Angeles River Basin (4B)."

Resolution No. 76-05. Adopted April 26, 1976
"Revisions to Water Quality Control Plan for Santa Clara River Basin (4A)."

Resolution No. 75-11. Adopted March 10, 1975
"Water Quality Control Plan for Los Angeles River Basin (4B)."

Resolution No. 75-10. Adopted March 3, 1975
"Water Quality Control Plan for Santa Clara River Basin (4A)."

Resolution No. 74-08. Adopted August 19, 1974
"Expressing Concern Over Possible Effects on Water Quality From Offshore Oil Drilling and Production."

Resolution No. 73-21. Adopted September 7, 1973
"Actions Affecting Water Quality by Local Agency Formation Commissions - Comments by this Agency on any Proposals within this Region to Incorporate New Cities or Form Special Districts that may Affect Water Quality."

Resolution No. 73-14. Adopted May 22, 1973
"Statement of Policy on Water Supply and Wastewater Disposal in Newly Developing Areas Within the Los Angeles Region."

Resolution No. 72-4. Adopted May 31, 1972
"Policy Statement Relative to Sewage Disposal in the Malibu Area."

Resolution No. 71-10. Adopted October 27, 1971
"Consideration of Dredging Activities Los Angeles-Long Beach Harbors."

Resolution No. 71-7. Adopted June 10, 1971
"Interim Water Quality Control Plan for Santa Clara River Basin and Los Angeles River Basin - with Project List Titled Appendix A."

Resolution No. 71-6. Adopted June 10, 1971
"Interim Water Quality Control Plan for Santa Clara River Basin and Los Angeles River Basin."

Resolution No. 70-68. Adopted November 18, 1970
"Requiring Cities and Counties to Notify the Regional Board of the Filing of Development Proposals Which Involve a Major Waste Discharge."

Resolution No. 70-16. Adopted February 11, 1970
"Well Standards in Ventura County."

Resolution No. 70-17. Adopted February 11, 1970
"Well Standards in Central, Hollywood, Santa Monica and West Coast Basins, Los Angeles County."

Resolution No. 69-53. Adopted December 3, 1969
"A Resolution Urging Close Cooperation Between the Southern California Coastal Water Research Authority and the Regional Board."

Resolution No. 69-33. Adopted July 30, 1969
"Recommending Consideration of Reclamation of Water from Sewage in the Malibu Area."

Resolution No. 54-4. Adopted January 14, 1954
"Waiving Reporting of Sewage Discharges from Family Dwellings with the City of Ojai."

Resolution No. 53-6. Adopted October 15, 1953
"Waiving Reporting of Sewage Discharges from Family Dwellings, City of South Pasadena."

Resolution No. 53-5. Adopted October 15, 1953
"Waving Reporting Of Waste Water Discharges from Family Dwelling Swimming Pools."

Resolution No. 52-4. Adopted on October 30, 1952
"Waiving Reporting of Sewage Discharges from Family Dwellings."

Resolution No. 52-3. Adopted October 16, 1952
"Prescribing Requirements for Subsurface Disposal of Sewage from Private Sewage Disposal Systems."

STATE WATER RESOURCES CONTROL BOARD

RESOLUTION NO. 77-1

POLICY WITH RESPECT TO WATER RECLAMATION IN CALIFORNIA

WHEREAS:

1. The California Constitution provides that the water resources of the State be put to beneficial use to the fullest extent of which they are capable, and that waste or unreasonable use or unreasonable method of use of water be prevented, and that conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare;

2. The California Legislature has declared that the State Water Resources Control Board and each Regional Water Quality Control Board shall be the principal state agencies with primary responsibility for the coordination and control of water quality;

3. The California Legislature has declared that the people of the State have a primary interest in the development of facilities to reclaim water containing waste to supplement existing surface and underground water supplies;

4. The California Legislature has declared that the State shall undertake all possible steps to encourage the development of water reclamation facilities so that reclaimed water may be made available to help meet the growing water requirements of the State;

5. The Board has reviewed the document entitled "Policy and Action Plan for Water Reclamation in California," dated December 1976. This document recommends a variety of actions to encourage the development of water reclamation facilities and the use of reclaimed water. Some of these actions require direct implementation by the Board; others require implementation by the Executive Officer and the Regional Boards. In addition, this document recognizes that action by many other state, local, and federal agencies and the California State Legislature would also encourage construction of water reclamation facilities and the use of reclaimed water. Accordingly, the Board recommends for its consideration a number of actions intended to coordinate with the program of this Board;

6. The Board must concentrate its efforts to encourage and promote reclamation in water-short areas of the State where reclaimed water can supplement or replace other water supplies without interfering with water rights or instream beneficial uses or placing an unreasonable burden on present water supply systems; and

7. In order to coordinate the development of reclamation potential in California, the Board must develop a data collection, research, planning, and implementation Program for water reclamation and reclaimed water uses.

THEREFORE, BE IT RESOLVED:

1. That the State Board adopt the following Principles:

   I. The State Board and the Regional Boards shall encourage, and consider or recommend for funding, water reclamation projects which meet Condition 1, 2, or 3 below and which do not adversely impact vested water rights or unreasonably impair instream beneficial uses or place an unreasonable burden on present water supply systems.

      (1) Beneficial use will be made of wastewaters that would otherwise be discharged to marine or brackish receiving waters or evaporation ponds,

      (2) Reclaimed water will replace or supplement the use of fresh water or better quality water,

      (3) Reclaimed water will be used to preserve, restore, or enhance instream beneficial uses which include, but are not limited to, fish, wildlife, recreation and esthetics associated with any surface water or wetlands.

   II. The State Board and the Regional Boards shall (1) encourage reclamation and reuse of water in water-short areas of the State, (2) encourage water conservation measures which further extend the water resources of the State, and (3) encourage other agencies, in particular the Department of Water Resources, to assist in implementing this policy.

   III. The State Board and the Regional Boards recognize the need to protect the public health including potential vector problems and the environment in the implementation of reclamation projects.

IV. In implementing the foregoing Principles, the State Board or the Regional Boards, as the case may be, shall take appropriate actions, recommend legislation, and recommend actions by other agencies in the areas of (1) planning, (2) project funding, (3) water rights, (4) regulation and enforcement, (5) research and demonstration, and (6) public involvement and information.

2. That, in order to implement the foregoing Principles, the State Board:

(a) Approves Planning Program Guidance Memorandum No. 9, "PLANNING FOR WASTEWATER RECLAMATION,"

(b) Adopts amendments and additions to Title 23, California Administrative Code Sections 654.4, 761, 764.9, 763, 2101, 2102, 2107, 2109, 2109.1, 2109.2, 2119, 2121, 2133(b)(2), and 2133(b)(3),

(c) Approves Grants Management Memorandum No. 9.01, "WASTEWATER RECLAMATION,"

(d) Approves the Division of Planning and Research, Procedures and Criteria for the Selection of Wastewater Reclamation Research and Demonstration Project,

(e) Approves "GUIDELINES FOR REGULATION OF WATER RECLAMATION,"

(f) Approves the Plan of Action contained in Part III of the document identified in Finding Five above,

(g) Directs the Executive Officer to establish an Interagency Water Reclamation Policy Advisory Committee. Such Committee shall examine trends, analyze implementation problems, and report annually to the Board the results of the implementation of this policy, and

(h) Authorizes the Chairperson of the Board and directs the Executive Officer to implement the foregoing Principles and the Plan of Action contained in Part III of the document identified in Finding Five above, as appropriate.

3. That not later than July 1, 1978, the Board shall review this policy and actions taken to implement it, along with the report prepared by the Interagency Water Reclamation Policy Advisory Committee, to determine whether modifications to this policy are appropriate to more effectively encourage water reclamation in California.

4. That the Chairperson of the Board shall transmit to the California Legislature a complete copy of the "Policy and Action Plan for Water Reclamation in California."

CERTIFICATION

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a special meeting of the State Water Resources Control Board held on January 6, 1977.

Original signed by
Bill B. Dendy
Executive Officer
State Water Resources Control Board

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 88-63

ADOPTION OF POLICY ENTITLED "SOURCES OF DRINKING WATER"

WHEREAS:

1. California Water Code Section 13140 provides that the State Board shall formulate and adopt State Policy for Water Quality Control; and,

2. California Water Code Section 13240 provides that Water Quality Control Plans "shall conform" to any State Policy for Water Quality Control; and,

3. The Regional Boards can conform the Water Quality Control Plans to this policy by amending the plans to incorporate the policy; and,

4. The State Board must approve any conforming amendments pursuant to Water Code Section 13245; and,

5. "Sources of drinking water" shall be defined in Water Quality Control Plans as those water bodies with beneficial uses designated as suitable, or potentially suitable, for municipal or domestic water supply (MUN); and,

6. The Water Quality Control Plans do not provide sufficient detail in the description of water bodies designated MUN to judge clearly what is, or is not, a source of drinking water for various purposes.

THEREFORE BE IT RESOLVED:

All surface and ground waters of the state are considered to be suitable, or potentially suitable, for municipal or domestic water supply and should be so designated by the Regional Boards [1] with the exception of:

1. Surface and ground waters where:

   a. The total dissolved solids (TDS) exceed 3,000 mg/L (5,000 uS/cm, electrical conductivity) and it is not reasonably expected by Regional Boards to supply a public water system, or

   b. There is contamination, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices, or

   c. The water source does not provide sufficient water to supply a single well capable of producing an average sustained yield of 200 gallons per day.

2. Surface waters where:

   a. The water is in systems designed or modified to collect or treat municipal or industrial wastewaters, process waters, mining wastewaters, or storm water runoff, provided that the discharge from such systems is monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards; or,

   b. The water is in systems designed or modified for the primary purpose of conveying or holding agricultural drainage waters, provided that the discharge from such systems is monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards.

3. Ground water where:

   The aquifer is regulated as a geothermal energy producing source or has been exempted administratively pursuant to 40 Code of Federal Regulations, Section 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR, Section 261.3.

4. <u>Regional Board Authority to Amend Use Designations:</u>

Any body of water which has a current specific designation previously assigned to it by a Regional Board in Water Quality Control Plans may retain that designation at the Regional Board's discretion. Where a body of water is not currently designated as MUN but, in the opinion of a Regional Board, is presently or potentially suitable for MUN, the Regional Board shall include MUN in the beneficial use designation.

The Regional Boards shall also assure that the beneficial uses of municipal and domestic supply are designated for protection wherever those uses are presently being attained, and assure that any changes in beneficial use designations for waters of the State are consistent with all applicable regulations adopted by the Environmental Protection Agency.

The Regional Boards shall review and revise the Water Quality Control Plans to incorporate this policy.

CERTIFICATION

The undersigned, Administrative Assistant to the Board, does hereby certify that the foregoing is a full, true, and correct copy of a policy duly and regularly adopted at a meeting of the State Water Resources Control Board held on May 19, 1988.

Original signed by
Maureen Marche
Administrative Assistant to the Board

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[1] This policy does not affect any determination of what is a potential source of drinking water for the limited purposes of maintaining a surface impoundment after June 30, 1988, pursuant to Section 25208.4 of the Health and Safety Code.

6. MONITORING AND ASSESSMENT

Table of Contents

Introduction

Monitoring and assessment are essential to the success of the Region's water quality control program. Monitoring is necessary to assess existing water quality conditions, examine long-term trends, and ensure the attainment and maintenance of beneficial uses consistent with state and federal standards. Monitoring is also necessary to assess the effectiveness of clean-up programs. This chapter contains a description of State and Regional Board programs that have been developed to meet these monitoring objectives.

The State's Monitoring Programs

The Porter-Cologne Water Quality Control Act (§13163) established the State Board as the lead agency for monitoring and assessment of water quality in California. The State Board's monitoring and assessment program is designed to meet the objectives in Table 6-1. In order to fully address these objectives, the State Board developed a comprehensive program in the mid-1970s. Monitoring activities were coordinated with the California Department of Fish and Game (DFG), California Department of Water Resources (DWR), and California Department of Health Services (DHS), and the U.S. Bureau of Reclamation, U.S. Geological Survey (USGS), and U.S. Environmental Protection Agency (USEPA) Descriptions of specific programs are outlined below. Not all of these programs are currently active in the Los Angeles Region, as many are unfunded at this time.

Table 6-1. Objectives of an Adequate State Surveillance and Monitoring Program.

Measure the achievement of water quality objectives specified in the Basin Plans.
Measure effects of water quality changes on beneficial uses
Measure background conditions of water quality and determine long-term trends.
Locate and identify sources of water pollution that pose an acute, accumulative, and/or chronic threat to the environment.
Provide information needed to relate receiving water quality to mass emissions of pollutants by waste dischargers.
Provide data for determining discharger compliance with permit conditions.
Measure waste loads discharged to receiving waters and identify their effects in order to develop waste load allocations.
Provide the documentation necessary to support the enforcement of permit conditions and waste discharge requirements.
Provide data needed for the continuing planning process.
Measure the effects of water rights decisions on water quality, and to guide the State Board in its responsibility to regulate unappropriated water for the control of quality.
Provide a clearinghouse for water quality data gathered by other agencies and private parties cooperating in the program.
Report on water quality conditions as required by federal and state regulations or requested by others.

Primary Monitoring Network

The State Board developed a primary water quality monitoring network for California in April 1976. Participants in the network include the California

Department of Health Services, Department of Water Resources, and Department of Fish and Game, and the U.S. Bureau of Reclamation, the U.S. Geological Survey, and U.S. Environmental Protection Agency. The goal of the primary network is to provide a consistent long-term assessment of water quality across the state. This network consists of stations on high priority streams, estuaries, coastal areas, and groundwater basins throughout the state (California Water Resources Control Board, 1975).

The primary network for the Los Angeles Region originally consisted of eight freshwater sampling stations. These eight stations laid the foundation for a consistent surface water monitoring effort in the Region and were regularly monitored by the California Department of Water Resources (DWR). By 1978, DWR regularly monitored 36 stations in the Region. Currently, DWR monitors 11 of these 36 stations.

The regional network for groundwater monitoring originally consisted of seven groundwater basins selected by the State Board. While this monitoring was never fully implemented, the Regional Board as well as other agencies have undertaken several localized groundwater investigations. For example, as part of this Basin Plan Update, the Regional Board contracted with the California State University at Fullerton for an assessment of regional ground waters. The results of this study were used to review and update the groundwater sections of this Basin Plan and will be used to plan for future program development.

Discharger Self-Monitoring

Dischargers regulated under Waste Discharge Requirements (WDRs) are required to "self-monitor," that is, to collect regular samples of their effluent and receiving waters according to a prescribed schedule to determine facility performance and compliance with their requirements. Over 5,500 monitoring reports are submitted to the Regional Board annually. The Regional Board uses these data to determine compliance with requirements, issue enforcement actions, and to perform water quality assessments.

Compliance Monitoring

In addition to self-monitoring by dischargers, the Regional Board makes unannounced inspections and collects samples to determine compliance with discharge requirements and receiving water objectives and to provide data for enforcement actions. In the event of violations, the Regional Board undertakes appropriate enforcement actions as described in Chapter 4. The scope of the Regional Board's compliance monitoring depends on the number and complexity of discharges, the dischargers' history of compliance, and the Regional Board's resources. Over 550 inspections were scheduled for the fiscal year 1993-94. Major surface water dischargers are inspected at least once a year.

Complaint Investigations

The Regional Board responds to a variety of incidents, including accidental and illegal discharges of oil from offshore pipelines, oily waste discharges, and dumping in the storm drains. Complaints and reports of such incidents, that are received from citizens as well as other agencies, often require on-site inspections during which the Regional Board collects samples and obtains other evidence (e.g., photographs) to investigate and document the extent of the problem. In addition, such documentation provides a basis for enforcement of corrective action and/or assessments that are levied on responsible parties.

Lake Surveillance

The Lake Surveillance program stemmed from early requirements set forth in the CWA (§314), that required states to identify the trophic condition of all publicly-owned fresh water lakes. The State Board inventoried about 5,000 freshwater lakes in California and initiated a program to make an estimate of the lakes' trophic status.

Several lakes in the Los Angeles Region are on the federal "314 list," which designates candidates for restoration funds. This information also is included in the State Board's *Water Quality Assessment Report* (see next page). While federal grants from the USEPA have been available in the past to conduct diagnostic or feasibility studies for lake restoration, continued funding is uncertain at this time.

As part of this Basin Plan Update, the Regional Board contracted with the University of California at Riverside (Lund, 1993) for a comprehensive water quality assessment of 24 lakes in the Region.

Visual observations, aerial photographs, water quality data, and analyses of fish tissues were used in the assessments, and observations from this study were used to update this Basin Plan.

Bay Protection and Toxic Cleanup Program

In 1989, state legislation added Sections 13390 through 13396 to the California Water Code which established the Bay Protection and Toxic Cleanup Program (BPTCP). The program has four main goals:

- to provide protection of existing and future beneficial uses of bays and estuarine waters,
- to identify and characterize toxic hot spots,
- to plan for cleanup or other mitigating actions of toxic hot spots, and
- to develop effective strategies to control toxic pollutants, abate existing sources of toxicity, and prevent new sources of toxicity.

Identification and characterization of toxic hot spots involves the implementation of regional monitoring programs at each of the Regions along the coast. Sediment toxicity tests and chemical analyses are being used to classify each bay or estuarine waterbody according to its toxicity. Waterbodies are generally "pre-screened" for contamination, followed by intensive monitoring that confirms both the existence and spatial extent of contamination.

Quality Assurance

Federal regulations require that the State Board establish guidelines and standard methods for quality assurance (QA) and quality control (QC) as it relates to sample collection and analysis carried out by State and Regional Boards. To fulfill this requirement, the State Board prepared a *Quality Assurance Program Plan* (QAPP) which was approved by USEPA on April 20, 1990. This Plan was prepared in accordance with USEPA *Guidelines and Specifications for Preparing Quality Assurance Program Plans* (1980) and *Guidance for Preparation of Combined Work/Quality Assurance Project Plans for Environmental Monitoring* (1985). The QAPP outlines procedures used by the State and Regional Boards for obtaining environmental data. The Regional Board follows these procedures when collecting, transporting, and analyzing water quality samples. Each Regional Board has a QA/QC Officer who must approve all QAPPs prepared for outside studies funded under State and Regional Board Programs.

Data Storage and Retrieval

The monitoring programs implemented by the State and Regional Boards generate considerable data. Unless these data are incorporated into a "usable" form for storage and retrieval, their value is minimal. The State Board chose the USEPA STORET (Storage and Retrieval) database to store data generated under the various monitoring programs. The State Board also maintains separate databases for the Toxic Substances Monitoring and the State Mussel Watch Programs (described below).

Biennial Water Quality Inventory/Water Quality Assessment Report

The CWA (§305(b)) requires all states to prepare and submit a biennial *Water Quality Inventory Report* (commonly referred to as a *305(b) Report*). In California, this report is used by the State Board and the USEPA to prioritize funding for water quality programs. As required by the CWA, the report must contain:

- a description of the water quality of the major navigable waterbodies in the state;
- an analysis of the extent to which significant navigable waters provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife and allow recreational activities in and on the water;
- an analysis of the extent to which elimination of the discharge of pollutants has been achieved;
- an estimate of the environmental impact, the economic, and social costs necessary to achieve the objective of the CWA, the economic and social benefits of the achievement, and the date of such achievement; and
- a description of the nature and extent of nonpoint sources of pollutants and recommendations as to the programs which must be taken to control them, with estimates of cost.

Table 6-2. Constituents Analyzed under the State Mussel Watch and Toxic Substances Monitoring Programs.

a) Metals Analyzed.

Aluminum[1]	Lead[3]
Arsenic[2]	Manganese[1]
Cadmium[3]	Mercury[3]
Chromium[3]	Nickel[3]
Copper[3]	Silver[3]
Lead[3]	Zinc[3]

b) Synthetic Organic Compounds Analyzed.

Aldrin	p,p'-DDMU	delta Lindane
Chlorbene	O,P,-DDT	Total Lindane[2]
alpha Chlordane	P,P'-DDT	Methoxychlor
gamma Chlordane	Total DDT	Methyl Parathion
cis Chlordane	Diazinon	Oxadiazon[2]
trans Chlordane	Dieldrin	PCB 1248
Oxychlordane	Endrin	PCB 1254
Total Chlordane	Endosulfan 1	PCB 1260
cis Nonachlor	Endosulfan 2	Total PCB
trans Nonachlor	Endosulfan Sulfate	Pentachlorophenol[1]
Chlorpyrifos	Total Endosulfan	Phenol[1]
Dacthal	Ethyl Parathion	Ronnel[1]
Dicofol[2]	Heptachlor	Tetrachlorophenol[1]
P,P'-DDE	Heptachlor Epoxide	Tetradifon[1]
O,P,-DDE	Hexachlorobenzene	Toxaphene
O,P'-DDD	alpha Lindane	Tributylin[1]
P,P'-DDD	beta Lindane	
P,P'-DDMS	gamma Lindane	

[1] These constituents only analyzed for in the State Mussel Watch program

[2] These constituents only analyzed for in the Toxic Substances Monitoring Program

[3] These constituents analyzed for in both the monitoring programs

Each Regional Board prepares a biennial *Water Quality Assessment (WQA) Report* for its Region using data collected by regional planning, permitting, surveillance, and enforcement programs. The regional reports contain inventories of the major waterbodies in the region including rivers and streams, lakes, bays, estuaries, harbors, coastal waters, wetlands, and ground water. For each waterbody, the report classifies the water quality (as "good," "intermediate," "impaired," or "unknown") and describes general problems and sources of water quality impairment. In addition, the report notes those waterbodies that are included on the federal lists. These lists, which indicate specific types of water quality impairments, are organized by CWA section (§131.11, §303(d), §304(M), §304(S), §304(L), §314, and §319).

After Regional Boards adopt their individual *WQA Reports*, they are compiled into a statewide report entitled *California Water Quality Assessment Report*. Upon adoption of this statewide report by the State Board, the information is converted to the *305(b) Report* format and submitted to the USEPA to satisfy the CWA requirements. The most recent California *Water Quality Assessment Report* was published in May 1992, and is available from the State Board office in Sacramento.

Toxic Substances Monitoring and State Mussel Watch Programs

Water column monitoring for toxic substances can be unreliable since toxic substances are often transported intermittently and can be missed with standard "grab" sampling of water. In addition, harmful levels of toxicants are often present in such low concentrations in water that make them difficult and expensive to detect. In some cases, a more realistic and cost-effective approach is to test the flesh of fish and other aquatic organisms that bioaccumulate these compounds in their tissues and concentrate toxicant through the food web.

In 1977, the State Board added two biomonitoring elements to the State Board's Monitoring Program: the Toxics Substances Monitoring (TSM) Program and the State Mussel Watch (SMW) Program. The Los Angeles Region has active Toxics Substances Monitoring and State Mussel Watch programs. These programs are implemented jointly by the State Board and the California Department of Fish and Game. The field sampling is performed by Fish and Game and Regional Board staff, while the laboratory analyses are performed by Fish and Game. The objectives of the Toxics Substances Monitoring and State Mussel Watch Program Programs are:

- to develop statewide baseline data and to demonstrate trends in the occurrence of toxic elements and organic substance in aquatic biota;
- to assess impacts of accumulated toxicant upon the usability of State waters by humans;
- to assess impacts of accumulated toxicant upon aquatic biota; and
- where problem concentrations of toxicant are detected, to attempt to identify sources of toxicant and to relate concentrations found in biota to concentrations found in water.

Tissue samples collected under the Toxics Substances Monitoring program are usually fish, but can also include benthic invertebrates. Fish and invertebrate tissues are analyzed for trace metals and synthetic organic chemicals, most of which are pesticides (Table 6-2). Toxics Substances Monitoring data have been collected in rivers and lakes throughout the Los Angeles Region since 1978 (Table 6-3). This program primarily monitors inland fresh waters.

The State Mussel Watch Program provides similar documentation of the quality of coastal marine and estuarine waters. Mussels, which are sessile (attached) bivalve invertebrates, serve as indicator organisms and provide a localized measurement of water quality, as they accumulate trace metals and synthetic organic chemicals in their tissues (Table 6-2). Mussels transported from "clean areas" of the State are primarily used, although local mussels are sometimes used. Other types of shellfish can be used at times, and occasionally, sediments are also collected as part of the program. State Mussel Watch Program data have been collected in coastal waters throughout the Region since 1977 (Table 6-4).

After more than 15 years of monitoring, the State Board has accumulated a considerable amount of data from these two programs. These data have been useful in assessing regional waters as they provide a direct measure of beneficial use impairment.

Table 6-3. Toxic Substances Monitoring Stations and Type of Samples Collected (LA Region).

Station No.	Station Name	81	82	83	84	85	86	87	88	89	90	91	92	93
402.10.02	Ventura River	–	EO	EO	O	–	–	–	–	EO	EO	EO	–	–
402.10.00	Ventura River Estuary	–	–	–	–	–	–	–	–	–	–	–	–	EO
402.20.02	Casitas Lake	–	–	–	–	–	–	–	O	–	–	–	EO	–
402.20.21	Ventura R/Ojai	–	–	–	–	–	–	–	–	–	–	–	–	EO
403.21.05	Santa Clara River/Santa Paula	EO	–	–	O	–	–	–	–	–	–	E	O	–
403.51.05	Santa Clara River/Valencia	–	–	–	–	–	–	–	–	–	–	O	EO	–
403.11.04	Revolon Slough	–	–	–	–	O	EO	EO	–	EO	EO	–	O	O
403.11.02	Rio de Santa Clara/Oxnard Drain	–	–	–	–	–	–	–	–	EO	EO	O	–	–
403.11.03	Oxnard Drainage Ditch 2	–	–	–	–	–	–	–	–	–	–	–	–	O
403.11.91	Mugu Lagoon	–	–	–	–	–	–	O	EO	EO	EO	E	EO	EO
403.12.06	Calleguas Creek	–	–	–	–	EO	EO	O	EO	EO	EO	O	O	O
403.67.04	Arroyo Simi	–	–	–	–	–	–	–	–	–	–	EO	–	–
403.64.02	Arroyo Conejo	–	–	–	–	–	–	–	–	–	EO	EO	–	–
403.64.03	Arroyo Conejo (downstream of forks)	–	–	–	–	–	–	–	–	–	–	–	–	EO
403.12.07	Conejo Creek	–	–	–	–	–	–	–	–	–	–	EO	EO	–
404.26.01	Sherwood Lake	–	–	–	–	–	–	–	–	–	–	EO	EO	–
404.26.00	Eleanor Lake	–	–	–	–	–	–	–	–	–	–	EO	–	–
404.25.01	Westlake Lake	–	–	–	–	–	–	–	–	–	–	EO	EO	–
404.23.04	Lindero Lake	–	–	–	–	–	–	–	–	–	–	EO	EO	–
404.21.00	Malibu Lagoon	–	–	–	–	–	–	–	–	–	–	–	–	EO
404.21.01	Malibu Creek	–	–	–	–	EO	–	–	EO	–	–	EO	–	–
404.21.04	Malibu Creek/Tapia Park	–	–	–	–	–	–	–	–	–	–	–	EO	–
404.21.07	Malibou Lake	–	–	–	–	–	–	–	–	–	–	EO	EO	–
405.21.03	Calabasas Lake	–	–	–	–	–	–	–	–	–	–	EO	EO	–
405.13.00	Marina del Rey	–	–	–	–	–	–	–	–	–	–	–	–	EO
405.13.01	Ballona Creek	–	–	–	–	–	–	–	–	–	–	–	–	EO
405.13.03	Ballona Wetlands	–	–	–	–	–	–	–	–	–	–	–	–	EO
405.13.02	Venice Canals/Sherman Ave.	–	–	–	–	–	EO	–	–	–	–	–	–	–
405.12.90	Harbor Park Lake	–	–	EO	EO	EO	O	O	O	EO	EO	O	EO	O
405.12.91	Simms Pond	–	–	–	–	–	–	–	–	–	–	–	–	EO
405.15.98	Hollenbeck Park Lake	–	–	–	–	–	–	–	–	–	–	EO	–	–
405.15.97	Belvedere Park Lake	–	–	–	–	–	–	–	–	–	–	EO	EO	–
405.15.99	Lincoln Park Lake	–	–	EO	–	–	–	–	–	–	–	EO	EO	–
405.15.24	Echo Park Lake	–	–	–	–	–	–	O	–	–	–	EO	EO	–
405.21.11	Hanson Dam Lake	–	–	E	–	–	–	–	–	–	–	–	–	–
405.12.03	Los Angeles River	–	–	EO	–	–	–	–	–	–	–	–	–	–
405.21.06	Los Angeles River/Los Feliz Road	–	–	–	–	–	–	–	–	–	–	–	EO	–
405.21.16	Los Angeles River/Sepulveda Basin	–	–	–	–	–	–	–	–	–	–	EO	EO	–
405.41.00	Peck Road Lake	–	–	–	–	–	EO	–	–	–	–	EO	EO	–
405.12.00	Alamitos Bay	–	–	–	–	–	–	–	–	–	–	EO	–	–
405.12.02	Dominguez Channel	–	–	–	–	–	–	–	–	–	–	–	EO	–
405.12.04	Colorado Lagoon	–	–	–	–	–	–	–	–	–	–	–	EO	–
405.15.04	San Gabriel River	–	–	EO	–	E	–	–	EO	EO	EO	E	EO	EO
–	San Gabriel River/Coyote Creek	–	–	–	–	–	–	–	–	–	–	–	EO	–
405.15.02	El Dorado Park Lake	–	–	–	–	–	–	–	–	–	–	EO	EO	–
405.41.01	Legg Lake	–	–	–	EO	–	–	–	EO	–	–	EO	EO	–
405.52.01	Puddingstone Reservoir	–	–	–	–	–	EO	O	O	–	–	EO	EO	–
405.41.11	Santa Fe Dam Park	–	–	–	–	–	–	–	–	–	–	–	EO	–

E = Trace Elements; O = Organic Chemicals; EO = Trace Elements & Organic Chemicals; – = Not Sampled;

Table 6-4. State Mussel Watch Sampling Stations and Type of Samples Collected (LA Region).

Station No.	Station Name	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
485.00	Ventura Marina	–	–	–	–	–	–	–	–	–	–	EO	–	–	–	–
485.20	Ventura River Estuary	–	–	–	–	–	–	–	–	–	–	–	–	–	–	O
487.10	Santa Clara River Estuary 1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	O
487.30	Santa Clara River Estuary 2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	O
502.00	Santa Cruz Island	EO	EO	–	–	–	–	–	–	–	–	–	–	–	–	–
503.00	Anacapa Island	EO	EO	EO	EO	–	–	–	–	–	–	–	–	–	–	–
504.00	Santa Barbara Island	EO	EO	–	–	–	–	–	–	–	–	–	–	–	–	–
505.00	Channel Island Harbor	–	–	E	EO	O	–	–	–	–	–	–	–	–	–	–
505.20	Channel Island Harbor/North	–	–	–	–	–	–	–	–	–	EO	–	–	–	–	–
506.00	Port Hueneme	–	–	EO	EO	O	–	–	–	–	–	–	–	–	–	–
506.10	Port Hueneme/Wharf B	–	–	–	–	–	–	–	–	O	O	EO	O	–	–	–
506.20	Port Hueneme/Wharf 1	–	–	–	–	–	–	–	–	O	EO	EO	O	–	–	–
506.30	Port Hueneme/Entrance	–	–	–	–	–	–	–	–	–	–	EO	–	–	–	–
507.00	Point Mugu	EO	EO	–	–	–	–	–	–	–	–	–	–	–	–	–
507.10	Mugu Lagoon/L Street	–	–	–	–	–	–	–	–	–	EO	–	–	–	O	–
507.20	Mugu Lagoon/Laguna Road	–	–	–	–	–	–	–	–	O	EO	–	–	–	O	–
507.30	Mugu Lagoon/Calleguas Creek	–	–	–	–	–	–	–	–	O	EO	–	EO	O	O	O
507.40	Ag Drain/Etting Road	–	–	–	–	–	–	–	–	–	–	–	–	–	O	–
507.60	Ag Drain/Pleasant Valley Road	–	–	–	–	–	–	–	–	–	–	–	–	–	O	–
507.70	Revolon Slough/Las Posas Road	–	–	–	–	–	–	–	–	–	–	–	–	–	O	–
507.80	Revolon Slough	–	–	–	–	–	–	–	–	–	EO	O	O	O	O	–
508.10	Mugu Drainage 1	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–
508.20	Mugu Drainage 2	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–
508.30	Mugu Drainage 3	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–
508.40	Mugu Drainage 4	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–
508.50	Mugu Drainage 5	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–
508.60	Mugu Drainage 6	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–
508.70	Mugu Drainage 7	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–
509.00	Calleguas	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–
553.00	Marina Del Rey/Entrance	–	–	–	–	–	–	–	–	–	–	–	EO	–	–	–
554.00	Marina Del Rey/Harbor Patrol Docks	–	–	–	–	–	–	–	–	EO	–	EO	EO	–	–	–
555.00	Marina Del Rey/Basin G	–	–	–	–	–	–	–	–	EO	EO	EO	EO	–	–	–
555.20	Marina Del Rey/Basin D	–	–	–	–	–	–	–	–	–	–	EO	–	–	–	–
556.00	Marina Del Rey/Basin E	–	–	–	–	–	–	–	–	EO	EO	EO	EO	–	–	–
557.00	Marina Del Rey/Ballona Creek	–	–	–	–	–	–	–	–	EO	EO	EO	EO	–	–	–
559.00	King Harbor	–	–	–	–	–	–	–	–	–	–	EO	–	–	–	–
601.00	LA Harbor/National Steel	–	–	–	–	EO	–	EO	EO	EO	EO	EO	EO	O	O	EO
602.00	LA Harbor/West Basin	–	–	–	–	EO	–	E	EO	EO	EO	EO	–	–	–	–
602.50	LA Harbor/Todd Shipyards	–	–	–	–	–	–	–	EO	EO	–	EO	EO	O	O	–
602.60	LA Harbor/Berth 50	–	–	–	–	–	–	–	–	–	–	–	–	E	–	–
602.70	LA Harbor/Pacific Ave/Storm Drain	–	–	–	–	–	–	–	–	–	–	EO	–	–	–	–
602.80	LA Harbor/Berth 49	–	–	–	–	–	–	–	–	–	EO	E	E	E	E	–
602.90	LA Harbor/Berth 51	–	–	–	–	–	–	–	–	–	–	–	–	E	–	–
603.00	LA Harbor/Berth 151	–	–	–	–	EO	–	EO	EO	EO	–	EO	O	–	–	–

Table 6-4. State Mussel Watch Sampling Stations and Type of Samples Collected (LA Region) (cont.)

Station No.	Station Name	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
603.60	LA Harbor/Slip 240	–	–	–	–	–	–	–	–	–	EO	EO	–	–	–	–
603.80	LA Harbor/West Channel	–	–	–	–	–	–	–	–	–	EO	EO	–	–	–	–
604.00	LA Harbor/GATX Terminal	–	–	–	O	EO	O	–	–	EO	–	–	–	–	–	–
604.50	LA Harbor/Berth 212	–	–	–	–	–	–	–	–	–	–	–	E	–	–	–
605.00	LA Harbor/Cabrillo Pier	–	O	O	–	EO	–	EO	–	–	–	–	EO	–	–	O
606.00	LA Harbor/Fish Harbor/Outer	–	–	–	–	EO	–	–	–	–	–	–	–	–	–	–
606.20	LA Harbor/Fish Harbor	–	–	–	–	–	–	–	–	–	EO	EO	–	–	–	–
606.30	LA Harbor/Watchorn Basin	–	–	–	–	–	–	–	–	–	EO	–	–	–	–	–
607.00	LA Harbor/Terminal Island	–	–	–	O	EO	–	E	–	EO	–	–	–	–	–	–
607.40	LA/LB Harbors/Berth 214	–	–	–	–	–	–	–	–	–	EO	–	–	–	–	–
607.60	LA/LA Harbors/Channel 2	–	–	–	–	–	–	–	–	–	EO	–	–	–	–	–
607.70	LA/LB Harbors/Navy Mole Jetty	–	–	–	–	–	–	–	–	–	O	–	–	–	–	–
607.80	LA/LB Harbors/Pier J	–	–	–	–	–	–	–	–	–	EO	–	–	–	–	–
608.00	LA/LB Harbors/Navy Mole	–	–	–	–	EO	–	O	–	–	–	–	–	–	–	–
609.00	LA/LB Harbors/Tide Gauge	–	–	EO	EO	EO	O	EO	–	EO	–	O	–	–	–	–
609.40	Long Beach/Queensway Bay	–	–	–	–	–	–	–	–	–	EO	–	–	–	–	–
610.00	LA River/Mouth	–	–	–	O	–	O	–	EO	–	–	–	–	–	–	–
611.00	Long Beach Harbor/Pier F	–	–	–	–	EO	–	–	–	–	–	–	–	–	–	–
611.50	Long Beach Harbor/LAPD Ramp	–	–	–	O	–	–	–	–	–	–	–	–	–	–	–
612.00	LA/LB Harbors/Navy Channel	–	–	–	O	–	O	–	–	–	–	–	–	–	–	–
613.00	LA/LB Southern California Edison	–	–	–	–	EO	–	EO	–	EO	–	–	–	–	–	–
614.00	Long Beach/Channel 3	–	–	–	–	EO	–	–	–	–	–	–	–	–	–	–
615.00	LA Harbor/Henry Ford Bridge	–	–	–	–	–	EO	–	–	–	–	EO	EO	–	–	–
616.00	LA Harbor/Consolidate Slip	–	–	–	–	EO	O	O	EO	EO	EO	EO	EO	O	O	EO
617.00	White's Point	–	–	–	–	EO	–	–	–	–	–	–	–	–	–	–
618.00	LA Harbor/Angels Gate	–	–	–	–	–	–	–	–	–	–	–	–	–	EO	O
619.00	LA Harbor/San Pedro Boatworks	–	–	–	–	–	–	–	–	–	–	–	–	–	EO	–
620.00	LA/LB Harbor/JH Baxter 80	–	–	–	–	–	–	–	–	–	–	–	–	–	O	–
620.50	LA River/Upstream	–	–	–	–	–	–	–	–	O	–	–	–	–	–	–
621.00	LA Harbor/Berth 120	–	–	–	–	–	–	–	–	–	–	–	–	–	O	–
622.00	LA Harbor/Commer Marine	–	–	–	–	–	–	–	–	–	–	–	–	–	EO	–
625.00	Alamitos Bay/West 2nd Street	–	–	–	–	–	–	–	–	EO	–	–	–	–	–	–
626.00	Alamitos Bay/Cerritos Channel	–	–	–	–	–	–	–	–	EO	–	–	–	–	–	–
627.00	Alamitos Bay/Marina Stadium	–	–	–	–	–	–	–	–	EO	–	–	–	–	–	–
627.40	Alamitos Bay/Marina Stadium/North	–	–	–	–	–	–	–	–	–	EO	–	–	–	–	–
647.00	Point Dume	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
648.00	Malibu	–	–	–	E	–	–	–	–	–	–	–	–	–	EO	–
648.10	Malibu Lagoon/Channel A	–	–	–	–	–	–	–	–	–	–	–	–	–	–	EO
648.30	Malibu Lagoon/Channel C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	EO
648.50	Malibu Lagoon/PCH	–	–	–	–	–	–	–	–	–	–	–	–	–	–	EO
649.00	Big Rock Beach	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–

Table 6-4. State Mussel Watch Sampling Stations and Type of Samples Collected (LA Region) (cont.)

Station No.	Station Name	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
650.00	Santa Monica	–	–	–	E	–	–	–	–	–	–	–	E	–	EO	–
651.00	Marina Del Rey/North docks	–	–	E	EO	–	–	–	–	–	–	–	–	–	–	–
652.00	Marina Del Rey/North Docks Jetty	–	–	E	–	–	–	–	–	–	–	–	–	–	–	–
653.00	Marina Del Rey/South Docks Jetty	–	–	–	–	EO	–	–	–	–	–	–	–	–	–	–
654.00	Playa Del Rey	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
655.00	El Segundo/Grand Avenue	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
656.00	Manhattan Beach	–	–	–	E	–	–	–	–	–	–	–	TE	–	–	–
657.00	Hermosa Beach	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
658.00	Redondo Beach	–	–	–	E	–	–	–	–	–	–	–	TE	–	–	–
659.00	Palos Verdes Point	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
660.00	Point Vincente	–	–	E	EO	–	–	–	–	–	–	–	–	–	–	–
661.00	Royal Palms/North	–	–	E	E	–	–	–	–	–	–	–	–	–	–	–
662.00	Royal Palms	–	EO	EO	EO	O	EO	EO	EO	EO	EO	EO	EO	EO	EO	EO
663.00	Royal Palms/South	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
664.00	Cabrillo Beach	–	E	O	–	–	–	–	–	–	–	–	–	–	–	O
680.00	Catalina Island/East	–	EO	E	EO	–	–	–	–	–	–	–	–	–	–	E
681.00	Catalina Island/West	EO	EO	E	E	–	–	–	–	–	–	–	–	–	–	–
682.00	Catalina Island/Ribbon Rock	–	–	–	E	–	–	–	–	–	–	–	–	–	E	–
683.00	Catalina Island/Ben Weston	–	–	–	EO	–	–	–	–	–	–	–	–	–	–	–
684.00	Catalina Island/Silver Cny.	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
685.00	Catalina Island/Church rock	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
701.00	Colorado Lagoon/West	–	–	–	–	EO	–	–	EO	EO	–	–	–	–	–	–
701.20	Colorado Lagoon/East	–	–	–	–	–	–	–	–	–	EO	–	–	–	–	–
703.00	Alamitos Bay/Pier 22	–	–	–	–	O	–	–	–	–	–	–	–	–	–	–

E = Trace Elements; O = Organic Chemicals; – = Not Sampled

Regional Board Monitoring Programs

The Regional Board conducts its own surface waters monitoring program that supplements the state monitoring programs described above (which are, for the most part, implemented by the Regional Boards).

Regional Board Surface Water Monitoring Network

Many of the State monitoring programs described above are no longer funded and thus many sampling stations have been dropped. Under these circumstances, it has been necessary for the Regional Board to develop and implement its own ambient surface water monitoring program to continue to meet state and regional monitoring and assessment objectives. This monitoring network currently consists of 60 primary stations on rivers and streams throughout the Region. Stations are placed to most effectively assess Regional waters and measure long term trends at certain historic stations developed by the Regional Board or other agencies.

Currently, each station is sampled at least once a year. In addition to water quality sampling, observations are made of existing beneficial uses, surrounding land use(s), potential sources of pollutants, and other conditions. The monitoring network is flexible and stations are added, moved, or deleted as the need arises; the Regional Board, however, maintains a core network of monitoring stations to the extent that funding is available.

Intensive Surveys

The Regional Board has started to perform Intensive Surveys to obtain detailed information on the effects of pollutant loadings from point and nonpoint sources on particular waterbodies. These surveys often involve coordination with other governmental agencies and organizations.

In addition to quantifying the effects of pollutant loadings, data from intensive surveys also augment the regional water quality database and are used for water quality assessments and basin planning updates.

Coordination With Other Agencies

Regional Board staff regularly coordinate with other agencies to share data, reduce overlap in sampling efforts, and use limited monitoring monies in the most efficient way possible.

Biological Criteria

Biological criteria are narrative (and sometimes numeric) expressions that describe the biological integrity of aquatic communities (EPA, 1991). Biological criteria supplement other water quality objectives (physical, chemical, toxicity) by providing a direct measure of aquatic communities at risk from human activities. These criteria can also provide evidence of streams with exceptional water quality. Baseline data must be collected from both reference and impacted streams in the Region. Regular monitoring of these areas can then provide a continual assessment of instream impacts. Over 30 of the 50 states have developed, or are developing, biological criteria programs. Although there is not a current biological criteria program in the Region, Regional Board staff are planning to begin conducting baseline surveys in the coming years.

APPENDIX C

DWR California Water Update 2009
(Bulletin 160-09)

California Water Today

Chapter photo. Harvesting in the Central Valley

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Chapter 4. California Water Today

About this Chapter

Chapter 4 California Water Today describes California's diverse communities and environment; the challenges of meeting our water demands; and initiatives to meet these challenges undertaken by federal, State, and local government, and regional and Tribal entities. We are already witnessing the effects of climate change—on hydrology (snowpack, river flows), storm intensity, temperature, winds, and sea levels. California is facing multiple dry years and operating under court restrictions and new regulations brought about by declining ecosystems. Meanwhile, California's policymakers and water communities are finding ways to integrate planning and water management, promote stewardship and sustainable practices, build partnerships, enact legislation, and secure funding.

See Chapter 5 Managing an Uncertain Future for discussion of how California can prepare for future water management by navigating uncertainty and risk, evaluating plausible futures, and choosing management strategies that provide for more sustainable water supply and flood management systems and ecosystems. With the use of three alternative scenarios, we project plausible, yet very different, statewide and regional water needs through year 2050.

In addition to a discussion of California's water conditions, this chapter presents statewide water balance data and summary for water years 1998 through 2005. Regional water balance summaries can be found in Volume 3 Regional Reports. More detailed data about statewide and regional water uses and supply distribution are in Volume 5 Technical Guide.

- Variable and Extreme Resources
- Land Use and Development Patterns
- Water Conditions
- Critical Challenges
- Responses and Opportunities

Variable and Extreme Resources

With its wide variety of climates and landforms, California is often described as a land of extremes; its water resources can best be described as variable. Precipitation, the primary source of the state's water supplies, varies from place to place, season to season, and year to year. Most of the snow and rain fall in the mountains in the north and eastern parts of the state, and most water is used in the central and southern valleys and along the coast. In addition, the state's ecosystem, agricultural, and urban water users have variable demands for the quantity, timing, and place of use. In any year, the state's water systems may face the threat of too little water to meet needs during droughts or the threat of too much water during floods.

Given this variability, California's local, State, and federal projects and programs form the backbone of a statewide water system that was developed during the first part of the 20th century, and these projects have worked together to make water available at the right places and times and to move floodwaters. In the past, this system has allowed California to meet most of its agricultural and urban water management objectives and

Figure 4-1 Map of California with major rivers and facilities

flood management objectives (Figure 4-1 Map of California with major rivers and facilities).

Generally, during a single dry year or two, surface water and groundwater storage can supply most water deliveries, but dry years can result in critically low water reserves. Ecosystems and agriculture often face more significant reductions in available water than do urban areas. Longer droughts can create extreme fire danger, economic harm to urban and rural communities, loss of crops, and the potential for species collapse and degraded water quality. Greater reliance on groundwater during dry years results in high costs for many users and more groundwater overdraft. At the same time, water users who have already increased efficiency may find it more challenging to achieve additional water use reductions during droughts.

In 2009, California experienced a third consecutive year of drought. Below-average precipitation and runoff began in fall 2006. The water shortage has affected the state's economy, slowing development projects and forcing growers to fallow land. For example, farmers in northern San Diego County stumped avocado trees and pulled out citrus trees due to water shortages. The Westlands Water District reported that one-third of the farmland was being fallowed in 2009, at a loss of at least 500 jobs.

In fall 2009, the US Department of Agriculture granted agricultural disaster designations due to drought, either primary, contiguous, or both, for 50 of California's 58 counties. By October, 25 California counties had requested primary designations and provided the California Emergency Management Agency (CalEMA) with estimates of the dollar value of their drought-related losses for one or more crops for various reporting periods. The total loss for all the reporting counties was about $876 million. (See Box 4-1 Acronyms and Abbreviations Used in This Chapter.)

Californians also face the risk of extensive property damage and loss of life when too much water overwhelms the system's capacity and floods cities and farmlands as witnessed yet again in 2006.

As we develop and improve water delivery systems, we must also preserve and protect our watersheds and maintain healthy ecosystems. We rely on our watersheds and groundwater basins to provide clean and adequate surface water and groundwater. Their health is essential to California's resources and economic future. California's public agencies must manage these public trust resources for generations to come.

As we develop and improve water delivery systems we must also preserve and protect our watersheds and maintain healthy ecosystems. Their health are essential to California's resources and economic future.

Hydrologic Regions and Areas of Interest

The Department of Water Resources (DWR) divides California into 10 hydrologic regions corresponding to the state's major water drainage basins (Figure 4-2). Using these hydrologic regions and their nested subareas as planning boundaries allows consistent tracking of their natural water runoff and the accounting of surface water and groundwater supplies. See Box 4-2 (About Update 2009 Regional Reports) for a detailed description of each of these hydrologic regions and the river basins that they include.

Figure 4-2 Hydrologic regions of California, the Sacramento-San Joaquin River Delta, and Mountain Counties Area

Box 4-1 Acronyms and Abbreviations Used in This Chapter

BDCP	Bay Delta Conservation Plan	EO	executive order
BLM	U.S. Bureau of Land Management	FEMA	Federal Emergency Management Agency
Cal EMA	California Emergency Management Agency	GHG	greenhouse gas
CEC	California Energy Commission	IRWM	Integrated Regional Water Management
CVP	Central Valley Project	NFMS	National Marine Fisheries Service
DAU	detailed analysis unit	PA	planning area
Delta	Sacramento-San Joaquin River Delta	RAP	region acceptance process
DFG	California Department of Fish and Game	SB	Senate bill
DRMS	Delta Risk Management Strategy	SGP	(Governor's) Strategic Growth Plan
DWR	California Department of Water Resources	SWP	State Water Project
		UWMPs	Urban Water Management Plans

Some areas of the state share common water issues or interests that stretch across boundaries from one hydrologic region to another. Two such regional overlays, the Mountain Counties area and the Sacramento-San Joaquin River Delta (the Delta) region, are part of this Water Plan. Many other regional overlays could be developed based on boundaries such as county lines, water districts, or integrated regional water management (IRWM) groups.

A component of the IRWM Program Guide is the region acceptance process (RAP), a process for identifying regions for the purpose of developing or modifying IRWM plans. At a minimum, a region is defined as a contiguous geographic area encompassing the service areas of multiple local agencies and is defined to maximize the opportunities to integrate water management activities and effectively integrate water management programs and projects within a hydrologic region defined in the California Water Plan, the Regional Water Quality Control Board (Regional Water Board region), or subdivision or other region specifically identified by DWR.

In November 2009, DWR completed the first RAP cycle by documenting recommendations on 46 submitted RAP applications. DWR approved 36 and conditionally approved 10 regions. Approved regions will be eligible for the next round of IRWM grant funding, and conditionally approved regions may have restricted eligibility for future funding (Figure 4-3).

For detailed planning and data collection purposes, DWR further subdivides the 10 hydrologic regions into 56 smaller planning areas (PAs), plus a more detailed breakdown into 278 detailed analysis units or DAUs. DWR starts most of its water supply and water use data collection activities at the DAU level. This regional information is collected, analyzed, and compiled by each of DWR's four regional offices, which are located in Red Bluff, Sacramento, Fresno, and Glendale. (Figure 4-2 also shows the boundaries for these four regional offices). Regional water plan data are then consolidated into the larger hydrologic regions for presentation in the California Water Plan (Volume 3 Regional Reports). See also Volume 5 Technical Guide for list of California's PAs.

Climate

The amount and variability of precipitation can change dramatically between the northern regions of California and its southeast portions such that statewide average information does not truly depict regional conditions. Generally wet, average, and dry conditions presented for the entire state are not universally the same for individual regions of the state. It is common for the winter precipitation to be wet or above average

Box 4-2 About Update 2009 Regional Reports

In California Water Plan Update 2009, we expanded the regional reports. Each report now includes a summary of surface water quality issues and needs, regional flood and flood management issues, a table of strategies proposed by recent integrated regional water management efforts, climate change challenges, and projected water demands to the year 2050 for three alternative scenarios. These regional reports have also added information about Tribal populations in each region and Tribal lands.

The organization of these regional reports presents the water conditions today and challenges and opportunities for their future. Each separately bound regional report contains a main section as a concise summary of the most significant water information and issues related to that region. The inclusion of new information categories has greatly expanded the amount of materials collected; therefore, regional report includes a set of appendices, including information about flood management and water quality as well as data sets and other detailed information. In this manner, all of the information for each region is assembled in a single place to facilitate easier access to the materials.

Following are short descriptions of the 10 hydrologic region areas.

- North Coast. Klamath River and Lost River Basins, and all basins draining into the Pacific Ocean from Oregon south through the Russian River Basin.
- San Francisco Bay. Basins draining into San Francisco, San Pablo, and Suisun Bays, and into the Sacramento River downstream from Collinsville; western Contra Costa County; and basins directly tributary to the Pacific Ocean below the Russian River watershed to the southern boundary of the Pescadero Creek Basin.
- Central Coast. Basins draining into the Pacific Ocean below the Pescadero Creek watershed to the southeastern boundary of Rincon Creek Basin in western Ventura County.
- South Coast. Basins draining into the Pacific Ocean from the southeastern boundary of Rincon Creek Basin to the international border with Mexico.
- Sacramento River. Basins draining into the Sacramento River system in the Central Valley (including the Pit River drainage), from the Oregon border south through the American River drainage basin.
- San Joaquin River. Basins draining into the San Joaquin River system, from the Cosumnes River basin on the north through the southern boundary of the San Joaquin River watershed.
- Tulare Lake. The closed drainage basin at the south end of the San Joaquin Valley, south of the San Joaquin River watershed, encompassing basins draining to Kern Lakebed, Tulare Lakebed, and Buena Vista Lakebed.
- North Lahontan. Basins east of the Sierra Nevada crest and west of the Nevada state line, from the Oregon border south to the southern boundary of the Walker River watershed.
- South Lahontan. The interior drainage basins east of the Sierra Nevada crest, south of the Walker River watershed, northeast of the Transverse Ranges, and north of the Colorado River Region. The main basins are the Owens and the Mojave River Basins.
- Colorado River. Basins south and east of the South Coast and South Lahontan regions; areas that drain into the Colorado River, Salton Sea, and other closed basins north of the border with Mexico.

The Delta Region and Mountain Counties Area

- Sacramento-San Joaquin Delta and Suisun Marsh. An overlay area because of its common characteristics, environmental significance, and important role in the state's water systems. The region was the focus of the Governor's Blue Ribbon Delta Vision Task Force in 2006 through 2008. In December 2008, the Delta Vision Committee issued a final implementation report to the Governor and Legislature that includes near-term actions necessary to achieve Delta sustainability and to avoid catastrophe (see Chapter 3 Companion State Plans).
- The Mountain Counties area. Includes the foothills and mountains of the western slope of the Sierra Nevada and a portion of the Cascade Range. The area includes the eastern portions of the Sacramento River and San Joaquin River hydrologic regions and watersheds, and stretches from Plumas County in the north, into Fresno County in the south. This area shares common water supply and other resource issues that are compounded by urban growth. It also is the area of origin for much of the state's developed surface water supply.

Figure 4-3 Integrated Regional Water Management planning regions accepted or conditionally accepted by DWR in November 2009

Table 4-1 California population change from 2000 to 2005 by hydrologic region

Hydrologic region	2000 Population	2005 Population	Growth
North Coast	644,000	670,267	4.1%
SF Bay	6,105,650	6,282,480	2.9%
Central Coast	1,459,205	1,524,720	4.5%
South Coast	18,223,425	19,638,116	7.8%
Sac River	2,593,135	2,882,452	11.2%
San Joaquin River	1,751,010	1,991,731	13.7%
Tulare Lake	1,884,675	2,098,631	11.4%
North Lahontan	99,010	103,885	4.9%
South Lahontan	721,490	822,168	14.0%
Colorado River	606,535	713,726	17.7%
California	34,088,135	36,728,196	7.8%

in the northern portions of the state, and below average to dry in the south and southeast portions for the same winter.

Land Use and Development Patterns

Population growth is a major factor influencing current and future water uses. From 1990 to 2005, California's population increased from about 30 million to about 36.5 million. The California Department of Finance projects that this trend means a state population of roughly 60 million by 2050. For historical population growth data by region, 1960-2005, go to Volume 5 Technical Guide. Table 4-1 shows California population change from 2000 to 2005 statewide and by hydrologic region.

California is one of the most productive agricultural regions in the world. Agriculture is an important element of California's economy, with 88,000 farms and ranches generating $32 billion in gross income in 2006, according to the California Department of Food and Agriculture and generating $100 billion in related economic activity. In 2000, California irrigated an estimated 9.6 million acres of cropland (includes multicropping) using roughly 34 million acre-feet of applied water. (See Box 4-3 The Rising Economic Efficiency of California Agricultural Water Use and the agricultural land stewardship strategy in Volume 2 Resource Management Strategies.)

California has more than 37 million acres of forest located primarily in the major mountain ranges of the state. Forests in California are owned and managed by a wide array of federal, State, Tribal, and local agencies, private companies, families and individuals, and nongovernmental organizations, each having a different forest management strategy with different goals and constraints. (See forest management strategy in Volume 2 Resource Management Strategies.)

Box 4-3 The Rising Economic Efficiency of California Agricultural Water Use

Comparing Changes in Applied Water Use and the Real Gross Value of Output for California Agriculture: 1967 to 2007

By Jim Rich, Economist, DWR
July 31, 2009

DWR economists recently analyzed how over the past 40 years the real value of California agricultural output has changed with respect to the water applied to California's farmland. The value of livestock and livestock products were included in this analysis because the vast majority of California's animal-based agriculture depends, in part, on our irrigated crops.

DWR estimates that the real, inflation-adjusted gross revenue for California agriculture increased about 84 percent between 1967 and 2007, from $19.9 billion (in 2007 dollars) to $36.6 billion. During that period, total California crop applied water use fell by 14.6 percent, from about 31.2 million acre-feet (maf) in 1967, to a preliminary estimate of 26.7 maf in 2007.

The rising real value of our agricultural output, coupled with falling crop water use, has more than doubled the "economic efficiency" of agricultural water use in California during the past 40 years. In 1967 about $638 (in 2007 dollars) of gross agricultural revenue was produced in California for each acre-foot of applied agricultural water. By 2007 this measure had risen to $1,373 per acre-foot. That represents a 115 percent increase in 40 years. Much of this increase has occurred since 2000 (see note below).

The main reason for the rise in the economic efficiency of California agricultural water use is the long-term shift out of lower-valued field crops, and into riskier, higher-valued truck, tree, and vine crops. Although such crops may bring in more average gross revenue per acre, they are subject to overproduction and sharp market swings, sometimes resulting in large net losses for the farmers who grow them.

NOTE: The source of the estimates in the second and third paragraphs is a draft DWR paper, Comparing Changes in Applied Water Use and the Real Gross Value of Output for California Agriculture: 1967 to 2007, March 2009. Find in Volume 4 Reference Guide.

Box 4-4 Land Use Jurisdiction

Cities and counties have the primary jurisdiction over land use and planning and regulation. Their authority derives from the State and its constitutional powers to regulate land use to protect the public health, safety, and welfare. Also, several statutes specifically authorize the preparation of local general plans and specific plans. The Governor's Office of Planning and Research provides advisory guidance in the preparation of the State's General Plan Guidelines that assist local governments in land use planning and management.

State and regional agencies play a limited role in local land use planning and regulation, for example:

- The California Coastal Commission regulates land use planning and development in the coastal zone, together with local agencies (cities and counties).
- The California Energy Commission has exclusive permitting authority for thermal powerplants 50 megawatts or greater and serves as a lead agency under the California Environmental Quality Act for projects within its jurisdiction.
- Three regional land use agencies have regulatory responsibilities: San Francisco Bay Conservation and Development Commission, the Coastal Commission and the Tahoe Regional Planning Agency. The regional Delta Protection Agency does not have permitting or regulatory authority.
- Regional Councils of Government (COGs) serve as metropolitan planning organizations for federal transportation planning and funding purposes although they differ from region to region in organization and regional effectiveness; COGs prepare regional growth plans to meet regional housing and transportation demand.

Land Use Patterns

California State government has typically played a limited or indirect role in land use planning (see Box 4-4 Land Use Jurisdiction). To the extent they exist for land use, state policies are expressed and "enforced" through local general plans and land use regulations.

Tribal Lands

California's 160 or so Native American Tribes may or may not be federally recognized. The federal government may set aside public lands for these Tribes as reservations or rancherias. Lists of these lands and more Tribal information appear in the regional reports. See also Tribal articles in Volume 4 Reference Guide.

Senate Bill 18 (Chapter 905, Statutes of 2004) requires cities and counties to consult with Native American Indian Tribes during the adoption or amendment of local general plans or specific plans. A contact list of California Tribes and representatives within a region is maintained by the Native American Heritage Commission. Each regional report in Volume 3 lists some Tribal information known for that region.

Water Conditions

A survey of California's water scene yields an assortment of existing crises. For example, the Delta, the hub of the state's water supply and delivery system and a crossroad of other critical infrastructure, faces serious ecosystem problems and substantial seismic risk that threaten water supply reliability and quality. Many groundwater basins suffer from overdraft and pollution. The Colorado River, an important source of water for Southern California, is weathering a historic drought that has again brought into question the hydrology used for the allocation of water among the seven states that share it. Throughout California, flood risk grows as levees age and more people live and work in floodplains.

Environmental Water

Although a considerable amount of water is dedicated to maintenance and restoration of aquatic and riparian ecosystems, environmental needs are not always met. Recent studies of the streamflow requirements of aquatic life, mainly represented by salmon, reveal that flows in many California rivers and streams sometimes fall below minimum desirable levels.

These minimum flow levels are called objectives in the scenarios of Chapter 5 Managing an Uncertain Future. Objectives for the major rivers, estuaries, and wetlands of northern and central California are tabulated in Chapter 5, along with the amount of water needed to meet each of them.

Box 4-5 DFG Streamflow Recommendations Developed in 2008

Pursuant to Public Resources Code (PRC) Section 10001, in the early 1980s the Department of Fish and Game identified 21 streams and watercourses for which minimum flow levels needed to be established in order to assure the continued viability of stream-related fish and wildlife resources. The following list of streams with high priority for the development of flow recommendations was developed in coordination with all DFG regional offices:

- Carmel River, Monterey County
- Redwood Creek, Marin County
- Brush Creek, Mendocino County
- Lower American River, Sacramento County
- Lagunitas Creek, Marin County
- Lake Tahoe Basin, multiple counties
- North Fork Feather River, multiple counties
- Upper West Fork of the San Gabriel River, Los Angeles County
- Yuba River, Yuba County
- Rush Creek, Mono County
- Lower Mokelumne River, San Joaquin County
- Parker Creek, Mono County
- South Parker Creek, Mono County
- Walker Creek, Mono County
- Upper Owens River, Mono County
- Lee Vining Creek, Mono County
- Merced River, Merced County
- Scott Creek, Santa Cruz County
- Mill Creek, Mono County
- Truckee River Basin, multiple counties
- Battle Creek, Shasta and Tehama counties

Restoration of adequate instream flows, as well as the floodplain functions that depend on flow, is the statewide priority for the California Department of Fish and Game. Thus, DFG looked beyond the list of major water bodies to identify 21 additional streams (Box 4-5 DFG Streamflow Recommendations Developed in 2008) for which flow objectives needed to be established to assure the continued viability of their fish and wildlife resources. DFG developed objectives for those streams and submitted them as flow recommendations to the State Water Resources Control Board (State Water Board) in May 2008. Flows in all 21 streams are believed to fall short of the objectives in at least some seasons and years.

DFG also developed a list of 22 other streams regarded by State and federal fish and wildlife agencies as high priority for future instream flow studies (Box 4-6). That list was submitted to the State Water Board in August 2008. Again, flows in those streams are thought to be insufficient. The combined list of 43 streams represents a broad cross-section of smaller perennial watercourses in the various regions of California.

Water Supplies and Uses

During the 20th century, Californians were able to meet water demands primarily through an extensive network of water storage and conveyance facilities, groundwater development, and more recently, by improving water efficiency.

Significant water supply and water quality challenges persist on the local and regional scale. Although some regions have made great strides in water conservation and

Box 4-6 High-priority List of Streams for Future Instream Flow Studies

The Department of Fish and Game developed this list of 22 priority streams or watercourses for future instream flow. The list was compiled and ranked based on input from DFG staff, staff from the State Water Board, US Fish and Wildlife Service, and the National Marine Fisheries Service. In developing the ranking, staff considered criteria such as (1) presence of anadromous species; (2) likelihood, that DFG flow recommendations would provide a high level of improvement; (3) availability of recent flow studies or other relevant data; and 4) the possibility of partners/willing partners and landowners.

Rank	Stream or Watercourse	DFG Region	County
1	Butte Creek	2	Butte
2	Tuolumne River (below La Grange Dam)	4	Stanislaus
3	San Gregorio Creek (lower)	3	San Mateo
4	North Fork of Navarro River	1	Mendocino
5	Big Sur River	4	Monterey
6	Santa Maria River	5	Santa Barbara
7	Redwood Creek (tributary to Maacama)	3	Sonoma
8	Bear River (below Camp Far West)	2	Placer and Nevada
9	Shasta River	1	Siskiyou
10	Carmel River	4	Monterey
11	Santa Margarita River	6	Riverside
12	Merced River (below Crocker-Huffman Dam)	4	Merced
13	Redwood Creek (tributary to Napa)	3	Napa
14	Scott River	1	Siskiyou
15	Mattole River (near Whitethorn)	1	Humboldt
16	Dry Creek (tributary to Napa River)	3	Napa
17	Deer Creek (tributary to Yuba River)	2	Nevada
18	Mojave River	6	Riverside
19	Carpinteria Creek	5	Santa Barbara
20	Santa Ana River	6	Riverside, San Bernardino
21	Middle Fork Feather River	2	Plumas
22	Dos Pueblos Creek	5	Santa Barbara

Prepared by the Department of Fish and Game Pursuant to Public Resources Code (PRC) Section 10004, August 8, 2008

efficiency, the state's water consumption has grown along with its population. Many communities in the state are reaching the limits of their supply with current water systems management practices and regulations.

The state's water resources are variable, and agricultural, urban, and environmental water uses all vary according to the wetness or dryness of a given year. In very wet water years with excessive precipitation, agricultural and urban landscape (outdoor) water demands are lower due to the high amount of rainfall that directly meets the needs. Water demands are usually highest during average to below-average water years in which agricultural and outdoor water uses are at full deployment. During the very dry water years, demands for water are reduced as a result of urban and agriculture water conservation practices and because the available surface water supplies are at less-than-average levels for use.

An indicator of California's hydrology and the annual surface water supplies is the amount of water that flows into major rivers of the state. For the central portions of California, the Sacramento River Basin and San Joaquin River Basin indices have been used for many years to evaluate the amount of surface water available. As shown in Figure 4-4 and Figure 4-5 these two river indices describe unimpaired natural runoff from year 1906 to the present, with five-year classifications identified from wet to critical. Many decisions about annual water requirements for the Delta are based on these indices, as are the amounts of surface water supplies available to many agricultural and urban regions of the state.

Water years are measured from October 1 through September 30 of the following year. A water year refers to the September year. For example, water year 2006 covers the months October 2005 through September 2006.

Surface and Groundwater—a Single Resource

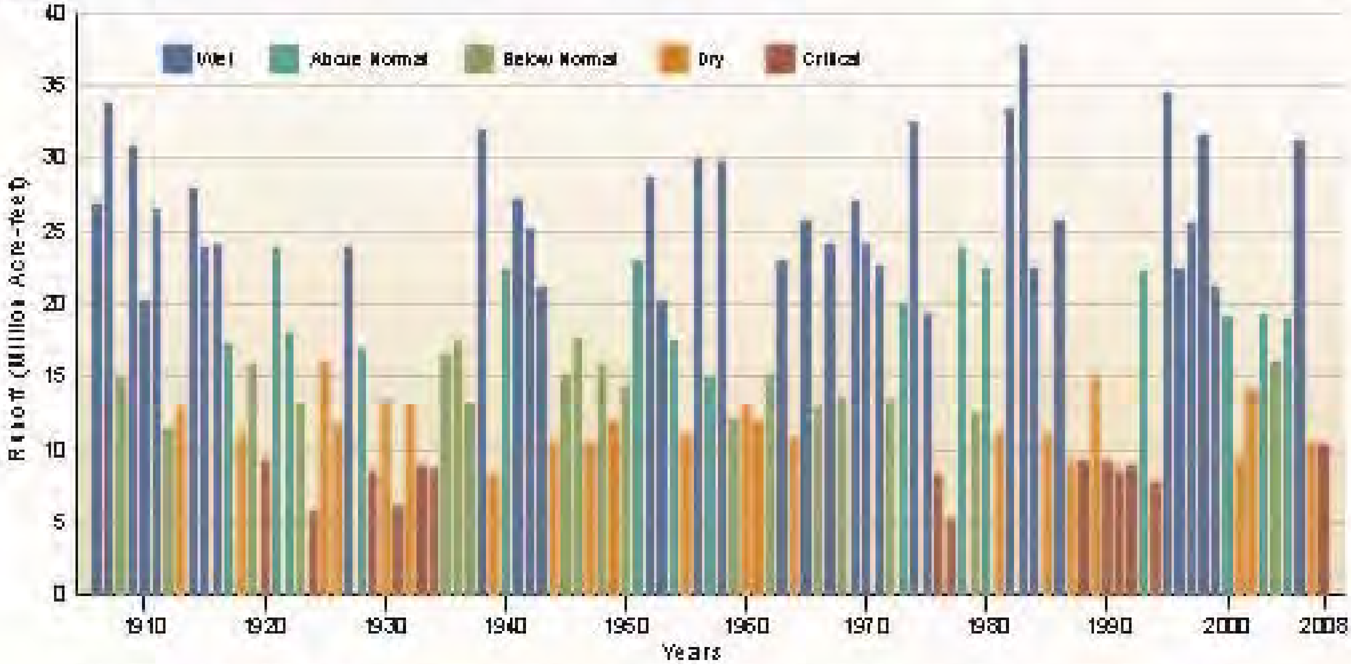
In California, winter precipitation and spring snowmelt are captured in surface water reservoirs to provide both flood protection and water supply to the state. Reservoir storage also factors into drought assessment. The state's largest surface "reservoir" is the Sierra Nevada snowpack, about 15 million acre-feet on average. A projected reduction in this snowpack due to climate change will have a critical impact on California water management. (See climate change discussion under Critical Challenges.)

Water year 2009 was another dry year for California. Figure 4-6 shows statewide runoff in percentage for 2006 through 2009 and end-of-year storage for the state's larger reservoirs: Trinity, Shasta, Oroville, Folsom, Don Pedro, New Melones, and San Luis reservoirs.

Other factors also affect the availability of surface water. In December 2007, US District Court Judge Oliver Wanger imposed restrictions on water deliveries from the Delta to protect the threatened delta smelt. This can significantly decrease deliveries to homes, farms, cities, and industry by both the State Water Project (SWP) and the federal Central Valley Project (CVP) depending on the water year type. In 2009, National Marine Fisheries Service issued a biological opinion intended to protect salmon, steelhead, and green sturgeon. NFMS calculates that its biological opinion will reduce by 5 to 7 percent combined the amount of water federal and State projects will be able to deliver from the Delta.

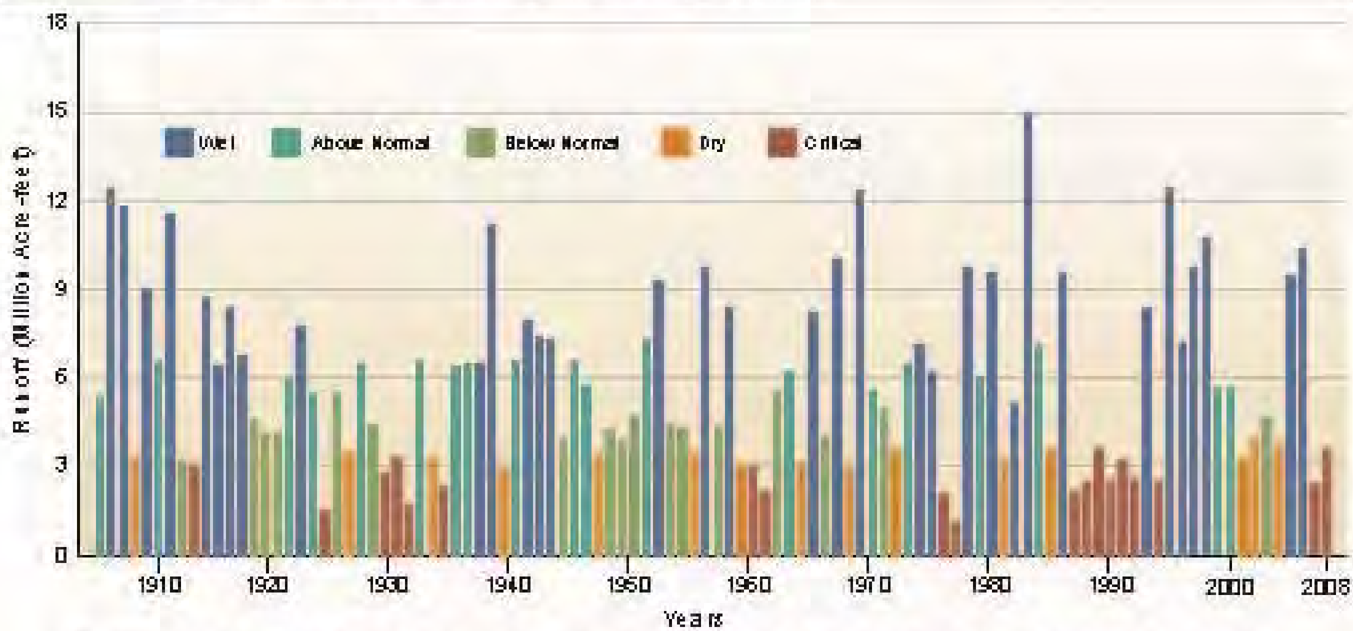
Initial SWP deliveries in 2009 were only 15 percent, although the final allocation was raised to 40 percent after early May snow and rain improved water conditions. Since the SWP began allocating deliveries in 1968, the lowest final allocations have been 35 percent in 2008; 39 percent, 2001; and 30 percent, 1991. DWR announced in December 2009 an initial allocation of 5 percent of total contracted water deliveries to the SWP contractors for 2010.

Figure 4-4 Sacramento Four Rivers unimpaired runoff, 1906–2008



The Sacramento Four Rivers are: Sacramento River above Bend Bridge, near Red Bluff; Feather River inflow to Lake Oroville; Yuba River at Smartville; American River inflow to Folsom Lake

Figure 4-5 San Joaquin Four Rivers unimpaired runoff, 1906–2008



The San Joaquin Four Rivers are: Stanislaus River inflow to New Melones Reservoir, Tuolumne River inflow to New Don Pedro Reservoir. Merced River inflow to New Exchequer Reservoir. San Joaquin River inflow to Millerton Reservoir.

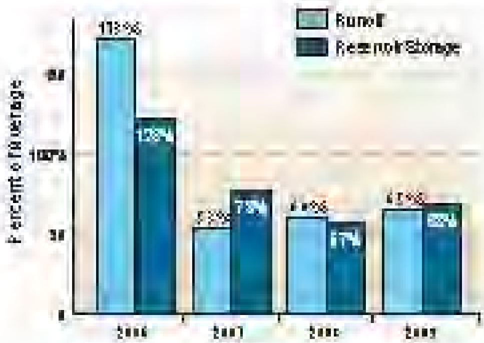
Box 4-7 Groundwater Overdraft

Overdraft is the condition of a groundwater basin in which the amount of water withdrawn by pumping over the long term exceeds the amount of water that recharges the basin. Overdraft is characterized by groundwater levels that decline over a period of years and never fully recover, even in wet years. Overdraft can lead to increased extraction costs, land subsidence, water quality degradation, and environmental impacts. A comprehensive assessment of overdraft in California's groundwater basins has not been conducted since 1980 (DWR 1980). It is estimated that overdraft is between 1 million and 2 million acre-feet annually (DWR 2003 Bulletin 118), but the estimate is only tentative with no current corroborating data.

In some cases the term overdraft has been incorrectly used to describe a short-term decline in groundwater in storage during a drought, or to describe a one-year decline of groundwater in storage. A one-year decrease of the amount of groundwater in storage is an annual change in storage and does not constitute overdraft. During a drought the aquifer is being used as a reservoir, and water is being withdrawn with the expectation that the aquifer will be recharged during a wet season to follow.

The total water year 2008 deliveries for the CVP are estimated at 5.7 million acre-feet. Historically, the CVP supplies annually about 7 million acre-feet of water for agriculture, cities, and the environment.

Figure 4-6 Total statewide runoff and key reservoir storage end of water years 2006-2009



Statewide runoff totals and end-of-water-year storage, 2006 to 2009, for key reservoirs (Trinity, Shasta, Oroville, Folsom, Don Pedro, New Melones, and San Luis) as a percentage of average.

Source: DWR 2009

Future deliveries of SWP water are subject to several areas of uncertainty:

- the recent and significant decline in pelagic organisms (open-water fish such as delta smelt and striped bass) in the Delta;
- climate change and sea level rise; and
- the vulnerability of Delta levees to failure due to floods and earthquakes.

In some areas, use of groundwater resources is threatened by high rates of extraction and inadequate recharge, or by contamination of aquifers as a result of land use practices (Box 4-7 Groundwater Overdraft) or naturally occurring contaminants. Management of groundwater resources is more complex than management of surface water resources because groundwater is not visible. The quality of water in private wells is unregulated and, thus, private well owners are often unaware of the potential water quality threats in their drinking water.

Small water systems and private well owners have historically experienced most of the water shortage emergencies during droughts. The majority of these problems result from dependence on unreliable water sources, commonly groundwater in fractured rock or small coastal terrace groundwater basins. Historically, at-risk geographic areas include the foothills of the Sierra Nevada and Coast Range, inland Southern California, and the

Box 4-8 Water Portfolio Concept and Key Definitions

This box explains how to read the water balance figures and tables—statewide and regional and about related information contained in this chapter, the regional reports, and in Volume 5 The Technical Guide.

The primary reason for using water portfolio tables and flow diagrams is to provide an accounting of all water that enters and leaves the state and how it is used and exchanged between the regions. This is important to all water planning activities. Water portfolio data provide information for comparison about how water uses and sources of supply can vary between the wet, average, and dry hydrologic conditions for each of the hydrologic regions of the state. The statewide information has been compiled from the 10 hydrologic regions.

The water summary table provides more detailed information about total statewide water supply sources and provides estimates for the primary uses of the state's supplies for these years. As indicated, a large component of the statewide water supply is used by natural processes, such as evaporation, evapotranspiration from native vegetation and forests, and percolation to groundwater. This water is generally not counted as part of the dedicated water supplies. Each of the regional reports presents this information at the regional level. For some of the items presented in this table, the numerical values were estimated because measured data are not available on a statewide basis.

A more detailed statewide summary of dedicated water supplies and uses for water years 1998-2005 is presented in Volume 5 The Technical Guide, which provides a breakdown of the components of developed supplies and uses for agricultural, urban, and environmental purposes. For each of the water years, information is presented as applied water and net water usage, as well as the calculated total water depletion. Much of the environmental water in this table is dedicated to meeting instream flow requirements and in Wild and Scenic rivers, which in some cases can later be reused for other downstream purposes.

Key Water Supply and Use Definitions

For consistency with the 1998 and 2005 updates of the California Water Plan, Update 2009 computes dedicated water supplies and uses on the basis of applied water data.

- Applied water refers to the total amount of water that is diverted from any source to meet the demands of water users, without adjusting for water that is used up, returned to the developed supply, or considered irrecoverable.
- Water Supplies and Uses present total statewide information only on an applied water basis. However, for the subsequent more detailed statewide data tables and each of the individual regional reports the information has been expanded to also present net water uses and water depletion.
- Net water supply and net water use data are smaller than applied water use. Net water use consists of water that is consumed in the system plus irrecoverable water and return flows.
- Water depletion is net water use minus water that can be later recovered, such as deep percolation and return flows to developed supply. Water supply information that is presented using applied water methodology is easier for local water agencies to evaluate because applied water use information is closer in concept to agency water system delivery data.

North Coast and Central Coast regions. Most small systems and private wells are located in lightly populated rural areas where opportunities for interconnections with another system, water transfers, or emergency relief are difficult.

Colorado River Supplies

Prior to 2003, California's annual use of Colorado River water ranged from 4.5 million to 5.2 million acre-feet. In recent years, Arizona has begun full use of its basic apportionment, and Nevada has approached full use of its entitlement and surplus allocation. Therefore, California has had to reduce its dependence on Colorado River water to 4.4 million acre-feet in average years.

A record eight-year drought in the Colorado River Basin has reduced current reservoir storage throughout the river system to just over 50 percent of total storage capacity.

Figure 4-7 California water balance by year, 1998-2005

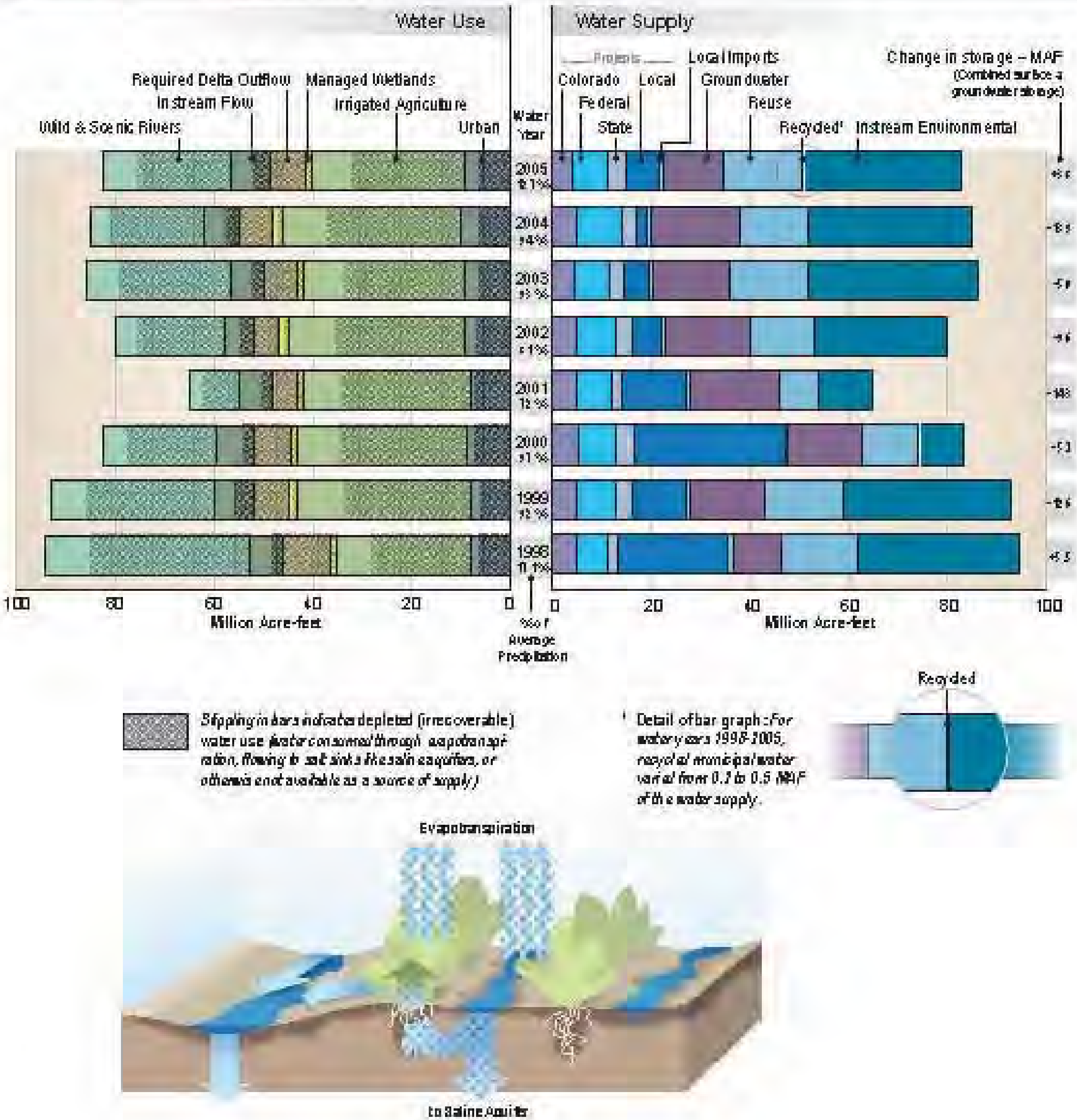


Table 4-2 California water balance summary, 1998-2005. (Numbers in million acre-feet)

Statewide	Water Year (Percent of average precipitation)							
	1998 (171%)	1999 (82%)	2000 (97%)	2001 (72%)	2002 (81%)	2003 (93%)	2004 (94%)	2005 (127%)
Water Entering the Region								
Precipitation*	329.6	181.3	187.7	139.2	160.1	184.4	186.5	251.9
Inflow from Oregon/Mexico	2.3	2.4	1.7	1.1	1.1	1.1	1.1	1.0
Inflow from Colorado River	5.0	5.1	5.3	5.2	5.4	4.5	4.8	4.2
Imports from Other Regions	NA	NA	NA	NA	NA	NA	NA	NA
Total	336.8	188.8	194.7	145.5	166.7	190.0	192.4	257.2
Water Leaving the Region								
Consumptive Use of Applied Water ** (Ag, M&I, Wetlands)	22.5	27.6	27.9	27.8	29.3	26.7	29.2	24.4
Outflow to Oregon/Nevada/Mexico	1.6	1.7	0.9	0.7	0.8	1.1	0.8	1.4
Exports to Other Regions	NA	NA	NA	NA	NA	NA	NA	NA
Statutory Required Outflow to Salt Sink	43.8	51.8	28.0	13.9	29.6	39.8	36.7	37.3
Additional Outflow to Salt Sink	73.0	34.0	37.1	17.7	24.0	29.9	24.7	22.7
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	190.5	86.3	106.5	99.7	92.7	97.7	114.9	167.6
Total	331.4	201.4	200.4	159.8	176.4	195.2	206.3	253.4
Storage Changes in the Region								
[+] Water added to storage [-] Water removed from storage								
Change in Surface Reservoir Storage	7.2	-4.1	-1.3	-4.6	0.1	3.7	-4.1	7.9
Change in Groundwater Storage ***	-1.7	-8.5	-4.4	-9.7	-9.7	-8.7	-9.8	-4.1
Total	5.5	-12.6	-5.7	-14.3	-9.6	-5.0	-13.9	3.8
Applied Water ** (compare with Consumptive Use)	33.9	41.3	41.8	41.2	43.9	40.6	44.1	38.2

* The percent precipitation is based upon a running 30-year average of precipitation for the region; discrepancies can occur between information calculated for Update 2009 and earlier published data.

** Definition: Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.

*** Change in Groundwater Storage is based upon best available information. Basins in the north part of the state (North Coast, San Francisco, Sacramento River and North Lahontan regions and parts of Central Coast and San Joaquin River Regions) were modeled - spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and years were calculated using the following equation:

GW change in storage = intentional recharge + deep percolation of applied water + conveyance deep percolation and seepage - withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

NA = Not Applicable

Water Portfolio and Water Balances

Statewide information has been compiled to present the current levels of California's developed water uses and the water supplies available for water years 1998 through 2005. Data for years 1998, 2000, and 2001 were presented Update 2005. For Update 2009, the same data structure and water portfolio concepts have been used to assemble and present statewide information for the additional years (see Box 4-8 Water Portfolio Concept and Key Definitions). Statewide summaries of the detailed water supplies and applied water uses, 1998 through 2005, are presented in Volume 5 Technical Guide. For consistency, the same portfolio format and data tables are used for regional reports.

Statewide balances are available for eight years, 1998-2005 (Figure 4-7 California water balance by year, 1998-2005 and Table 4-2 California Water summary, 1998-2005). Regional balances are available in the regional reports (Volume 3). The eight-year sequence did not include any major floods and does not encompass the possible range of far wetter and far drier years in the record.

The statewide water balance figure demonstrates the state's variability for water use and water supply. "Water use" shows how applied water was used by urban and agricultural sectors and dedicated to the environment; and "water supply" shows where the water came from each year to meet those uses.

California in an average water year like 2000 receives close to 200 million acre-feet of water from precipitation and imports from Colorado, Oregon, and Mexico. Of this total supply, about 50 to 60 percent is either used by native vegetation; evaporates to the atmosphere; provides some of the water for agricultural crops and managed wetlands (referred to as effective precipitation); or flows to Oregon, Nevada, the Pacific Ocean, and salt sinks like saline groundwater aquifers and Salton Sea. The remaining 40 to 50 percent, identified as dedicated or developed water supplies as shown in the figure and the table, is distributed among urban and agricultural uses, for protecting and restoring the environment, or as storage in surface water and groundwater reservoirs for later use. In any year, some of the dedicated supply includes water that is used multiple times (reuse) and water held in storage from previous years. Ultimately, about a third of the dedicated supply flows to the Pacific Ocean or to other salt sinks, in part to meet environmental water requirements for designated Wild and Scenic rivers and other environmental requirements and objectives.

In each of the regional reports, bar charts similar to the statewide water balance summary provide regional data; they can be compared to the statewide figure to understand how individual regions compare to the statewide distribution. Figure 4-8 depicts water balances for the hydrologic regions for year 2005, considered a wet year statewide. Water balances can be used to compare how water supplies and uses can vary between wet, average, and dry hydrologic conditions by region and how each region's water balance can vary from year to year.

Water balances can be used to compare how water supplies and uses can vary between wet, average, and dry hydrologic conditions by region and how each region's water balance can vary from year to year.

Figure 4-8 Water balance by region for water year 2005

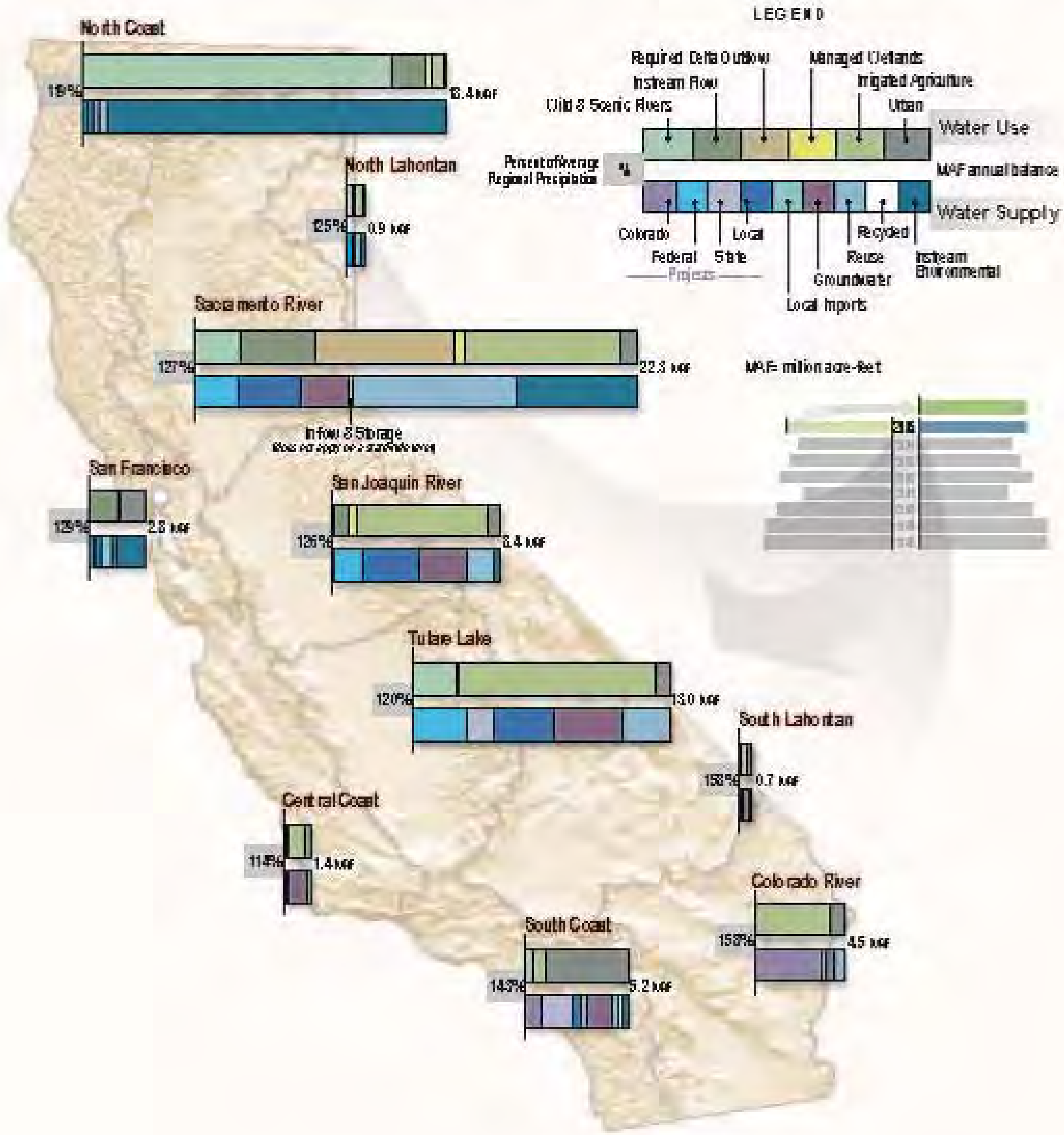


Figure 4-9 Regional inflows and outflows, water year 2005

Table 4-3 Basin plan adoption dates

Regional Board Region	Latest Basin Plan
1. North Coast	2007
2. San Francisco Bay	1995
3. Central Coast	1994
4. Los Angeles	1994
5. Sacramento-San Joaquin	4th edition 1998
5. Tulare Lake	2nd edition 2004
6. Lahontan	2007
7. Colorado	2006
8. Santa Ana	2008
9. San Diego	1994

When water supply and water use information from the regional reports is accumulated for the statewide totals, some categories are not applicable, such as interregional water transfers between one hydrologic region and an adjoining region. This type of information is not shown in the statewide tables. Figure 4-9 shows inflows and outflows between California's hydrologic regions using data from current base year 2005, a wet water year.

Water Quality

With a growing population of more than 30 million and a limited supply of fresh water, the protection of water for beneficial uses is of paramount concern for all Californians. The State Water Board and the nine Regional Water Boards, under the umbrella of the California Environmental Protection Agency, are responsible for protecting California's water resources. The Department of Public Health is responsible for protecting drinking water quality. Significant discussion of the major water quality issues and initiatives are included in the 12 regional reports of Volume 3. See further discussion under Contamination of Surface Water and Groundwater under Critical Challenges.

Since the passage of the federal Clean Water Act in 1972, California has made great strides in cleaning up its rivers, lakes, groundwater aquifers, and coastal waters. The primary focus of that effort, both in California and nationally, has been on wastewater discharged from "point sources," for example, sewer outfalls and other easily identifiable sources such as pipes. An even greater challenge is pollution resulting from "nonpoint sources," for example, runoff and drainage from urban areas, agriculture, timber operations, mine drainage, and other sources for which there is no single point of discharge. Nonpoint source pollution is the most significant California water quality challenge today and requires flexible and creative responses. Although water quality issues can be essentially divided into the two categories—point and nonpoint sources—specific constituents and circumstances vary from region to region as can be seen in reading each regional report.

Drought periods underscore the inseparability of water supply and water quality. Over-pumping groundwater basins to augment water supplies reduces long-term available water supply, increases pumping costs, and in some areas, like along the coast, degrades groundwater quality. In many areas surface water and groundwater are impaired by natural and human-made contaminants that can threaten human health, degrade the natural environment, increase water treatment costs, and effectively reduce the available water supply.

By law, water quality basin plans prepared by the State and Regional Water Boards when approved become part of the California Water Plan. In the future, those basin plans along with other water quality reports will be integrated regionally into the water portfolios. (See Table 4-3 Basin Plan adoption dates.)

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Project Operation and Reoperation

California depends on vast statewide water management systems to provide clean and reliable water supplies, protect lives and property from floods, withstand drought, and sustain environmental values. These water management systems include physical facilities and their operational policies and regulations. Facilities include more than 1,200 State, federal, and local reservoirs, as well as canals, treatment plants, and levees. Systems are often interconnected. The operation of one system can depend on the smooth operation of another. The successful operation of the complete system can be vulnerable if any parts fail. (Read more about this management objective and related strategies in Volume 2 Resource Management Strategies.)

Conditions today are much different than when most of California's water systems were constructed; and upgrades have not kept pace with changing conditions, especially considering growing population; changing society values, regulations, and operational criteria; and the future challenges accompanying climate change. California's flood protection system, composed of aging infrastructure with major design and construction deficiencies, has been further weakened by lack of maintenance. State and regional budget shortfalls and tightened credit market may delay new projects and programs.

Conditions today are much different than when most of California's water systems were constructed; and upgrades have not kept pace with changing conditions, especially considering growing population; changing society values; regulations, and operational criteria; and the future challenges accompanying climate change.

Surface and groundwater resources must be managed conjunctively to meet the challenges of climate change. Additional water storage and conveyance improvements are necessary to provide flexibility to facilitate water transfers between regions and to provide better flood management, water quality, and system reliability in response to daily and seasonal variations and uncertainties in water supply and use.

Water Governance

In California, water use and supplies are controlled and managed under an intricate system of common law principles, constitutional provisions, State and federal statutes, court decisions, and contracts or agreements. All of these components constitute the institutional framework for the protection of public interests and their balance with private claims in California's water allocation and management.

Many State agencies are involved in California water management. For example, DWR focuses on water delivery, water supply and flood planning, and infrastructure development. The State Water Boards manage water rights and water quality through regulation. Federal agencies also play a role in California water supply, quality, and flood control. DWR formally recognized the multiple levels of water-related interests and mandates by establishing the Water Plan's Steering Committee—composed of 21 State agencies and departments—and collaborating with federal and other non-State agencies. See more discussion of this cooperation in this volume: Chapter 1 Introduction and Chapter 3 Companion State Plans. See also Water Allocation, Use, and Regulation in California and other articles on water governance in Volume 4 Reference Guide.

California Constitution

The California Constitution was amended in 1928 to require that all water uses be reasonable and beneficial and to prohibit the waste and unreasonable use or unreasonable method of use of all water resources (Art. X, sec 2).

Federal Land Management

Federal agencies are trustees of about 50 percent of California land. The federal government owns more than 62 percent of California's 37 million-plus acres of forest land with the US Department of Agriculture Forest Service as the largest public forest landowner in the state. The national forests in California were established under the Organic Act of 1897, which states that a primary purpose of the national forests is to "secure favorable flows of water."

- US Forest Service, 20,166,000 acres (53.7 percent)
- US Bureau of Land Management, 1,650,000 acres (4.4 percent)
- National Park Service, 1,287,000 acres (3.4 percent)
- Other federal entities, 231,000 acres (0.6 percent)

Environmental issues related to resource management on national forests are addressed under the National Environmental Policy Act. (See forest management strategy in Volume 2 Resource Management Strategies.)

The US Bureau of Land Management administers more than 15 million acres of California's public lands, about 15 percent of the state's total acreage. Among these lands are 10.66 million acres of National Conservation Area and 3.7 million acres of Wilderness. Through BLM, the federal government also holds most (in volume) of the water rights in the state with more than 112 million acre-feet of water rights held, mainly through the delivery of the CVP.

Tribal Water Management

Water needs, rights, and uses of the many Tribes in California are as varied as the state's diverse water community. Some lack clean affordable water. Some need water for fisheries, wildlife, agriculture, and other cultural practices associated with Tribal lands

See information on Tribes and Tribal water issues in Volume 4 Reference Guide. Regional reports list Tribal concerns expressed at Water Plan regional workshops and plenary meetings to support the California Tribal Water Summit held in November 2009. Proceedings of this summit are in Volume 4

Flood Management

Traditionally, flood management practices focused on reducing flooding and susceptibility to flood damage largely through the physical measures intended to store floodwaters, increase the conveyance capacity of channels, and separate rivers from adjacent populations. In recent years, flood managers have recognized the potential for natural watershed functions and worked to integrate these two methods. Integrated flood management is a comprehensive approach to flood management that considers land and water resources at a watershed scale within the context of integrated water management, which aims to maximize the benefits of floodplains, minimize the loss of life and damage to property from flooding, and recognize the benefits to ecosystems from periodic flooding. Integrated flood management does not rely on a single approach to flood management, but instead uses various techniques—including traditional (or structural) flood protection projects, nonstructural measures (such as land use practices), and reliance on natural watershed functions—to create an integrated flood management system.

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For the purposes of federal flood insurance, the Federal Emergency Management Agency (FEMA) has traditionally used the "100 year" flood event, which refers to the level of flood flows expected at least once in a 100-year period. As California's hydrology changes, what is currently considered a "100-year" flood may strike more often, leaving many communities at greater risk. Moreover, as climate change alters predicted peak flows and precipitation levels, the assumption of "stationarity," which is used in flood-related statistical analyses like the "100-year" flood, becomes less assured. Planners need to factor a new level of safety into the design, operation, and regulation of flood control facilities—such as dams, floodways, bypasses, and levees—as well as the design of local sanitary sewers and storm drains.

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Critical Challenges

California is facing one of the most significant water crises in its history—one that is hitting hard because it has so many aspects. Growing population and reduced water supplies are exacerbating the effects of a multi-year drought. Climate change is reducing our snowpack storage and increasing floods. Court decisions and new regulations have resulted in the reduction of Delta water deliveries by 20 to 30 percent. Key fish species continue to decline. In some areas of the state our ecosystems and quality of underground and surface waters are unhealthy. The current global financial crisis will make it even more difficult to invest in solutions.

Figure 4-10 Potential impacts of continuing drought

Source: DWR 2009

The challenge to make sure that water is in the right place at the right time is at its greatest during dry years—when water for the environment is curtailed sharply, less water is available from rainfall for agriculture, and greater reliance on groundwater results in higher costs for many users. In the meantime, those who have already increased water use efficiency may find it more challenging to achieve additional water use reductions.

The quality of California water is of particular and growing concern. Various water management actions potentially have water quality impacts. These include transfers, water use efficiency, water recycling, conjunctive use of aquifers, storage and conveyance, Delta operations, crop idling, and hydroelectric power. Degraded water quality can limit, or make very expensive, some water supply uses or options because the water must be pretreated. Furthermore, water managers increasingly recognize that the water quality of various water supplies needs to be matched with its eventual use and potential treatment.

Challenges persist for California water management at statewide, regional, and local levels. Significant statewide challenges that require improved water management are summarized here. Challenges and opportunities on a regional level are addressed in the regional reports of Volume 3.

Dry-year Period (Drought)

A third consecutive dry year, drought conditions in the Colorado River Basin, and a Sierra snowpack that is now dangerously unreliable due to climate change are leaving many communities throughout California facing mandatory restrictions on water use and/or rising water bills. In 2008 and again in 2009, the Governor issued an executive order and proclamation in response to statewide drought conditions. If the conditions continue, the results could be catastrophic for our economy.

Impacts of drought are typically felt first by those most reliant on annual rainfall—ranchers engaged in dryland grazing, rural residents relying on wells in low yield rock formations, or small water systems lacking a reliable source. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in groundwater basins decline (Figure 4-10 Potential impacts of continuing drought).

California's drought periods could be extended and worsened by climate change. Warming temperatures and changes in rainfall and runoff patterns may exacerbate the frequency and intensity of droughts. Regions that rely heavily upon surface water (rivers, streams, and lakes) could be particularly affected as runoff becomes more variable and more demand is placed on groundwater. Combined with urbanization expanding into wildlands, climate change could further stress the state's forests, making them more vulnerable to pests and disease and changes in species composition (see more discussion of effects and impacts of climate change in subsection on later pages). Along with drier soils, forests may experience more frequent and intense fires, resulting in changes in vegetation, and eventually a reduction in the water supply and storage capacity of a healthy forest.

During droughts, California has historically depended upon its groundwater. However, many aquifers are contaminated, requiring remediation if they are to be used as water banks. Moreover, groundwater resources will not be immune to climate change; in fact, historical patterns of groundwater recharge may change considerably. Because droughts may be exacerbated by climate change, more efficient groundwater basin management will be necessary to avoid additional overdraft and to take advantage of opportunities to store water underground and eliminate existing overdraft.

During droughts, California has historically depended upon its groundwater. Because droughts may be exacerbated by climate change, more efficient groundwater basin management will be necessary to avoid additional overdraft and to take advantage of opportunities to store water underground and eliminate existing overdraft.

Floods and Flooding

The need for flood management improvements is more critical now than ever before. Over the years, major storms and flooding have taken many lives, caused significant property losses, and resulted in extensive damage to public infrastructure. However, a combination of recent factors has put public safety and the financial stability of State government at risk. California's flood protection system, composed of aging infrastructure with major design deficiencies, has been further weakened by deferred maintenance caused by funding shortfalls and regulatory obstacles. Escalating development in floodplains has increased the potential for loss of life and flood damage to homes, businesses, and communities.

Every region of the state faces flood risks. The Central Valley is a floodplain that historically was inundated at regular intervals. Coastal streams can overflow their banks during winter storms. Southern California is vulnerable to infrequent but devastating flooding. Development on alluvial fans faces unpredictable and changing paths of floodflows. Our water supplies and economy are threatened when Delta islands flood, and every part of California is exposed to the potential financial liability when levees of the Central Valley flood management system fail.

California's population growth and current development patterns present a major challenge to the state's flood management system.

California's population growth and current development patterns present a major challenge to the state's flood management system. In the Central Valley alone, much of the new development is occurring in areas that are susceptible to flooding. In some cases, land use decisions are based on poor or outdated information regarding the severity of the flood threat. Many flood maps being used by public agencies are decades old and do not reflect the most accurate information regarding potential flooding.

Catastrophic flooding within the Central Valley could equal or exceed the economic, social, and environmental damage caused by Hurricane Katrina in 2005. More than a half-million people live behind levees in California now, with populations continuing to grow. Further, State government potential liability in the aftermath of *Paterno v. State of California,* which held the state liable for flood-related damages caused by a levee failure, worsens the financial consequences of flooding.

Due to lack of funding and environmental concerns, both the State and local agencies in all regions of California have found it increasingly difficult to carry out adequate maintenance programs using established methods. Environmental regulations require that local and State agencies develop new approaches to deal with the backlog of maintenance activities. The time needed to complete environmental permitting processes can delay prompt maintenance of critical public safety infrastructure.

Climate change may worsen the state's flood risk by producing higher peak flows and a shift toward more intense winter precipitation. Rising snowlines caused by climate change will allow more of the Sierra Nevada watersheds to contribute to peak storm runoff. High-frequency flood events (e.g., 10-year floods) in particular may increase with changing climate. Along with changes in the amount of the snowpack and accelerated snowmelt, scientists project greater storm intensity, resulting in more direct runoff and flooding, which is exacerbated in urban areas by impervious land surfaces such as asphalt and traditional impervious concrete. Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. As streamflows and velocities change, erosion patterns will also change, altering channel shapes and depths, possibly increasing sedimentation behind dams, and affecting habitat and water quality. With potential increases in the frequency and intensity of wildland fires due to climate change, there is in turn a potential for more floods following fire, which will increase sediment loads and degrade water quality.

Adaptive Capacity: The ability of systems, organizations, and individuals to: (1) adjust to actual or potential adverse changes and events, (2) take advantage of existing and emerging opportunities that support essential functions or relationships, and/or (3) cope with adverse consequences, mitigate damages, and recover from system failures. It is an indicator of how well a system could or would adjust and/or recover to external changes or large perturbations (e.g., severe floods or droughts).

Resilience: Improve the capacity of resources and natural systems to return to prior conditions after disturbance.

Environment/Ecosystem

California has lost more than 90 percent of the wetlands and riparian forests that existed before the Gold Rush. Successful restoration of aquatic, riparian, and floodplain species and communities ordinarily depends upon at least partial restoration of physical processes that are driven by water. These processes include the flooding of floodplains, the natural patterns of erosion and deposition of sediment, the balance between infiltrated water and runoff, and substantial seasonal variation in streamflow. The diminution of these physical processes lead to displacement of native species by exotics, presenting another huge barrier to ecosystem restoration.

As an example, nearly all California waterways are controlled to reduce the natural seasonal variation in flow. Larger rivers are impounded to capture water from winter runoff and spring snowmelt and release it in the dry season. Many naturally intermittent streams have become perennial, often from receipt of urban wastewater discharges or from use as supply and drainage conveyances for irrigation water. The Delta has become more like a year-round freshwater body than a seasonally brackish estuary. In each case, native species have declined or disappeared. Exotics have become prevalent, often because they are better able to use the greater or more stable summer moisture and flow levels than the drought-adapted natives. (See ecosystem restoration in Volume 2 Resource Management Strategies.)

Reliable water supplies and resilient flood protection require ecosystem stewardship and sustainability to be a primary goal and fundamental activity for water resources management. Building adaptive capacity and system sustainability requires water and flood management projects to incorporate restoration and maintenance of biological diversity and natural ecosystem processes. Water supply and flood management systems are significantly more sustainable and economical when they preserve, enhance, and restore ecosystem functions. Planning and designing for ecosystem functions will help maintain resilient systems that can recover from severe natural disruptions and, in fact, allow quicker recovery with lower economic costs. Moreover, by reducing existing, non-climate stressors on the environment, ecosystems will have more capacity to adapt to new stressors and uncertainties brought by climate change.

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Climate Change

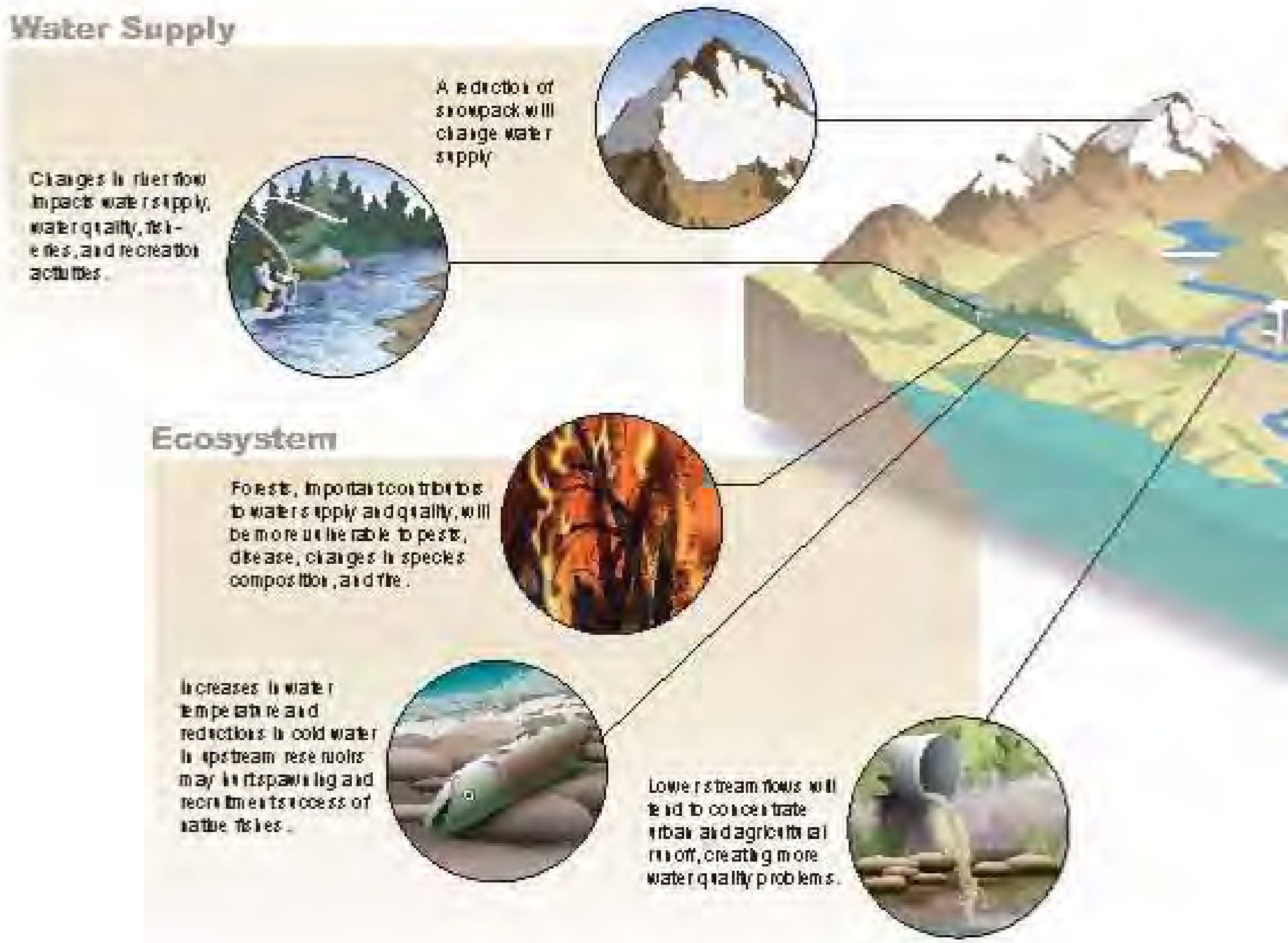
The exact conditions of future climate change remain uncertain, but there is no doubt that we are already seeing climate change effects (see Chapter 5 Managing an Uncertain Future and Volume 4 Reference Guide articles for further discussion on climate change science). Analysis of paleoclimatic data, such as tree-ring reconstructions of streamflow and precipitation, indicates a history of naturally and widely varying hydrologic

Figure 4-11 Climate change effects in California

What are the Expected Impacts from These Changes?

Climate change is already having a profound effect on California's water resources as evidenced by changes in snowpack, river flows, and sea levels. Scientific studies show these changes will increase stress on the water system in the future. Because some level of climate change is inevitable, the water system must be adaptable to change.

The impacts of these changes will gradually increase during this century and beyond. California needs to plan for water system modifications that adapt to the following impacts of climate change:



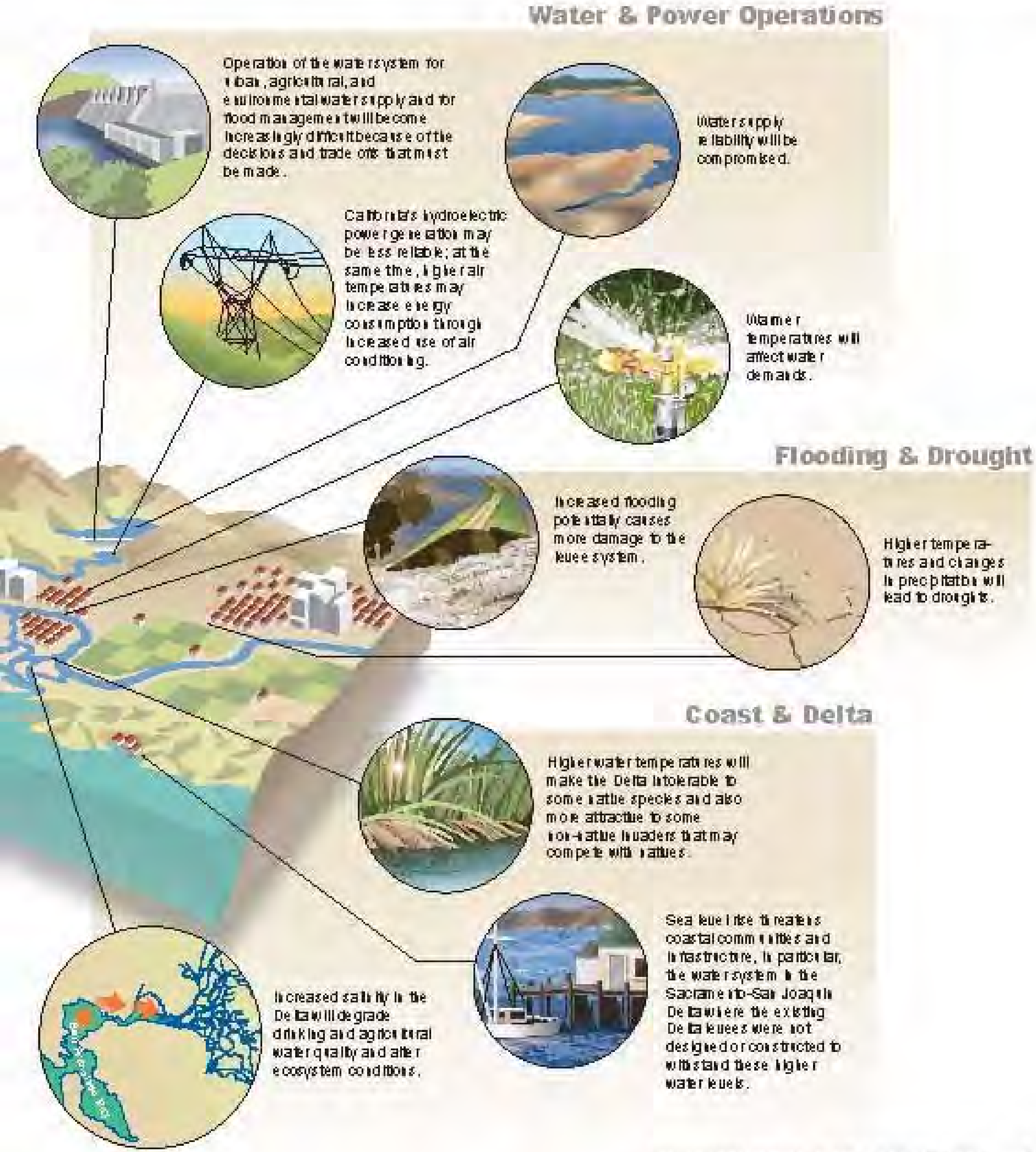
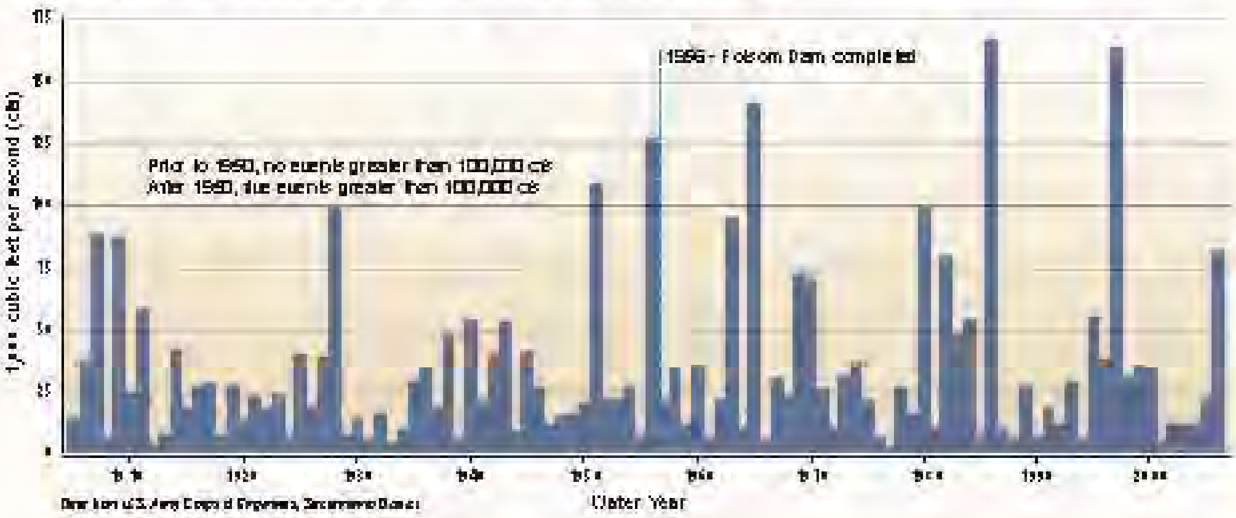

Water & Power Operations
Operation of the water system for urban, agricultural, and environmental water supply and for flood management will become increasingly difficult because of the decisions and trade offs that must be made.
Water supply reliability will be compromised.
California's hydroelectric power generation may be less reliable; at the same time, higher air temperatures may increase energy consumption through increased use of air conditioning.
Warmer temperatures will affect water demands.
Flooding & Drought
Increased flooding potentially causes more damage to the levee system.
Higher temperatures and changes in precipitation will lead to droughts.
Coast & Delta
Higher water temperatures will make the Delta intolerable to some native species and also more attractive to some non-native invaders that may compete with natives.
Sea level rise threatens coastal communities and infrastructure, in particular, the water system in the Sacramento-San Joaquin Delta where the existing Delta levees were not designed or constructed to withstand these higher water levels.
Increased salinity in the Delta will degrade drinking and agricultural water quality and alter ecosystem conditions.

Figure 4-12 American River runoff annual maximum three-day flow

The five highest floods of record on the American River have occurred since 1950.



conditions in California and the West, including a pattern of recurring and extended droughts. The average early spring snowpack in the Sierra Nevada decreased by about 10 percent during the last century, a loss of 1.5 million acre-feet of snowpack storage. During the same period, sea level rose 7 inches along California's coast. A disturbing pattern has also emerged in flood patterns. During the last 50 years, peak natural flows have increased on many of the state's rivers. At the other extreme, many Southern California cities have experienced their lowest recorded annual precipitation twice within the past decade. In a span of only two years, Los Angeles experienced both its driest and wettest years on record (Figure 4-11 Climate change effects in California).

Each region of the state will experience unique impacts from climate change.

California lies within multiple climate zones. Therefore, each region of the state will experience unique impacts from climate change. For some regions, improving watershed health will be an important concern. Other areas will be affected by saltwater intrusion. In particular, regions that now depend heavily on water imports from other regions will need robust strategies to increase regional self-sufficiency and cope with greater uncertainty in their future supply. Because economic and environmental effects depend on location, adaptation strategies must be regionally suited.

The water management community has invested in, and now depends upon, a system that relied on historical hydrology as a guide to the future for water supply and flood protection.

From all indications, the impact of climate change on hydrology and water resources management will be significant. The trends of the last century will likely intensify in this century. While the existing system has some capacity to cope with climate variability, extreme weather events, increased droughts and floods, and scarcity of water in some parts of the state will stretch that capacity to meet future needs. The water management community has invested in, and now depends upon, a system that relied on historical hydrology as a guide to the future for water supply and flood protection.

However, historical hydrology will have limited utility as a future planning tool. (Figure 4-12 American River runoff annual maximum three-day flow).

Climate change may also impact water demand. Warmer temperatures may increase evapotranspiration rates and extend growing seasons, thereby increasing the amount of water that is needed for the irrigation of certain crops, urban landscaping, and environmental needs. Warmer temperatures will also increase evaporation from surface reservoirs. Reduced soil moisture and surface flow will disproportionately affect the environment and other water users that rely heavily on annual rainfall such as rainfed agriculture, livestock grazing on non-irrigated rangeland, and recreation.

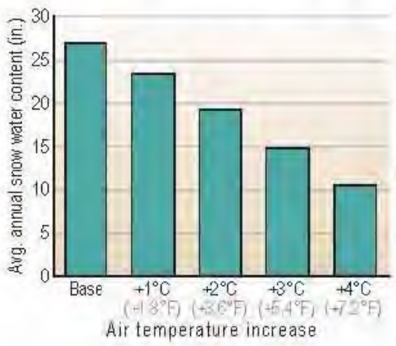
Snowmelt provides an annual average of 15 million acre-feet of water, slowly released from about April to July each year. Much of the state's water infrastructure was designed to capture the slow spring runoff and deliver it during the drier summer and fall months. Based upon historical data and modeling, DWR projects that by 2050 the Sierra snowpack will experience a 25 to 40 percent reduction from its historical average (Figure 4-13 Average annual snowmelt and Figure 4-14 Historical and projected decreasing California snowpack). Climate change is also anticipated to bring warmer storms that result in less snowfall at lower elevations, reducing the total snowpack.

Sea Level Rise

Of the many impacts of climate change, sea level rise presents the most challenging problem for which to plan because of the great uncertainty around ice sheet dynamics, as well as the potentially large impacts. Sea level rise also depends on local and regional factors such as land movement and atmospheric conditions. Much of the Delta, the current hub of California's State and federal water projects, consists of islands that are below sea level and protected by levees. Rising sea levels will increase pressure on fragile levees and will pose a significant threat to water quality. Local and regional investments in water and flood management infrastructure, as well as wetland and aquatic restoration projects, are also vulnerable to rising seas. (See Figure 4-15 Historical and projected sea level rise at Golden Gate.)

Recent peer-reviewed studies estimate a sea level rise of 4 to 16 inches by 2050 and between 7 and 55 inches by 2100 along California's coast. The implications of a 7-inch rise are dramatically different from a rise at the high end of the range. However, even a rise at the lower end of this range poses an increased risk of storm surge and flooding for California's coastal residents and infrastructure, including many of the state's wastewater treatment plants. Moreover, for Californians living in the Delta, or the millions who rely on drinking water or agriculture irrigated by Delta exports, the most critical impact of rising seas may be additional pressure on an already vulnerable levee system, which protects numerous islands that are currently below sea level and sinking. Catastrophic levee failures would likely inundate Delta communities and interrupt water supplies throughout the state.

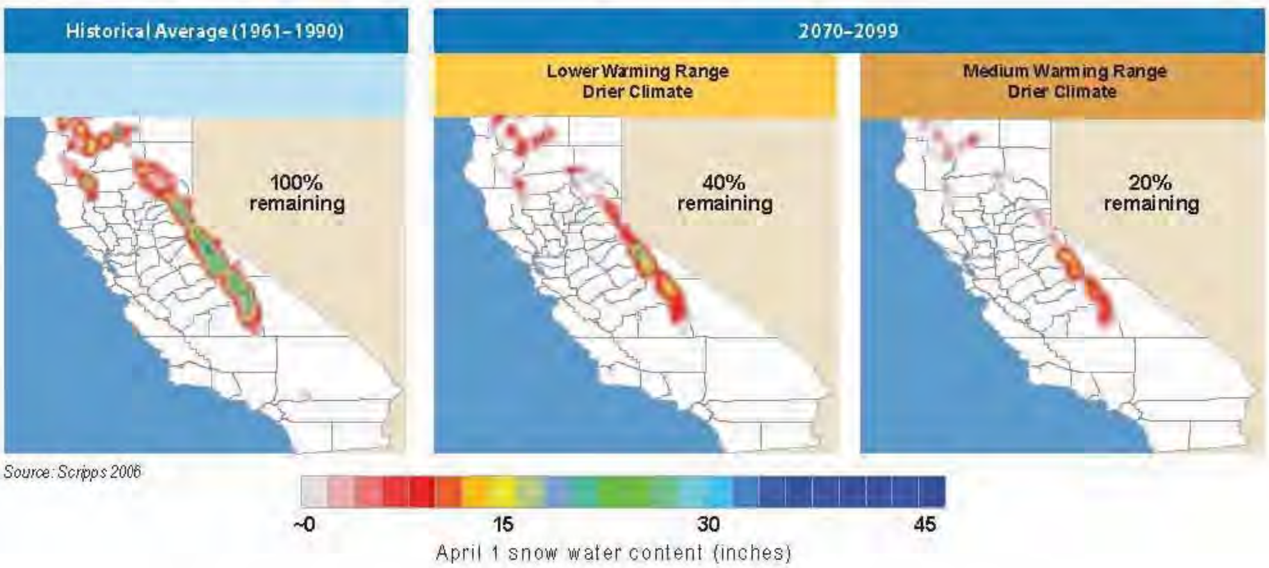
Figure 4-13 Average annual snowmelt for Upper Feather River Basin



Warming air temperatures may cause some of our precipitation to shift from snow to rain. This would lead to a reduction in the amount of snowpack, an important natural reservoir for storing water in the winter and later augmenting the water supply as spring snowmelt. Climate-change-induced shifts in the timing and the amount of snowmelt runoff may require revising traditional water planning practices. The Upper Feather River Basin provides water for Lake Oroville, the main water supply reservoir for the State Water Project.

Source: DWR 2009

Figure 4-14 Historical and projected decreasing California snowpack



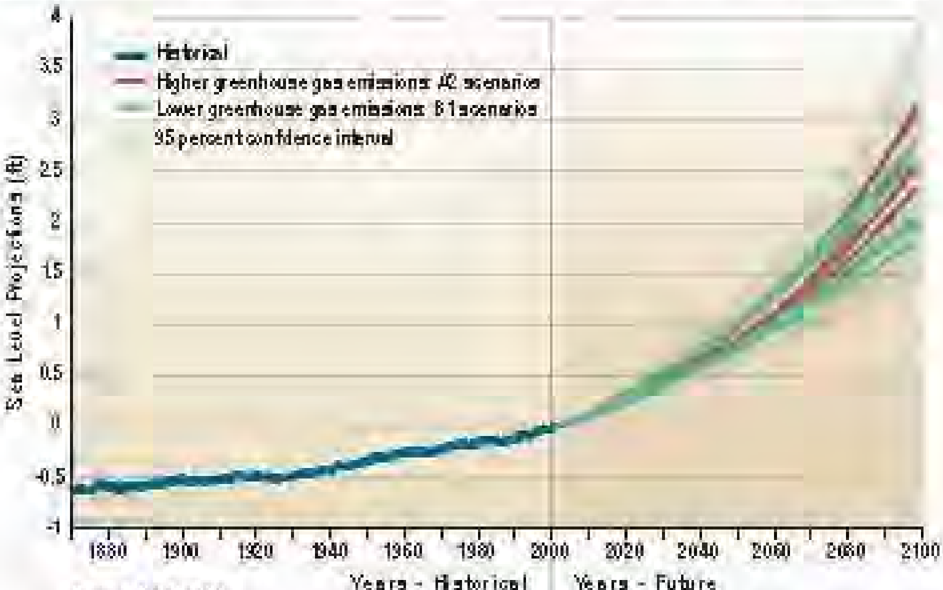
Source: Scripps 2006

Even without levee failures, Delta water supplies and aquatic habitat will be affected due to saltwater intrusion. An increase in the penetration of seawater into the Delta will further degrade drinking and agricultural water quality and alter ecosystem conditions. With the current water management system, more freshwater releases from upstream reservoirs will be required to repel the sea to maintain salinity levels for municipal, industrial, and agricultural uses. Alternatively, changes in upstream and in-Delta diversions, exports from the Delta, and conveyance through or around the Delta may be needed. Sea level rise may also affect drinking water supplies for coastal communities due to the intrusion of seawater into overdrafted coastal aquifers.

Water and Energy

Water and energy are two resources that are inherently linked, especially in California. Although water generates approximately 33 percent of the state's electricity, according

Figure 4-16 Historical and projected sea level rise at Golden Gate



Source: DWR 2009

Local and regional investments in water and flood management infrastructure, as well as wetland and aquatic restoration projects, are vulnerable to rising seas

to the California Energy Commission (CEC), water-related energy use in California consumes approximately 20 percent of the state's electricity, and 30 percent of the state's non-power plant natural gas (i.e., natural gas not used in turn to produce electricity). Water-related energy use includes pumping, treating, and distributing potable water, groundwater pumping, desalination, heating and cooling processes, pressurization, and the collection, treatment, recycling, and discharge of wastewater. Some water systems are net energy producers, for example, the federal CVP as well as San Francisco's Hetch Hetchy and the Los Angeles Aqueduct water systems. Others are net energy consumers, for example, Metropolitan Water District's Colorado River Aqueduct and the SWP. In fact, the SWP is the single largest user of electricity in the state, although the project produces about half of the energy it consumes.

Water-related energy use in California consumes approximately 20 percent of the state's electricity, and 30 percent of the state's non-power plant natural gas

Climate change may reduce the reliability of California's hydroelectric operations, which, according to the California Climate Action Registry and the California Air Resources Board, is the state's largest source of emission-free greenhouse gas energy. Changes in the timing of inflows to reservoirs may exceed generation capacity, forcing water releases over spillways and resulting in lost hydropower. Higher snow elevation, decreased snowpack, and early melting may result in less water available for power generation during hot summer months when energy demand is highest. The impact is compounded overall by the anticipated increased energy consumption due to higher temperatures and greater water demands in summer when less water is available. These conditions may in turn force greater dependency on fossil fuel generation that produces greenhouse gases.

Contamination of Surface Water and Groundwater

Water bodies may be impaired from various sources. For example, discharges from municipal and industrial facilities can impact water bodies. But compared to other sources, pollution from these point source discharges has been largely controlled. Discharges from agricultural lands, including irrigation return flow, flows from tile drains, and storm water runoff, can affect water quality by transporting pollutants, including pesticides, sediment, nutrients, salts, pathogens, and heavy metals, from cultivated fields into surface waters. Groundwater, in turn, has been affected by pesticide, nitrate, and salt contamination. Storm water flows over urban landscapes, as well as dry-weather flows from urban areas, also constitute a significant source of pollutants that contribute to water quality degradation in the state. These flows carry pollutants downstream, which often end up on the beaches and in coastal waters.

Changes in temperature and precipitation patterns caused by climate change will affect water quality. Higher water temperatures reduce dissolved oxygen levels, which can have an adverse effect on aquatic life. Where river and lake levels fall, pollutant concentrations will increase. Increased frequency and intensity of rainfall will produce more pollution and sedimentation due to runoff. In addition, more frequent and intense rainfall may overwhelm pollution control facilities that have been designed to handle sewage and storm water runoff under assumptions anchored in historical rainfall patterns.

Increased frequency and intensity of rainfall will produce more pollution and sedimentation due to runoff and may overwhelm pollution control facilities.

Changes in streamflow timing may require new approaches to manage discharge permitting and nonpoint source pollution.

Changes in the timing of river flows may affect water quality and beneficial uses in many different ways. At one extreme, flood peaks may cause more erosion, resulting in higher turbidity and concentrated pulses of pathogens, nutrients, and other pollutants. This will challenge water treatment plant operations to produce safe drinking water. Increased sediment loads associated with higher intensity flooding can also threaten the integrity of water works infrastructure, including more rapid buildup of sediments reservoir, and deposition of debris and sediments in canals and intakes. At the other extreme, lower summer and fall flows may provide less dilution of contaminants. These changes in streamflow timing may require new approaches to manage discharge permitting and nonpoint source pollution. Warmer water will distress many fish species and could require additional cold water reservoir releases. Higher water temperatures will also accelerate certain biological and chemical processes, increasing the growth of algae and microorganisms and the depletion of dissolved oxygen, and worsen the various impacts to water treatment processes. An increase in the frequency and intensity of wildfires will also have a deleterious effect on watersheds, vegetation, runoff, and, in the end, water quality.

Delta Vulnerabilities

The California Delta is in many respects the heart of our state, at once a water supply, an ecosystem, and a place that is indispensable to modern California.

The California Delta is in many respects the heart of our state, at once a water supply, an ecosystem, and a place that is indispensable to modern California. Improving the Delta ecosystem is a legally required condition of improving the water delivery system for Californians. But the Delta ecosystem is in deep trouble and the problems are increasing. Invasive species, water pumping facilities, and urban and agricultural pollution are degrading water quality and threatening multiple fish species with extinction. Encroaching urban development in the Delta is reducing wildlife habitat today and foreclosing opportunities to improve the ecosystem—and the Delta water conveyance system—in the future. The levee system has eliminated the dynamic land-water interfaces crucial for aquatic and riparian plants and animals.

In December 2008, the US Fish and Wildlife Service issued a new biological opinion for Delta smelt that would severely constrain water project operations, especially in the fall months.

More than half of Californians rely on water conveyed through the Delta's fragile and vulnerable levee system for at least part of their water. Residents and businesses near the Delta and San Francisco Bay area are most dependent on water from the Delta and its watershed. Urban areas south of the Tehachapi Mountains also use water exported from the Delta. Much of California's irrigated agriculture depends on water from the Delta watershed; one-sixth of all irrigated lands in the nation are in this watershed, including the southern San Joaquin Valley.

More than half of Californians rely on water conveyed through the Delta's fragile and vulnerable levee system for at least part of their water.

Overall, climate change will exacerbate many of the Delta's most difficult challenges. The seasonal mismatch between the demand for and availability of water will widen. The conditions under which the ecosystem will need to be managed will become more uncertain.

Deferred Maintenance and Aging Infrastructure

California's facilities require costly maintenance and rehabilitation as they age. In addition, they face many challenges: meeting the needs of a growing population and changing water use patterns, withstanding catastrophic natural events like earthquakes and floods, and adapting to the changes that accompany global climate change. Bottlenecks develop when physical and operational changes of existing water management systems do not keep pace with changes in capacity, regulations, and new environmental data.

Aging facilities risk public safety, water supply reliability, and water quality. The SWP is more than 35 years old; the federal CVP is more than 50 years old. Some local facilities were constructed nearly 100 years ago. Current infrastructure disrepair, outages, and failures and the degradation of local water delivery systems are in part the result of years of underinvestment in preventive maintenance, repair, and rehabilitation. The Public Policy Institute of California estimated the state's water supply and wastewater treatment systems maintenance backlog to be about $40 billion.

Aging facilities risk public safety, water supply reliability, and water quality. The SWP is more than 35 years old; the federal CVP is more than 50 years old. Some local facilities were constructed nearly 100 years ago.

Current water resources infrastructure is already strained to meet existing, competing objectives for water supply, flood management, environmental protection, water quality, hydropower, and recreation. In a changing climate, the conflicts between competing interests will be even greater as supplies become less reliable. Because prediction of climate change impacts will never be perfect, flexibility must be a fundamental tactic, especially with respect to water system operations. The improved performance of existing water infrastructure cannot be achieved by any single agency, and will require the explicit and sustained cooperation of many.

Levees

Much of the land in the Delta region is below sea level and is protected by a fragile system of levees. Many of the region's 1,330 miles of levees were built in the late 1800s and early 1900s without using modern engineering practices. The Delta levees are critical for protecting the various assets, resources, uses and services that Californians obtain from the region.

Since 1900, levee failures during high water and during dry weather have caused Delta islands to be flooded a total of 158 times. Some islands have been flooded and recovered multiple times.

Since 1900, levee failures during high water and during dry weather have caused Delta islands to be flooded a total of 158 times. Some islands have been flooded and recovered multiple times. A few islands, such as Franks Tract, have never been recovered.

Delta Risk Management Strategy Phase I (DRMS 2009) identified other concerns including the following:

- A major earthquake of magnitude 6.7 or greater in the vicinity of the Delta region has a 62 percent probability of occurring sometime between 2003 and 2032. This could cause multiple levee failures fatalities, extensive property destruction, and adverse economic impacts of $15 billion or more.
- While earthquakes pose the greatest risk to Delta region levees, winter storms and related high water conditions are the most common cause of levee failures in the region. Under business-as-usual practices, high water conditions could cause about 140 levee failures in the Delta over the next 100 years.
- Dry-weather levee failures (also called "sunny-day" events) unrelated to earthquakes, such as from slumping or seepage, will continue to occur in the Delta about once every seven years. Costs to repair a single island flooded as the result of a dry-weather levee failure are expected to exceed $50 million.
- The failure of levees in Suisun Marsh could result in impacts on several terrestrial wildlife species of concern, including the federally endangered saltmarsh harvest mouse and the California clapper rail.

DWR's document "Flood Warnings: Responding to California's Flood Crisis," submitted to the Legislature in January 2005 identified major deficiencies and challenges to the flood management system in the California Central Valley. A majority of California's agriculture industry is dependent on water from the Delta, and a catastrophic levee failure would result in cessation of pumping capacity for as much as 18 months, causing $30 billion to $40 billion in economic damage to the state.

The urgency of California's vulnerable Delta levees became more pronounced as the world watched the Katrina disaster hit New Orleans in August 2005. The US Army Corps of Engineers, in cooperation with DWR, identified 24 critical erosion sites on project levees in the Sacramento and San Joaquin River Flood Control systems that need repair before a catastrophic levee failure occurs.

Following these revelations and other findings, Governor Schwarzenegger in 2006 declared a State of Emergency for California's levee system.

Catastrophic Events and Emergency Response

The Delta faces extraordinary risks in both the near term and the long term. Earthquakes, river floods, sunny-day levee failures, and continuing subsidence and sea level rise all pose substantial risks to people, property, and infrastructure. Yet emergency response is divided among many different entities—at least 14 fire districts and 14 sheriff and police departments. During high water, many islands direct their own flood fights, although some uniformity is provided by DWR. The US Army Corps of Engineers has oversight authority only for those levees that meet its standards.

Traveling Delta roads to repair levees can be difficult, especially during high water when response crews must cross bridges or use auto ferries. Island living presents challenges for individual family emergency plans when children attend schools on islands separate from their homes.

Effective emergency preparedness and other actions are needed to reduce risks to people, property, and State interests in the Delta.

In other areas of California, catastrophic failure of dams could expose people and property to severe and swift flooding. Dams are designed and constructed to meet stringent safety standards and are subject to periodic inspection by DWR's Division of Dam Safety. Evacuation procedures are incorporated into hazard mitigation plans of local jurisdictions. Maintenance of these structures is needed to maintain their integrity and periodic review of potential structural risks associated with catastrophic events (such as earthquakes and floods) are needed to assure that these structures can withstand future threats.

Data Gathering and Sharing

A growing population, our stressed ecosystems, and California's economic future and its reliance on agriculture, industry, and technology all compete for the state's limited water resources. At the same time, uncertainty in climate change, energy sectors, and other drivers of future change require that we develop effective management strategies based on better science and technology. Data analysis, modeling, and other scientific tools are required to create and improve strategies that can maximize water supply reliability and water quality.

Scientists and managers must employ integrated water management and a systems approach to freshwater withdrawals, use, and disposal that considers physical, chemical, biological, social, behavioral, and cultural aspects.

Government reports have concluded that a key role for science and technology is to expand options for management and use of our water resources. Scientists and managers must employ integrated water management and a systems approach to freshwater withdrawals, use, and disposal that considers physical, chemical, biological, social, behavioral, and cultural aspects. Water law, economic incentives, public awareness, public education, and sensitivity to differences in value systems are cornerstones of effective water resource management. These require data and analytical tools that are greater than now available to water managers. (Read further discussion in Chapter 6 Integrated Data and Analysis.)

Disadvantaged Communities

All Californians do not have equal opportunity or equal access to State planning processes, programs, and funding.

Californians from disadvantaged, small, and underrepresented communities continue to face economic and environmental inequities with respect to water supply, participation in water policy and management decisions, and access to State funding for water projects. All Californians do not have equal opportunity or equal access to State planning processes, programs, and funding for water allocation, improving water quality, and determining how to mitigate potential adverse impacts to communities associated with proposed water programs and projects. (See Volume 4 Reference Guide article Environmental Justice in California Government.)

Most water, wastewater, and flood projects are not developed for disadvantaged and underrepresented communities; yet they can impact them. Even projects that convey "general" public benefit may not benefit environmental justice or disadvantaged communities proportionally. For example, water conservation programs that are heavily dependent upon toilet and washing machine rebates will have greater penetration in middle and upper class communities than they will on poorer communities that purchase less frequently and cannot afford the initial outlay for the fixture.

Funding

At a time when flood management maintenance and improvement efforts should be increased, investments in water, water quality, and infrastructure have been reduced at local government levels. Local governments in California have been severely restricted by two constitutional amendments regarding the use of property tax or benefit assessments to generate revenue (Propositions 13 and 218). The federal government also reduced the maximum that it would pay for the cost of new flood management projects, from 75 percent to 65 percent of the total project cost.

Although recent bond measures like Propositions 84 and 1E will provide a down payment for improving California's water and flood systems, climate change presents an ongoing risk that requires a long-term commitment of funding that is properly matched to anticipated expenditures, beneficiaries, and responsible parties.

Responses and Opportunities

Stewardship and Sustaining Natural Resources

California water resource management is placing more emphasis on integrated water management. Update 2005 promoted integrated water management to ensure sustainable water uses with and emphasis on environmental stewardship. Proposition 84 (see

Box 4-9 Investing in Watersheds

- Invest Consistently. A steady investment in watersheds results in the best yields. For over 30 years, DWR's programs have provided technical and financial assistance to local watershed managers on an ongoing basis.
- Actively Manage Resources. DWR works with agencies and groups to continually evaluate priorities, needs, and outcomes from State grants and assistance.
- Promote Diversity and Balance Assets. DWR offers diverse programs and local support activities, and has successfully invested millions of dollars to achieve sound watershed management for people and communities throughout California.
- Build Trust. DWR staff works closely with project proponents to guarantee a sound technical basis for their projects; conducts fair and open project selection processes for grant and loan programs; and promotes and participates in Environmental Justice efforts. DWR provides technical and financial assistance to support local community consensus building, planning and project implementation, and provides local coordinators for projects, giving a face to the program at the local, State, and federal levels.
- Create Enduring Value. DWR works in partnership with stewardship groups, organizations, and government agencies at all levels. DWR resource restoration programs reduce flood damage, support water supply reliability, protect and aid recovery of endangered species, protect and restore wetlands, enhance natural stream and river functions, and preserve the public trust resources of California.

discussion in Statewide and Interregional) authorized the appropriation of $1 billion to DWR to allocate to foster IRWM. Grants are awarded for projects that provide more than one benefit. Among those benefits can be water conservation and water use efficiency, creation and enhancement of wetlands and the acquisition, protection, and restoration of open space and watershed lands; watershed protection and management; agricultural lands stewardship; and ecosystem and fisheries restoration and protection.

Agricultural lands stewardship and working landscapes will increasingly be relied on to attenuate peak precipitation runoff and conserve water, as well as to provide critical habitat at key locations and sequester carbon while maintaining ongoing primary productivity of food and fiber. Moreover, this strategy helps landowners maintain their farms and ranches rather than being forced to sell their land because of pressure from urban development. New assistance programs and laws and regulations affecting agriculture have been created and enacted and old ones eliminated, reduced, or expanded as described in Chapter 20 Agricultural Lands Stewardship of Volume 2 Resource Management Strategies.

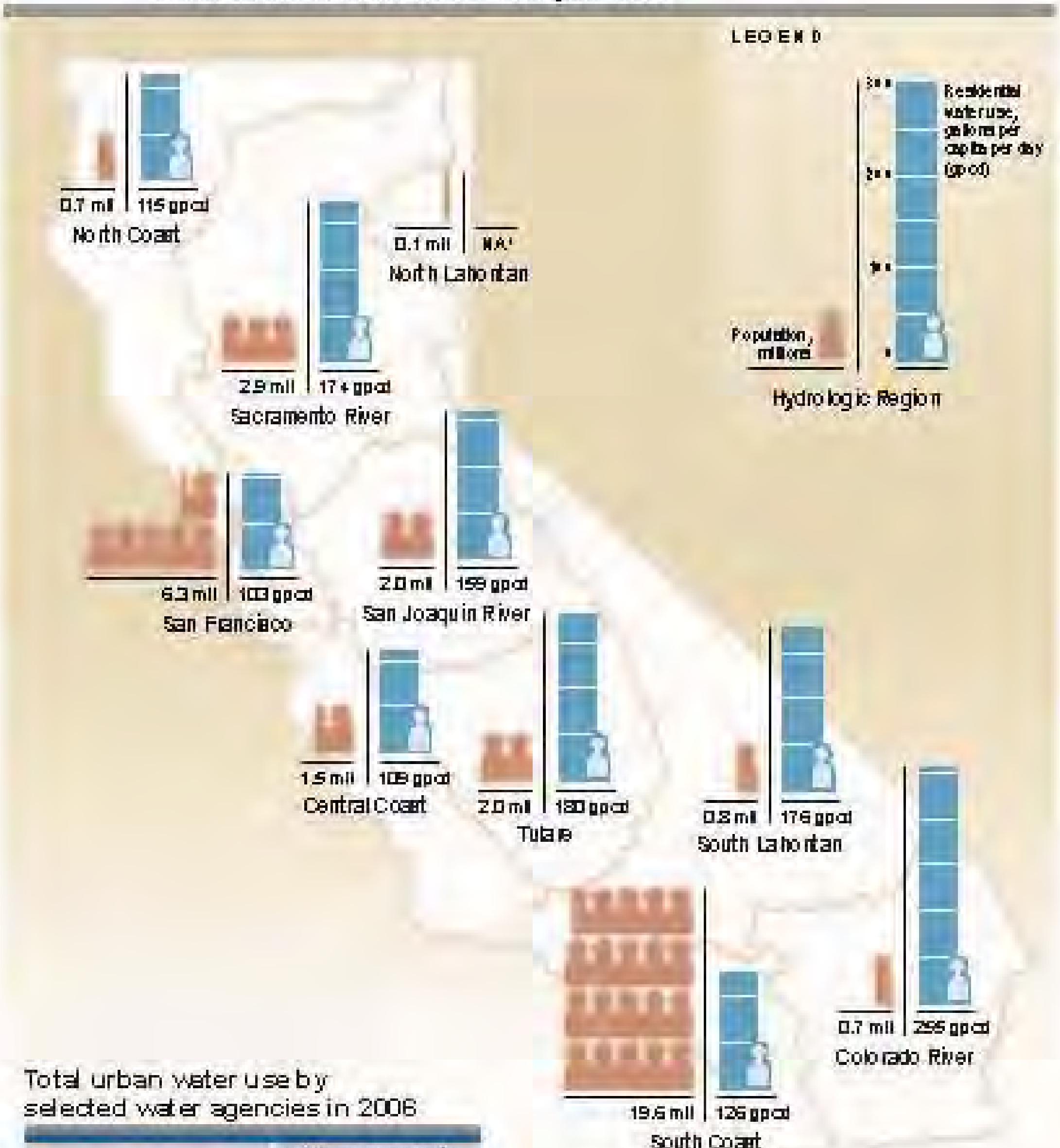
Watershed and Resource Restoration Programs

The DWR Watershed Program works with locally led stewardship efforts to integrate the needs of communities, urban and rural, with resource management that sustains watershed ecology. The program strives to inform and educate people about their watersheds and the benefits and values that those watersheds provide. It promotes managing water resources to protect, restore, and enhance the natural and human environments in California. DWR uses an investment strategy to guide its watershed programs (Box 4-9).

The California Watershed Indicators Council was formed to begin developing a framework for assessing the health of watersheds throughout the state.

The California Department of Conservation administers its Watershed Program to advance sustainable watershed-based management of California's natural resources through community-based strategies. The new statewide watershed program is an extension of the previous CALFED Bay-Delta Watershed Program and will include grants for watershed coordinators. Go to Web site: www.conservation.ca.gov/dlrp/wp/Pages/Index.aspx.

Figure 4-16 Regional population and per capita residential water use in California for water year 2005



Total urban water use by selected water agencies in 2006

Water Agency	Gallons per capita per day
San Francisco	95
Santa Barbara	127
Marin (MWD)	136
Los Angeles (LADWP)	142
Contra Costa (CCWD)	157
San Diego	157
East Bay (EBMUD)	166
Victorville (VVCWD)	246
Bakersfield	279
Sacramento	279
San Bernardino	296
Fresno	354

Developed by DWR staff using PWSS data from 2006

1. *The North Lahontan Hydrologic Region does not have enough usable data in the Public Water Systems Survey (PWSS) database to compute for baseline values.*

Population data source: CA Department of Finance 2006. *Report E-4 Population Estimates for Cities, Counties and State, 2001-2006 with 2000 DRU Benchmark.*

Residential water use data source: 20x2020 Agency Team. *20x2020 Water Conservation Plan.* 2009.

The per capita residential water use numbers in this map were taken from the *20x2020 Water Conservation Plan.* Those numbers were developed using DWR's Public Water Systems Survey (PWSS) data, averaging available data from 1995 to 2005. The urban water use data in the portfolios in the Water Plan were developed using the PWSS data for specific years, not an average of years. Thus, it is possible to compute a per capita residential water use number using the Water Plan urban residential water use values and populations, with differing results from the *20x2020 Water Conservation Plan* values.

Conservation: 20 percent Reduction by 2020

On February 28, 2008, Governor Schwarzenegger wrote to the leadership of the California State Senate outlining key elements of a comprehensive solution to problems in the Delta. The first element on the Governor's list was "a plan to achieve a 20 percent reduction in per capita water use statewide by 2020." In March 2008, the 20x2020 Agency Team convened and has developed a plan to meet the goal set by the Governor. Go to http://www.swrcb.ca.gov/water_issues/hot_topics/20x2020/index.shtml for information. See Senate Bill No. 7 Statewide Water Conservation as part of the 2009 Comprehensive Water Package discussed later under Statewide and Interregional Planning and Response. Figure 4-16 shows regional population and per capita residential water use in California for water year 2005.

Some of DWR's conservation efforts include:

- Encouraging widespread implementation of cost-effective conservation programs by urban and agricultural water suppliers.
- Helping water agencies develop water shortage contingency plans so they are prepared for future dry conditions or supply interruptions.
- Implementing programs to conserve water in landscaping and helping irrigation districts, farmers, and managers of large urban landscapes stretch their available water by providing daily information on plant water needs.

According to the California Energy Commission, end use of water is the most energy intensive portion of the water use cycle in California. Measures to increase water use efficiency and reuse will reduce electricity demand from the water sector which in turn can reduce greenhouse gas emissions.

End use of water is the most energy intensive portion of the water use cycle in California.

Regional/Local Planning and Management

Water managers have learned that even though imported supplies will continue to be important, they cannot be relied on to satisfy growing water demands. In the 1980s, concerns for protecting the environment were manifested in strong new laws and regulations. These regulations affected the ability of interregional water projects to deliver water. The resulting uncertainty also contributed to hesitancy to invest in additional facilities for these interbasin systems and forced water agencies to make difficult decisions about how to provide a reliable water supply.

Water managers are learning that planning for sustainable water use must address multiple resource objectives—water use efficiency, water quality protection, and environmental stewardship—and consider broad needs—economic growth, environmental quality, and social equity.

Local and regional agencies are looking more intensely at local water management options such as water conservation and recycling measures and groundwater storage. Water managers are learning that planning for sustainable water use must address multiple resource objectives—water use efficiency, water quality protection, and environmental stewardship—and consider broad needs—economic growth, environmental quality, and social equity.

Box 4-10 Complementary Management Approaches: IRWM and Watershed Management

Many overlapping characteristics and issues confront integrated regional water management and watershed management. Both approaches are being used in California to combine local, State, and federal resources to create a broader, more flexible water management system. Watershed management is a process of evaluating, planning, managing, and organizing land and other resource use within a watershed while maintaining a sustainable ecosystem. For regional planning purposes in California, a watershed includes living (including the people who live and work in the watershed) and nonliving elements within a defined geographical area that is generally characterized by the flow of water. Watershed management seeks to balance changes in community needs with evolving ecological conditions. (See Volume 2 for more discussion of watershed management as a resource management strategy.)

Coordination of Water and Land Use Planning

Several recently adopted and ongoing General Plan updates (e.g., Marin County, Solano County) have included local Climate Action Plans that establish local policies to reduce greenhouse gas emissions and adapt to the potential effects of climate change. The areas of local government influence and authority for reducing greenhouse gas emissions include community energy use, waste reduction and recycling, water and wastewater systems, transportation, and site and building design.

Large water purveyors (3,000 acre-feet/year or serving 300 customers) must prepare Urban Water Management Plans (UWMPs) that evaluate water supplies and demands over a 20-year period and are updated every 5 years (Water Code Sec. 10610 et seq.).

Integrated Regional Water Management and Planning (IRWM)

With integrated regional water management (IRWM), regions have been able to take advantage of opportunities that are not always available to individual water suppliers: reduce dependence on imported water and make better use of local supplies; enhance use of groundwater with greater ability to limit groundwater overdraft; increase supply reliability and security; and improve water quality. The extent to which regions have carried these out has been driven by considerations like economics, environment, engineering, and institutional feasibility. (See Box 4-10 Complementary Management Approaches: IRWM and Watershed Management)

Throughout California, stakeholders are working together to develop regional and watershed programs that cover multiple jurisdictions and provide multiple resource benefits. In several regions, agencies have formed partnerships to combine capabilities and share costs. IRWM has taken a foothold and is on the rise (Box 4-11 Examples of Regional Water Planning Efforts and Figure 4-3 for region acceptance process, 2009).

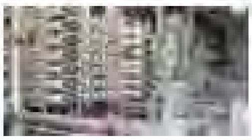
On September 30, 2008, Governor Schwarzenegger signed SBxx 1 (also denoted as SBx2 1 or SB2x 1) (http://www.leginfo.ca.gov/pub/07-08/bill/sen/sb_0001-0050/sbx2_1_bill_20080930_chaptered.pdf). SBx2 1 contains replacement language for

Box 4-11 Examples of regional water planning efforts

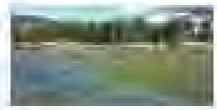
The following examples were provided to the Water Plan by the Roundtable of Regions

North Coast
- Araujo Dam Restoration Project
- Newell Water System Upper Mattole River Culvert Replacement
- Westport Water Tank

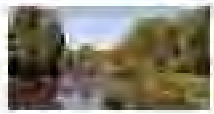
Sacramento River
- Red Clover Valley Restoration – Upper Feather River Watershed
- The Bear River Project: Reducing Legacy Mercury Contamination



San Francisco Bay
- Mocho Groundwater Demineralization Plant
- Water Saving Hero Campaign

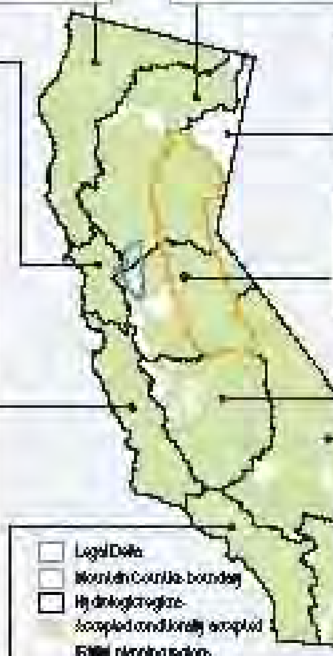


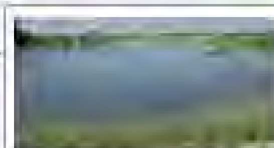
North Lahontan
- Merrill Davies Meadow Restoration Project



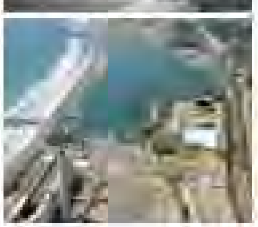
San Joaquin River
- Yosemite Spring Park Utility Company Improvements

Central Coast
- Groundwater Recharge Enhancement
- City of Watsonville Recycled Water Facility and Pajaro Valley Water Management Agency Coastal Distribution System
- Salinas Valley Water Project
- Santa Maria Wastewater Treatment Plant Expansion
- Los Osos Wastewater Project





Tulare Lake
- Southern Sierra IRWM Effort
- Alta Irrigation District Harder Pond recharge and banking project

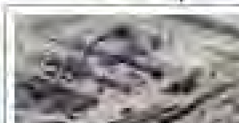


South Coast

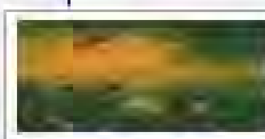
Los Angeles
- Calleguas Regional Salinity Management Project
- Arundo Removal
- Las Virgenes Creek Restoration
- Joint Water Pollution Control Plant Marshland Enhancement (Bixby Marshland)

Santa Ana
- Arlington Desalter
- Orange County Groundwater Replenishment System
- Solar Array at RP-6 Wastewater Treatment Plant

San Diego
- Tri-County Funding Area Coordinating Committee
- El Monte Valley Groundwater Recharge and River Restoration Project
- Carlsbad Desalination Project Local Conveyance
- Rancho California Water District Water Reclamation Project
- Santa Margarita Conjunctive Use Project



South Lahontan
- Inyo-Mono Integrated Regional Water Management Project
- Upper Amargosa Creek Recharge and Nature Park Project
- Antelope Valley Regional Recycled Water Project



Colorado River
- Coachella Valley Regional Water Management Group potential projects include water conservation, recycling, conjunctive use and water quality improvements.
- Salton Sea restoration partnership
- Coachella Canal Lining
- All-American Canal Project

Regional strategies information provided by Roundtable of Regions.

Box 4-12 New Law Supports Integrated Regional Water Management

The new Water Code language now known as the Integrated Regional Water Management Planning Act clarifies what an IRWM plan should address and also contains guidance to DWR as to the contents of guidelines for the IRWM grant program. The new language also broadens the definition of a regional water management group to include other persons who may be necessary for the development and implementation of a plan that meets requirements of Water Code Section 1040 and 10541.

The new IRWM Planning Act language includes seven things all IRWM plans shall do:

1. Protection and improvement of water supply reliability, including identification of feasible agricultural and urban water use efficiency strategies.
2. Identification and consideration of the drinking water quality of communities within the area of the plan.
3. Protection and improvement of water quality within the area of the plan, consistent with the relevant basin plan.
4. Identification of any significant threats to groundwater resources from overdrafting.
5. Protection, restoration, and improvement of stewardship of aquatic, riparian, and watershed resources within the region.
6. Protection of groundwater resources from contamination.
7. Identification and consideration of the water-related needs of disadvantaged communities in the area within the boundaries of the plan.

Among the contents of DWR guidelines requirements in the new planning act are:

- IRWM plans to be developed in a collaborative process;
- IRWM plans include consideration of the resource management strategies contained in the California Water Plan 2005 update and all subsequent updates;
- Evaluation of adaptability to climate change of water management systems; and
- IRWM plans include a public process that provides outreach and opportunity for participation in plan development and implementation of the plan by listed applicable stakeholders.

the Integrated Regional Water Planning Act of 2002 (California Water Code Section 10530 et seq) as well as the first appropriations for the IRWM grant program from Propositions 84 and 1E (see under Propositions and Bonds). See also Box 4-12 New Law Supports Integrated Regional Water Management.

Water agencies in many regions are successfully employing a mix of resource management strategies, many with State and federal incentives.

Water agencies in many regions are successfully employing a mix of resource management strategies, many with State and federal incentives. Experience is showing that these regional efforts can better resolve regional needs, especially when paired with statewide water management systems. Regional water management options can reduce physical and economic risks and provide regional control over water supplies. More is being done to meet water demands with water conservation, reoperation of facilities, water recycling, groundwater storage and management, transfer programs, and, in limited cases, regional or local surface storage reservoirs. (See Volume 2 Resource Management Strategies for further discussion of regional management options.) Overall, this increased focus on IRWM solves water management problems more efficiently, considers other resource issues, and enjoys broader public support.

Statewide and Interregional Planning and Response

We have learned that solutions to California's water management issues are best planned and carried out on a regional basis. However, State government has led collaborative efforts to find solutions to water issues having broad public benefits such as protecting and restoring the Delta, Salton Sea, Lake Tahoe, and Mono Lake. Statewide and interregional responses to water resource emergencies and management needs are

Box 4-13 Mokelumne River Forum and Interregional Conjunctive Use

A forum made up primarily of water agencies and local governments with an interest in the Mokelumne River has met since 2005 to discuss how to meet water management needs in the Sierra foothills, San Joaquin County, and the East Bay while resolving long-standing water rights disputes. The result of those discussions is a concept called the Mokelumne River Inter-Regional Conjunctive Use Project (IRCUP).

The IRCUP envisions conjunctive use on an inter-regional scale, with the potential to provide water supply and environmental benefits to a broad range of Mokelumne River basin stakeholders. Benefits would include:

- Storage and supplies for drought protection and to meet the future water needs of the citizens of Amador and Calaveras Counties.
- Long-term drought protection for areas of Alameda and Contra Costa Counties that are served by the East Bay Municipal Utility District (EBMUD).
- Drought protection, replenishment of water to reverse groundwater basin overdraft, and water to serve as a means to create a hydraulic barrier to prevent further salinity intrusion for the citizens of San Joaquin County.
- Replenishment of the groundwater basin by storing wet weather flows and then using that stored water to meet the supply and environmental needs of the citizens overlying the Eastern San Joaquin Groundwater Basin.

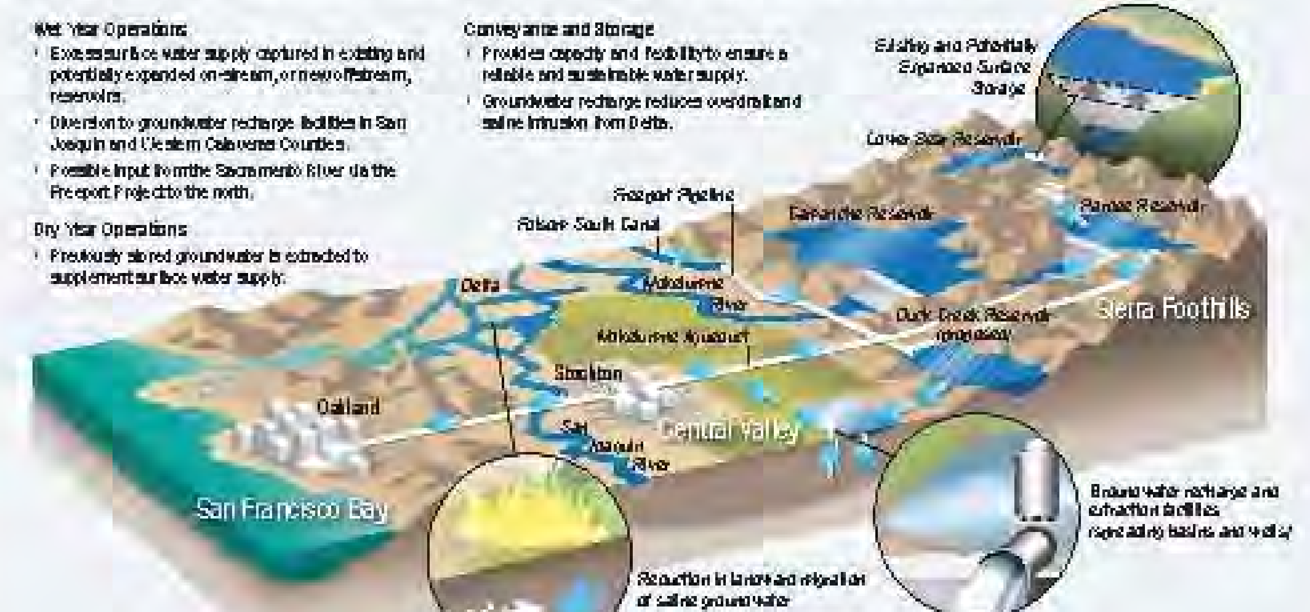
The forum has recently begun to expand its discussions to consider environmental principles and alternative water management solutions, such as demand-side management and the use of treated storm water and disinfected wastewater for groundwater recharge.

The Mokelumne River flows from the western Sierra Nevada into the Sacramento-San Joaquin River Delta and provides water for the environment, agriculture, hydropower generation, and communities in the watershed. Water is also exported for use in the EBMUD service area.

Mokelumne River Forum Members

- Alpine County
- Amador County
- Amador Water Agency
- Calaveras County Water District
- Calaveras Public Utility District
- California Department of Water Resources
- City of Lodi
- City of Stockton
- San Joaquin County Flood Control and Water Conservation District
- Mokelumne River Water and Power Authority
- East Bay Municipal Utility District
- Jackson Valley Irrigation District
- North San Joaquin Water Conservation District
- Stockton East Water District
- Woodbridge Irrigation District

Elements of the Mokelumne River Integrated Regional Conjunctive Use Project



summarized in this section, including programs, task forces, reports, water bonds, legislation, and federal programs. (See Box 4-13 Mokelumne River Forum as a specific example of interregional response.)

Recent Litigation

Pueblo right. A water right possessed by a municipality which, as a successor of a Spanish or Mexican pueblo, is entitled to the beneficial uses of all needed, naturally occurring surface water and groundwater of the original pueblo watershed. Pueblo rights are paramount to all other claims.

California's water rights system incorporates riparian doctrine, prior appropriation doctrine, ground water use, and pueblo rights. The state's water law is contained in the California Water Code at www.leginfo.ca.gov. For information on water litigation and legislation since Update 2005, go to Volume 4 Reference Guide.

Recent Legislation

2009 Comprehensive Water Package

Governor Schwarzenegger and State lawmakers successfully crafted a plan to meet California's growing water and ecosystem challenges. A comprehensive deal was approved and signed by the Governor as part of the 2009-10 Seventh Extraordinary Session in November 2009. The package represents major steps toward ensuring a reliable water supply for future generations, as well as restoring the Delta and other ecologically sensitive areas.

The plan is composed of four policy bills (SB-Senate bills) and an $11.14 billion bond. It establishes a Delta Stewardship Council, sets ambitious water conservation policy, ensures better groundwater monitoring, and provides funds for the State Water Boards for increased enforcement of illegal water diversions. The bond, which must be approved by voters, will fund, with local cost-sharing, drought relief, water supply reliability, Delta sustainability, statewide water system operational improvements, conservation and watershed protection, groundwater protection, and water recycling and water conservation programs. Some information about individual policy bills are listed below. For more information, see 2009 Comprehensive Water Package Summary in Volume 4 Reference Guide.

- SB 1 Delta Governance/Delta Plan establishes the framework to achieve the co-equal goals of providing a more reliable water supply to California and restoring and enhancing the Delta ecosystem. The co-equal goals will be achieved in a manner that protects the unique cultural, recreational, natural resource, and agricultural values of the Delta.
- SB 6 Groundwater Monitoring requires, for the first time in California's history, that local agencies monitor the elevation of their groundwater basins to help better manage the resource during both average water years and drought conditions.
- SB 7 Statewide Water Conservation creates a framework for future planning and actions by urban and agricultural water suppliers to reduce California's water use. For the first time in California's history, this bill requires the development of agricultural water management plans and requires urban water agencies to reduce statewide per capita water consumption 20 percent by 2020.

- SB 8 Water Diversion and Use/Funding improves accounting of the location and amounts of water being diverted by recasting and revising exemptions from the water diversion reporting requirements under current law. Additionally, this bill appropriates existing bond funds for various activities to benefit the Delta ecosystem and secure the reliability of the state's water supply, and to increase staffing at the State Water Boards to manage the duties of this statute.

The Safe, Clean, and Reliable Drinking Water Supply Act of 2010 is an $11.14 billion general obligation bond proposal that would provide funding for California's aging water infrastructure and for projects and programs to address the ecosystem and water supply issues in California. The bond is composed of seven categories, including drought relief, water supply reliability, Delta sustainability, statewide water system operational improvement, conservation and watershed protection, groundwater protection and water quality, and water recycling and water conservation. The proposed bond is expected to go before voters in November 2010.

Strengthening Flood Protection

In October 2007, the Governor signed several pieces of legislation aimed at strengthening flood protections in California. The legislative package will lead to the development of a comprehensive Central Valley Flood Protection Plan, reform the Reclamation Board to improve efficiency, require cities and counties to increase consideration of flood risks when making land use decisions, and create a new standard in flood protection for urban development in the region. Below are some examples of this legislative package. See Volume 4 the Reference Guide for article on more water-related legislation approved in California since Update 2005.

- **AB 162 Land Use: Water Supply.** AB 162 requires cities and counties to amend the land use element of their general plans to identify those areas that are subject to flooding as identified by floodplain mapping prepared by the Federal Emergency Management Agency or DWR. The act also requires, upon the next revision of the housing element, that the conservation element identify rivers, creeks, streams, flood corridors, riparian habitat, and land that may accommodate floodwater for purposes of groundwater recharge and stormwater management.
- **SB 5 Central Valley Flood Protection Act.** SB 5 requires DWR and the Central Valley Flood Protection Board (formerly named the Reclamation Board) to prepare and adopt a Central Valley Flood Protection Plan by 2012, and establishes flood protection requirements for local land-use decisions consistent with the Central Valley Protection Plan.

In 2006, DWR announced a multi-faceted initiative to improve public safety through integrated flood management. Success of the FloodSAFE program depends on active participation from many key partners.

California FloodSAFE Program

In January 2005, Governor Schwarzenegger drew attention to the state's flood problem, calling for improved maintenance, system rehabilitation, effective emergency response, and sustainable funding. In a white paper titled "Flood Warnings: Responding to California's Flood Crisis," DWR outlined the flood problems that California faces and offered specific recommendations for administrative action and legislative changes.

Since that time, California has begun the long process to improve flood management systems – investing heavily to complete emergency repairs quickly near several high-risk urban areas, informing the public about flood risks, enacting significant new laws, and providing funds to lead a sustained effort to improve flood management statewide. In 2006, DWR launched a multi-faceted initiative to improve public safety through integrated flood management. The FloodSAFE program is a collaborative statewide effort designed to accomplish five broad goals:

- **Reduce the Chance of Flooding.** Reduce the frequency and size of floods that could damage California communities, homes and property, and critical public infrastructure.
- **Reduce the Consequences of Flooding.** Take actions prior to flooding that will help reduce the adverse consequences of floods when they do occur and allow for quicker recovery after flooding.
- **Sustain Economic Growth.** Provide continuing opportunities for prudent economic development that supports robust regional and statewide economies without creating additional flood risk.
- **Protect and Enhance Ecosystems.** Improve flood management systems in ways that protect, restore and where possible enhance ecosystems and other public trust resources.
- **Promote Sustainability.** Take actions that improve compatibility with the natural environment and reduce the expected costs to operate and maintain flood management systems into the future.

Success of the FloodSAFE program depends on active participation from many key partners, such as Cal EMA, Central Valley Flood Protection Board, DFG, US Army Corps of Engineers, FEMA, US Fish and Wildlife Service, the National Oceanic Atmospheric Administration, Tribal entities, and many local sponsors and other stakeholders. DWR will continue to work closely with key partners and stakeholders to accomplish the FloodSAFE Vision.

Recent Drought Response

In June 2008, the Governor declared a statewide drought, directing State agencies and departments to take immediate action to address the serious drought conditions and water delivery reductions. He also issued a Central Valley State of Emergency Proclamation for nine Central Valley counties (Sacramento, San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Kern) to address urgent water needs. DWR and the US Bureau of Reclamation held workshops, "Preparing for Action," for urban water suppliers in October 2008 to help them better prepare for a drought.

In response to dry conditions in 2007, when Southern California communities experienced their driest year on record and when the Colorado River Basin continued in a period of unprecedented dryness, DWR published "California Drought: An Update" (April 2008). The purpose of this report was to update an earlier DWR report on drought published in 2000, with special emphasis on advanced drought-related research. The report features contributed articles from climate scientists whose research covers a wide range of drought, climate change, and variability topics. It also provides updates on hydrologic conditions and selected resource management subjects since publication of the 2000 report. A 2009 update was also published in December.

In February 2009, Governor Schwarzenegger issued a proclamation declaring a state of emergency due to drought conditions. In response, DWR issued a report to the Governor, California's Drought: Water Conditions and Strategies to Reduce Impacts (March 2009) and monthly drought updates that detail regional responses to this drought and its regional impacts. (See DWR's California's Drought Web page at http://www.water.ca.gov/drought/updates.cfm.)

The US Department of Interior responded by creating a Federal Drought Action Team of representatives from many federal agencies to work cooperatively with California's drought response team to respond to communities facing significant drought. In addition, the US Bureau of Reclamation would provide operational flexibility to convey and store water to facilitate transfers and exchanges that can move water to critical-need areas, and to expedite any related environmental review and compliance actions. See the American Recovery and Reinvestment Act for water reuse projects and other water projects.

DWR continues to work on actions to prepare for the possibility California's drought continuing into 2010 and beyond. These include increased water conservation, a 2010 drought water bank, a long-term water transfer program, improvements to the California Irrigation Management Information System, and meeting with Cal EMA and other state and local agencies to coordinate emergency response activities.

DWR and Water Plan staff and the State Agency Steering Committee prepared a five-year Statewide Drought Contingency Plan as part of Update 2009. The purpose of the plan is to articulate a coordinated State government strategy for preparing for, responding to, and recovering from drought. (See Volume 4 Reference Guide.)

2009 Drought Water Bank

To help facilitate the exchange of water throughout the state, DWR established the 2009 Drought Water Bank. Through the program, DWR purchased about 74,000 acre-feet of water from willing sellers primarily from water suppliers upstream of the Delta. This water was transferred using SWP or CVP facilities to water suppliers that were at risk of experiencing water shortages in 2009 due to drought conditions and required supplemental water supplies to meet anticipated demands.

Governor's Strategic Growth Plan

The Strategic Growth Plan (SGP), designed to restore and maintain California's roads, schools, ports, and water supply, was launched in January 2006. Governor Schwarzenegger proposed investing and leveraging billions of dollars in the state's infrastructure over the next 20 years to maintain California's economic strength and high quality of life.

In September 2008, Governor Arnold Schwarzenegger signed SB 732, creating the Strategic Growth Council. The council is a cabinet level committee that is tasked with coordinating the activities of state agencies to:

- improve air and water quality,
- protect natural resource and agriculture lands,
- increase the availability of affordable housing,
- improve infrastructure systems,
- promote public health, and
- assist State and local entities in the planning of sustainable communities and meeting AB 32 goals

The Council is composed of agency secretaries—from Business Transportation and Housing, California Health and Human Services, California Environmental Protection Agency, and the California Natural Resources Agency—the director of the Governor's Office of Planning and Research, and a public member appointed by the Governor.

Substantial investments in water management activities are needed to support a vital economy, a healthy environment, and a reliable water supply (http://gov.ca.gov/index.php?/issue/sgp-backpage/sgp-flood-water). The Strategic Growth Plan proposes $5.95 billion to ensure reliable water supplies and cope with climate change effects:

- Water Storage - $4.5 billion ($2.5 billion general obligation bonds and $2.0 billion revenue bonds)
- Delta Sustainability - $1.0 billion (general obligation bonds)
- Water Resources Stewardship - $250 million (general obligation bonds)
- Water Conservation - $200 million (general obligation bonds)

AB 32 – California Global Warming Solutions Act of 2006

The AB 32 Scoping Plan was developed in coordination with the Climate Action Team. The Scoping Plan proposes a comprehensive set of actions designed to reduce overall GHG emissions in California.

California is the 12th largest emitter of carbon in the world despite leading the nation in energy efficiency and environmental protection standards. For this reason, the California Global Warming Solutions Act of 2006 mandated a reduction of greenhouse gas (GHG) emissions to 1990 levels by 2020. The California Air Resources Board is the lead agency for implementing AB 32 and developing a scoping plan to outline the State's strategy to achieve the 2020 GHG emissions limit. The board approved the Scoping Plan in December 2008.

The AB 32 Scoping Plan was developed in coordination with the Climate Action Team. CAT included a multi-agency water-energy subgroup that developed GHG mitigation strategies for energy consumption related to water use. The Scoping Plan proposes a comprehensive set of actions designed to reduce overall GHG emissions in California, improve the environment, reduce the state's dependence on oil and diversify energy sources, save energy, create new jobs, and enhance public health. The measures in the Scoping Plan will be developed over 2009 and 2010 and be in place by 2012.

The water and energy component of the Scoping Plan includes six approaches to achieving a reduction in the energy intensity of water uses and water and wastewater management systems:

1. Water use efficiency
2. Water recycling
3. Urban water reuse
4. Locating renewable generation projects with existing water system infrastructure
5. Implementing energy efficiency and cost-effectiveness at local and regional water infrastructure projects
6. Establishing a public goods charge for funding investments in water efficiency and other IRWM strategies that will lead to GHG reductions

The water and energy component of the Scoping Plan includes six approaches to achieving a reduction in the energy intensity of water uses and water and wastewater management systems ... and improving water quality and water supply reliability.

These actions may also have the co-benefit of improving water quality and water supply reliability.

Sea Level Rise

In November 2008, the Governor issued an executive order (EO S-13-08) to enhance the state's management of climate impacts from sea level rise, increased temperatures, shifting precipitation, and extreme weather events. Among other benefits, the executive order was meant to provide consistency and clarity to State agencies on how to address sea level rise in current planning efforts, thereby reducing the time and resources unnecessarily spent on developing different policies using different scientific information.

The order contained four key actions:

- Initiate California's first statewide climate change adaptation strategy that will assess the state's expected climate change impacts, identify where California is most vulnerable, and recommend climate adaptation policies by early 2009
- Request the National Academy of Sciences establish an expert panel to report on sea level rise impacts in California to guide state planning and development efforts
- Issue interim guidance to State agencies to plan for sea level rise in designated coastal and floodplain areas for new projects
- Initiate a report on critical existing and planned infrastructure projects vulnerable to sea level rise

State Water Resources Control Board (California Water Boards)

The California Water Boards adopted their Strategic Plan Update 2008-2012 on September 2, 2008. It includes environmental, planning, and organizational priorities.

Adaptive Management: In regard to a marine fishery, this is a scientific policy that seeks to improve management of biological resources, particularly in areas of scientific uncertainty, by viewing program actions as tools for learning. Actions shall be designed so that even if they fail, they will provide useful information for future actions. Monitoring and evaluation are emphasized so that the interaction of different elements within the system can be better understood.

The Water Boards' Strategic Plan considers climate change and other drivers that affect future change. Most of the actions in this strategic plan will be carried out in a watershed framework. (See Box 4-11 Complementary Management Approaches: IRWM and Watershed Management).

Delta and Suisun Marsh Planning and the Delta Vision

State government is involved in a number of major planning efforts to evaluate the Delta and Suisun Marsh ecosystems and water supply issues and to recommend strategies and actions for their improvement including Bay Delta Conservation Plan, Delta Risk Management Strategy (DRMS), Delta Regional Ecosystem Restoration Implementation Plan, the Suisun Marsh Plan, and Delta Vision. These overlapping concurrent efforts are forging strategies and actions that will be comprehensive and cohesive, and build upon each other to improve the Delta ecosystem and water supply reliability in response to the impacts of climate change.

- The purpose of the Bay Delta Conservation Plan (BDCP) is to help recover endangered and sensitive species and their habitats in the Delta in a way that also provides for sufficient and reliable water supplies. The BDCP will (1) identify and implement conservation strategies to improve the overall ecological health of the Delta, (2) identify and implement ecologically friendly ways to move fresh water through and/or around the Delta, (3) address toxic pollutants, invasive species, and impairments to water quality, and (4) provide a framework to implement the plan over time. More information is available at www.resources.ca.gov/bdcp/.
- DRMS evaluates the risks from Delta levee failures and ways to reduce those risks. Preliminary evaluations show that the risks from earthquakes and floods are substantial and are expected to increase in the future. In Phase 1, DRMS is evaluating the risk and consequences to the Delta and the state associated with the failure of Delta levees and other assets considering their exposure to a number of hazards today and in the future. In Phase 2, DRMS will evaluate strategies and actions that can reduce risks and consequences. Additional information is available at www.drms.ca.gov.
- The Delta Regional Ecosystem Restoration Implementation Plan is identifying restoration opportunities within the Delta and Suisun Marsh ecological restoration zones. It applies the Ecosystem Restoration Program Conservation Strategy to the Delta, refines existing, and develops new, Delta restoration actions, and includes a conceptual model, implementation guidance, program tracking, performance evaluation, and adaptive management feedback. Additional information is available at www.deltadfg.ca.gov/erpdeltaplan/.
- The Governor established the Delta Vision Task Force in 2006 to develop a durable vision for sustainable management of the Delta including Suisun Marsh. The task force published its vision for the future of this crucial and gravely threatened resource in December 2007. In that vision, the task force described a future in which the California Delta will continue to thrive over the coming generations, despite the major challenges – ranging from climate change to subsidence to population growth – that it will face. At the core of the Delta Vision is a set

of 12 integrated and linked recommendations. Of these 12 recommendations, two are especially central:

- The Delta ecosystem and a reliable water supply for California are the primary, coequal goals for sustainable management of the Delta.
- The California Delta is a unique and valued area, warranting recognition and special legal status from the State of California.

Federal, State, and local agencies, duck clubs, and other private landowners have developed a landmark comprehensive plan to protect and enhance public trust and wildlife values, water quality, and recover endangered species in the Suisun Marsh. The Suisun Marsh Plan is intended to enhance habitat for migratory birds as well as aquatic and terrestrial species, improve levees, restore tidal marshes and other ecosystems, and improve water quality. More information on the planning effort is available at: www.delta.dfg.ca.gov/suisunmarsh/charter

The Delta Vision Task Force completed its Delta Strategic Plan in October 2008 with strategies, actions, and performance measures for realizing the vision. More information is available at www.deltavision.ca.gov.

On January 5, 2009, The Delta Vision Committee submitted its final implementation plan to the Governor on recommended actions to how the California Delta should be managed to fulfill its co-equal goals. The implementation plan sets priorities based on the Delta Vision Strategic Plan (http://www.deltavision.ca.gov/).

A government framework to address Delta issues is part of the 2009 Comprehensive Water Package. See that (earlier) subsection for discussion of SB 1 Delta Governance/ Delta Plan.

SWAN (Statewide Water Analysis Network)

For Update 2009, SWAN (the Statewide Water Analysis Network) prepared both a short-term and long-term plan to improve and peer-review data and analytical tools. SWAN's plan includes pilot studies and the development of presentation and decision-support tools to make complex technical information more accessible to decision-makers and resource managers.

For example, the uncertainty that remains in the rate and magnitude of long-term climate change must be reduced. Improved data collection and a robust monitoring network will help identify trends, provide for better real-time system management, and evaluate and, if necessary, correct mitigation and adaptation strategies. (See Chapter 6 Integrated Data and Analysis.)

Propositions and Bonds

In recent years, California voters approved a series of bonds to preserve and enhance the state's natural resources. Propositions 12, 13, 40, and 50 made available a total of $10.1 billion that have been used by local governments and State agencies for a wide variety of activities such as water conservation, acquisition of land to protect wildlife habitats, and restoration of damaged ecosystems.

The infrastructure package approved by the voters in November 2006 included water and flood measures in propositions 1E and 84. These measures provided $4.9 billion

Box 4-14 SBxx 1 Appropriations for Integrated Regional Water Management (IRWM) Grants

SBxx 1 contains appropriations for the IRWM grant program from Proposition 84 and Proposition 1E. The appropriations consist of:

- $150 million from Proposition 1E for Storm Water Flood Management projects
  - Not less than $100 million will be available for projects that address immediate public health and safety needs and strengthen existing flood control facilities to address seismic safety issues.
  - $20 million will be available for local agencies to meet immediate water quality needs related to combined municipal sewer and storm water systems to prevent sewage discharge to state waters.
  - $20 million will be available for urban stream storm water flood management projects to reduce the frequency and impacts of flooding in watersheds that drain to the San Francisco Bay.
- $181.791 million from Proposition 84 subdivided to:
  - $100 million for implementation grants (from funding area allocations in Proposition 84):

    Not less than $20 million shall be allocated to support urban and agricultural water conservation projects to meet a 20 percent reduction in per capita water use by 2020.

    Not less than $10 million will be used to support projects that address critical water supply or water quality needs for disadvantaged communities.
- $39 million for planning grants and local groundwater assistance grants which consist of:
  - $30 million for planning grants (half interregional and half funding area allocation),
  - Not less than $3.9 million to facilitate and support the participation of disadvantaged communities in integrated regional water management planning,
  - $9 million for local groundwater assistance grants (interregional allocation).
- $22.091 million for interregional projects, which includes:
  - $10 million to connect municipal and industrial water supply aqueducts that cross the Delta, and
  - $2 million to Tulare County for development of an integrated water quality and wastewater treatment program plan.
- $20.7 million for program delivery

NOTE: The $150 million is half of the amount of Storm Water Flood Management funding authorized by Proposition 1E. The $100 million in IRWM implementation funds is one-ninth of the $900 million total funding allocated to specific regions in Proposition 84.

for flood management and approximately $1 billion for IRWM including wastewater recycling, groundwater storage, conservation, and other water management actions.

Following the Governor's emergency declaration for California's levee system in February 2006, key repairs to 33 critical erosion sites protecting Central Valley communities were completed in record time. The State is advancing funds and working with the federal government to repair 71 additional levee erosion sites damaged in last year's floods. The State began an effort to evaluate 350 miles of urban levees for hidden defects, and is leading a coordinated effort involving federal and local agencies to avoid a major flood disaster in California.

In September 2008, Governor Schwarzenegger signed SBx2 1 to appropriate $842 million in funding from Proposition 1E and 84 passed by voters in 2006 (See Box 4-14 for appropriations). See also separate entry for information on propositions.

Proposition 1E – Disaster Preparedness and Flood Protection Bond Act

In 2008, the State took action to improve California's flood protection system by including $211 million in Proposition 1E funding for four critical levee improvement and construction projects in three Northern California counties. This $211 million investment will help rebuild California's aging levee system and protect Californians from dangerous floods that could harm communities, agriculture, and water supplies.

The bond funds will fund four critical flood protection projects:

- Sacramento Area Flood Control Agency, Natomas Levee Improvement Program (Sacramento County), $49 million.
- Levee District No. 1 of Sutter County, Lower Feather River Setback Levee at Star Bend (Sutter County), $16.3 million.
- Reclamation District 2103 (Wheatland), Bear River North Levee Rehabilitation Project (Yuba County), $7.4 million.
- Three Rivers Levee Improvement Authority, Feather River Setback Levee (Yuba County), $138.5 million.

Proposition 84

In November 2006, voters approved The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 (Proposition 84) authorizing $5.4 billion in general obligation bonds for natural resources purposes. These new bond funds will enable the state to continue investing in important projects targeted to improve water quality and drinking water availability, flood protection, State and local parks, coastal and ocean protection, and habitat conservation.

These funds have contributed to programs and projects in 18 State departments, boards, and conservancies, including:

- Tahoe Conservancy's Environmental Improvement Program, which will help preserve the world renowned clarity of North America's largest alpine lake;
- Department of Forestry and Fire Protection to preserve urban forestry and biomass projects to reduce the state's emissions of greenhouse gases;
- Department of Fish and Game to restore Bay-Delta and coastal fisheries;
- Wildlife Conservation Board to preserve and protect forests, wildlife habitat, rangeland, grazing land and grasslands, and oak woodlands;
- State Coastal Conservancy and the San Francisco Bay Area Conservancy Program to help protect the scenic beauty, recreational opportunities, and economic vitality of California's 1,100 miles of magnificent coastline;
- Ocean Protection Trust Fund to expand efforts to preserve and protect California's unique ocean resources and diverse marine life;
- DWR for IRWM projects that will improve and enhance California's use of its natural water resources and for a wide array of expenditures to improve flood protection around the state; and

- State Water Board to leverage federal funds for infrastructure investments to prevent pollution of drinking water supplies and for matching grants to local agencies to reduce stormwater contamination of rivers, lakes, and streams.

Safe, Clean, and Reliable Drinking Water Supply Act of 2010

A $11.14 billion water bond proposal is part of 2009 Comprehensive Water Package discussed earlier in this section. Californians will have an opportunity to vote on this proposal in November 2010.

Federal Government

Water for America Initiative

In 2008, the federal government created a national Water Initiative to coordinate and support federal water research, education, and technology transfer activities to address changes in water use, supply, and demand in the United States. It includes support to increase water supply through greater efficiency and conservation. The Water for America Initiative merges three US Bureau of Reclamation water supply management programs (Water 2025, Water Conservation Field Services, and Investigations) and uses the scientific expertise of the US Geological Survey to monitor water quality, quantity, and flows in the nation's rivers and streams as well as the conditions of the its major aquifers.

Under the initiative, the Department of Interior (DOI) partnerships with state, local, and tribal governments will use the latest technologies in water planning and management to help communities respond to their changing water needs. At the watershed level, DOI agencies will work with urban, rural, and agricultural water users to stretch existing water supplies and carry out measures to protect endangered species at high-risk watersheds, thereby averting water crises.

The initiative will

- conduct a nationwide assessment of water availability and human and environmental water use by 2019, describing the change in water flows, groundwater storage, and water use,
- proceed with regional-scale studies that compare the current status of water storage and flows to prior conditions for each of the nation's 21 water resource regions,
- cooperate with states and local government in selected watersheds or aquifer systems to increase use of new technologies in water planning and management,
- cooperate with states to map the geologic framework of the nation to improve characterization of the nation's aquifers, and
- modernize the nation's 7,000 stream gages by replacing obsolete telemetry to ensure continued real-time operations and provide more timely information needed for better water management, and stabilize the long-term network by reestablishing critical streamgages discontinued in the past two decades.

American Recovery and Reinvestment Act of 2009

Under the American Recovery and Reinvestment Act of 2009, California water agencies were awarded $391 million to expand water supplies, repair aging water infrastructure, and address drought mitigation. Projects include the installation of temporary pipelines and pumps, drilling and installation of new water wells, well-enhancement projects, and a groundwater monitoring effort. These investments will help preserve permanent crops and associated jobs in an area that is experiencing a prolonged drought, economic hardship and some of the highest unemployment rates in the United States.

With the assistance of the Bureau of Indian Affairs, Native American projects were identified that will assist in meeting the water supply needs of Tribal communities impacted by the drought. Funds for the Gray Lodge, Pixley, and Volta Wildlife Refuges will assist in protecting the environment by providing more reliable water sources for the refuges and make more water available for other uses. Find a description of the projects at http://www.doi.gov/documents/BORDroughtProjectSummaries.pdf.

Federal Water Action Plan

In December 2009, President Obama's administration released a coordinated interim action plan to be taken by six federal agencies in addressing California's water crisis. The coordinated federal water action plan will:

- strengthen the federal government's coordination of actions with the state,
- help to meet water needs through actions that promote smarter water supply and use,
- help ensure healthy ecosystems and improved water quality, and
- call for agencies to help deliver drought relieve services and ensure integrated flood risk management.

View the Interim Federal Action Plan for the California Bay-Delta at www.doi.gov/documents/CAWaterWorkPlan.pdf.

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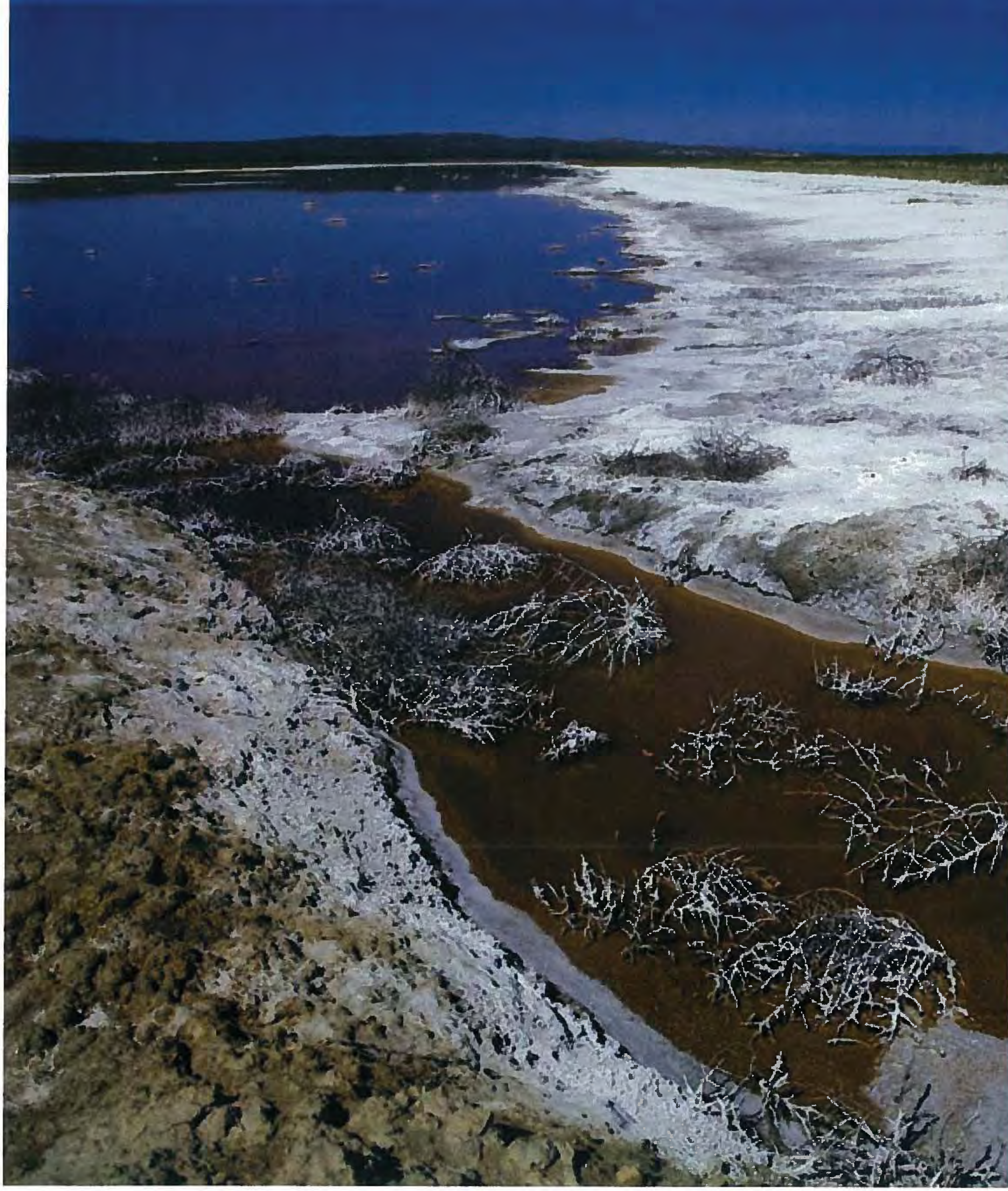
VOLUME 2 - RESOURCE MANAGEMENT STRATEGIES
CHAPTER 18

Salt and Salinity Management



MANAGEMENT OBJECTIVE – IMPROVE WATER QUALITY

Photo caption. Salt in irrigation evaporation ponds near Kettleman City.

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IMPROVE WATER QUALITY

Chapter 18. Salt and Salinity Management

Salts may be defined as materials that "originate from dissolution or weathering of the rocks and soil, including dissolution of lime, gypsum and other slowly dissolved soil minerals" (Ayers and Westcot 1994). "Salinity" describes a condition where dissolved minerals, of either natural or anthropogenic origin and carrying an electrical charge (ions), are present. In water, salinity is usually measured as electrical conductivity (EC) or total dissolved solids (TDS), and the major ionic substances found in water are calcium, magnesium, sodium, potassium, bicarbonate, sulfate, chloride, and nitrate. Both salinity measurement methods give an indication of how concentrated salts are in water or soils, but since mineral ions do not all carry the same electrical charge, and organic dissolved solids can skew TDS readings, these measurement methods must either be placed into context (was the sample collected in a tidal estuary, at a municipal outfall or from a domestic supply well?, for example) or used in tandem with additional analyses.

With the exception of freshly fallen snow, salt is present to some degree in virtually all natural water supplies, because soluble salts in rocks and soil begin to dissolve as soon as water reaches them. Water reuse increases salinity since each use subjects the water to evaporation. If reused water passes through soil, additional dissolved salts will be picked up. Most salts provide some benefit to living organisms when present in low concentrations; however, salinity very quickly becomes a problem when consumptive use and evaporation concentrates salts to levels that adversely impact beneficial uses. Salts are essential to plant, human and animal nutrition; salts are present in our food, in our soils and in the cleaning and personal care products we use every day; and all Californians make choices that contribute to or compensate for salinity problems, whether they are aware of it or not.

In California, as in other parts of the world, salinity problems tend to have both natural and human causes. Many of California's most productive soils originated from materials that were once under the ocean. These soils are naturally high in salts. Oftentimes salts are added to soil or water intentionally as fertilizers or soil amendments, or to assist in some industrial, domestic, or other process. Examples of the latter include food processing and water softening. Salts may also enter a watershed through inadvertent means. These might be thought of as "unintentional salts," where human action aimed at some other purpose has resulted in salts being added to the watershed. One example of this is seawater intrusion in coastal aquifers triggered by the removal of more fresh water than is being recharged. Climate change and the predicted sea level rise associated with it will worsen this problem.

In California's interior valleys, our extensively modified natural water systems and constructed conveyance channels supply large cities, small communities, farms and wetlands with water, but each water delivery carries a salt load. When water is consumed through use, the majority of its salt load remains behind. In fact, San Joaquin

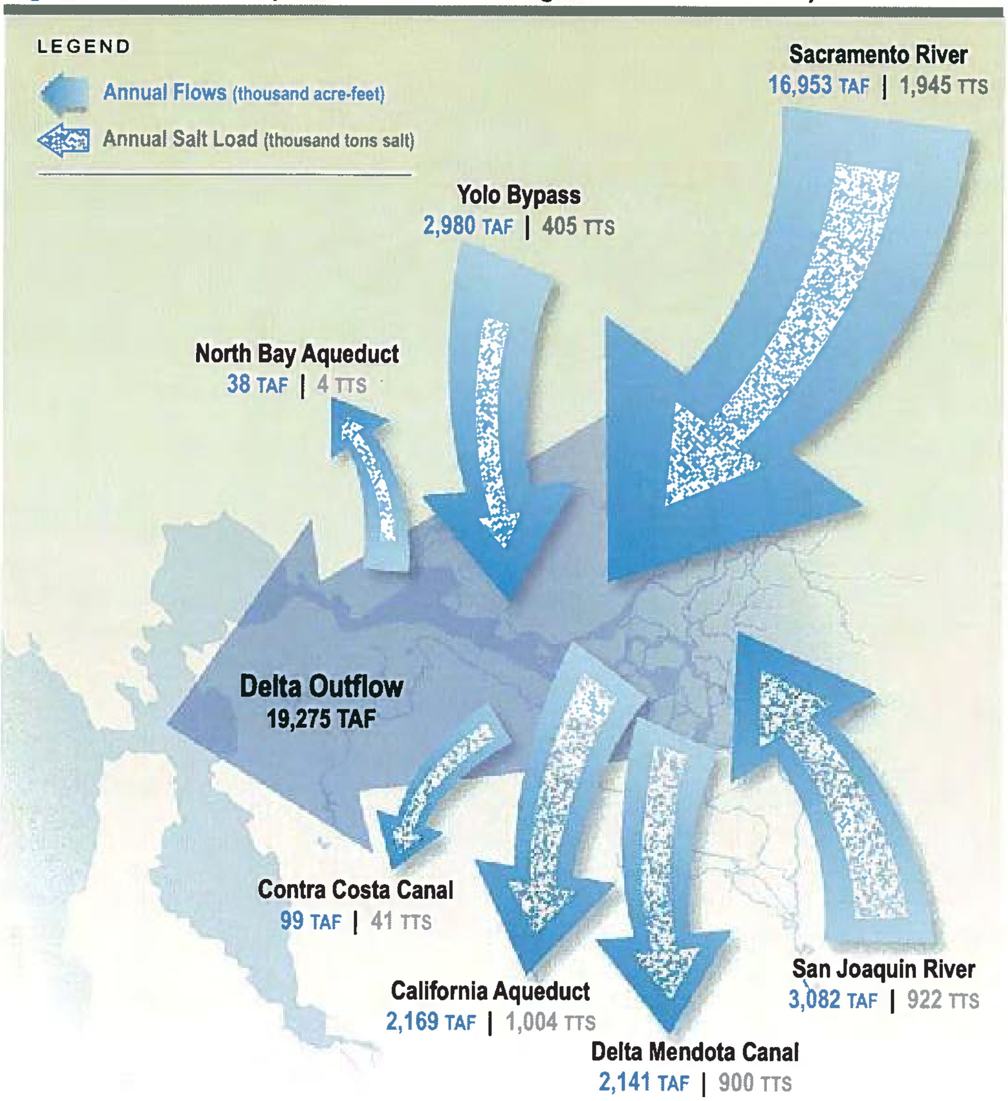
Box 18-1 Acronyms and Abbreviations

AB	California State Assembly bill
AGR	agricultural production
Basin Plans	Water Quality Control Plans
CV-SALTS	Central Valley Salinity Alternatives for Long Term Sustainability
DWR	California Department of Water Resources
EC	electrical conductivity
FAO	Food and Agriculture Organization of the United Nations
GAMA	Groundwater Ambient Monitoring and Assessment
IFDM	Integrated On-Farm Drainage Management
IWRIS	Integrated Water Resources Information System
mg/L	milligrams per liter
MUN	drinking water
PRO	industrial processing
Prop.	ballot proposition
Regional Water Board	Regional Water Quality Control Board
SARI	Santa Ana Regional Interceptor
SAWPA	Santa Ana Watershed Project Authority
SRWS	self-regenerating water softeners
State Water Board	State Water Resources Control Board
SWAMP	Surface Water Ambient Monitoring Program
TDS	total dissolved solids
TMDL	total maximum daily load
µS/cm	microSiemens per centimeter
USBR	US Bureau of Reclamation
USCR	Upper Santa Clara River

Valley's Tulare Lake Basin is a closed basin, i.e., no stream normally exits the basin. In the San Joaquin Valley, an area highly dependent on irrigation, not enough salt exits the basin through the area's rivers and streams to offset the imported and recirculated salts. Figure 18-1, taken from the Central Valley Regional Water Quality Control Board's 2006 salinity overview report depicts the mean annual salt loads conveyed to and from the Delta through the major river systems of the Central Valley (CVRWQCB, 2006).

Coastal and estuarine environments require some measure of salinity to remain healthy. But even these systems can be adversely impacted when salt becomes too concentrated, nutrient salts become excessive and create hypoxic zones, or, in the case of estuarine systems, when the mix of saline and fresh flows gets out of balance. The salt evaporation ponds in the southern portion of San Francisco Bay provide a noteworthy example of this. The salt produced in these ponds came at a high environmental cost, impacting thousands of acres of marine habitat and reducing bird and fish populations in San Francisco Bay. Today they are slowly being restored to their natural condition, serving as a reminder that restoration is always more difficult than prevention.

Figure 18-1 Salt load (mean of annual averages from 1959 to 2004)



Beneficial Uses

In California, waters of the state are designated as having one or more beneficial uses. State Water Resources Control Board (State Water Board) Resolution No. 88-63 (SWRCB, 1988) directs each Regional Water Quality Control Board (Regional Water Board) to designate surface water and groundwater in the region as being potentially suitable for drinking water unless certain existing conditions apply, and individual boards may use other region-wide use designations in their Water Quality Control Plans (Basin Plans). (A water body is exempted from the designation if, for example, salinity is 5000 µS/cm or more and where "it is not reasonably expected by Regional Boards to supply a public water system.) For example, in addition to the aforementioned drinking water designation, surface water and groundwater in the Central Valley Region is designated as also having agricultural and industrial use unless specified conditions similar to those constraining municipal use exist or the water body has been evaluated and found to have specific beneficial uses. This is important because the three uses that are generally impacted by salinity first are agricultural production (AGR), drinking water (MUN), and industrial processing (PRO) as shown in Table 18-1. Regulatory thresholds are determined by taking into consideration established thresholds, background conditions, and existing and potential beneficial uses.

Several environmental uses can also be impacted by excessive salinity. Habitat can be impaired, breeding areas can become less functional, and in extreme cases, organisms can succumb to salt toxicosis. It is beyond the scope of this general salinity discussion to address the impacts of specific ions in great depth, but certain individual ions can limit attainment of beneficial use even when the general salinity level may not otherwise pose a problem (See Box 18-1 Case Study 1: Santa Clara River Salinity Success Story). Groundwater recharge can be impacted when the receiving aquifer cannot accept the saline water without violating California's anti-degradation policy (SWRCB, 1968). Groundwater overdraft also poses a salinity problem in areas like Madera County, where excessive drawdown of fresh water leaves the aquifer vulnerable to intrusion from high salinity shallow groundwater in neighboring areas, threatening the basin's supply of usable water for drinking and irrigation. Recreational use can be lost, as happens in Southern California periodically when the Salton Sea becomes too saline to support fish and sport-fishing. The Salton Sea Authority reports that salinity is a growing problem in this water body—if trends continue, beneficial uses including fish reproduction, commercial fishing, and recreation will be increasingly negatively impacted (Salton Sea Authority, 2009).

Beneficial use discussions sometimes leave the impression that water supports one set of uses and then becomes waste. In California, as in most arid states, this is rarely the case. Most California communities routinely reuse, reclaim and recycle water multiple times. There is often a high demand for recycled water for landscape use but salt concentrations must be managed to protect the beneficial use (in this case, irrigation and possibly groundwater recharge) or this potential water supply is lost.

Salt and Salinity Management in California

Salts have been managed and mismanaged (or not managed) over the centuries in all parts of the globe where irrigation has been used. Mismanagement has often been attributable to a poor understanding of the dynamics of salt movement—how displaced salt can accumulate over time to salinize soils and aquifers, in much the same way as sweeping a room displaces dust. Unless sufficient dust is picked up and taken out of the room at some point, it will continue to accumulate and redisperse, ultimately making the room unfit for use. Traditional irrigation practices tend to have this effect on agricultural land unless steps are taken to close the loop on salt displacement (Case Study 2 is an example of farm-level salt management).

Table 18-1 Example of impacts of salinity on three beneficial uses

Beneficial use	Salinity threshold (µS/cm)[a]	What does the target protect?
AGR	Variable	The Food and Agriculture Organization of the United Nations (FAO) notes that an EC of 700 µS/cm protects the most salt-sensitive crops under normal irrigation operations. Ayers and Westcot describe how the target can be shifted somewhat by adjusting irrigation practices.
MUN	900 (long term) 2200 (short term)	This range of numbers, used by the Department of Public Health, is based on taste thresholds. Health-based standards exist for concentrations of specific ions such as nitrate and chloride
PRO	Variable	The Basin Plans do not cite a threshold value to protect industrial process use, but it is known that some industrial processes require low salinity water.

[a] Electrical Conductivity is reported in Siemens (or in this case, microSiemens) per centimeter, expressed in Table 1 as µS/cm. Some readers may be more familiar with an older unit of measure: mhos. 1 microSiemen = 1 micromho.

Lack of knowledge is not the only cause of salt mismanagement. In his book *Collapse*, Jared Diamond describes how Australia's current salinity problems can be traced back to decisions to mine the continent of its resources rather than harvest resources sustainably and preserve the land for future generations (Diamond, 2005). Today's Australians are living with that legacy and attempting to reverse the damage caused by over a century of salt mismanagement, on top of facing unprecedented drought conditions. It's an uphill battle that Californians will only avoid by making sustainable salt management a priority today.

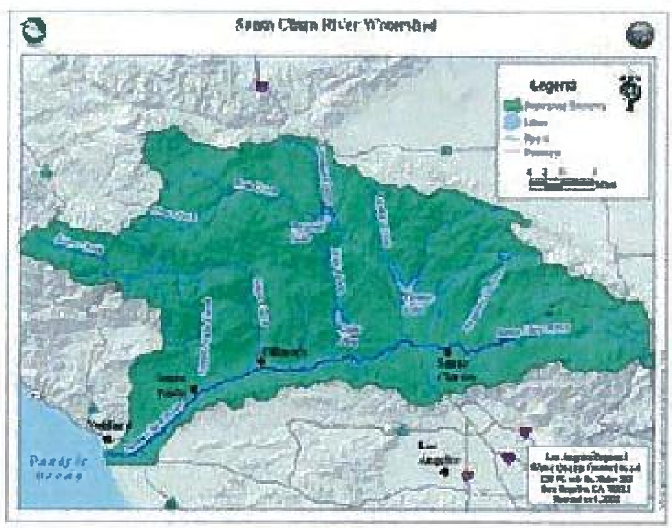
How Salt Dilution and Displacement Works

High salinity in surface water, soil, or groundwater impacts the organisms that rely on these media. Historically, dilution and displacement have been used to deal with excess salinity. Agricultural operations typically displace soil salts by applying more irrigation water than the crop is able to take up to flush salts out of the root zone and relocate them in a lower part of the soil profile or in groundwater (the leaching fraction). The salt may then wick upwards again if evaporation exceeds recharge. Salt concentrations in surface water can be decreased by dilution with lower salinity water. Conversely, the load of salt transported in water can increase with dilution since dilution water generally carries some load of salt as well. A high volume of low salinity water can move significant amounts of salt to other areas, making it worthwhile to also investigate whether management of salinity is appropriate in areas where salt problems do not yet exist. All of these factors and more must be taken into account and dilution and displacement strategies must be coupled with long-range water, ecosystem, and land resource management planning so that opportunities to move closer to a sustainable salt balance in California's hydrologic basins are not missed. Opportunities could include taking full

Box 18-2 Case Study 1: Santa Clara River Salinity Success Story

The Los Angeles Regional Water Quality Control Board adopted a chloride Total Maximum Daily Load (TMDL) for the Upper Santa Clara River (USCR) that became effective in 2005. Implementation of the TMDL included special studies to look at crop effects, endangered species protection, and groundwater impacts. Earlier TMDL studies had identified chloride sources in the region. Significant amounts of chloride are imported in State Water Project deliveries, but about one-third of the chloride entering the watershed could be attributed to self-regenerating water softeners. Although technically not nonpoint sources, water softener discharges end up aggregated in municipal wastewater collection systems, so it makes sense to include these in the TMDL approach.

The State Water Project picks up water in the Sacramento-San Joaquin Delta and delivers it to Southern California. In drier years, greater proportions of saltier seawater and San Joaquin River water are exported by the State Water Project and chloride concentrations therefore increase. The Los Angeles Regional Board first adopted a Total Maximum Daily Load (TMDL) for chloride in the USCR in 2000. The TMDL showed that chloride is loaded primarily into the Santa Clara River from water reclamation plants serving residential, commercial and industrial users in the Santa Clarita Valley. The sources of the chloride which are loaded into the Santa Clara River are primarily chloride contained in the imported source water and chloride added by domestic uses, including self regenerating water softeners (SRWS). In 2003, a ban on SRWS installations was enacted. A buy-back program was initiated for existing SRWS, and by 2005 approximately 1,200 of these softeners had been inactivated or removed. Chloride loads in the Santa Clara River improved measurably. In 2009 the California Legislature enacted Assembly Bill (AB) 1366, Residential Self-Regenerating Water Softeners, that included a voluntary buy-back or exchange program for residential self-regenerating water softeners, consistent with existing law.



Box 18-3 Case Study 2: Integrated On-farm Drainage Management—A Farm-level Solution to Problem Salinity

Salinity problems tend to impact individual operations long before the effects are noticed in neighboring areas with more favorable hydrology and soil conditions. This was the case for Red Rock Ranch, where Integrated On-Farm Drainage Management (IFDM) was first pioneered. IFDM is a salinity management tool that is gaining in popularity as a means of maintaining the ability to farm salinity-impaired agricultural land.

IFDM is an integrated agricultural water management system that applies subsurface drainage water to a sequence of increasingly salt-tolerant crops. The number of steps comprising the reuse sequence is variable, as are the crops to which the drainage water is applied at each stage of the sequence. The residual drainage effluent from the final stage in the sequence of reuse is disposed in a solar evaporator, an enhanced evaporation system that uses timed sprinklers or other equipment that allows the discharge rate to be set and adjusted as necessary to avoid standing water within the surface of the solar evaporator. When conditions are not favorable for evaporation, drainage water is stored, temporarily, in underground and/or covered reservoirs. The operation and management of solar evaporators are regulated by Title 27 of the California Code of Regulations.

Existing IFDM systems have three or four stages designed to come to equilibrium at differing salinities for each of the crops being grown so that the equilibrium salinity is appropriate to the salt tolerance of the particular crop. The concentrated brine collected from the final stage is unsuitable for further treatment by agricultural processes and must be disposed in a solar evaporator. IFDM can be implemented at different scales. Different stages of the treatment process can be contained within a single farm, as is the case at Red Rock Ranch and Rainbow Ranch. Alternatively, different stages of treatment could be sited at different locations so that the overall IFDM system would assume a district or regional scale. At a regional scale, the Grasslands Area farmers are planning to implement a version of an IFDM system in their Westside Regional Drainage Plan on their 97,000 acres, using 6,000 acres for drainage reuse and a zero liquid discharge system to treat the effluent from the reuse area.

Drain water being applied to a gravel bed collector in a solar evaporator (vertically oriented nozzles at riser height = 1.00 ft)

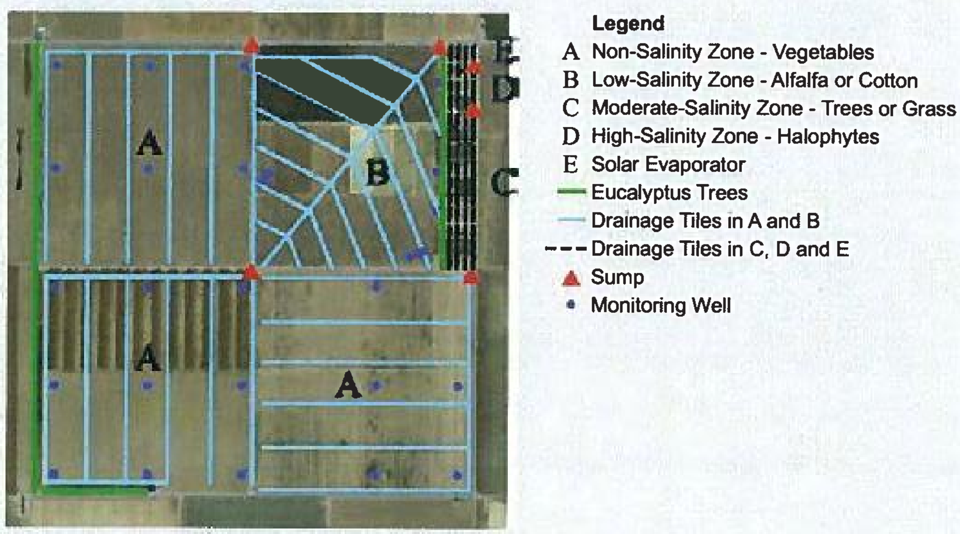
IMPROVE WATER QUALITY

Box 18-3 Case Study 2: Integrated On-farm Drainage Management—A Farm-level Solution to Problem Salinity (continued)

The IFDM system at Red Rock Ranch starts with low salinity water to irrigate salt sensitive crops. Subsurface drainage water from this low salinity zone is blended with tailwater (irrigation water, in the case of Rainbow Ranch) and used to irrigate salt-tolerant commercial crops such as cotton, sugar beets and grasses on a "low-saline" zone occupying about 20 percent of the area. The drainage water from this zone is used on very salt-tolerant grasses or halophytes in the "moderate-saline" zone. This drain water is used on halophytes in the "high-saline" zone (the Rainbow Ranch system only has the first three stages). The concentrated brine collected from the "high-saline" zone is disposed in a solar evaporator.

An advantage of IFDM is that it uses drainage water to produce marketable crops. For example, the cotton grown in the "low-saline" zone at Rainbow Ranch produces high yields. Research has determined the suitability of various salt-tolerant forages such as Bermuda and Jose Tall Wheat grasses that could be grown in the "moderate-saline" zone. These forages could be used to make up the existing shortfall of forages on the west side of the San Joaquin Valley. Continuing research is examining the potential of halophytes, such as Atriplex, *Prosopis alba* (a tree), Creeping Wildrye, and Salt Grass to concentrate brine in the "high-saline" zone and to produce marketable products such as biofuels and construction materials. Brine discharged as tile drainage from the "high-saline" zone is disposed safely in a solar evaporator, resulting in crystallized salt.

Another option would be to collect the brine for further treatment and disposal by non-agricultural processes at regional centers. These centers could attract mining companies to separate and recycle marketable salts from the brine such as calcium sulfate (gypsum), sodium chloride, and sodium sulfate. Currently, high costs of transportation favors establishment of regional industries close to their markets.



Design of the Integrated on-Farm Drainage Management (IFDM) System at Red Rock Ranch

Box 18-3 Case Study 2: Integrated On-farm Drainage Management—A Farm-level Solution to Problem Salinity (continued)

Red Rock Ranch IFDM Project

Total acres	640		
Water Sources	California Aqueduct, Subsurface Saline Drainage Water, Recirculated Surface Runoff Water (Tailwater), and a water well on site.		
Crop Mixes	**Before IFDM**	**After IFDM**	
	Wheat Alfalfa Seed Safflower Cotton	Salt-sensitive crops Broccoli Lettuce Tomatoes Other vegetables	Salt-tolerant crops Canola Cotton Jose wheat grass Rye grass
Average yields	**Before IFDM**	**After IFDM**	
Cotton	2 to 2.5 bales/ac	3.5 to 4 bales/ac	
Land Value	**Before IFDM**	**After IFDM**	
	$1,500/ac (salinized soils)	$5,000/ac (2008 value)	
Recycled Irrigation Salinity Range (TDS)	**First reuse**	**Second reuse**	**Third Reuse**
	3,000 mg/l	10,000 mg/l	20,000 mg/l
Drainage Systems	**Estimated Infrastructure Costs**		
Six fields with drainage collector placed 6 feet deep with 18 monitoring wells.	Drainage System $320,000	Pilot Solar Evaporator $50,000	

advantage of wet water years to flush salts back to the ocean and to store water for future use as dilution flow or to prevent saline water intrusion; leveraging funding availability, where a community can use both public and private monies to upgrade infrastructure to improve salt management; and developing a new business such as energy production (using saline water for cooling, sending high salt, high nitrate dairy waste to digesters for methane production, collecting salt to capture energy in solar ponds, etc.).

Salt Treatment, Salt Storage

Other salt management strategies have included treatment using membrane or distillation technologies. Treatment, however, generates a highly saline solid or liquid waste product that must be managed appropriately and also has a significant energy demand. Treatment technologies are used sparingly in much of the state because energy and waste disposal costs can often exceed the economic value of the fresh water being produced. There have been some pilot studies of combined energy generation/ salt separation methodologies. Given the heightened focus in California on energy and greenhouse gas these methodologies may gain more attention as a possible salt management strategy. Because mineral salts are not all the same, salt treatment

Salt-crusted soil near Fresno.

technologies vary in effectiveness and cost for any given situation. Desalination of high sulfate groundwater, for example, requires a different approach than desalination of high sodium seawater. Seawater desalination is a relatively mature technology, but additional research and development is needed to make brackish water desalination cost effective in a broader range of settings. For a broader discussion of desalination the reader is directed to the desalinization resource management strategy, Chapter 9.

Salt collection and storage is another strategy that is often used in inland areas, however, this may not be a sustainable solution if the collection area could release the salt to groundwater or if a severe storm event could potentially re-disburse the salt outside of the collection area. Evaporation basins such as the one shown in the photo raise other issues as well. A collection and storage strategy is expensive, requiring a large amount of land and appropriate mitigation for the impacts to wildlife. It can also be complicated by other water quality issues. An evaluation of the impacts of evaporation basins should be weighed against possible alternatives such as construction of a brine line. Ideally, collected salt could be marketed as an industrial product. Some preliminary studies have been undertaken but it is not generally considered feasible to market salt harvested as a byproduct of drainage management, for example, since industrial salt users require a purer and less seasonally variable product than can be produced from most saline drainage collection facilities. There has also been some discussion of harvesting and marketing other materials (selenium, boron) from certain salty waste streams to make the waste less of an environmental problem, but this strategy would have the same issues of cost effectiveness, purity and seasonal variability. However, markets change and it may be worthwhile to pursue these options in the future. Salt treatment, including brackish water and seawater desalinization will continue to be an expensive but increasingly attractive alternative for communities as California continues to grow and demand for water increases. Salt storage, while expensive and often environmentally problematic, should be researched further and new strategies for interim and long-term salt storage and salt disposal should be developed, as the need to close the loop and dispose and sequester salts is becoming more urgent, particularly in inland areas of the state.

Local and regional solutions to salt management can vary significantly, but are generally most appropriate to local and regional scales, unless the planning process in developing those solutions determine that there is a benefit to developing infrastructure at a State level. Therefore salt management should be fully integrated into water management such as through integrated regional water management plans.

Adaptation

A very commonly employed but ultimately unsustainable management strategy is adaptation to increasingly saline conditions. This situation exists in the Tulare Lake

Basin. The basin does not have a reliable natural outlet; so in the absence of some mechanism to remove and dispose salts, salt imported into the basin in irrigation water, in soil amendments, for water softening and for other purposes, remains in the basin. The Water Quality Control Plan for the Tulare Lake Basin recommends that a drain be constructed to remove the excess salts from the basin to begin to correct the problem. This option is not being pursued at this time so the plan also includes a strategy of controlled degradation to extend the beneficial uses of the water in this basin and the environmental, economic and social infrastructure those uses support, for as long as possible. The monitoring network needed to track groundwater salinization in this area has never been developed. With this management approach, at some point in the future beneficial uses will be impacted. Some land in this basin has already been abandoned due to salinization. Additional discussion of land retirement is provided in Chapter 29, Other Resource Management Strategies.

Unlike the crisis scenarios California routinely prepares for, chronic water quality problems like increasing salinity do not trigger overnight evacuations or mobilize teams of emergency personnel, and the media rarely picks these up as newsworthy until it is too late to avoid problem impacts. There is no single solution that can be implemented once to make the problem go away. Salinity generally shows up in localized areas, it expands slowly and its effects are usually incremental rather than event-based. Salinity impacts can be measured as yearly reduction of crop revenues and farmable land, lost jobs, higher utility rates, reduction of community growth potential, loss of habitat, premature corrosion of equipment, and in lost opportunities.

But the salt management news is not all bad in California. Of significant note is the adoption by the State Water Resources Control Board of its 2009 Recycled Water Policy, which includes a requirement that local water and wastewater entities, together with local salt/nutrient contributing stakeholders, prepare salt and nutrient management plans and that those plans be completed and proposed for adoption by the Water Board within five years. The State Water Board also committed to seeking state and federal funds to cost share in the preparation of these plans (see also Chapter 11 Recycled Municipal Water Resource Management Strategy in Volume 2). In addition, the case studies in this chapter illustrate types of approaches currently being used to address problem salinity in various parts of the state. They range from a solution developed by a local stakeholder to address a local salinity issue, to salinity management spurred by regulatory action to address non-point source pollution in a small watershed, and finally to collaborative efforts between regulators and stakeholders to develop and implement regional plans that encompass multiple salinity sources and an array of management options. CV-SALTS, showcased in Case Study 3, is a regional collaborative salinity management effort that will have spillover benefits for areas beyond the region.

Potential Benefits of Salt and Salinity Management

Sustainable salt management in any hydrologic region in California protects water resources that may be serving multiple regions in the state. For example, salinity control in the Sacramento Basin may have a relatively small direct benefit in this watershed, which normally receives high rainfall and therefore usually has adequate dilution flows to maintain salinity at acceptable levels. But Sacramento River water is not only used in the Sacramento Basin. Reducing salt loads in tributary rivers to the Delta could provide a significant benefit to those receiving water through the California Aqueduct (much of Southern California) and the Delta-Mendota Canal (much of the San Joaquin Valley), in terms of higher quality drinking water, avoided costs, continued ability to produce food and fiber, habitat maintenance, and reduced pre-treatment costs for industries requiring low salinity water supplies. Because the San Joaquin River is more saline than that of the Sacramento, the San Joaquin watershed will likely respond more dramatically to effective salinity management. Research, planning, monitoring and stakeholder collaboration will help water managers identify salt management's "low-hanging fruit": those watersheds and basins where salt management will yield the biggest improvement for the broadest geographic area for the lowest cost in the quickest time.

Water from the Colorado River serves several states, including California, and the river carries a significant load of salt. Reducing salt inputs in the upper watershed would, therefore, be beneficial to downstream California water users. California may have little ability to control salt loads imported into the state through the Colorado: typically, accepting water means accepting its salt load and the responsibility for managing any problems that salt load will contribute to in the receiving basin. But the benefits of reducing the salt imported into parts of the state where opportunities for export, treatment or storage are limited are significant enough that upstream salt load reductions are worth pursuing. Any time salinity treatment can be avoided there will be significant energy savings benefits as well.

Salt management does not simply reduce the salt loads impacting a region; it can also improve water supplies. Climate change will undoubtedly alter the way California manages water, and altered weather patterns will likely impact the volume, location and timing of available low salinity flows in many, if not all, parts of the state. Sustainable salt management is therefore a key component of securing, maintaining, expanding, and recovering usable water supplies. Recovered water supplies would include recycled wastewater and brackish water desalination projects. Some water authorities in Southern California utilize both strategies.

The issues related to recovering usable water supplies are further discussed in Chapter 11, Recycled Municipal Water resource management strategy. The local benefits of sustainable salinity management mirror the statewide benefits: securing and, in some cases, improving the reliability of the water supply and restoring and maintaining beneficial uses of water within the basin.

There are significant costs that can be avoided by managing salt today. In a recently completed study, a State Water Board study team found that Central Valley salinity accumulations are projected to cause a loss of $2.167 billion in California's value of goods and services produced by the year 2030 (Howitt, et al., 2008). Income is

Box 18-4 Case Study 3: We're All in this Together: Regional Collaboration

Once upon a time, the Santa Ana Basin was primarily an agricultural area and a large percentage of the state's dairy farms were located here. A lot of dairies remain, but the former agriculturally based regional economy is now dominated by industry, urban development, and tourism (Disneyland is only one of the attractions the region is famous for). Groundwater salinity threatened this prosperity.

Regulatory limits were established that would protect the aquifer but which could have had the side effect of stopping growth and development in the area. Understanding the limits of the regulatory process, a group of stakeholders approached the Santa Ana Regional Water Quality Control Board (Santa Ana Regional Water Board) with a plan to conduct the studies needed to determine what was going on in the watershed at a more detailed level and come up with an alternative strategy for dealing with salinity in the basin. The Santa Ana Regional Water Board agreed to work with the alternative, and the group began to pursue management actions and construct facilities to deal with the problem. The local water authorities formed a Joint Powers Authority to coordinate salinity management efforts, the Santa Ana Watershed Project Authority (SAWPA). The group has constructed a brine line to remove salt from the basin and trunk lines connecting to the main brine line (the Santa Ana Regional Interceptor or SARI line). Member districts operate groundwater desalters (treatment and recharge facilities) to reclaim the degraded aquifer. SARI line users pay a fee to remove salt from the basin based on the volume of wastewater they discharge to the line.

Salinity also threatens the long-term reliability of water supplies in the Central Valley Region. Valley regulators and stakeholders initiated a collaborative salinity management effort modeled on the SAWPA experience, only on a grander scale. The effort has been strengthened by recent requirements from the State Water Board to develop regional salt and nitrate management plans. The Central Valley region is comprised of three major basins and covers a 60,000 square mile area, extending from the Tehachapi Mountains in the south to the Oregon border in the north.

CV-SALTS (Central Valley Salinity Alternatives for Long Term Sustainability) is an initiative to address salinity throughout the region and Delta in a comprehensive, consistent, and sustainable manner. Working in partnership with the State Water Board, CV-SALTS will be the vehicle used to review and update the Water Quality Control Plans for the Sacramento and San Joaquin River Basins, the Tulare Lake Basin, and the Delta Plan in regards to salinity and nitrate management. The effort encourages stakeholder-regulator collaboration so that management of saline discharges can be accomplished more economically, more effectively and more sustainably (success measured not only by permit compliance rates but also by quantifiable improvements in the watershed's salt balance. Like the SAWPA effort, CV-SALTS will encourage and work with stakeholder-initiated actions that the Regional Water Boards are unable to require but which will make it possible to achieve and maintain sustainable salinity management in the region.

Several working bodies are currently involved in the CV-SALTS initiative. The Water Boards provided the initial impetus for the effort and will continue to play key advisory roles.
A Leadership Group, made up of upper management from State, federal, and local governments; nongovernment, environmental, social justice, and industry organizations; and top researchers in the field convenes annually to review progress. Committees made up of policy group members, their designees, and interested parties serve as technical advisors, conduct outreach, review economic studies, and coordinate efforts. The Central Valley Salinity Coalition recently formed to secure and manage funding for key preliminary work. For more information on the CV-SALTS committees or the Central Valley Salinity Coalition, contact the Central Valley Regional Water Quality Control Board.

expected to decline by $941 million, employment by 29,270 jobs, and population by 39,440 persons because of the increase in commercial operating expenses incurred by water supplies that have higher salinity concentrations. Irrigated agriculture, confined animal operations, food processors and residential water users were included in the study. Potential benefits of implementing a Central Valley salinity management program are estimated at $10 billion. Similar studies have been performed in other parts of the state (see reference section) and all indicate that proactive salt management is economically beneficial.

Potential Costs of Salt and Salinity Management

It is extremely difficult to estimate the cost of sustainable salt management in California as an isolated statewide strategy. Ideally, salinity control should be (and often is) incorporated into some broader effort to protect or expand water supplies, optimize water use, offset land subsidence, protect fisheries or store water for future use. Salt management methods vary in effectiveness and cost, depending on the volume and concentration of salts, salt type, other materials present, the desired salt concentration after management (dependent on water use) and the type of management strategy used (prevention, salt input minimization, salt removal at the end of a process, etc.). A 2007 study illustrates the wide range of costs that a single industry might face in dealing with salt management. Rubin, Sundig and Berkman (2007)_investigated the cost of managing TDS at food processing plants and found that costs for removing dissolved solids (TDS) by various means ranged from $258 per ton (deep well injection of collected untreated effluent) to over $8,000 per ton (end of pipe effluent treatment). While cost variability is high, multiple salt management options are necessary because the least-cost salt management option appropriate for a given area may be inconsistent with sustainability when considered in a broader context of local, regional or statewide salt management, energy consumption, water availability or other resource issues.

Major Issues Facing Salt and Salinity Management

Although the local impacts of salinity have been severe in certain parts of California such as the Salinas Valley, the Tulare Lake Basin, and the Lower San Joaquin River Basin, salinity has not historically been a high profile issue to the general public in California. Water Plan Update 2009 marks a paradigm shift in California's thinking. As a society, we increasingly recognize that high quality water is a limited resource; that once salinity concentrations become excessive, the available technically feasible recovery options are likely to be very expensive; that adaptation to increasing salinity is an interim measure at best; and that water quality protection is more cost effective and has a greater chance of success than water quality remediation.

Understanding the need for salt management is only a first step. California faces some major challenges to sustainable salt management.

Urgent Needs (Loss or Impending Loss of Beneficial Use)

1. Each hydrologic region has its own priorities and limitations on the resources available to address those priorities. A few of the common, ongoing, and emerging threats are listed below.
   - **Nitrates.** Dairy waste management, septic systems, and fertilizer use can all contribute to groundwater degradation by nitrate. Excessive nitrate salts in groundwater is a human health issue. Excessive nutrient salts in surface water can spur explosive, unwanted algal growth that not only impacts aquatic life but also interferes with recreational and commercial use of water bodies.
   - **Seawater intrusion.** Seawater intrusion into the Delta has a significant impact on the quality of water exported from the Delta. Coastal aquifers are at risk of seawater intrusion when more fresh water is withdrawn than can be recharged. Aquifers and surface water are vulnerable to sea level rise and seawater brought in by storm surges that may increase in intensity or frequency as a result of climate change. Seawater intrusion threatens drinking water and water used for irrigation.
   - **Soil and groundwater salinization.** Salinization occurs when salts are allowed to accumulate over time in soil or groundwater. Soil salinization results in a loss of soil productivity due to a chronically unfavorable balance of salt and water in the soil profile. Groundwater salinization results in the loss of utility of an aquifer, meaning that the water no longer supports municipal or agricultural use. Both processes are virtually irreversible. Although some communities reclaim brackish water at great expense, most California water users cannot afford to do this. Despite contributing $31.4 billion to California's economy in 2006, several of the most productive farming regions of the state (including the Imperial, Salinas and San Joaquin Valleys) are vulnerable to soil and/or groundwater salinization.
   - **Reduced availability of fresh water flows.** In some regions, dilution with low salinity water is the primary means used to manage salinity in California. Dilution in the right place may provide some side benefits due to increased flow (supporting aquatic life for example) but more often, water used for dilution is water that is unavailable for other purposes at other times.

Less urgent, but equally important

2. Salt management has not kept up with emerging salt problems in many parts of the state. As a general rule, salt management has been reactive rather than proactive in California: problem salinity emerges and a plan is formulated to deal with it; or problem salinity is anticipated and a plan is formulated but the plan is incompletely implemented or is not flexible enough to adjust to changing conditions, like ecosystem or other water quality priorities. Sustainable salt management will require a more concerted, coordinated, proactive planning effort than most regions of the state and most California communities have been able to achieve to date. This planning should be integrated with other water management alternatives as it could result in efficiencies and cost reduction and should be included in integrated regional water management planning efforts.

3. Funding to support salt management planning, project development, project operation and maintenance and salinity monitoring has been absent or insufficient in some parts of the state. With very few exceptions, public funding dispersed through grants or loans to agencies and organizations has excluded or severely limited funding for planning efforts. Salt management on the scale needed for sustainability in California will require a great deal of coordinated planning at the local and regional levels.

4. Grants and loans targeting project development and operation also often fail to serve salt management, since the programs are usually competitive and award caps may be set to favor multiple small projects over a smaller number of larger, coordinating projects. This strategy is effective for some purposes (for example, funding irrigation efficiency improvements on multiple farms across a large geographic area), but may be counterproductive for salt management, which is often more cost-effectively achieved at a sustainable level through community-, watershed- and regionally-scaled efforts (see Case Studies 1 & 2 for examples).

5. Project maintenance and closure is often overlooked in budgeting for salt management. But as with the case of the incomplete San Luis Drain (see #7(b) below), the unforeseen environmental consequences of incomplete or abandoned salt management projects can result in greater hazards than if the project had never been undertaken. Sustainable salt management will need sufficient funding to ensure that salt management projects are maintained and closed properly, and adapt to unforeseen additional environmental issues. Timely and adequate investments in salt management will ensure that salt control projects do not exacerbate existing salt conditions.

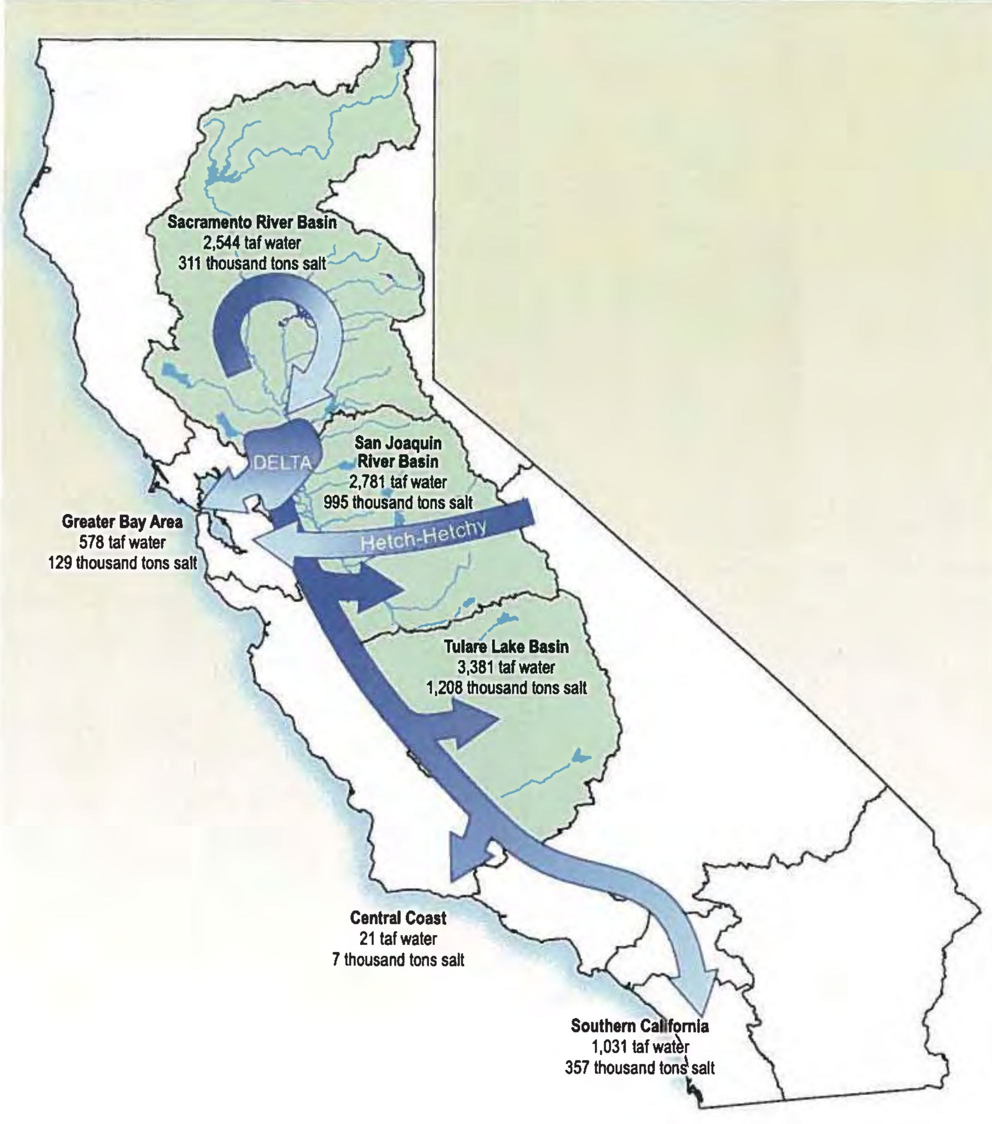
6. Salinity monitoring is under-funded and insufficiently coordinated, and provides inadequate coverage of the salt situation in most regions. Monitoring has historically been under-funded; however, coordinated monitoring is the only way to assess salt impairment, track the rate of salinity degradation or improvement, and determine the effectiveness of salt management actions.

7. Effective salt management may be constrained by federal, State and local policies crafted to serve other needs. This is a similar problem to the funding issues discussed previously (#3, above). Very few policies were developed with salt management in mind. As a result, water use and reuse, prioritization of resources, pollutant control, land use, and habitat management policies, to name a few, may be inconsistent with optimal salt management. Water management decisions have historically been driven primarily by water use efficiency policies, often without any consideration of the salinity issues. Consumptive use of water never results in the consumptive use of the water's total salt load. As California uses water more efficiently, supplies will tend to become more saline unless practices and policies are intentionally implemented to maintain salinity at acceptable concentrations. Compromises between efficiency and quality will likely be needed to ensure a sustainable water supply for future generations.

8. Environmentally and economically feasible options for sustainable salt collection, storage, and disposal do not exist for many parts of the state. Supporting beneficial uses when water is becoming increasingly saline often means that salt must be harvested from the water periodically and disposed. Treatment technologies like reverse osmosis or distillation generate a highly saline solid or liquid waste product. Some areas, such as the Santa Ana Basin, have conveyance channels that take brine from inland areas to the ocean, where it mixes with the salt already there; but California's interior valleys don't have this option. A few facilities use deep-well injection to sequester saline wastewater, and some areas use lower-tech solutions such as evaporation basins to isolate and store collected salt, but both of these alternatives are expensive and can only be used in areas where the geology and soil structure support this type of management. Also evaporation basins have environmental impacts requiring mitigation. Other areas are investigating strategies such as Integrated Farm Drainage Management, which applies water to progressively more saline-tolerant crops, ultimately disposing the remaining drainage in a solar evaporator but these systems have not been tested at a scale needed for regional salt management. Some saline discharges cannot be managed feasibly, sustainably or economically with the management tools currently available.

9. Salinity problems often stem from decisions and actions taken elsewhere, but the costs to manage salt are generally borne by the receiving basin, watershed, community, or individual water user. Salt problems are rarely attributable to a single cause, but rather reflect a suite of decisions, conditions, conflicting water needs, and shifting State and local priorities. Problem salinity in California, as in other parts of the country and other parts of the world, can often be traced back to decisions that seemed like a good idea at the time but that did not take into account the long-term impacts of salinity. Local salinity problems often are not solely due to local decisions or conditions. The most significant example of this is the operation of the State and federal water projects, which move water and the associated salt loads from one basin to another around the state in order to meet water supply needs while operating to Delta water quality objectives set by the State Water Board. (Figure 18-2). A few additional examples follow.
   - Hetch Hetchy and Pardee reservoirs serve as a water supply for San Francisco and East Bay Municipal Utility District respectively, diverting high quality water supplies from their basin of origin. These flows would otherwise assist in salt management by diluting the concentrations of salts downstream.
   - Planning for drainage facilities in the San Joaquin Valley began in the mid-1950s. Drainage service was initially considered at the time the US Bureau of Reclamation (USBR) first studied the feasibility of supplying water to the San Luis Unit. In 1960, Congress enacted Public Law 86-488 authorizing construction of the Unit, including an interceptor drain discharging to the Sacramento-San Joaquin Delta. Between 1975 and 1979 a joint State-federal team, the San Joaquin Valley Interagency Drainage Program, was formed to find an acceptable solution to San Joaquin Valley drainage problems, eventually

Figure 18-2 State and federal water projects



recommending that a drain be completed to the Delta, terminating near Chipps Island.

- As a result, USBR initiated a San Luis Unit Special Study to fulfill requirements for a discharge permit from the State Board for a federal-only drain. By 1975, an 82-mile segment of the San Luis Drain (ending at Kesterson Reservoir) had been completed and 120 miles of collector drains were constructed in a 42,000 acre area of the northeast portion of Westlands Water District. In 1983 the discovery of embryonic deformities of aquatic birds at Kesterson Reservoir significantly changed the approach to drainage solutions in San Joaquin Valley. Because of the high selenium (Se) levels found in the drainwater and its effects at Kesterson Reservoir, the San Luis Unit Special Study was suspended. In 1985, following a Nuisance and Abatement Order issued by the State Water

Board, discharges to Kesterson Reservoir were halted and feeder drains leading to the San Luis Drain were plugged.

- The San Joaquin Valley Drainage Program (SJVDP) was formed in 1991 by the US Secretary of the Interior and the Governor of California in response to issues at Kesterson Reservoir. This joint federal/State effort was established to develop solutions to drainage and drainage-related problems. While the initial efforts looked at all possible solutions, a policy decision in 1987 limited studies to In-Valley drainage management measures based on a recommendation from a citizen's advisory committee consisting of water users, environmental advocates, and public interests.
- The SJVDP's final report (SUTC, 1999) recommended an in-Valley solution that included source reduction, drainage reuse, land retirement, evaporation basins, groundwater management, San Joaquin River discharge, and institutional changes. This report provided a strategy for managing salts through 2040 and stated that eventually salts may need to be removed from the San Joaquin Valley. In the meantime, the Barcellos Judgment directed USBR to develop, adopt and submit to Westlands a plan for drainage service facilities by the end of 1991, leading to preparation of the "San Luis Unit Drainage Feature Re-evaluation Preliminary Alternatives Report" and the related Draft EIS in December.
- An additional lawsuit concluding in 2000, ordered USBR to re-evaluate this report, resulting in the "San Luis Drainage Feature Reevaluation Plan Formulation Report" in 2002 and Draft EIS in 2005 (USBR, 2002, 2009). The Plan identified the In-Valley Disposal/Water Needs Land Retirement Alternative as the proposed action to provide drainage service based on cost, implementation, and other environmental information. In May 2003, the Westside Regional Drainage Plan was developed as a collaborative effort between the San Luis Unit water districts and the San Joaquin River Exchange Contractors Authority to provide drainage relief in portions of the Unit and adjacent areas (SJRECW, et al., 2003). The Westside Regional Drainage Plan is currently being implemented by its proponents and with the assistance of state and federal funding.
- Los Angeles Basin biosolids are exported and applied to land in Kern County. From a salinity standpoint, salt is being redirected to a basin that is already under salt stress.
- In Southern California, only about half of the region's salt comes from local sources. The rest is brought in with imported water. The Colorado River Aqueduct constitutes Metropolitan's highest source of salinity, averaging about 700 mg/L TDS. This leads to salt scale problems for indoor plumbing appliances and equipment at homes, business and industries, which can also contribute to a consumer choice to install water softening equipment, exacerbating the overall problem.

These examples illustrate California's need for long-term planning to deal with the ultimate disposal or long-term sequestration of salt and equitable distribution of salt management costs. Salt disposal and re-location is not simply a local engineering problem, but may potentially pose economic, social justice or environmental problems for the state.

California's communities, watersheds and regions can only achieve a salt balance if the salt leaving the area equals or, in the case of basins already out of balance, (which includes most agricultural areas) exceeds the amount taken outside of the area. The state's "plumbing"—the natural and constructed conveyance systems that move water and drainage around the state—is not optimized for salt management. It may not be possible to achieve sustainable salt management solely through conveyance system changes, but studies should be conducted to quantify the benefits of optimizing conveyance systems for the additional purpose of salt management.

Recommendations to Promote and Facilitate Salt and Salinity Management

Recommendation to address urgent needs

1. Stakeholders in areas impacted by saline elements at levels that pose a threat to human health (for example, high nitrate) should without delay seek to identify sources, quantify the threat, prioritize necessary mitigation action and work collaboratively with entities with the authority to take appropriate action. Local solutions should be sought first, as these can be implemented more rapidly than those imposed by State or federal authorities. All stakeholders affected by nitrate, seawater intrusion, soil or groundwater salinization or loss of fresh water flows should address salt management through an expedited combination of:
    - adequate funding
    - monitoring to identify the location
    - extent and magnitude of the salt problem
    - planning to incorporate the salt management elements addressing the urgent needs into a community-, watershed- or regionally-scaled management plan
    - policy changes where needed, and
    - collaboration with other interest groups to optimize resources and effectiveness

Each of these elements is addressed separately in more detail below.

Recommendations to address longer-term and ongoing needs

Planning

2. The California Department of Water Resources (DWR) and the US Bureau of Reclamation (USBR) should actively participate in the Central Valley Salinity Alternatives for Long Term Sustainability (CV-SALTS) to develop regional salinity management plans that would include their respective water projects. (Salinity

management plans are salt management plans. Some organizations use one appellation and some use the other. CV-SALTS uses "salinity management plan.")

These regional plans should include:

- An assessment of salt sources, loads, and timing
- An assessment of conveyance flexibility to minimize exportation of salts
- A regional implementation strategy, which could include offsetting/reducing salt loads relocated to salt-stressed interior basins as a result of water project operations. For example, USBR and the Central Valley Regional Water Quality Control Board entered into a Management Agency Agreement in December 2008 to address salinity brought into the San Joaquin Basin via the Delta Mendota Canal. From 2008 - 2010, USBR will implement its Action Plan to quantify offsets from current mitigation projects and continue to implement existing projects.
- A funding strategy that supports the implementation strategy
- A stakeholder participation process to increase the likelihood of achieving plan goals and to ensure transparency in project planning and implementation
- A monitoring program to track the success of the implementation strategy
- An adaptive management strategy that should ensure the plan can be modified to respond to drought, emergencies, climate change, and other changes appropriately

3. Also, over the next 5-7 years, federal, State and local entities with planning authority should review their planning documents (integrated regional water plans, basin plans, general plans, etc.) for consistency with sustainable salt management, making revisions where necessary. Plans serving areas where salt accumulation in groundwater is currently unavoidable should address options for extending the life of the aquifer, including, but not limited to, source control strategies and construction of salt disposal or long-term storage facilities. These plans are living documents, so salt management sections should be updated in accordance with salt management actions that have been taken (or in response to expanded salinity problems due to action not taken) since the previous review. (See also Recommendations 4 through 8, 11, and 12.)

Funding

4. Salt management is a complex issue that has no easy solution and should require diligent attention on an ongoing basis, so California should fund salinity management through multiple mechanisms. Options the State should consider include but are not limited to:
    a. Collect a salt fee on wholesale water deliveries to fund mitigation of the impacts of imported and displaced salts.
    b. Collect an annual salt fee for water rights permits to implement mitigation for lost dilution flows, environmental salinity impacts and salinity impacts to other water rights holders.

  c. Collect a salt surcharge on water diversions within adjudicated basins to provide funding for projects designed to restore a salt balance in the basin.
  d. Collect a salt fee on transfers of surface water or groundwater that adversely affect the salt balance in the basin of origin to fund mitigation actions.

5. The State should review its funding guidance and policies for consistency with sustainable salt management and make revisions where necessary. Specifically:
  a. Grant and loan programs (including Prop. 84) should address salt management differently than other constituents, favoring projects that coordinate with a regional salt management plan and are supported by the entities maintaining the salt plan.
  b. When not explicitly prohibited by statute, public funding proposal solicitations should welcome projects with community-, watershed-, and regional-scale planning (specifically salt management planning) and water quality monitoring components.
  c. Award caps should be consistent with implementation of community-, watershed- and regional-scale salt management projects.
  d. All projects receiving State money for salt management should be required to follow appropriate quality assurance protocols and submit salt data to a publicly accessible database.
  e. All salt projects receiving public funding should be required to provide the awarding agency with an assurance that sufficient funding should be available to maintain the project during its life and close the project in an environmentally acceptable manner at its termination based upon what can be foreseen at the time of project proposal.

6. The federal government should ensure that all federal facilities are contributing their fair share to mitigate federal contributions to salt imbalances in California's communities, watersheds and regions and participate in regional salt management efforts where appropriate.

7. Business, industry, agriculture, development and the general public should contribute financially to sustainable salt management. Several organizations representing water providers and wastewater treatment operators recently offered to fund development of regional salinity and nutrient management plans around the state. Californians should be paying for salt management either reactively as rates increase, equipment wears out prematurely, food costs soar (loss of farmland means higher transportation costs for imports), fish and wildlife habitat is lost and business and development opportunities disappear as operations leave the area for states with more favorable water conditions; or proactively, through adequate, continuous funding of sustainable salt management. With so much at stake on a statewide, community and personal level, funding for salt management cannot be solely a State or federal responsibility. (See also Recommendations 8 and 12.)

Monitoring

8. Federal, State, Tribal, local, non-government and private stakeholders should work collaboratively to fund, develop and operate a monitoring network or an array of compatible networks capable of identifying emerging salinity problems and tracking the success of ongoing salinity management efforts where such networks do not already exist. Using the model of the Pesticide Use Reporting program, continuous funding for operation and maintenance of these networks might be made possible through a mil tax (1 mil = $0.0001) on salt–containing products sold in the state (fertilizers, detergents, personal care products, water softener salts, processed foods, etc.), since many of these salts may end up in our wastewater treatment plants, ultimately discharged to groundwater or surface streams. New or expanded networks should build off of and remain compatible with existing relevant statewide monitoring programs such as the Surface Water Ambient Monitoring Program (SWAMP) and Groundwater Ambient Monitoring and Assessment (GAMA) program. Data should be made available to the public through a web-based user interface such as the Integrated Water Resources Information System (IWRIS). (See also Recommendations 2, 3, 11 and 12.)

Policies

9. Over the next 5 years, entities with water policymaking authority should review existing policies, including those related to water use efficiency and funding of water projects, for consistency with sustainable salt management. Revisions should be made where necessary to ensure consistency with long-term sustainability objectives. Effective salt management is not a stand-alone strategy, but should be integrated with other strategies. Every water use, water reuse, and waste disposal decision should include consideration of how the decision may affect the local and regional salt balance. Projects that propose to introduce saline water that may eventually mix with groundwater should be evaluated in the context of the basin's assimilative properties and California's anti-degradation policy. (See also Recommendations 11 and 12.)

Salt storage and other research and implementation

10. Additional options for salt collection, salt treatment, salt disposal and long-term storage of salt should be developed. University researchers should work with regulatory agencies and stakeholders to identify environmentally acceptable and economically feasible methods of closing the loop on salt for areas of the state that do not currently have sustainable salt management options. Funding for this sort of research should be prioritized to ensure that areas with the greatest needs (i.e. high salt and few or no feasible management options) are targeted first. (See also Recommendations 2 through 7, 11 and 12.)

Movement of Salts with Water

11. The movement of salts with water should be acknowledged and mitigated as appropriate. Mitigation could involve ceasing the activity that is causing the impact or provision of financial assistance to help the impacted community deal with the problem on an ongoing basis, or mitigation might take some other form as agreed to by the parties dealing with the salt impact and those causing it. (See also Recommendations 2 through 9.)

Salt balance

12. Where appropriate, State and federal water agencies with the necessary expertise and authority should implement projects that assist the state's communities, watersheds and regions in achieving a sustainable salt balance. Public interests should work with industry, environmental interests, agriculture and other stakeholder groups to develop both long term and interim salt management projects so that salts are safely collected, stored and managed over the short term and disposed in an environmentally acceptable manner over the long term. Options that should be considered include but are not limited to:
    - Avoid/minimize salt importation. Additional discussion of avoidance/minimization of salt importation is included in Chapter 4, Conveyance Delta resource management strategy.
    - Upgrade existing conveyance structures, and if planning efforts determine that new structures are warranted, invest in new structures to safely collect, transport and dispose of salts. Additional discussion of conveyance is provided in Chapter 5, Conveyance Regional and Local resource management strategy.
    - Invest in research and development of environmentally acceptable means of storing salts for extended periods (decades) and sequestering salts (100+ years). Research should include identification of areas within the state where such facilities can be sited with the least environmental impacts.
    - Additional research into more feasible means of utilizing collected salts should be encouraged.

    (See also Recommendations 2 through 7, 10 and 12. For additional discussion of resource management strategies that have benefits to salt and salinity management, see the chapters Agricultural Water Use Efficiency, Matching Water Quality to Use, Land Use Management and Planning, and Recycled Municipal Water.)

Collaboration (Recommended for all recommendations)

13. All entities that make decisions with a bearing on salt management should be participating in regional salt management planning, monitoring and implementation projects. Effective and sustainable salt management decisions rest in the hands of a wide range of water managers, regulators, facility operators, policy makers, landowners and other stakeholders in any given watershed. These entities should strive to coordinate their efforts where possible in order to utilize resources

efficiently, develop regional solutions to regional problems, optimize funding opportunities and achieve a salt balance in the basin as quickly as possible.

14. Salt moves with water; therefore, effective salinity management should address the routes water takes within and between basins. Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) is an initiative aimed at developing and implementing sustainable regional salinity management plans for the Delta and Central Valley regions. Because water operations in the Delta and Central Valley and the beneficial uses the operations support are critical to the state, policy makers and stakeholders should support and participate in the CV-SALTS effort. (See Case Study 3). Salinity stakeholder groups should conduct outreach aimed at educating specific target audiences with the ability to influence salinity decisions (Legislature, interest groups, general public, etc.) about the need for sustainable salinity management.

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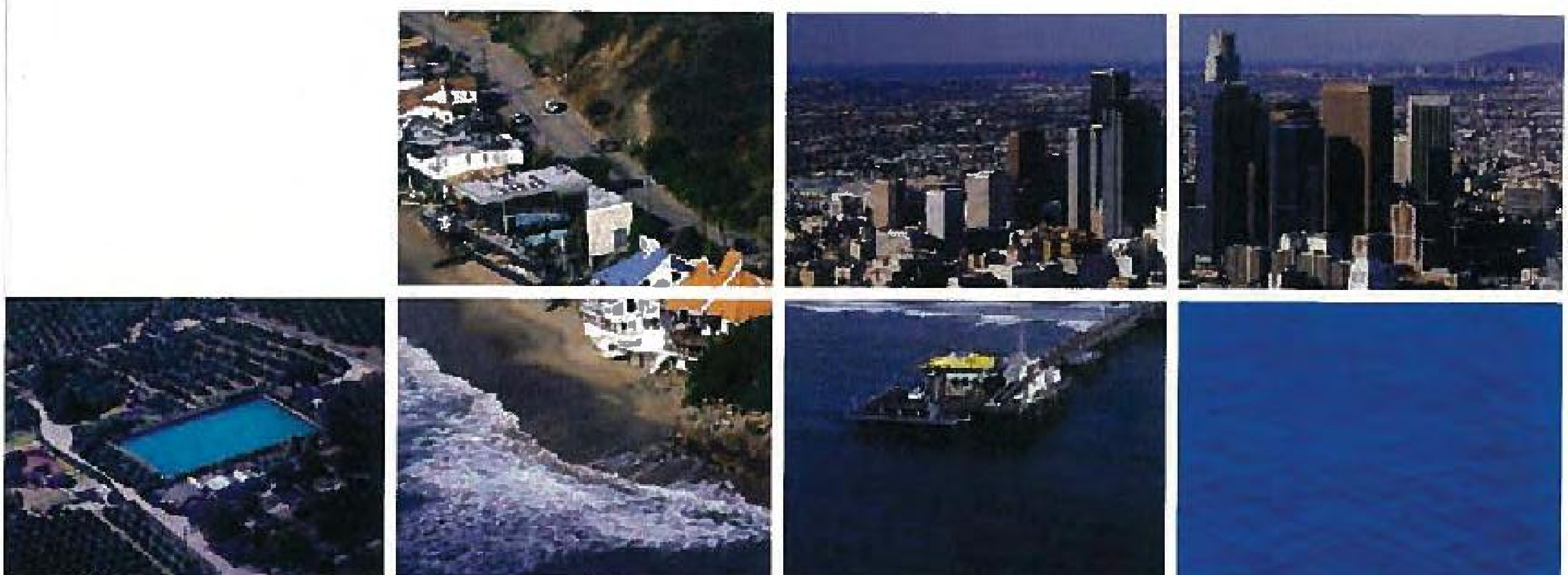
California **Water Plan**
Update 2009

South Coast

INTEGRATED WATER MANAGEMENT



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Volume 3
Regional Reports

Southern Region Office

The Division of Integrated Regional Water Management assists public and private agencies and the general public with water issues throughout the state. Four regional offices are located throughout California to maintain close contact with local interests to facilitate communication and to work on water-related matters. The offices are:

- Northern Region in Red Bluff,
- North Central Region in West Sacramento,
- South Central Region in Fresno, and
- Southern Region in Glendale.

Each of the regional offices offers technical guidance and assistance in water resource engineering, project management, hydrology, groundwater, water quality, environmental analysis and restoration, surveying, mapping, water conservation, and other related areas within the boundaries of their offices. Because of the regional offices' close ties with local interests, DWR regional coordinators in each office facilitate overall communication between DWR divisions and local partners to ensure coordinated efforts throughout all DWR programs and projects.

For more information on DWR and DWR projects, please contact the Regional Coordinators at:
DWR-RC@water.ca.gov

Southern Region Office address:
770 Fairmont Avenue, Suite 102
Glendale, CA 91203-1035
Southern Region Office phone number:
(818) 500-1645
Department of Water Resources' website:
http://www.water.ca.gov/

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4	*5*	*6*	

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2, 3. Downtown Los Angeles
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South Coast Hydrological Region

Within the South Coast Hydrologic Region, wholesale and retail water agencies, groundwater agencies, and watershed managers are working together to meet current and future demands of municipal, industrial, and agricultural users and the environment and to sustain the region's economy. To achieve this they are planning and implementing large and diverse water supply and water quality projects and water use efficiency projects. Cooperation between agencies and organizations and use of integrated resources planning have improved the flexibility and diversity of the region's water supplies.

Setting

The South Coast Hydrologic Region is California's most urbanized and populous region. More than half of the state's population resides in the region (54 percent), which covers 11,000 square miles or 7 percent of the state's total land. It extends from the Pacific Ocean east to the Transverse and Peninsular Ranges, and from the Ventura-Santa Barbara County line south to the international border with Mexico. The region includes all of Orange County and portions of Ventura, Los Angeles, San Bernardino, Riverside, and Sana Diego counties (see Figure SC-1).

Topographically, most of the South Coast region is composed of several large, undulating coastal and interior plains. Several prominent mountain ranges comprise its northern and eastern boundaries and include the San Gabriel and San Bernardino mountains. Most of the region's rivers drain into the Pacific Ocean, and many terminate in lagoons or wetland areas that serve as important coastal habitat. Many river segments on the coastal plain, however, have been concrete-lined and in other ways modified for flood control operations.

Although much of the land is used for either urban or agricultural land uses, all or portions of several national and State parks are located in the South Coast region. They are the Los Padres, Angeles, San Bernardino, and Cleveland national forests and Cuyamaca-Rancho and Chino Hills State parks.

Watersheds

There are 19 major rivers and watersheds in the South Coast region (Figure SC-2). Many of these watersheds have densely urbanized lowlands with concrete-lined channels and dams controlling floodflows. The headwaters for many rivers, however, are within coastal mountain ranges and have remained largely undeveloped.

Figure SC-1 **South Coast Hydrologic Region**

Figure SC-2 Watersheds of the South Coast region

Santa Clara Planning Area Watersheds

The watersheds of the Santa Clara Planning Area provide important habitat and water resources within Ventura County and northern Los Angeles County. They are not heavily urbanized and efforts are under way to protect remaining ecosystems and water supplies while providing flood protection to existing developments. The major watersheds are the Ventura River, Santa Clara River, and Calleguas Creek (including Oxnard Plain). Watershed scale planning efforts include the Ventura River Watershed Protection Plan, Santa Clara River Enhancement and Management Plan, and the Calleguas Creek Watershed Management Plan.

Box SC-1 Acronyms and Abbreviations Used in This Report

af	acre-feet
AHPS	Advanced Hydrologic Prediction Service
ALERT	Automated Local Evaluation in Real Time
API	antecedent precipitation index
BDCP	Bay-Delta Conservation Plan
BMPs	best management practices
Cal Fire	California Department of Forestry and Fire Protection
Cal EMA	California Emergency Management Agency
CCP	Conservation Credits Program
CDEC	California Data Exchange Center
CRA	Colorado River Aqueduct
CRS	Community Rating System
DFG	California Department of Fish and Game
cfs	cubic feet per second
CLWA	Castaic Lake Water Agency
CRA	Colorado River Aqueduct
CRS	Community Rating System
CUWCC	California Urban Water Conservation Council
CVWD	Coachella Valley Water District
Delta	Sacramento-San Joaquin Delta
DFG	California Department of Fish and Game
DWR	California Department of Water Resources
EOCWD	East Orange County Water District
FACC	funding area coordinating committee
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GMA	Groundwater Management Agency
IEUA	Inland Empire Utilities Agency
IID	Imperial Irrigation District
IPR	indirect potable reuse
IRWD	Irvine Ranch Water District
IRWM	Integrated Regional Water Management
LAA	Los Angeles Aqueduct
LACDA	Los Angeles County Drainage Area
LACDPW	Los Angeles County Department of Public Works
LACFCD	Los Angeles County Flood Control District
LADWP	Los Angeles Department of Water and Power
LID	Low Impact Development
Metropolitan	Metropolitan Water District of Southern California
MGD	million gallons per day
MSCP	Multiple Species Conservation Plan
MWC	Mutual Water Company
MWD	Municipal Water District
MWDOC	Municipal Water District of Orange County
NFIP	National Flood Insurance Program
NIMS	National Incident Management System
NPDES	National Pollutant Discharge Elimination System
NPS	nonpoint source
NRCS	Natural Resources Conservation Service
OCWD	Orange County Water District
OES	Office of Emergency Services
ppm	parts per million
PUD	Public Utilities District
QSA	Federal Quantification Settlement Agreement 2003
RAP	regional acceptance process
Regional Water Board	Regional Water Quality Control Board
RWMG	Regional Watershed Management Group
SARI	Santa Ana Regional Interceptor
SAROC	Santa Ana River and Orange County
SAWPA	Santa Ana Watershed Project Authority
SC	South Coast
SDCWA	San Diego County Water Authority
SEMS	Standardized Emergency Management System
SGPWA	San Gorgonio Pass Water Agency
SMP	Salinity Management Project
SWP	State Water Project
State Water Board	State Water Resources Control Board
TDS	total dissolved solids
TMDLs	Total Maximum Daily Loads
USACE	US Army Corps of Engineers
USBR	US Bureau of Reclamation
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
VCWPD	Ventura County Watershed Protection District
WRD	Water Replenishment District of Southern California
WSD	Water Storage District
WWTP	wastewater treatment plant

The 228-square mile Ventura River watershed extends from the upper slopes of the Transverse Ranges southward to an estuary north of the City of Ventura. Drainage is provided by the Ventura River and its tributaries which include the Matilija, North Fork Matilija, and San Antonio creeks. The watershed also has one major reservoir, Lake Casitas, which provides water supplies downstream for local urban and agricultural users. The upper portion of the watershed is minimally developed and provides excellent aquatic habitat. Water quality issues from point and nonpoint pollution sources are present in the lower portion.

The 1,600-square mile Santa Clara River watershed extends from the northern slope of the San Gabriel Mountains in Los Angeles County westward to the City of Oxnard in Ventura County. Drainage is provided by the Santa Clara River and its tributaries which include Piru, Sespe, San Francisquito, Castaic, and Santa Paula creeks. The Santa Clara is the largest river in Southern California that remains in a relatively natural state. The upper watershed (portion in Los Angeles County) consists of approximately 680 square mile of mostly undeveloped land. The only urban development in the upper portion is in the Santa Clarita Valley. Agricultural and urban land use activities are more extensive in the lower portion of the watershed. Although the Santa Clara River typically has an intermittent flow regime in the main stem, flows can increase rapidly in response to high intensity rainfall with the potential for severe flooding. Controlled releases of water from Lake Piru supplement surface flows in Ventura County.

The 343-square mile Calleguas Creek watershed drains the Oxnard Plain in Ventura County. Drainage is provided by Calleguas Creek and its tributaries Conejo Creek and Arroyo Santa Rosa. Calleguas Creek begins on the eastern Ventura County, meanders through the cities of Simi Valley, Moorpark, and Camarillo, and drains into the Pacific Ocean at Mugu Lagoon. Along the way it is also known as Arroyo Simi and Arroyo Las Posas. Groundwater supplies are quite extensive in the alluvial aquifers beneath the plain. Urban, industrial, and agricultural land use activities within the watershed have resulted in the degradation of water resources, loss of sensitive ecosystems, flooding, and erosion and sedimentation. Nutrients and other dissolved constituents in irrigation return-flows are seeping into shallow aquifers and degrading groundwater in this basin.

Metropolitan Los Angeles Planning Area Watersheds

The watersheds of the Metropolitan Los Angeles Planning Area have been subjected to some of the densest urbanization in California and have issues associated with urban runoff, groundwater contamination, and the loss of major historical ecosystems. The planning area has four major watersheds: Santa Monica Bay, Los Angeles River, Dominguez Channel, and San Gabriel River. These watersheds begin in the surrounding Santa Monica and San Gabriel Mountains and flow south across the coastal plains into the Pacific Ocean. Extensive watershed scale planning has taken place, including Santa Monica Bay Restoration Plan, Malibu Creek Watershed Management Plan, Los Angeles River Master Plan, Arroyo Seco Watershed Restoration Feasibility Study, Dominguez Watershed Management Master Plan, and San Gabriel River Master Plan.

The 200-square mile North Santa Monica Bay watershed is in the northwest corner of Los Angeles County and comprises several smaller subwatersheds, including Malibu and Topanga creeks. The topography of the watershed is a combination of steep-slope mountains, coastal sand dunes, and several broad, gently sloping alluvial valleys. The coastal margin and portions interior valleys are urbanized. Healthy riparian habitats continue to exist because many of the mountainous canyons remain undeveloped. Malibu Creek drains the southern Simi Hills, western San Fernando Valley, and the western Santa Monica mountains, entering the Pacific Ocean at Malibu Lagoon.

The 130-square mile Ballona Creek watershed extends from downtown Los Angeles westward to the Pacific Ocean. It is bounded to the north by the Santa Monica Mountains and the south by the Baldwin Hills. Drainage is provided by Ballona Creek and two small tributaries. The watershed is heavily urbanized and includes the cities of Beverly Hills, Culver City, and West Hollywood and portions of the cities of Inglewood, Los Angeles, and Santa Monica. Several environmental sites are located in the western margin of the watershed. These are the Ballona Wetlands, Ballona Lagoon, and Oxford Lagoon. Water quality issues in Ballona Creek are caused by industrial effluent, illegal dumping, and nonpoint source pollutants. Upgrades of the Hyperion Sewage Treatment Plant have eliminated the outflow of untreated sewage during storm events.

The 834-square mile Los Angeles River watershed is shaped by the Los Angeles River, which flows from its headwaters in the Santa Monica Mountains, through the San Fernando Valley, south through the Glendale Narrows and across the coastal plain into San Pedro Bay. The river's major tributaries are the Arroyo Calabasas and Bell Creek (at the river's origin), Brown's Canyon Wash, the Burbank Western Channel, Tujunga Wash, Arroyo Seco, Rio Hondo, and Compton Creek. The watershed contains 22 lakes and flood control reservoirs, as well as a number of spreading grounds. The Los Angeles River is hydraulically connected to the San Gabriel River through the Whittier Narrows Reservoir, although this occurs primarily during large storm events. The Los Angeles River, which once flowed freely over the coastal plain, was channelized between 1914 and 1970 to control the runoff and reduce the impacts of major flood events in the region. Today, over 90 percent of the Los Angeles River is concrete-lined. The watershed has impaired water quality in the middle and lower portions of the basin due to urban runoff from dense urbanization.

The 110-square mile Dominguez Channel watershed is in southern Los Angeles County and defined by a complex network of storm drains and smaller flood control channels. The Dominguez Channel extends from the Los Angeles International Airport to the Los Angeles Harbor and drains a large portion, if not all, of the cities of Inglewood, Hawthorne, El Segundo, Gardena, Lawndale, Redondo Beach, Torrance, Carson, and Los Angeles.

The 640-square mile San Gabriel River watershed is in the eastern portion of Los Angeles County and extends from the San Gabriel Mountains to the Pacific Ocean at the City of Seal Beach. Drainage is provided by the San Gabriel River and its tributaries, which include Coyote Creek. Although the watershed contains portions of 37 incorporated cities, only 26 percent of its total land area is developed. Flows in the San Gabriel River are diverted into four different spreading grounds and impounded behind several rubber dams in order to control flow for groundwater recharge.

Santa Ana Planning Area Watersheds

The Santa Ana Planning Area has experienced some of the most rapid urbanization in the state over the past 10 to 15 years, which has created numerous challenges in balancing growth with water supplies, flood protection, and ecosystem preservation. The planning area consists of one major watershed, the Santa Ana River watershed, and a few subwatershed areas including the San Diego Creek subwatershed and the San Jacinto River subwatershed. Watershed scale planning is provided by the Santa Ana Watershed Project Authority Santa Ana (One Water One Watershed) Integrated Water Resources Management Plan. This plan was supported by a number of subwatershed integrated plans including Central Orange County Integrated Regional and Coastal Watershed Management Plan, North Orange County Integrated Regional and Coastal Watershed Management Plan, Integrated Regional Management Plan for San Jacinto River Watershed, Upper Santa Ana River Watershed Integrated Regional Water Management Plan, and Western Municipal Water District Integrated Regional Water Management Plan.

The 2,800-square mile Santa Ana River watershed is the largest coastal stream system in Southern California including parts of Orange, Riverside, San Bernardino, and Los Angeles counties. The principle river in the watershed is 96-mile long Santa Ana River. The river has its headwaters in the San Bernardino Mountains, and it meanders through the San Bernardino Valley, Chino Basin, and the coastal plain of Orange County before it drains into the Pacific Ocean near the City of Newport Beach. Most of the river channel in Orange County has been altered for flood management purposes including a section that has been concrete-lined. Upstream, the river is in its natural state. Flows in the river are perennial. The watershed also contains several human-made water storage facilities, including Lake Perris, Lake Mathews, and Big Bear Lake. Other flood control facilities along the river are Prado and Seven Oaks dams. Most of the watershed has both urban and agricultural land use activities. In the upper portion of the watershed, urbanization is a factor in the degradation of sensitive aquatic and riparian habitats and has impacted local water quality. The watershed continues to have riparian, wetland, and other wildlife habitat.

The 112-square mile San Diego Creek subwatershed is in central Orange County, and drains a portion of the area into Upper Newport Bay. It is a subwatershed to the Santa Ana River watershed. Erosion of the creek channels in the watershed have resulted in the sedimentation of the bay and channel basins. For years there have been concerns about declining water quality from sediments, nutrients, pathogens, and toxics. Habitats for many wildlife species are being isolated by new construction that cuts off long-used wildlife corridors.

The 765-square mile San Jacinto River subwatershed is in western Riverside County and is a subwatershed to the Santa Ana River watershed. It extends from the San Bernardino National Forest in the San Jacinto Mountains to Lake Elsinore in the west. Drainage is provided by the San Jacinto River. The lower portion of the watershed is being urbanized while the upper portion is a mixture of high- and low-density urbanization, agriculture, and undeveloped lands.

San Diego Planning Area Watersheds

The watersheds of the San Diego Planning Area are generally smaller than in other areas of the South Coast Hydrologic region. These watersheds are being urbanized, resulting in local water quality issues and loss of ecosystems. Local water supplies are limited in these watersheds. The planning area has nine major watersheds: San Juan, Santa Margarita, San Luis Rey, Carlsbad, San Dieguito, San Diego River, Sweetwater, Otay, and Tijuana. These watersheds generally flow east to west, a majority discharging into lagoons that been designated as ecological reserves. Watershed-scale planning efforts include Santa Margarita Watershed Management Plan, San Dieguito Watershed Management Plan, San Diego River Watershed Management Plan, Otay River Watershed Management Plan, and Tijuana River Bi-national Vision.

The 134-square mile San Juan Creek watershed extends from the Cleveland National Forest in the Santa Ana Mountains of eastern Orange County to the lagoon at the Pacific Ocean near the City of Dana Point. Drainage is provided by San Juan Creek and its tributaries, which include Trabuco and Oso creeks. Modifications have been made for flood control. Urbanization of the watershed is more extensive on the lower end of the watershed. Issues include channelization and poor surface water quality from urban runoff, loss of floodplain and riparian habitat, decline of water supply and flows, invasive species, and erosion.

The 750-square mile Santa Margarita River watershed resides in both Riverside and San Diego counties. It extends southwestward from the confluence of Temecula and Murrieta creeks in southern Riverside County to the Pacific Ocean at the US Marine Corps Base Camp Pendleton, north of the City of Oceanside. The lower portion of the watershed and estuary has largely escaped the development typical of the South Coast and are, therefore, able to support a relative abundance of functional habitats and wildlife. The upper portion is one of the fastest growing areas in California. Issues that have arisen include excessive nutrient inputs, erosion and sedimentation, groundwater degradation and contamination with nitrates and other salts, habitat loss, channelization, and flooding.

The 562-square mile San Luis Rey River watershed is in San Diego County and extends westward from the Palomar and Hot Springs Mountains in the Cleveland National Forest to the Pacific Ocean near the City of Oceanside. Drainage is provided by the San Luis Rey River and its tributaries. Most of the river channel remains in its natural state. The river is generally dry but can carry floodflows during winter storms. The other major water feature in the watershed is Lake Henshaw, which impounds water on the San Luis

Rey River near its headwater. Water supplies from the dam are used downstream for urban uses in the City of Escondido and Vista Irrigation District. The eastern portion of the watershed is owned and managed by governmental agencies, local districts, and Native American Tribes. Urban and agricultural land uses occur throughout much of the watershed, with the urban uses concentrated in the lower portion. Agricultural and livestock operations, urban runoff, and sand mining operations, and septic tanks are among the factors in local surface water quality issues. They include high chloride, total dissolved solids (TDS), and bacteria levels.

The 210-square mile Carlsbad watershed is in the coastal margin of San Diego County and has six smaller watersheds that all drain separately to the Pacific Ocean. The watershed is extensively urbanized and includes the cities of Oceanside, Carlsbad, Encinitas, Solana Beach, Vista, San Marcos, Rancho Santa Fe, and Escondido. Water quality issues include toxic substances, nutrients, bacteria and pathogens, and sedimentation. The Agua Hedionda, Buena Vista, and San Elijo lagoons are experiencing excessive coliform bacteria and sediment loading from upstream sources.

The 346-square mile San Dieguito River watershed extends westward from the Volcan Mountains to its outlet to the Pacific Ocean, San Dieguito Lagoon near the City of Del Mar. Drainage is provided by the San Dieguito River and its tributaries which include Santa Ysabel and Santa Maria creeks. Over half of the watershed is vacant or undeveloped; however, much of this is zoned for future residential development. There are several important natural areas within the watershed that sustain a number of threatened and endangered species. Among these are the 55-mile-long, 80,000-acre San Dieguito River Park, the 150-acre San Dieguito Lagoon, and five water storage reservoirs including Lake Hodges, Lake Sutherland, and Lake Poway. The San Dieguito Lagoon is especially sensitive to the effects of pollutants and oxygen depletion from restricted or intermittent tidal flushing.

The 440-square mile San Diego River watershed extends westward from the Volcan and Cuyamaca Mountains through the San Diego urban area to the Pacific Ocean at Ocean Beach. Drainage is provided by the San Diego River and its tributaries which include San Vicente and Boulder creeks. There are four imported-water storage reservoirs within the watershed: El Capitan, San Vicente, Lake Jennings, and Cuyamaca. Famosa Slough is a tidal salt water marsh, which receives water via the San Diego River Flood Control Channel. Beach postings and closures from elevated levels of coliform bacteria were common in the last 10 years due to urban runoff and sewage spills. Excessive groundwater extraction, increasing TDS, and MTBE contamination threatens this limited resource.

The 230-square mile Sweetwater River watershed extends westward from the Cuyamaca Mountains to the San Diego Bay. Drainage is provided by the Sweetwater River. The San Diego Bay, which constitutes the largest estuary along the San Diego coastline, has been extensively developed with port facilities. Similar to other major bays of the region, 90 percent of the original salt marshes have been filled or dredged. Construction of Loveland and Sweetwater reservoirs, as well as extensive local groundwater pumping, has substantially reduced freshwater input to San Diego Bay. Storm water outfalls provide some flows and nutrients to the bay, but not with natural seasonality, timing, frequency, or content.

The 160-square mile Otay River watershed extends westward from the San Miguel Mountains to San Diego Bay. Drainage is provided by the Otay River which flows through the Upper and Lower Otay lakes. These lakes provide water supply, wildlife habitat, and recreational opportunities. Approximately 36 square mile of the watershed are part of the San Diego Multiple Species Conservation Plan (MSCP) effort that provides habitat for endangered plant and animal species. Other important conservation areas include the San Diego National Wildlife Refuge, Rancho Jamul Ecological Reserve, and vernal pools. Water quality concerns include elevated coliform bacteria in the Pacific Ocean receiving waters near Coronado.

The 1,700-square mile Tijuana River watershed is a bi-national watershed (455 square miles in the United States and 1,245 square miles in Mexico) on the westernmost portion of the US/Mexico border. The watershed contains three surface water reservoirs, various flood control works, and a National Estuarine Sanctuary. Major drainages include Cottonwood and Campo creeks in the United States, and the Rio Las Palmas system in Mexico. Cottonwood Creek begins about 20 miles north of the international boundary in the Laguna Mountains. Numerous tributaries come together near Barrett Lake, where the creek continues, entering Mexico west of Tecate. The main river returns to the United States near San Ysidro and joins the Pacific Ocean south of Imperial Beach. Poor water quality is a major issue in the Tijuana River watershed. Although discharges from the Tijuana River account for only a small percentage of total gaged runoff to the ocean, it contains the highest concentrations of suspended solids and heavy metals among the eight largest creeks and rivers in Southern California. Surface water quality has been affected by urban runoff from Mexico, and groundwater contamination has occurred as a result of seawater intrusion and waste discharges.

Ecosystems

Ecosystems in the South Coast region are host to a wide diversity of special status plants and wildlife. Despite their exceptional value, many of the region's ecosystems have suffered from over 100 years of human development activities. Rivers, streams, and wetlands have been diked, ditched, filled, and channelized. Dams and flood control channels have been built to contain and direct waterways, fundamentally altering their natural processes. Various flood, vector, and fire districts frequently enter streambeds, wetlands, or riparian buffers to remove vegetation from channels and adjacent habitats. Riparian vegetation is not only important for raptor nesting and other bird species, but vegetation within streambeds and along the edge of streams provides essential cover for aquatic species and fish fry. Removal of riparian vegetation eliminates essential habitat, degrades water quality, causes scour and erosion, and affects the natural flow regime. Loss of vernal pools, seasonally flooded depressions found on hardpan soils, has been extensive; the largest remnant patch in San Diego County occurs on the US Marine Corps Air Station Miramar (Bauder and McMillan 1998). Much of the historical coastal dunes, wetlands, and estuary ecosystems in the region have also been degraded by declines in water quality and ecosystem functionality. The introduction of invasive Quagga mussels in Lake Havasu, the Colorado River Aqueduct (CRA), and multiple San Diego reservoirs threatens to both disrupt the food chain within those aquatic ecosystems and impede the flow of water supply to users. Finally, invasive plant species, such as *Arundo donax*, have further impaired local ecosystems by choking out native plants and competing with other plant and animal species for limited available water.

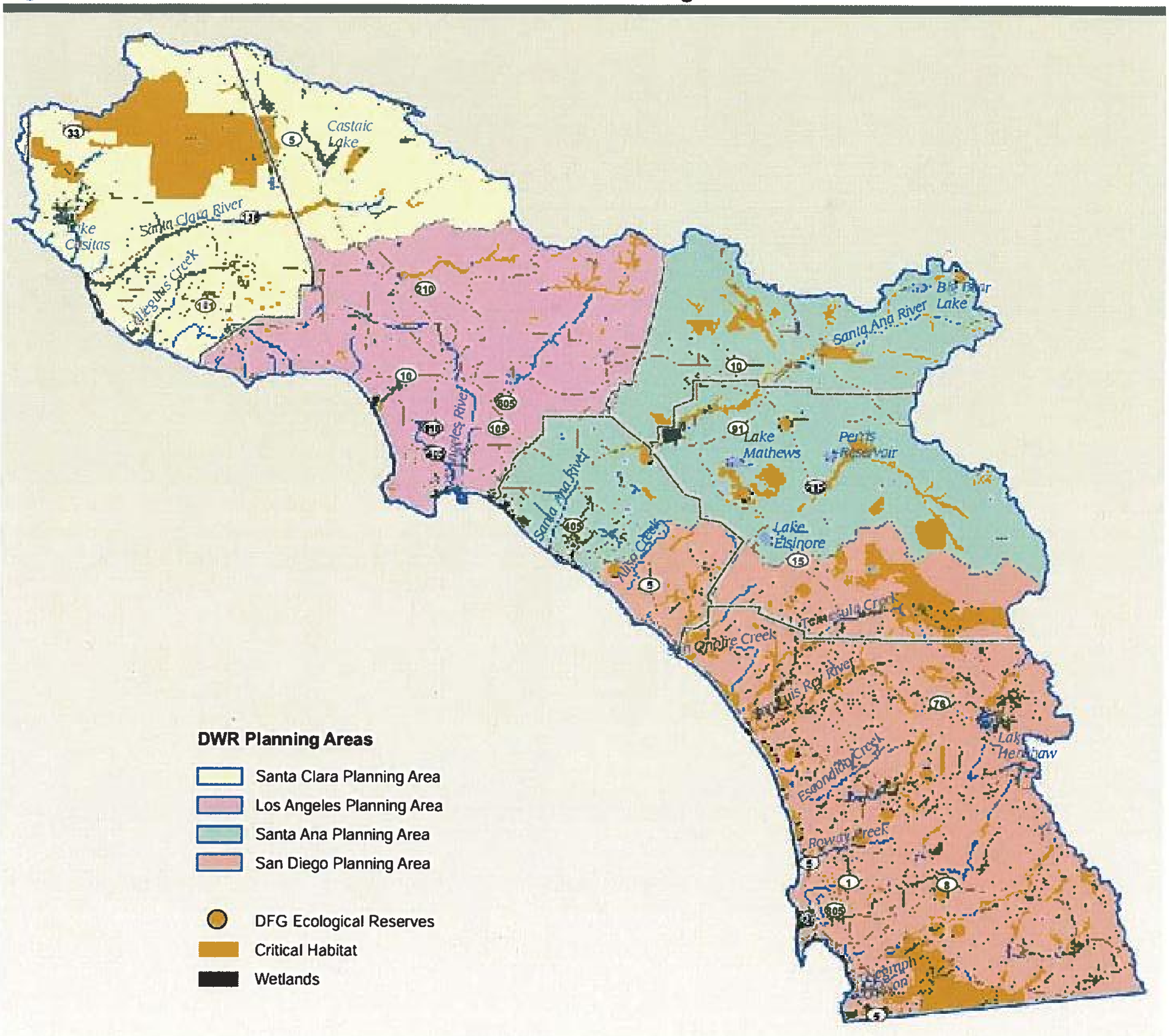
In recent decades, however, concerted planning efforts and technologies have emerged to restore function and productivity to degraded or destroyed ecosystems. Additionally, important ecological areas have been set aside and designated for protection including Significant Ecological Areas by county governments; Environmentally Sensitive Habitat Areas by the Coastal Commission; State Water Quality Protected Areas (formerly Areas of Special Biological Significance) by the State Water Resources Control Board (State Water Board); Ecological Reserves by the California Department of Fish and Game (DFG); and Critical Habitat by the US Fish and Wildlife Service (USFWS). See Figure SC-3 Wetlands and critical habitat in the South Coast Region.

Key ecosystems in the Santa Clara Planning Area include the aquatic and riparian habitats along Ventura and Santa Clara rivers and their tributaries and estuaries. The primary goal of the Watersheds Coalition of Ventura County is to bring together stakeholders to develop integrated watershed management strategies and coordinate ecosystem restoration efforts to achieve long term sustainability of local water resources. Ongoing projects and programs include land acquisition for protection and restoration of habitat areas; ecosystem restoration projects to remove barriers to steelhead passage, restore sediment transport and natural hydrologic regimes on the river, and restore riparian and wetland habitats; and remove the invasive giant reed (*Arundo donax*) from local rivers and tributaries.

Key ecosystems in the Metropolitan Los Angeles Planning Area include intermittent canyons in the inland San Gabriel Mountains and coastal Santa Monica Mountains. Because of extensive development in the Los Angeles area, the physical and hydrologic landscape has been irreversibly altered. Nevertheless, opportunities for aquatic and riparian restoration, wetlands enhancement, and habitat creation are being actively pursued. Ecosystem protection efforts are under way in the San Gabriel River headwaters in Angeles National Forest.

Key ecosystems in the Santa Ana Planning Area include the upper Newport Bay and the constructed wetlands behind Prado Dam. Seven Oaks Dam, and Hemet/San Jacinto. The Santa Ana Watershed Project Authority (SAWPA) is responsible for many impressive projects underway or under development within the Santa Ana watershed, including its 93-mile Santa Ana Regional Interceptor (SARI) pipeline designed to convey non-reclaimable, high-saline brine out of the watershed, non-native plant removal program, constructed wetlands, wetland expansion, habitat restoration, and wildlife conservation and enhancement. Environmental groups such as the Orange County Coastkeeper are working to restore ecosystem function and improve water quality within coastal

Figure SC-3 Wetlands and critical habitat in the South Coast Region



marshes. In Orange County's developed watersheds, restoration activities include the removal of debris and trash, reversion to natural channel configuration, revegetation with native species, and a regional invasive species removal program. Many projects contain a public education component intended to integrate public outreach and education of outlying neighborhoods, as well as of visitors to the restoration site.

Key ecosystems in the San Diego Planning Area include the coastal lagoons and wetlands, protected reservoir lands, and the San Dieguito River Park area. The San Diego area's vegetation communities support a wide array of wildlife species and are

Table SC-1 Representative climate data for South Coast planning areas

	Planning areas			
	Santa Clara	Metropolitan LA	Santa Ana	San Diego
Rainfall (inches per year)[1]	10 to 46	12 to 47	10 to 53	8 to 38
Minimum Temperature (°F)[1]	29 to 54	35 to 55	23 to 54	37 to 54
Maximum Temperature (°F)[1]	55 to 78	52 to 79	48 to 81	63 to 81
Average Eto (feet per year)[2]	4.6	4.3	4.4	4.5

1. PRISM Group 2008. Averages calculated from 1971 to 2000.
2. California Irrigation Management Irrigation System 2008. Reference Evapotranspiration.

home to hundreds of native plant species. However, invasive species are a major threat to native species in the area. The San Diego County MSCP effort is implementing comprehensive programs to protect these resources.

Climate

The coastal and interior valleys of the South Coast region feature Mediterranean climates characterized by mild, wet winters and warm, dry summers. See Table SC-1 for climate data by planning area. The bordering mountains have climates that range from Mediterranean to subtropical steppe, with a greater range of maximum and minimum temperatures and higher precipitation amounts for all seasons. Most of the region's precipitation (75 percent) falls between December and March. Average precipitation can vary greatly along the South Coast, ranging from over 40 inches annually in the mountains to less than 10 inches annually in the valleys. Although generally dry, the eastern and southern portions of the region may be impacted in the late summer by monsoonal thunderstorms which result from low pressure cells in the Southwest. The region generally experiences substantial climactic variability, with periods of higher than normal precipitation followed by lower than normal precipitation. Periodic drought conditions present a challenge to water providers throughout the region as they attempt to meet growing demands for water.

Precipitation extremes were experienced in the South Coast region between 2000 and 2005. Very dry conditions were experienced in 2002 in the region. At the Los Angeles Civic Center, 4.4 inches was recorded in water year 2002, which was 30 percent of normal. At the San Diego Airport, 3.3 inches was recorded, which is 33 percent of normal. Above average precipitation was recorded in 2005. At the Los Angeles Civic Center, 37.5 inches was recorded in water year 2005, which was 254 percent of normal. At the San Diego Airport, 22.6 inches was recorded, which is 222 percent of normal.

Population

In 2005, South Coast Hydrologic Region had the largest population of the state's 10 hydrologic regions with 19.6 million people. About 54 percent of the state's total

Box SC-2 California Native American Tribal Information, South Coast Hydrologic Region

- Demographics: Tribes with historic or cultural ties to the Central Cost region are primarily the Cahuilla, Cupeno, Diegueno, Gabrieleno, Kumeyaay, Luiseno, Serrano, and Tongva (previously referred to collectively as the Mission Indians).
  - Currently, Tribal landholdings located in this region include the Barona, Campo, Capitan Grande, Highland (Serrano), Inaja-Cosmit, Jamul, La Jolla, La Posta, Mesa Grande, Pechanga, Pala, Pauma-Yuima, Poway (San Luis Rey), Ramona, Rincon, Riverside (Sherman Indian Museum), San Fernando (Fernando Tataviam), San Manuel, San Pasqual, Santa Ana (Juaneno/ Acjachemem), Santa Ysabel, Soboba, Sycuan, and Viejas reservations, rancherias, and communities. On the boundary with the Colorado River region are the Cahuilla, Ewiiaapaayp (Cuyapaipe), Los Coyotes, Manzanita, and Santa Rosa reservations.
- Collaborative Efforts:
  - Through an agreement with the US Bureau of Reclamation, the La Jolla Band of Luiseno Mission Indians received funding to support fire suppression, increased storage, and the development a drought contingency plan.
  - Pechanga established a full response fire department and has mutual and autoaid agreements with the City of Temecula and the California Department of Forestry, including access to Pechanga's two artificial lakes for supplying aerial water drops in fighting wild fires.
  - The Pala Band, San Luis Rey Indian Water Authority, and the Native American Environmental Protection Coalition participate on the San Luis Rey Watershed Council, working with local jurisdictions, water districts, and non-profit organizations.
- Concerns and Priorities:
  - Tribal water rights are often "paper water" and are not linked to actual water deliveries or supplies.
  - Water quality for surface and groundwater resources along the Mexico border.
- Accomplishments:
  - The San Luis Rey Indian Water Authority is close to completing a 40-year effort to restore and perfect senior water rights that were bypassed in 1895 with the diversion of San Luis Rey River waters into the Escondido Canal. A 1969 lawsuit led to the 1988 San Luis Rey Indian Water Rights Settlement Act. The lining of the All-American Canal, completed in May of 2009, and the settlement agreement provides the necessary supplemental water. Funding options are currently being explored for construction of a pipeline, an important component of actual water deliveries to the reservations. At present, the final settlement agreement is in a period of review by the parties.

NOTE: Above information was gathered from Tribal input at the California Water Plan Update regional workshops and the Tribal water plenary sessions that are supporting the California Tribal Water Summit.

population lives in this region, and 88 percent of the region's population lives in incorporated cities. Between 2000 and 2005, the region grew by 1,414,691 people, a growth of 8 percent over the 5-year period. For historical population data, 1960–2005, see Volume 5, The Technical Guide.

In Water Plan Update 2009, we project population growth based on the assumptions of future scenarios. Discussion of the three scenarios used in this Water Plan and how the region's population may change through 2050 can be found later in this report under Looking to the Future.

Senate Bill 18 (Chapter 905, Statutes of 2004) requires cities and counties to consult with Native American Indian Tribes during the adoption or amendment of local general plans or specific plans. A contact list of appropriate Tribes and representatives within a region is maintained by the Native American Heritage Commission. Box SC-2 lists information about regional Tribal concerns.

Economic Drivers

Historically dominated by the aerospace and defense industries, the South Coast region has diversified into multiple technological fields. Research and development activities are concentrated within the region's universities, including UC Los Angeles, University of Southern California, Caltech, UC Irvine, UC Riverside, and UC San Diego, and their associated research institutes, as well as countless technology-based companies. The top industries in the South Coast, according to the US Census Bureau (2006), are: manufacturing (computers and electronics, transportation equipment, metal fabrication, food, and apparel); healthcare and social assistance; professional, scientific and technical services (legal, accounting, architectural/engineering services); and wholesale trade (grocery, professional and commercial equipment, apparel, machinery).

The tourism industry, which is supported by coastal and beach ecosystems, is a key economic driver in the South Coast region. The region also includes the largest port complex in the United States, the adjacent 7,500-acre Port of Los Angeles and 3,200-acre Port of Long Beach, as well as several smaller ports and harbors. In 2003, merchandise trade passing through the Port of Long Beach was valued at $96 billion: 12 percent of the value of total US international waterborne trade. Coastal and channel erosion, polluted runoff, and sea level rise are all water resources issues that affect these important industries.

Though not as high in value as the above industries, the agricultural industry still plays an important role in the South Coast economy. The top agricultural products in 2005 include: strawberries, assorted nursery products, and citrus.

Land Use Patterns

With over half of the State's population, urbanization and its associated impacts are key challenges to future land use and water resources planning. The mild climate and gentle hillscapes in the South Coast region have encouraged growth since the first great development boom of the late 1880s. Typical land use patterns include urban development in the coastal plains and interior valleys, with open space maintained in the mountains. Nearly 40 percent of the South Coast's land area is urban and suburban use, which has led to fragmentation of wildlife habitats by urban sprawl and freeways. Recent urban development has occurred on the coastal plains, valleys, and hillsides of Ventura, Orange, and San Diego counties and on the remaining undeveloped land in the Inland Empire. Managed wetlands, reservoirs, and riparian corridors provide pockets of open space within the urban grid. Historical agricultural areas are giving way to urbanization. There are numerous Native American reservations in the South Coast region. See Table SC-2 for information on Tribal lands.

Agricultural land uses remain important in the South Coast region. Important agricultural areas are the Oxnard Plain and Santa Clara River and Santa Rosa valleys in Ventura County and several coastal and interior valleys of San Diego County. Other notable locations include the Chino, Perris, and San Jacinto valleys and near the

Table SC-2 Tribal lands with acreage, South Coast Hydrologic Region

Federal Trust Lands	Acres	Tribal owners
Campo Reservation (Splits with CR Region, but mostly in SC)	16,512	Kumeyaay (Diegueño) Indians
La Posta Reservation	3,556	Kumeyaay (Diegueño) Indians
Manzanita Reservation (Splits with CR Region, but mostly in CR)	See CR Region for acres	
Cuyapaipe Reservation (Splits with CR Region, but mostly in CR)	See CR Region for acres	
Santa Ysabel Reservation (Splits with CR Region, but almost entirely in SC Region)	15,526	Diegueño Indians
Los Coyotes Reservation (Splits with CR Region, but mostly in SC Region)	25,050	Cahuilla and Cupeño Indians
Pala Reservation (2 separate locations – one large and one really small a distance away).	11,893	Cupeño and Luiseño
Cabazon Reservation	1,706	Cahuilla Indians of the Cabazon Reservation.
Santa Rosa Reservation (Splits with CR Region, but almost entirely in CR Region)	See CR Region for acres	
Morongo Reservation (Splits with CR Region, but is almost entirely in CR Region except for one small parcel)	See CR Region for acres	
San Manuel Reservation	658	Serrano Indians
Soboba Reservation	5,915	Luiseño Indians
Ramona Reservation	560	Cahuilla Indians
Pechanga Reservation	4,394	Luiseño Indians
Pauma-Yuima Reservation	5,877	Luiseño Indians
La Jolla Reservation	8,541	Luiseño Indians
Reservation Rincon	4,275	Luiseño Indians
San Pasqual Reservation	1,380	Kumeyaay (Diegueño) Indians
Mesa Grande Reservation	1,803	Diegueño Indians
Inaja - Cosmit Reservation	880	Diegueño Indians
Barona Reservation	5,903	Barona Band of Mission Indians
Capitan Grande Reservation	15,753	Today, the Capitan Grande Reservation is owned by Viejas, Barona, and other non-reservation groups.
Reservation Viejas	1,609	Kumeyaay (Diegueño) Indians
Sycuan Reservation	640	Kumeyaay (Diegueño) Indians
Jamul Village	Unknown at this time	

*Data taken from the San Diego State University's online library and information access (http://infodome.sdsu.edu/research/guides/calindians/calinddict.shtml#a) cities of Irvine, Redlands, and Riverside. Total crop acres in 2005 for the region was 242,000 acres; a decrease from 2000 when 280,000 acres was harvested.

In the major agricultural areas, the emphasis was on growing high market value crops. The Oxnard Plain is still recognized for fresh market vegetables. Citrus and subtropical fruits are produced in the Santa Clara River Valley and the interior valleys of San Diego County. Forage crops are still grown in the Chino, Perris, and San Jacinto Valleys in support of the dairy industry in Chino.

The South Coast's watersheds typically do not resemble their natural state due to urbanization and agricultural practices that have modified waterways and surrounding habitats. Numerous waterways have been impacted by hydromodification and channelization. Many streambeds have been lined with concrete to facilitate flood management, thereby decreasing groundwater recharge. This is a particular problem for those groundwater basins which have historically been over-pumped, such as in the Los Angeles River watershed. Bridges and other structures over channelized streams can slow flow velocity and cause adjacent flood damage, as seen in the Calleguas Creek watershed. Due to intense urbanization and loss of natural habitat, there is a focus on conserving the natural areas that remain within the region.

Concern over effective land use planning for reducing wildfire risk and ensuring rapid response strategies have become more urgent as development continues to move into urban interface areas. Brush fires in San Diego County in October 2003 burned about 265,000 acres (Cal Fire 2003). Not only was the loss to wildlands severe during this nightmare, including devastating nearly all of Cuyamaca Rancho State Park, but more than 5,000 homes and other structures were damaged or completely destroyed. San Diego County burned again in October 2007, losing 347,000 acres and damaging 2,600 structures (Cal Fire 2007). In 2009, a brush fire in the Angeles National Forest in Los Angeles County burned over 160,000 acres and damaged 89 structures. Fires have always been a component of life in California, but the likelihood of fire causing profound damage for local residents has increased with ongoing urbanization. Planners and legislators are increasingly looking to understand and manage the South Coast landscape to reduce such losses.

Regional Water Conditions

The region has developed a diverse mix of local and imported water supply sources, available in differing amounts throughout the South Coast region. The following sections provide an overview of regional water conditions.

Environmental Water

Given the arid nature of the region and the flashy nature of storm events, the native South Coast environment is generally very sensitive to water. Although numerous structures have been built to alter the natural flows of local water bodies, many efforts are under way to restore these damaged environments, protect existing ones, and develop new ones to replace those that have been lost.

Water supply dedicated to environmental management includes instream flows for fisheries, aquatic vegetation, and water quality protection. Although environmental water use is limited in the South Coast region, local agencies have developed beneficial reuse programs for reclaimed water. Managed wetlands—e.g., Balboa Lake in the Sepulveda Basin area of Los Angeles County, Hemet/San Jacinto Multi-Purpose Constructed Wetlands in Riverside County, San Jacinto Wildlife Area in Riverside County, San Joaquin Marsh along San Diego Creek in Orange County, and Santee Lakes in San Diego—are maintained through discharge of reclaimed water supplies. Discharges from upstream wastewater treatment plants (WWTPs) contribute inflows to many of the region's coastal lagoons and estuaries. Constructed wetlands along the Santa Ana River, including lands behind Prado Dam, have effectively demonstrated the ability to reduce nitrogen levels and recharge the groundwater aquifer. These managed wetlands, fed by Santa Ana River flows, provide for migratory and resident waterfowl and shorebird habitat, wildlife diversity, and public education and recreation opportunities. The source of the wetland flows is assured by the Santa Ana River Stipulated Judgment (overseen by the Santa Ana River Watermaster) which requires minimum average annual flows and guaranteed TDS concentrations within the river.

A 31-mile section of Sespe Creek in the Los Padres National Forest (Ventura County) was designated by USFWS as a Wild and Scenic River in 1992. Unusual geologic formations, gorges, and riparian vegetation provide excellent scenic diversity and recreation opportunities. This stream is considered a rainbow trout fishery and provides critical habitat for the endangered California condor. Sespe Creek and Bear Creek/Bear Valley Dam (impounding Big Bear Lake) are both designated as "wild trout waters" by DFG and are further regulated to maintain appropriate instream habitat conditions (DFG 2008). These South Coast fisheries are limited by diversions and dams that have cut off important spawning areas through diminished flows and poor water quality.

Water Supplies

To meet current and growing demands for water, the South Coast region is leveraging all available water resources: imported water, water transfers, conservation, captured surface water, groundwater, recycled water, and desalination. Given the level of uncertainty about water supply from the Delta and Colorado River, local agencies have emphasized diversification. Local water agencies now utilize a diverse mixture of local and imported sources and water management strategies to adequately meet urban and agricultural demands each year. For example, San Diego is projected to produce approximately 185,000 acre-feet per year of local supplies through water recycling, desalination, groundwater, and surface storage programs by 2030. By 2021, the area will receive an additional 277,000 acre-feet per year due to San Diego County Water Authority-Imperial Irrigation District (SDCWA-IID) water conservation, transfer, and canal-lining programs. This diverse mix of sources provides flexibility in managing resources in wet and dry years.

Imported Water

Water is brought into the South Coast region from three major sources: the Sacramento-San Joaquin Delta, Colorado River, and Owens Valley/Mono Basin. All three are facing water supply cutbacks due to climate change and environmental issues. Although historically imported water served to help the South Coast region grow, it is today relied upon to sustain the existing population and economy. As such, parties in the South Coast region are working closely with other regions, the State, and federal agencies to address the challenges facing these imported supplies. Meanwhile, the South Coast region is working to develop new local supplies to meet the needs of future population and economic growth.

State Water Project

The State Water Project (SWP) is an important source of water for the South Coast region wholesale and retail suppliers. SWP contractors in the region take delivery of and convey the supplies to regional wholesalers and retailers. Contractors in the region are the Metropolitan Water District of Southern California (Metropolitan), Castaic Lake Water Agency (CLWA), San Bernardino Valley Municipal Water District (MWD), Ventura County Watershed Protection District (VCWPD) (formerly Ventura County Flood Control District), San Gorgonio Pass Water Agency (SGPWA), and San Gabriel Valley Municipal Water District. Metropolitan's contract with the California Department of Water Resources (DWR) is for 1.91 million acre-feet annually—about half the total project (see more discussion in Appendix B).

Colorado River System

Another key imported water supply source for the South Coast region is the Colorado River. California water agencies are entitled to 4.4 million acre-feet annually of Colorado River water. Of this amount, 3.85 million acre-feet are assigned in aggregate to agricultural users; 550,000 acre-feet is Metropolitan's annual entitlement. Until a few years ago, Metropolitan routinely had access to 1.2 million acre-feet annually because Arizona and Nevada had not been using their full entitlement and the Colorado River flow was often adequate enough to yield surplus water. Metropolitan delivers the available water via the 242-mile CRA and the regional conveyance system. (See more discussion in Appendix B.)

Owens Valley/Mono Basin

High-quality water from the Mono Basin and Owens Valley is delivered through the Los Angeles Aqueduct (LAA) to the City of Los Angeles. Construction of the original 233-mile aqueduct from the Owens Valley was completed in 1913, with a second aqueduct completed in 1970 to increase capacity. Approximately 480,000 acre-feet per year of water can be delivered to the City of Los Angeles each year; however the amount the aqueducts deliver varies from year to year due to fluctuating precipitation in the Sierra Nevada Mountains and mandatory instream flow requirements.

For more information on Water Supply and Suppliers in the South Coast Region, see Appendix B.

Diversion of water from Mono Lake has been reduced following State Water Board Decision 1631 and exportation of water from the Owens Valley is limited by the Inyo-Los Angeles Long Term Water Agreement (and related MOU) and the Great Basin Air Pollution Control District/City of Los Angeles MOU (to reduce particulate matter air pollution from the Owens Lake bed).

Other Water Transfers

Prior to 1991, water transfers within the South Coast region had been limited to transfers of annual groundwater basin rights (which continue to occur). Recently, municipal population growth and the need for water supply reliability have resulted in the growth of water transfer agreements. Metropolitan participates in multiple water exchange and storage programs, including agreements with Semitropic Water Storage District (WSD), Arvin-Edison WSD, San Bernardino Valley MWD, Kern-Delta Water District, Mojave Water District, and the Governor's Water Bank. CLWA has executed long-term transfer agreements with the Buena Vista and Rosedale-Rio Bravo WSDs (see Section, Relationship with Other Regions).

In 1998, SDCWA entered into a transfer agreement with Imperial Irrigation District (IID) to purchase conserved agricultural water. Through the agreement, SDCWA received 50,000 acre-feet in 2007. This quantity will increase in 10,000 acre-feet increments annually up to 200,000 acre-feet per year in 2021 and then remain fixed for the duration of the 75-year agreement. Metropolitan conveys the transfer water to SDCWA via an exchange agreement.

The Colorado River Water Delivery Agreement: Federal Quantification Settlement Agreement of 2003 (QSA) has resulted in the movement of supplies between the Colorado River and South Coast regions.

Local Surface Water

Local surface capture plays an important water resource role in the South Coast region. More than 75 impound structures are used to capture local runoff for direct use or groundwater recharge, operational or emergency storage for imported supplies, or flood protection. While precipitation contributes most of the annual volume of streamflow to the region's waterways, urban runoff, wastewater discharges, agricultural tailwater, and surfacing groundwater are the prime sources of surface flow during non-storm periods. The South Coast has experienced a trend of increasing dry weather flows during the past 30 years as the region has developed, due to increased imported water use and associated urban runoff. (See more discussion in Appendix B.)

Groundwater

During the first half of the 20th century, groundwater was important factor in the expansion of the urban and agricultural sectors in the South Coast region. Today, it remains important for the Santa Clara, Metropolitan Los Angeles and Santa Ana planning areas, but only a small source for San Diego. Court adjudications, recharge operations, and other management programs are helping to maintain the supplies available from many of the region's groundwater basins. Since the 1950s, conjunctive management and groundwater storage has been utilized to increase the reliability of supplies, particularly during droughts. Using the region's other water resources, groundwater basins are being recharged through spreading basins and injection wells. During water shortages of the imported supplies, more groundwater would be extracted to make up the difference. Water quality issues have impacted the reliability of supplies from some basins. However, major efforts are underway to address the problems and increase supplies for these basins. (See more discussion in Appendix B.)

Recycled Water

In the South Coast region, recycled water is becoming increasingly valuable given its reliability and cost-effectiveness as compared to tapping other water supplies. In addition to extending conveyance systems to deliver recycled water for non-potable uses (i.e., purple pipe), the region is leading implementation of groundwater recharge and reservoir augmentation with recycled water (i.e., indirect potable reuse, IPR). (See more discussion in Appendix B.)

Desalination

Desalination is being implemented in the South Coast region not only to help meet local water supply needs, but also to manage salinity levels and associated impacts on the environment. In the Santa Clara and Santa Ana planning areas, desalination is focused on brackish groundwater treatment. Large-scale seawater desalination facilities are moving through the approval process in the Santa Ana Planning Area. A large-scale seawater desalination facility has recently been approved in the San Diego Planning Area, and seawater desalination is being pursued in earnest in the Metropolitan Los Angeles Planning Area. (See more discussion in Appendix B.)

Urban Water Conservation

Water conservation is a fundamental component of the South Coast region's water management planning. Water agencies in the South Coast have been aggressively implementing water conservation since the 1990s. Many local water agencies are signatories to the California Urban Water Conservation Council (CUWCC) Memorandum of Understanding (MOU) for urban water conservation and also have adopted Urban Water Management Plans to ensure water supply reliability during normal, dry, and multiple dry years. These agencies implement the best management practices (BMPs) and demand management measures contained in those documents. The backbone of Metropolitan's conservation program is the Conservation Credits Program (CCP), initiated in 1988, that contributes $195 per acre-foot of water conserved to assist member agencies in pursuing urban BMPs and other demand management opportunities. All of the region's water suppliers have water conservation programs for their customers which feature residential and commercial water saving tips, rebates for water efficient purchases (e.g., low-flow toilets, high-efficiency clothes washers, weather-based irrigation controllers), and tools for implementing landscape/garden improvements. Local agencies are also developing water conservation master plans and conservation rate structures as well as working closely through Integrated Regional Water Management (IRWM) planning efforts to develop coordinated water efficiency programs. (See more discussion in Appendix B.)

Water Uses

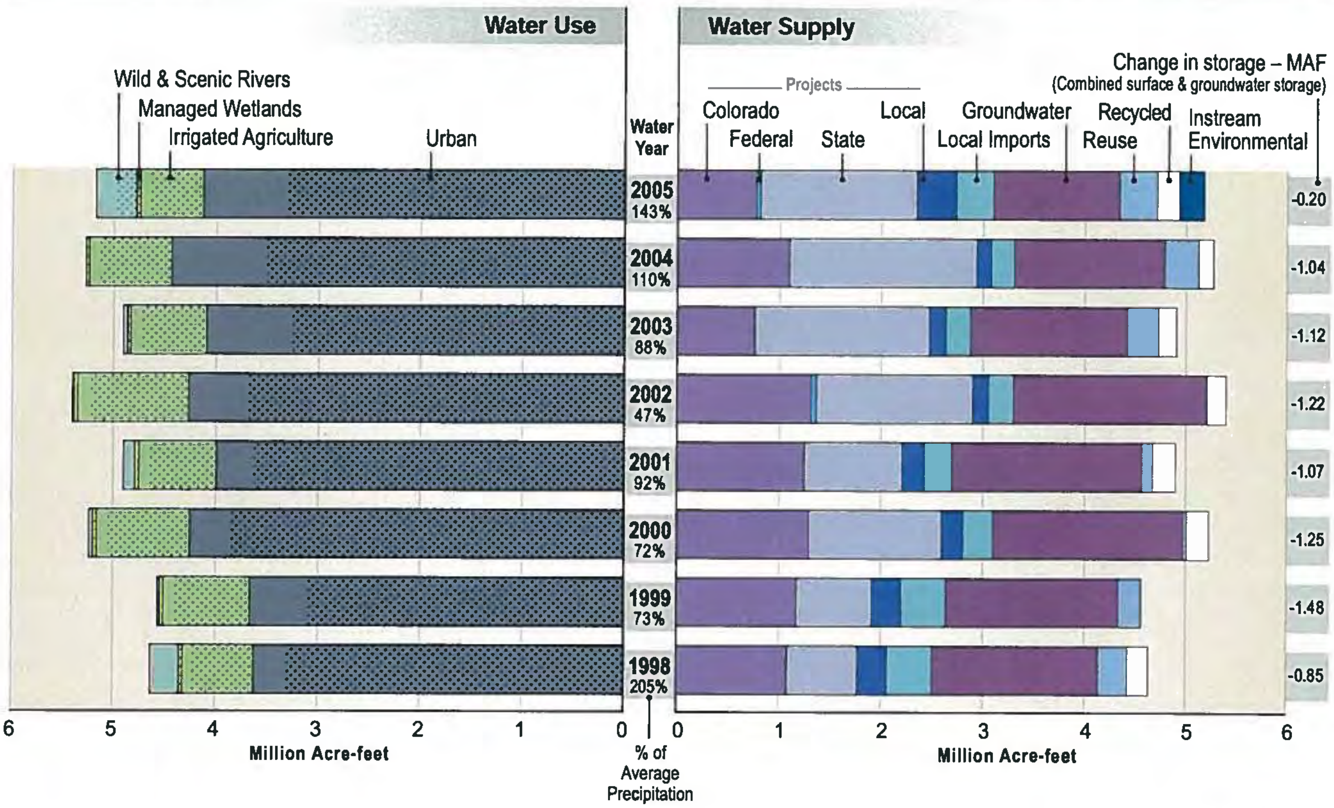
Urban Water Use

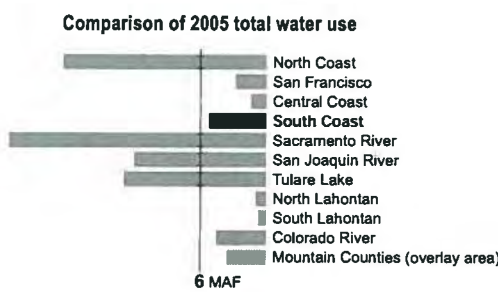
The South Coast Hydrologic Region is the most populous and urbanized region in California. In some portions of the region, water users consume more water than is locally available, which has resulted in an overdraft of groundwater resources and increasing dependence on imported water supplies. The distribution of water uses, however, varies dramatically across the South Coast's planning areas. As a result of recent droughts, South Coast water users have generally become more water efficient. Municipal water agencies are engaged in aggressive water conservation and efficiency programs to reduce per capita water demand. As a result of changes in plumbing codes, energy and water efficiency innovations in appliances, and trends toward more water efficient landscaping practices, urban water demand has become more efficient. (Read about the region's urban water conservation above under Water Supply and in Appendix B.)

Agricultural Water Use

Despite vast urbanization within the South Coast, about 240,000 acres of irrigated crops were harvested in 2005. Agricultural activities accounted for approximately 12 percent of the overall use in the region. In the main agricultural areas on the South Coast, growers are very conscious about the amount of water needed to produce a marketable crop and strive to be as efficient as possible. The largest area of concentrated row crops (35,000 acres of harvest produce) is in Ventura County. Although sprinkler and furrow irrigation is still used on several truck crops (celery, cabbage and broccoli), drip irrigation is used almost exclusively for other kinds of vegetable crops (lettuce, peppers, and tomatoes). In recent years, improvements in surface drip technology have permitted growers to use drip tape for consecutive years without a decrease in effectiveness. Additionally, many of the large-scale citrus and avocado operations in Ventura and San Diego counties are irrigated with micro-sprinkler systems. Improved technology has allowed growers to more accurately distribute water to the individual trees; pressure compensating valves and emitters have enabled growers to irrigate on steep slopes with better precision. Maximizing agricultural irrigation systems lowers the growers' irrigation demands.

Figure SC-4 South Coast Hydrologic Region water balance summary, 1998-2005





Water Balance Summary

Figure SC-4 summarizes the total developed water supplies and distribution of the dedicated water uses within this hydrologic region for the eight years from 1998 through 2005. As indicated by the variation in the horizontal bars for wet (1998) and dry (2002) years, the distribution of the dedicated supply sources (right side of Figure SC-4) can change significantly based on the wetness or dryness of the water year. The more detailed numerical information about the developed water supplies and uses is presented in Volume 5 Technical Guide, which provides a breakdown of the components of developed supplies used for agricultural, urban, and environmental purposes and Water Portfolio data.

For the South Coast region, urban water uses are the largest component of the developed water supply, while agricultural water use is a smaller but significant portion of the total. There is very little dedicated water required for instream flows within this region. The water supply portion of Figure SC-4 also indicates that imported water supplies and groundwater are the major components of the water supply for this region, with minor supplies from local surface waters and recycled water.

Table SC-3 presents information about the total water supply available to this region for the eight years from 1998 through 2005, and the estimated distribution of these water supplies to all uses. The annual change in the region's surface and groundwater storage is also estimated, as part of the balance between supplies and uses. In wetter water years, water will usually be added to storage, while during drier water years storage volumes may be reduced. Of the total water supply to the region, more than half is either used by native vegetation; evaporates to the atmosphere; provides some of the water for agricultural crops and managed wetlands (effective precipitation); or flows to other states, the Pacific Ocean, and salt sinks like saline groundwater aquifers. The remaining portion, identified as consumptive use of applied water, is distributed among urban and agricultural uses and for diversions to managed wetlands. For some of the data values presented in Table SC-3, the numerical values were developed by estimation techniques, because actual measured data are not available for all categories of water supply and use.

Water Quality

Water quality is a key issue in the South Coast region. Population and economic growth not only affect water demand, but add contamination challenges from increases in wastewater and industrial discharges, urban runoff, agricultural chemical usage, livestock operations, and seawater intrusion. Urban and agricultural runoff can contribute to local surface water sediment from disturbed areas; oil, grease, and toxic chemicals from automobiles; nutrients and pesticides from turf and crop management; viruses and bacteria from failing septic systems and animal waste; road salts; and heavy metals. Three areas that are receiving intense interest are nonpoint source (NPS) pollution control, salinity management, and emerging contaminants.

Three Regional Water Quality Control Boards (Regional Water Boards) have jurisdiction in the South Coast: Los Angeles (Region 4), Santa Ana (Region 8), and San Diego (Region 9). Each Regional Water Board identifies impaired water bodies, establishes priorities for the protection of water quality, issues waste discharge requirements, and takes appropriate enforcement actions within in its jurisdiction (Figure SC-5). Specific water quality issues within the South Coast include beach closures, contaminated sediments, agricultural discharges, salinity management, and port and harbor discharges. Outside the region, high salinity levels and perchlorate contamination contribute to degraded Colorado River supplies, while seawater intrusion and agricultural drainage threaten SWP supplies.

Table SC-3 South Coast Hydrologic Region water balance for 1998-2005 (thousand acre-feet)

South Coast	Water Year (Percent of Normal Precipitation)							
	1998 (205%)	1999 (73%)	2000 (72%)	2001 (92%)	2002 (47%)	2003 (88%)	2004 (110%)	2005 (143%)
Water Entering the Region								
Precipitation*	20,873	7,803	7,522	9,327	5,034	9,468	11,807	15,344
Inflow from Oregon/Mexico	0	0	0	0	0	0	0	0
Inflow from Colorado River	1,081	1,176	1,296	1,250	1,313	760	1,100	773
Imports from Other Regions	1,286	2,361	1,695	1,255	3,093	2,740	3,137	2,331
Total	**23,240**	**11,340**	**10,513**	**11,832**	**9,440**	**12,968**	**16,044**	**18,448**
Water Leaving the Region								
Consumptive Use of Applied Water ** (Ag, M&I, Wetlands)	1,468	1,585	1,819	1,628	1,887	1,651	1,739	1,515
Outflow to Oregon/Nevada/Mexico	0	0	0	0	0	0	0	0
Exports to Other Regions	0	0	0	0	0	0	0	0
Statutory Required Outflow to Salt Sink	0	0	0	0	0	0	0	202
Additional Outflow to Salt Sink	2,110	2,153	2,498	2,325	2,617	2,101	2,347	2,128
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	20,514	9,086	7,441	8,947	6,160	10,333	12,994	14,803
Total	**24,092**	**12,823**	**11,758**	**12,900**	**10,664**	**14,085**	**17,080**	**18,648**
Storage Changes in the Region [+] Water added to storage [–] Water removed from storage								
Change in Surface Reservoir Storage	372	-237	128	332	53	-81	-102	509
Change in Groundwater Storage ***	-1,224	-1,246	-1,373	-1,400	-1,276	-1,035	-934	-709
Total	**-852**	**-1,483**	**-1,245**	**-1,068**	**-1,223**	**-1,116**	**-1,036**	**-200**
Applied Water ** (compare with Consumptive Use).	4,184	4,386	5,041	4,633	5,173	4,676	5,068	4,564

* The percent precipitation is based upon a running 30 year average of precipitation for the region and discrepancies can occur between information calculated for Update 2009 and earlier published data.

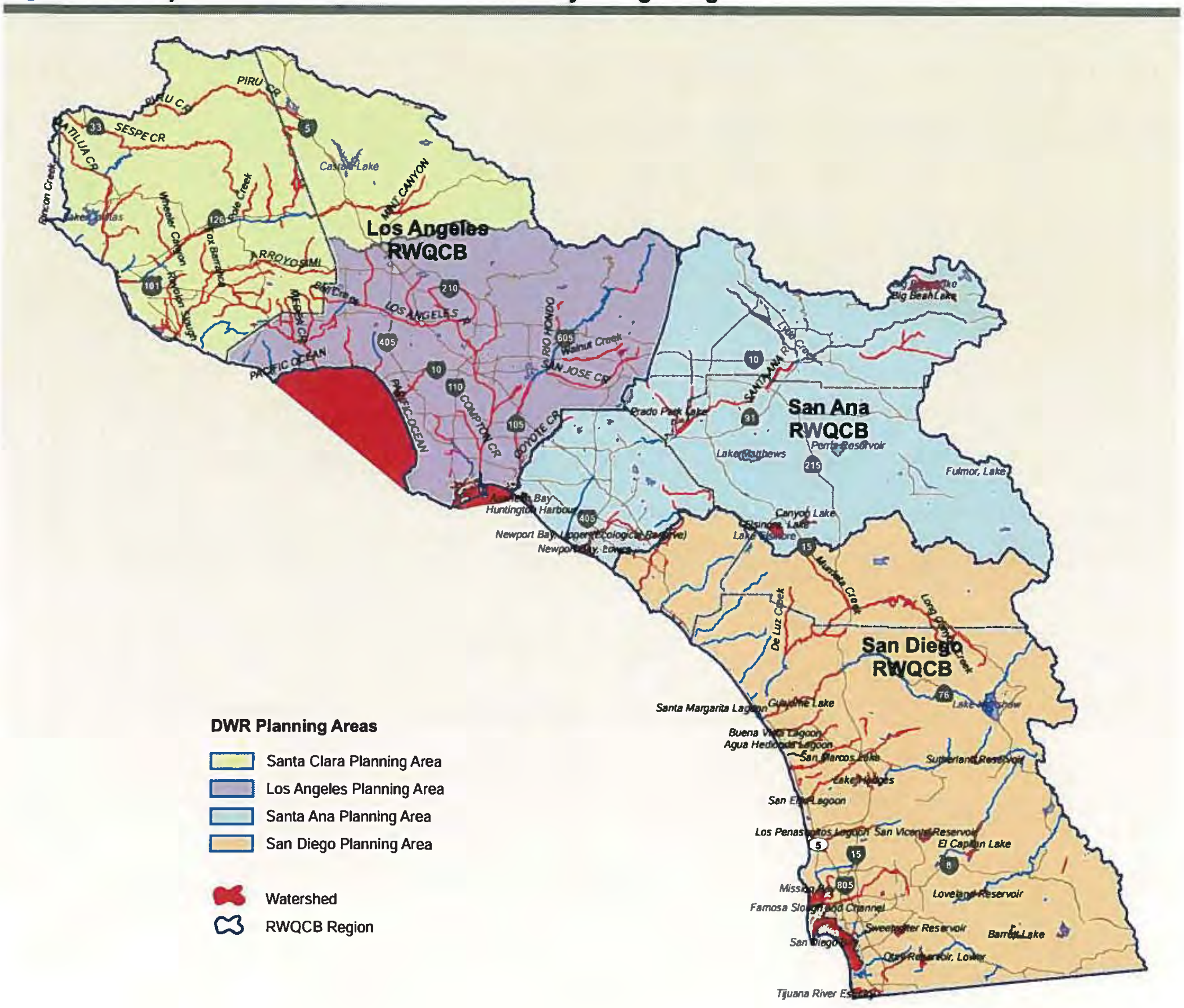
** Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows

*** Change in Groundwater Storage is based upon best available information. Basins in the north part of the state (North Coast, San Francisco, Sacramento River and North Lahontan regions and parts of Central Coast and San Joaquin River Regions) were modeled - spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and years were calculated using the following equation:

GW change in storage = intentional recharge + deep percolation of applied water + conveyance deep percolation and seepage - withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Figure SC-5 Impaired water bodies in South Coast Hydrologic Region



Nonpoint Source Pollution Control

All NPS pollution is currently regulated through either the National Pollutant Discharge Elimination System (NPDES) Permitting Program or the Coastal Non-point Pollution Control Program. All three Regional Water Boards issue municipal, industrial, and construction NPDES permits with the goal of reducing or eliminating the discharge of pollutants into the storm water conveyance system. The coastal program requires the US Environmental Protection Agency and National Oceanic and Atmospheric Administration to develop and implement enforceable BMPs to control non-point source pollution in coastal waters. Further, the Los Angeles and San Diego Regional Water Boards have adopted conditional waivers for discharges from irrigated agricultural lands, which require farmers to measure and control discharges from their property.

South Coast agencies have recently begun to implement Low Impact Development (LID) as a way of improving water quality through sustainable urban runoff management. LID practices include: bioretention and rain gardens, rooftop gardens, vegetated swales and buffers, roof disconnection, rain barrels and cisterns, permeable pavers, soil amendments, impervious surface reduction, and pollution prevention (SWRCB 2008). The Los Angeles and San Diego Regional Water Boards have both incorporated LID language into Standard Urban Storm Water Mitigation Plan requirements for municipal NPDES permits.

Salinity Management

Surface and groundwater salinity is an ongoing challenge for South Coast water supply agencies. Higher levels of treatment are needed following long-range import of water supplies, as TDS levels are increased during conveyance. Salinity sources in local supplies include concentration from agricultural irrigation, seawater intrusion, discharge of treated wastewater, and recycled water. Metropolitan depends on blending the higher salinity CRA supply at Parker Dam with the lower salinity SWP supply to maintain 500 milligrams per liter (mg/L) TDS or lower. The City of San Diego 2006 Water Quality Report shows average TDS for three water treatment plants using blended supplies ranging from 442 to 465 parts per million (ppm). Further, seawater intrusion and agricultural drainage threatens to increase the salinity of SWP supplies. Reduced surface water quality would require additional or upgraded demineralization facilities. Increased salinity also reduces the life of plumbing fixtures and consequently increases replacement costs to customers.

Groundwater quality has also been degraded by a long history of groundwater overdrafting and subsequent seawater intrusion. Orange County Water District (OCWD), Water Replenishment District of Southern California (WRD), and Los Angeles County Department of Public Works (LACDPW) operate groundwater injection programs to form hydraulic barriers that protect aquifers from seawater intrusion. Brackish groundwater treatment occurs throughout the Santa Clara and Santa Ana planning areas. Various local agencies have developed salinity and nutrient management plans to reduce salt loading. For example, the Chino Basin Watermaster developed an Optimum Basin Management Plan (1999) to develop the maximum yield of the basin while protecting water quality. Further development of IPR/groundwater recharge programs within the South Coast may exacerbate groundwater salinity and require additional technological advances in desalination.

Potential Contaminants

Chemical and microbial constituents that have not historically been considered as contaminants are increasingly present in the environment due to municipal, agricultural, and industrial wastewater sources and pathways. Established and emerging contaminants of concern to the region's drinking water supplies include pharmaceuticals and personal care products; disinfection byproducts; those associated with the production of rocket fuel, such as perchlorate and nitrosodimethylamine; those that occur naturally, such as arsenic; those associated with industrial processes, such as hexavalent chromium; and methyl tertiary butyl ether (MTBE), a gasoline additive. WWTPs are not currently designed to remove these emerging contaminants. However, Metropolitan, the National Water Resources Institute, and OCWD are studying the occurrence of emerging constituents in the Santa Ana River, SWP, and Colorado River water. Also, SAWPA is facilitating a task force of watershed stakeholders that is investigating emerging constituents as part of a voluntary cooperative agreement with the Santa Ana Regional Water Quality Control Board.

Planning Area Impairments

Water quality issues within the Santa Clara and Metropolitan Los Angeles planning areas (Los Angeles Regional Water Board) stem from a range of sources, including industrial and municipal operations, flow diversion, channelization, introduction of non-native species, sand and gravel operations, natural oil seeps, dredging, spills from ships, transient camps, and illegal dumping. Over time, these practices have resulted in the bioaccumulation of toxic compounds in fish and other aquatic life, instream toxicity, eutrophication, beach closures, and a number of Clean Water Act 303(d) listings. Water bodies within this planning area have been listed for metals, pesticides, nitrates, trash, salinity, and pH. The Regional Water Board is developing Total Maximum Daily Loads (TMDLs) for nutrients, pathogens, trash, toxic organic compounds, and metals (Los Angeles Regional Water Board 1994; 2007).

Key issues within the Santa Ana Planning Area (Santa Ana Regional Water Board) include: nitrogen/TDS due to flow diversion; nitrogen/TDS associated with past agricultural activities and dairies in the Chino Basin; and pathogen issues from urbanization impacting river and coastal beaches, and past contamination of groundwater basins from perchlorate which is related to rocket fuel disposal and fertilizer use. Water bodies within this planning area typically have nutrient issues, including organic enrichment, low dissolved oxygen, and algal blooms. These are particular problems in Big Bear Lake and Lake Elsinore. Water quality issues also include pathogens, metals, and toxic organic compounds in the lower watershed due to urbanization and agricultural activities. TMDLs have been developed throughout the Santa Ana River and San Jacinto River watersheds for nutrients and pathogens. Along the Newport coast, TMDLs are in place for metals, nutrients, pathogens, pesticides/priority organics, and siltation (Santa Ana Regional Water Board 1994; 2001).

The Chino Basin maintains a large concentration of dairy operations along with livestock. Runoff from the dairies contributes nitrate, salts, and microorganisms to both surface water and groundwater. Since 1972, the Santa Ana Regional Water Board has issued waste discharge requirements to the dairies in this basin. Groundwater quality in this basin is integrally related to the surface water quality downstream in the Santa Ana River, which in turn serves as a source for groundwater recharge in Orange County.

The San Diego Planning Area (San Diego Regional Water Board) is primarily concerned with the quality of coastal water bodies. Agricultural operations, urban runoff, marinas and boating, and hydromodification all pose a threat to coastal water quality. Several shorelines within this region are Clean Water Act 303(d) listed for pathogens, and a number of estuaries and lagoons are listed for nutrients, sediments, pathogens, and metals. TMDLs are under development for several lagoons for nutrients/eutrophication, sedimentation/siltation, TDS, and bacteria. A shoreline TMDL is being created for indicator bacteria as well. The bays and harbors in the region are Clean Water Act 303(d) listed for sediment toxicity, pathogens, pesticides, benthic community effects, copper, lead, and toxic organics. As with the rest of the South Coast, the lakes and reservoirs within the region are affected by nutrients, metals and pH, and rivers are streams are commonly listed for nutrients, pathogens, metals, pesticides, toxic organics, and salinity (San Diego Regional Water Board 1994; 2002).

The Tijuana River watershed poses a unique challenge water quality control as the upper watershed lies within Mexico. Urban runoff and untreated wastewater discharges from Mexico have created significant water quality impacts within the lower watershed. The river and its estuary have issues with nutrients, debris, bacteria, low dissolved oxygen, synthetic organics, pesticides, and metals. The Tijuana River Bi-national Vision is a project meant to identify these water quality issues and define ways to bring the watershed to an ideal state.

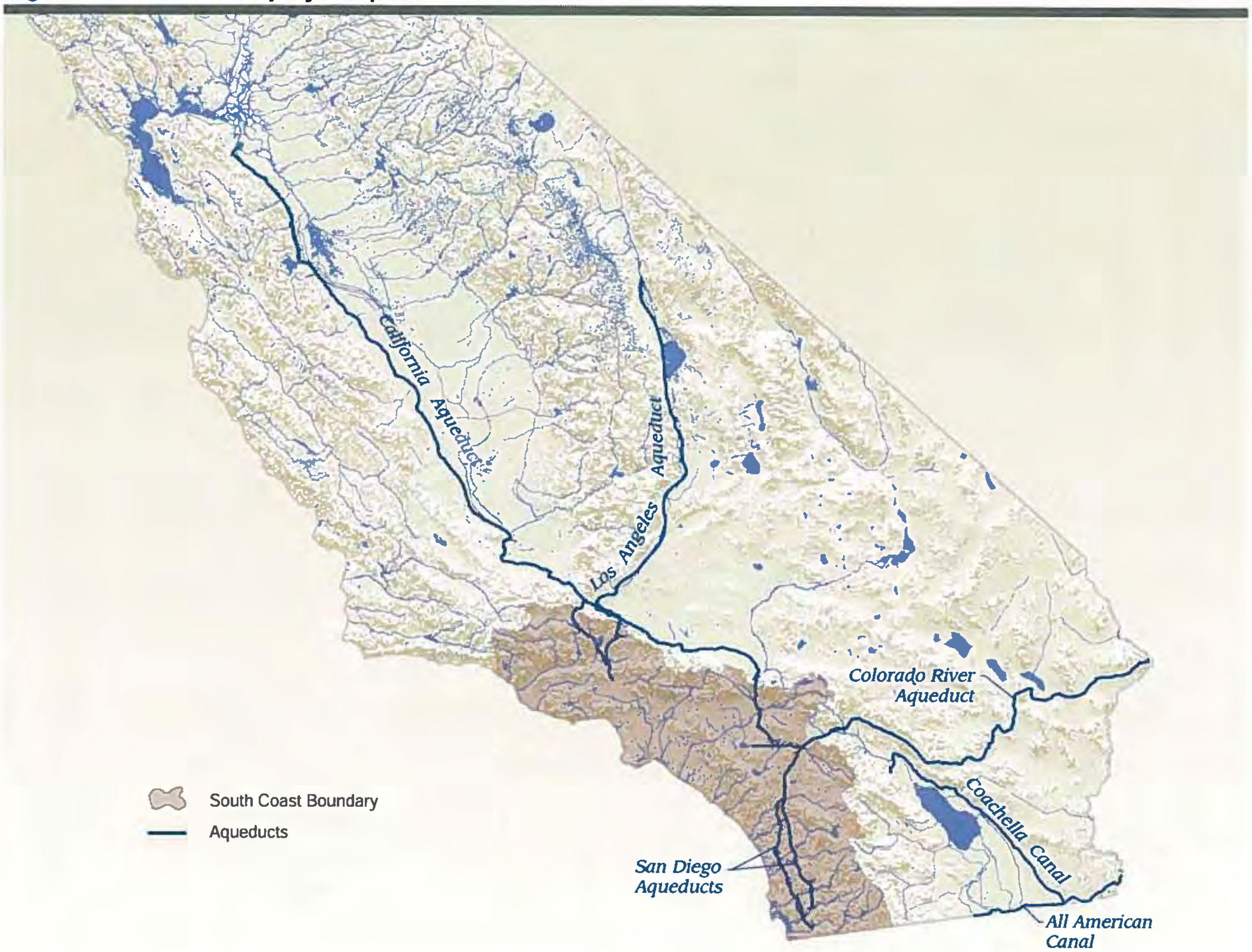
Project Operations

The South Coast region maintains one of the most far-reaching systems of water management in the world. This includes facilities to convey imported water to the region; capture, store, and treat water supplies within the region; and deliver water throughout the region. The following paragraphs describe major water supply infrastructure that deliver imported water to the South Coast region (Figure SC-6). Protection of this infrastructure from earthquakes and other major catastrophes is an essential component of water management.

The California Aqueduct is 444 miles long, owned and operated by DWR, and carries SWP supplies to water agencies throughout California. The aqueduct begins at the Delta and flows by gravity south through the Central Valley to the Edmonston Pumping Plant, where it is pumped 1,926 feet over the Tehachapi Mountains. Once it has crossed the Tehachapis, the aqueduct divides into two branches—the West and the East. The East Branch feeds Lake Palmdale, Lake Perris, and the San Gorgonio Pass area, and the West Branch heads toward Pyramid Lake and Castaic Lake in the Angeles National Forest to supply the western Los Angeles basin. The SWP consists of pumping and power plants (6.5 billion KWh generated annually); 21 reservoirs (5.8 million acre-feet capacity); storage tanks; and canals, tunnels, and pipelines (DWR 2008b).

The CRA is 242 miles long, owned and operated by Metropolitan, and conveys Colorado River water to Southern California. The CRA diverts water from the Colorado River at Lake Havasu on the California-Arizona border and conveys it west across the Mojave and Colorado deserts to Lake Mathews in western Riverside County. The CRA

Figure SC-6 Statewide project operations



was constructed between 1933 and 1941 to ensure a steady supply of drinking water to Los Angeles. The aqueduct consists of 2 reservoirs, 5 pumping plants, 63 miles of canals, 92 miles of tunnels, and 84 miles of buried conduit and siphons.

The Los Angeles Aqueducts comprise two aqueducts. The first LAA (or the Owens Valley aqueduct) was completed 1913 and the second LAA was completed 1970. The first LAA was designed to deliver water from the Owens River near Independence to the City of Los Angeles. The second LAA, which added transport capacity in order to exhaust the city's water rights from the Mono Basin, starts at the Haiwee Reservoir just south of Owens Lake. Running roughly parallel to the first aqueduct, it carries water 137 miles to the City of Los Angeles.

The San Diego Aqueducts, with two branch lines, make up the backbone of the SDCWA system. The five pipelines in the two aqueducts have a combined capacity of 826 cubic feet per second (cfs). The first aqueduct (Pipelines 1 and 2) extends 70 miles from the CRA near San Jacinto to San Vicente Reservoir. Constructed by the Navy Department and US Bureau of Reclamation (USBR) from 1945 to 1954, the two pipelines share common tunnels and inverted siphons. The 94-mile second aqueduct (Pipelines 3 and 4) were constructed from 1957 to 1979 and are operated separately. Pipeline 3 extends from the CRA to Lower Otay Reservoir, and Pipeline 4 terminates at San Diego's Alvarado Treatment Plant near Lake Murray. Metropolitan owns and operates the northern portions of the pipelines; the delivery point to SDCWA is located six miles south of the San Diego-Riverside county line (USBR 2008a).

Water Governance

Water governance is undertaken by various federal and State agencies, the courts, and sanctioned regional organizations to manage critical imported water and groundwater supplies, as well as coordinate flood management. As described in this report, there are hundreds of water supply agencies within the South Coast region. In addition, regional partnerships have been established by South Coast agencies to further collaborate on strategic water resources planning and implementation.

DWR administers long-term imported water supply contracts with 29 agencies for SWP supplies. In return for State financing, operation, and maintenance of SWP facilities, the agencies contractually agree to repay all associated capital and operating costs. The Colorado River is managed and operated by USBR under numerous compacts, federal laws, court decisions and decrees, contracts, and regulatory guidelines collectively known as the "Law of the River" (Table SC-4). This collection of documents apportions the water and regulates the use and management of the Colorado River among the seven basin states and Mexico. LADWP owns and operates the LAAs for conveyance of imported water from the Owens Valley to the City of Los Angeles. Metropolitan, the largest SWP contractor and primary South Coast wholesaler, delivers an average of 1.4 million acre-feet or more of SWP and CRA supplies (depending on the availability of surplus water) to its 26 cities, water districts, and a county authority. In fiscal year 2007-2008, SDCWA, the largest of Metropolitan's members, purchased about 593,500 acre-feet, or about 25 percent of Metropolitan's deliveries.

Groundwater adjudication limits the amount of groundwater that can be extracted by all parties based on a court-determined safe yield of the basin. A watermaster is then appointed by the court to administer the judgment. There are 13 court adjudications for groundwater basins in the South Coast, including Central Basin, Chino Basin, Cucamonga Basin, Goleta Basin, Main San Gabriel Basin, Puente Basin, Raymond Basin, San Bernardino Basin Area, Santa Margarita River watershed, Santa Paula Basin, Six Basins, Upper Los Angeles River, and the West Coast Basin.

Three Regional Water Boards manage water quality for the region by setting standards, issuing waste discharge requirements, determining compliance with those requirements, and taking appropriate enforcement actions. Each Regional Water Board

Table SC-4 Key elements of the Law of the Colorado River

Document	Date	Main Purpose
Colorado River Compact	1922	The Upper and Lower Basin are each provided a basic apportionment of 7.5 MAF annually of consumptive use. The Lower Basin is given the right to increase its consumptive use by an additional 1.0 MAF annually.
Boulder Canyon Project Act	1928	Authorized USBR to construct Hoover Dam and the All-American Canal (including the Coachella Canal), and gave congressional consent to the Colorado River Compact. Apportioned the Lower Basin's 7.5 MAF among the states of Arizona (2.8 MAF), California (4.4 MAF), and Nevada (0.3 MAF). Provided that all users of Colorado River water stored in Lake Mead must enter into a contract with USBR for use of the water.
California Limitation Act	1929	Confirmed California's share of the 7.5 MAF Lower Basin allocation to 4.4 MAF annually, plus no more than half of any surplus waters.
California Seven-Party Agreement	1931	An agreement among seven California water agencies/districts to recommend to the Secretary of Interior how to divide use of California's apportionment among the California water users.
US-Mexican Water Treaty	1944	Apportions Mexico a supply of 1.5 MAF annually of Colorado River water, except under surplus or extraordinary drought conditions.
US Supreme Court Decree in Arizona v. California, et al.	1964, supplemented 1979	Rejected California's argument that Arizona's use of water from the Gila River, a Colorado River tributary, constituted use of its Colorado River apportionment. Ruled that Lower Basin states have a right to appropriate and use tributary flows before the tributary co-mingles with the Colorado River. Mandated the preparation of annual reports documenting the uses of water in the three Lower Basin states. Quantifies tribal water rights for specified tribes, including 131,400 afy for diversion in California. Quantified Colorado River mainstream present perfected rights in the Lower Basin states.
Colorado River Basin Project Act	1968	Authorized construction of the Central Arizona Project. Requires Secretary of the Interior to prepare long-range operating criteria for major Colorado River reservoirs.
Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs	1970, amended 2005	Provided for the coordinated operation of reservoirs in the Upper and Lower Basins and set conditions for water releases from Lake Powell and Lake Mead.
Colorado River Water Delivery Agreement: Federal Quantification Settlement Agreement of 2003	2003	Complex package of agreements that, in addition to many other important issues, further quantifies priorities established in the 1931 California Seven-Party Agreement and enables specified water transfers (such as the water conserved through lining of the All-American and Coachella canals to SDCWA) in California.

Source: Adapted from USBR 2008c

identifies impaired water bodies and establishes priorities for the protection of surface water quality.

Regional planning has been advanced by IRWM introduced by DWR and the State Water Board. Regional planning efforts bring together water supply, wastewater, flood control, and environmental stakeholders to identify water management challenges, reduce conflicts, and develop the region's diversified water management portfolios.

Flood Management

Flood Hazards

Flooding in the South Coast region is predominately from winter storms. Precipitation over short periods can produce large amounts of water in the steep upper watersheds, often leading to very sudden and severe flooding of developed lowland areas. Debris flows are also a common occurrence during the winter months. Seasonal fires denude the watersheds of their vegetation, and can leave steep terrain vulnerable to winter storms. Thunderstorms are infrequent in the region and typically only occur at lower elevations during the winter months. Very little snow makes its way into this region and therefore has a marginal impact on flood events.

Representative hazards currently facing the region are listed below (for specific instances, see Challenges).

- Some existing culverts and channels do not have sufficient capacity to carry flow resulting from the event having 1 percent probability of occurrence in any year.
- Flood infrastructure is aging, leading to deterioration and costly maintenance.
- Population growth and the ensuing development increase the area of impervious surface without sufficient mitigation, increasing peak runoff.
- Development occurs in the floodplain of the 1 percent event without sufficient mitigation, causing increased flood damage risk.
- Development has resulted in poorly placed, flood-vulnerable structures.
- Unmanaged vegetation has reduced flood flow capacity at some locations.
- Clogged rivers, channels, and conveyance structures exacerbate flood risk.
- Existing properties are vulnerable to uncontrolled hillside sheet flow.
- Reservoir siltation has reduced flood storage capacity.
- Some debris basins do not have adequate capacity to capture the anticipated mudflows.
- Some dams do not meet current State seismic, spillway or other structural requirements.
- Wildfires may denude steep slopes, which are then vulnerable to increased runoff and debris flow during ensuing storms.

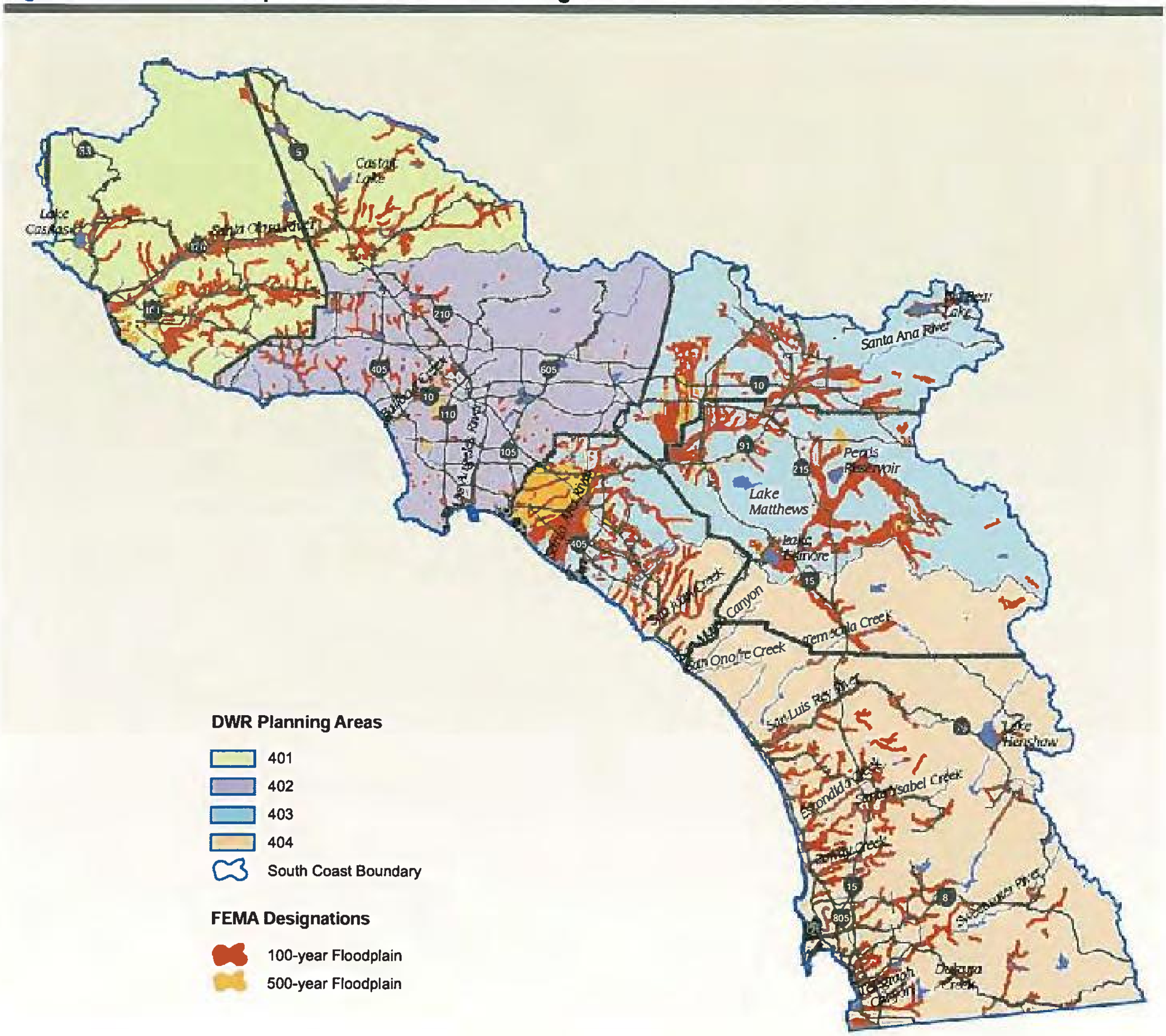
Figure SC-7 illustrates the 100- and 500-year floodplains identified by the Federal Emergency Management Agency (FEMA).

Historic Floods

The South Coast region has experienced many floods over the past 200 years. Significant floods occurred in 1810, 1861-62, 1884, 1914, 1916, 1925, 1928, 1938, 1969, 1978, 1980, and 1992.

The highest storm discharges on record have occurred on the Los Angeles River at Long Beach (128,700 cfs), the Santa Clara River at Montalvo (165,000 cfs), the Santa Ana River at Prado Dam (100,000 cfs), the San Diego River at Fashion Valley (75,000 cfs), and Sespe Creek near Fillmore (85,300 cfs).

Figure SC-7 FEMA floodplains in the South Coast region



For more information on these floods see Appendix A, Flood Management. Flood records for selected flood-producing streams are listed in Appendix A in Table SCA-1, Record floods for selected streams.

Flood Governance

Flood management is a cooperative effort in which federal, tribal, state, and local governments all play significant parts. The principal participants are listed in Box SC-3 Flood Management Agencies. For more information on the agencies' roles, see Table SCA-2, Flood management participants, in Appendix A.

Box SC-3 Flood Management Agencies

Federal

- Federal Emergency Management Agency
- National Weather Service
- Natural Resources Conservation Service
- US Geological Survey
- US Army Corps of Engineers

Tribal

- Tribal governments of the region

State

- California Conservation Corps
- California Emergency Management Agency
- Department of Corrections
- Department of Forestry and Fire Protection
- Department of Water Resources

Local

- Los Angeles County Department of Public Works—Watershed Management Division
- Los Angeles County Flood Control District
- Orange County Flood Control District
- Riverside County Flood Control and Water Conservation District
- San Bernardino County Flood Control District
- San Diego County Flood Control District
- Ventura County Watershed Protection District
- County and city emergency services units
- County and city planning departments
- County and city building departments
- Local flood maintenance organizations
- Local conservation corps
- Local emergency response agencies
- Local initial responders to emergencies

Flood Risk Management

Flood risk management includes a wide variety of projects and programs, which may be grouped as Structural Approaches (constructed facilities, coordination and reservoir operations, maintenance), Land Use Management (regulation, flood insurance), and Disaster Preparedness, Response, and Recovery (information and education, event management).

Structural Approaches

Constructed Facilities. The urban development that supports the South Coast's vast population produces many challenges for local flood control agencies. Flood control projects accommodate changing conditions by protecting life, property, public infrastructure, and watercourses from potential damage associated with storm flows and floods. County flood control districts in each of the six counties accomplish these goals through floodplain management, construction of flood control infrastructure, mapping, and development of flood control ordinances. Replenishment of local groundwater aquifers is also a major activity of the flood management agencies. Federal support for these efforts comes through project financing and construction by the US Army Corps of Engineers (USACE). Smaller watershed-related projects often have the support of Natural Resources Conservation Service (NRCS).

The South Coast region has one of the highest densities of flood control and water conservation structures in the state. Channels have been modified and realigned on many of the waterways to provide improved conveyance for floodflows. There is an extensive network of flood storage facilities throughout the region. Debris basins along many of the waterways provide protection against sedimentation, a major cause of flood damage. Many miles of levees provide flood protection to areas historically inundated by floodwaters.

The USACE Santa Clara River Project in the Santa Clara Planning Area includes levees on the Santa Clara River protecting Oxnard and Port Hueneme, and an improved channel on Santa Paula Creek at Santa Paula. Other USACE projects include levees on the Ventura River at Ventura and a debris basin and channel on Stewart Creek near Ojai. NRCS has provided construction funding for projects including a debris basin, spillways and channel work at Beardsley Wash and channel improvements on Revolon Slough, both in the Oxnard Plain and owned by Ventura County Watershed Management District; and sediment basins, debris dams, levees, channels, and spillways on Calleguas and Conejo creeks, Arroyo Simi, Arroyo Las Posas, and tributaries near Camarillo, Somis, Moorpark, and Simi Valley, all part of another project of Ventura County Watershed Management District.

In the Metropolitan Los Angeles Planning Area, the LACDPW, in cooperation with USACE, constructed one of the largest flood control projects ever built for a metropolitan area. The Los Angeles County Drainage Area Project includes 20 reservoirs, 90 debris basins, 458 miles of improved channels, and 1,424 separate storm drains. Included in the Los Angeles County Drainage Area (LACDA) project are the Sepulveda Dam on the Los Angeles River, Hansen Dam on Tujunga Wash, Santa Fe Dam on the San Gabriel River, Lopez Dam on Pacoima Wash, and the Whittier Narrows Dam on the San Gabriel River and Rio Hondo. Apart from LACDA, LACDPW also operates and maintains Big Dalton, Santa Anita, Big Tujunga, Cogswell, Devil's Gate, Live Oak, Eaton Wash, Pacoima, San Dimas, Puddingstone, Puddingstone Diversion, San Gabriel, and Thompson Creek reservoirs, all providing flood protection for the greater Los Angeles area.

USACE constructed conduit and channel at Kenter Canyon near Santa Monica. NRCS provided construction funding for many LADPW channel projects in the San Fernando Valley, including Aliso Creek, Arroyo Calabasas, Bell Creek, Browns Creek, Bull Creek, Limekiln Creek, Lower East Canyon, Santa Susana Creek, Upper East Canyon, and Wilbur Creek.

The USACE collaborated with the Orange County Flood Control District to develop major flood protection systems collectively called the Santa Ana River Basin and Orange County (SAROC) projects in the Santa Ana Planning Area. The SAROC projects include seven dams, one dam enlargement, ten channel modifications, three new channels, levees on five waterways, and bank protection. Dams include Brea and Fullerton protecting Fullerton, Prado and Seven Oaks protecting urban Orange County, and Carbon Canyon protecting Anaheim and Los Alamitos. USACE also constructed

San Antonio Dam, protecting the Ontario-Pomona area, and Orange County Flood Control District built Villa Park Dam for Orange County urban areas. SAROC also includes levees, improved channels, bypasses, debris basins, detention basins, groins, revetment, bank stabilization and floodplain management. Separately from SAROC, Riverside County Flood Control and Water Conservation District constructed, operates and maintains Allesandro, Box Springs, Harrison Street, Prenda, Sycamore, and Woodcrest dams to reduce flood risk in Riverside; and Pigeon Pass Dam to protect Moreno Valley. The City of Riverside contributed Mockingbird Dam. At Lake Elsinore, USACE constructed facilities to increase flood control storage in the lake.

USACE also constructed improved channels and a storage basin on Santiago Creek at Santa Ana and levees, an improved channel, and revetment on City Creek at San Bernardino.

In the San Diego Planning Area there is substantial investment in non-storage flood control projects. USACE has constructed levees or improved channels on the San Diego River, the Sweetwater River, and Rose Creek at San Diego, the San Luis Rey River in the San Luis Rey Valley, Los Coches Creek at Lakeside, and Telegraph Canyon Creek at Chula Vista. Internationally, a USACE project on the Tijuana River in the San Diego area protects property in Tijuana, Mexico. NRCS has provided construction funds for City of Vista channel improvements on Buena Vista Creek near Vista and a City of Escondido flood control reservoir and channels on Escondido Creek near Escondido.

Local sponsors and descriptions for reservoirs and non-storage flood control facilities in the region are listed in Appendix A in Table SCA-3, Flood control facilities. Also in Appendix A, Figure SCA-1 is a schematic of the LACDA project, and Figure SCA-2 depicts the SAROC projects.

Coordination and Reservoir Operations. There are no formal overall agreements for operation of flood protection facilities in the region. However, major drainage areas often drain separately to the ocean and are served by coordinated systems developed by USACE and a single local flood control entity. LADPW and USACE coordinate closely on the operation of the LACDA project and upstream reservoirs. Orange County Flood Control District and USACE also coordinate closely for operation of the SAROC system. In Riverside County, most flood control reservoirs are operated by a single agency, Riverside County Flood Control and Water Conservation District.

For most larger flood control reservoirs in California, USACE has participated with a federal contribution to the cost of the flood control space. Whether federally financed or not, the reserved space in multipurpose reservoirs is most often defined by a trapezoidal diagram of volume required versus date, modified by conditions in the latter part of flood season. Generally, the diagrams require a flood space reservation increasing from zero from the beginning of the flood season, invariant with date during mid-season, and decreasing to zero again at season's end. Superimposed on these diagrams are modifications based on either an antecedent precipitation index (API) or a runoff forecast. The index-controlled diagrams are usually decreased from the trapezoid and shortened in time during drier years, beginning in mid-season. The runoff-controlled diagrams increase the trapezoid and extend it in time for the greater runoff forecasts. Single-purpose flood control reservoirs are kept as low as possible. For any reservoir, there are usually downstream controls of various kinds on evacuation rates.

For more information on flood control reservoirs, see Table SCA-3, Flood control facilities, in Appendix A.

Maintenance. Maintenance of flood control works is a critical activity which preserves the integrity of the facilities, ensuring continued protection for the public. This effort is made more difficult by two factors: (1) Lack of adequate financing for many installations is the result of tax-management efforts of the late 20th century that have placed controls on former sources of revenue, and (2) Heightened public awareness of the environment has resulted in new regulations making the permitting process lengthy and expensive. Compounding the problem, deferred maintenance can cause establishment of new habitat which then must be protected.

Maintenance of flood control facilities is usually the responsibility of the local maintaining agency, which is usually the local sponsor; or if there is none, the constructing agency. Most USACE projects are maintained by the sponsoring local maintenance agency, but dams in particular may be exceptions. In this region, Hansen Dam, Lopez Dam, Santa Fe Dam, Sepulveda Dam, Whittier Narrows Dam, Prado Dam, Carbon Canyon Dam, San Antonio Dam, and the international Tijuana River levees and channel improvements are maintained directly by the USACE. NRCS projects follow a pattern of close cooperation with a local sponsor, with NRCS providing maintenance standards and the local sponsor performing the maintenance. The local constructing agency maintains non-federal projects in this region.

Land Use Management

Regulation. Counties are the main agencies responsible for designating and regulating floodways. Land development within the floodplains of the South Coast is primarily regulated by local building codes, subdivision regulations, and zoning ordinances. These ordinances regulate development and construction within flood-prone areas to minimize losses due to flood events. Floodplain ordinances are one of the key legislative tools used to regulate development within floodplains in the South Coast region. All counties and many cities have adopted such ordinances to protect their communities from flood hazards. All local land use jurisdictions must adopt a floodplain management ordinance identifying 1 percent floodplains and floodways, in order to qualify for FEMA flood insurance.

Flood Insurance. The National Flood Insurance Program is administered by FEMA. It enables property owners in participating communities to purchase insurance as protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. About 97 percent of California communities participate in the National Flood Insurance Program. Of those, approximately 12 percent participate in the Community Rating System (CRS) Program, which encourages communities to go beyond minimum program requirements in return for reduced insurance rates. Quality mapping is critical to administering an effective flood insurance program, developing hydrologic and hydraulic information for determining floodplain boundaries, and allocating flood protection project funds.

FEMA has provided Flood Insurance Rate Maps (FIRMs) for all areas within the region. CRS rates communities from 1 to 10 on the effectiveness of flood protection activities. The lower ratings bring larger discounts on flood insurance. Of the six counties and 179 cities in the hydrologic region, 5 counties and 17 cities participate in CRS. As of May 2009, Orange County, Huntington Beach, Long Beach, and Los Angeles are in Class 7; Los Angeles County, San Diego County, Anaheim, Fountain Valley, Irvine, Moreno Valley, Newport Beach, Oceanside, Poway, and San Juan Capistrano, Class 8; and Mission Viejo, Murrieta, Orange, Redlands, Santa Clarita, and Simi Valley, Class 9. See http://www.fema.gov/business/nfip/crs.shtm for more information on the CRS system.

Disaster Preparedness, Response, and Recovery

Information and Education. The California Data Exchange Center (CDEC) provides real-time and historical hydrometeorological data for hundreds of stations statewide, as well as real-time data on releases, spill rates, and elevations of many reservoirs. For this region, CDEC provides gage data from several federal, State, and local agencies, a total of 186 gages, and real-time flow and stage data for the Santa Clara, San Luis Rey, and San Diego rivers and Piru Creek. For access to CDEC data, see http://cdec.water.ca.gov.

The US Geological Survey maintains and publishes statistics for stream gages nationwide. USGS gages are the source of data for 28 of the 32 stations listed in Appendix A, Table SCA-1, Flood parameters for principal streams. For access to USGS gage data, see http://waterdata.usgs.gov/nwis.

DWR's Awareness Floodplain Mapping program provides an easy-to-use computer interface for viewing areas vulnerable to flooding by the flood event having a 1 percent probability of occurrence. The program applies to areas not already covered by FEMA Flood Insurance Rate Maps. For this region, maps have been drawn for all counties, but coverage of some areas may have been deferred. By 2015, all areas expected to develop over the next 25 years will have mapped floodplains.

Accurate hydrologic and hydraulic models inform the design of effective flood control structures and emergency actions before, during, and after floods. The National Weather Service's Advanced Hydrologic Prediction Service uses historical hydrologic data, current river and watershed conditions, and near-term meteorological outlooks to forecast river flows. The service is publicly available for certain streams of the South Coast region. Locations are given in Appendix A, Table SCA-5, AHPS stream forecast points.

Event Management. Under the Standardized Emergency Management System (SEMS) and the National Incident Management System (NIMS), initial flood emergency response is made by the responsible party at the site. When its resources are exhausted, the county emergency management organization (Operational Area) provides support. If necessary, additional support is coordinated by Southern Region or Inland Region of the California Emergency Management Agency (Cal EMA), formerly California Office of Emergency Services. Through the Cal EMA region and Cal EMA headquarters, help can be obtained from any State agency. Cal EMA coordinates with federal agencies and private organizations as well. The State-federal Flood Operations Center (a joint facility of DWR and the Sacramento Weather Office and California-Nevada River Forecast Center, both units of National Weather Service) is normally called early in the event to provide weather and river forecasts, facilitate information flow, provide field situation analysis, and give flood fight expertise. Severe situations that require Cal EMA involvement may also require emergency response by USACE, which is obtained by request of DWR. Table SCA-4, Flood emergency response organizations, in Appendix A, is a listing of specific response organizations.

Recovery after a flood event may involve the funding and construction services of USACE if the facilities are parts of federal projects. Availability of resources to repair local and private facilities; remove flood waters; and restore housing, businesses, and infrastructure often depends on the severity of the event and the allocation of event-specific federal or State funds.

Flood preparedness and mitigation efforts are promoted and funded by many organizations, including city and county governments, Cal EMA, DWR, National Weather Service, and USACE.

Relationship with Other Regions

The South Coast region is a major importer of water supplies from other regions both within and outside of the state. Because these supplies are vital to sustaining the South Coast region, local representatives work closely with other regions to ensure that their local resource needs are met while ensuring the reliability of supply to the South Coast region.

Within this region, water supply agencies have undertaken strategic regional planning to increase the reliability of local water supplies during normal and dry hydrologic conditions. This effort has resulted in the preparation and execution of water transfer and banking agreements both within and outside of the region. Outside of the South Coast region, environmental and water resource management in the Delta, Colorado River, and Owens River systems affect imported water supply reliability and quality. However, these inter-regional and inter-state linkages go well beyond direct water use. The overall planning direction (i.e., land use development patterns, economic drivers, agricultural production) established in other regions effect water resources available to the South

Coast. As a region dependent on others, the South Coast agencies recognize the need to invest in water management strategies in these other regions in order to provide coordinated benefits.

Sacramento-San Joaquin Delta

SWP contractors in the South Coast region—including Metropolitan, CLWA, San Bernardino Valley MWD, VCWPD, SGPWA, and San Gabriel Valley MWD—work with DWR to coordinate delivery of SWP supplies. Due to a series of short-term ecosystem collapses in 2007, including declines in native species and significant loss of habitat, Metropolitan also participates with DWR and other State, federal, and local agencies and environmental organizations in the development of the Bay-Delta Conservation Plan (BDCP). Metropolitan further maintains individual relationships with each of its 26 member agencies for sale and conveyance of SWP supplies, as well as adjacent agencies with which it has storage and transfer agreements (see discussion below).

Significant restrictions were placed on SWP pumping in accordance with the December 2007 federal court imposed interim rules to protect the Delta smelt (*Hypomesus transpacificus*). Additionally, the inherent annual variability in location, timing, and amount of precipitation in California introduces uncertainty to the availability of future SWP deliveries. In June 2008, the Governor issued Executive Order S-06-08 declaring a statewide drought, which directed State agencies and departments to take immediate action to address serious drought conditions and water delivery reductions. Solutions developed to address environmental and drought-related concerns, including conservation and restoration efforts associated with the BDCP, will continue to impact future SWP exports. Other important factors that impact supply reliability include the vulnerability of Delta levees to failure due to floods and earthquakes, as well as long-term management and maintenance of SWP conveyance infrastructure. As the regional SWP wholesaler, Metropolitan is continuing to develop closer relationships with DWR and other State agencies to deal with fundamental Delta issues including environmental protection and levee rehabilitation.

Colorado River System

Metropolitan and USBR have been working together for many decades to manage Colorado River deliveries, including drought allocation planning and salinity management. Allocations and diversions of Colorado River water function within the legal and administrative rules known as the "Law of the River" (see Table SC-4). With full implementation of the programs identified in the QSA, Metropolitan expects to be able to annually divert 852,000 acre-feet of Colorado River water plus any unused agricultural water that may be available. With continuation of the current drought, however, the South Coast's reliance on diversions of excess Colorado River water (such as wet-year flows and allocated but unused supplies) will place substantial pressure on regional water availability.

Metropolitan will continue to collaborate with USBR to ensure the reliability and quality of Colorado River supplies. Although agricultural water conservation and transfer agreements (described below) will increase the volume of water available to the South Coast region via the CRA, further development of local supplies will be necessary to defend against future shortages.

Owens Valley and Mono Basin

In 1991, LADWP entered into the Inyo/Los Angeles Long Term Water Agreement to address impacts from groundwater pumping in the Owens Valley. In 1994, the State Water Board ruled on decision 1631, restricting exports from the Mono Basin to protect the basin and the tributaries feeding into Mono Lake. As a result of these measures and other commitments to protecting and enhancing the environment, approximately half of the historical average annual LAA supplies are being diverted for environmental enhancement projects.

The Lower Owens River Project, considered one of the most ambitious river restoration projects in the West, is in operation with 62 miles of the Lower Owens River having been rewatered. LADWP is working with Inyo County and other stakeholders on numerous restoration projects, including instream flow management in Rush, Lee Vining, Walker, and Parker creeks, restoration of Mono Lake water surface elevation, riparian restoration on the Upper Owens River, Convict, Mammoth, and McGee creeks, and dust mitigation measures on the Owens Lake bed.

Other Water Storage and Transfers

South Coast agencies continue to build relationships with other areas of the state via various storage and transfer programs. Under many of the storage and exchange agreements, imported water supplies are banked in groundwater aquifers in neighboring regions. These agreements are an essential component of the region's overall strategic planning to meet peak demand during the dry season.

Metropolitan has agreements with the Semitropic and Arvin-Edison Water Storage Districts which can result in the delivery of 197,000 acre-feet to Metropolitan over a 10-month period. Metropolitan can store portions of its SWP entitlements in the groundwater basins managed by these agencies during wet hydrologic conditions and retrieve the supplies when conditions are dry. Metropolitan's program with the San Bernardino Valley MWD yields between 20,000-80,000 acre-feet during dry years and permits Metropolitan to store up to 50,000 acre-feet of transfer water supplies in its groundwater basin. Metropolitan's programs with the Kern-Delta Water District and Mojave Water District operate in a similar manner. Dry-year yields for Metropolitan are 50,000 acre-feet and 35,000 acre-feet, respectively.

Some excess floodwater can be routed into the California Aqueduct through the Kern River Intertie. This water is transported from the Tulare Lake Hydrologic Region to the

South Coast Hydrologic Region for water supply. Quantities are limited by the flow capability of the aqueduct and by available space in the SWP reservoirs in Southern California.

In addition to exchange agreements, Metropolitan is partnering with the Coachella Valley Water District (CVWD) and Desert Water Agency on an advance delivery agreement. The agreement allows Metropolitan to deliver exchange water in advance of receiving CVWD's and Desert Water Agency's SWP water. Metropolitan releases Colorado River water into the Whitewater River in Riverside which flows into the Coachella Valley and deep percolates in the groundwater basin. During dry hydrologic conditions, Metropolitan can take the CRA and SWP supplies for its partners until the banked water supplies are used. Through 2004, 177,400 acre-feet was banked in the groundwater basin.

CLWA has executed a long-term transfer agreement for 11,000 acre-feet per year with the Buena Vista and Rosedale-Rio Bravo water storage districts (WSD). These two districts, both in Kern County, joined to develop a program that provides a firm water supply and a water banking component. The supply is based on existing long-standing Kern River water rights, which would be delivered by exchange of SWP supplies.

In 1998, SDCWA entered into a transfer agreement with IID to purchase conserved agricultural water. Through the agreement, SDCWA will receive an annually increasing volume up to 200,000 acre-feet by 2021. The volume then remains fixed for the duration of the 75-year agreement.

In 2003, the QSA resulted in the movement of supplies between the Colorado River and South Coast regions. SDCWA was assigned rights to 77,000 acre-feet per year of water that will be conserved through lining of the All-American and Coachella canals in Imperial County. Another 16,000 acre-feet per year of water conserved with the lining of the All-American Canal will go the San Luis Rey Indian Water Rights Settlement Parties.

Regional Water and Flood Planning and Management

Integrated Regional Water Management

The IRWM Planning Act, signed by the Governor as part of SB 1 in 2008 (CWC Sec 10530 et seq), provides a general definition of an IRWM plan as well as guidance to DWR as to what IRWM program guidelines must contain. The Act states that the guidelines shall include standards for identifying a region for the purposes of developing or modifying an IRWM plan. The first regional acceptance process (RAP) spanned 2008-2009. Final decisions were released in fall 2009. The region acceptance process is used to evaluate and accept an IRWM region into the IRWM grant program. See

Figure SC-8 for map for regions in the South Coast Hydrologic Region's three funding areas: Los Angeles-Ventura, Santa Ana, and San Diego. Find more information on the DWR IRWM Web site: http://www.water.ca.gov/irwm/integregio_rap_summary2.cfm.

See Appendix A for discussion of flood control in the region's IRWM plans. The South Coast region implements to some extent nearly all of the resource management strategies in the Water Plan's Volume 2. Some regional projects in the South Coast region are highlighted here.

Los Angeles Subregion

Calleguas Regional Salinity Management Project. The Calleguas Regional Salinity Management Project (SMP) is a regional pipeline that will collect salty water generated by groundwater desalting facilities and excess recycled water and convey that water for reuse elsewhere. Any unused salty water will be safely discharged to the ocean, where natural salt levels are much higher. The SMP will improve water supply reliability by facilitating the development of up to 40,000 acre feet of new, local water supplies each year and expanding the distribution and use of recycled water from areas with abundant supplies to areas of need.

***Arundo* Removal.** *Arundo* (giant reed) removal projects have been completed in several watersheds in Ventura County and in the San Gabriel Valley of Los Angeles County. The objectives of removing the non-native invasive giant reed are to restore biological habitat, reduce flood hazards, reduce fire risks, improve water quality, and enhance water supply reliability and groundwater recharge.

Las Virgenes Creek Restoration. More than 1,500 tons of concrete and other non-native material were removed from a portion of the creek between Highway 101 and the Agoura Road Bridge. Native vegetation was planted where litter used to accumulate on concrete, and a walkway and gazebo were built along the creek's bank.

Joint Water Pollution Control Plant Marshland Enhancement (Bixby Marshland). Marshland conditions before restoration and enhancement included stagnant water pools and an abundance of non-native plants. A viewing and educational area was added to the marshland to provide the public with the opportunity to enjoy this green gem set amidst an industrial area. Open water pools were added to the marshland, which is located on the Pacific Flyway, to increase the habitat value for birds.

Santa Ana Subregion

Arlington Desalter. The Arlington Desalter, operated by Western Municipal Water District and constructed by the Santa Ana Watershed Project Authority in 1989, was the first operating groundwater desalter in the Upper Santa Ana River Watershed.

Orange County Groundwater Replenishment System. Orange County Groundwater Replenishment System produces 70 million gallons per day (MGD) of highly treated wastewater for groundwater recharge and a seawater intrusion barrier. Located in the lower Santa Ana River Watershed, it is one of the largest water reclamation facilities west of the Mississippi River.

Solar Array at RP-5 WWTP. The solar array at RP-5 WWTP, operated by Inland Empire Utilities Agency, produces 1 megawatt of power and is an example of sustainability efforts in the Santa Ana River Watershed.

San Diego Subregion

Tri-County Funding Area Coordinating Committee. The Upper Santa Margarita Regional Watershed Management Group (RWMG), San Diego RWMG, and South Orange County RWMG collaborate in the San Diego Funding Area through a joint Memorandum of Understanding that established the inter-regional body known as the Tri-County Funding Area Coordinating Committee (Tri- County FACC). The group is enthusiastically working together on common and long-term water quality issues and aim to improve planning across regional boundaries and identify opportunities to support common goals and projects. One example of this partnership is the Stormwater Monitoring Coalition, which enables the Tri-County FACC members to jointly address water quality concerns.

El Monte Valley Groundwater Recharge and River Restoration Project. The El Monte Valley Groundwater Recharge and River Restoration Project will recharge the El Monte Valley Basin using highly treated recycled water, raise the groundwater level to support habitat restoration, and subsequently withdraw up to 2,240 AFY of groundwater to supply the R.M. Levy Water Treatment Plant.

Carlsbad Desalination Project Local Conveyance. The Carlsbad Desalination Project Local Conveyance project will provide 56,000 acre-feet per year of new water supply for the San Diego region through the design and construction of pipelines and facilities to serve local desalinated water from the Carlsbad Desalination Plant to Water Authority member agencies, including Carlsbad Municipal Water District, City of Oceanside, Olivenhain Municipal Water District, Vallecitos Water District, Vista Irrigation District, and Santa Fe Irrigation District.

Santa Margarita Conjunctive Use Project. The Santa Margarita Conjunctive Use Project provides for enhanced recharge of the groundwater basin underlying US Marine Corps Base Camp Pendleton in northern San Diego County. The project also includes a seawater intrusion barrier using recycled water, a distribution system, and advanced water treatment facilities. This project will provide a water supply for both Camp Pendleton and Fallbrook as resolution of a long-standing water rights dispute.

Accomplishments

The South Coast has a long history of regional water management and planning that has helped form the backbone of its current system. As the state's water resources continue to become more precious, the South Coast has continued to make significant regional accomplishments. These include the following.

Integrating Water Management Efforts. Recent developments in IRWM planning and collaboration have expanded the development of strategic, multi-benefit projects that meet regional water demands, improve water quality, and enhance environmental functions. Coordination of numerous stakeholders in development of the IRWM plans has been one of the biggest successes in the region. As a result, South Coast agencies acquired $135 million in Proposition 50 grant funding for local water resources projects.

Diversifying Supplies. The South Coast has succeeded in diversifying its water supply sources over the last decade. Environmental and drought concerns have reduced imported water supplies, while local agencies have expanded local groundwater production, water recycling, and surface storage. Water transfers, banking, and conservation programs have further contributed to supply reliability.

Reducing Water Demands. DWR, State Water Board, and USBR are making major statewide investments in urban and agricultural water conservation programs, which regional and local agencies leverage with their own investments to reduce demands. Metropolitan and its member agencies have developed a robust interregional water conservation and efficiency program, and the CCP further assists member agencies in pursuing urban BMPs and other demand management opportunities. The 2007 Blueprint for Water Conservation was a San Diego regional partnership for increasing conservation. In tandem with these urban conservation efforts, Metropolitan and IID entered into an agricultural water savings program. In August 2008, the City of Los Angeles amended its conservation ordinance by expanding the prohibited uses of water and curtailing outdoor irrigation in conservation phases based on reduced water supply conditions.

Increasing Local Surface Storage. South Coast agencies are developing partnerships for reservoir construction, reoperation, and maintenance in order to meet water demands. The Carryover Storage and San Vicente Dam Raise project is a joint project by SDCWA and the City of San Diego to raise the existing dam at San Vicente Reservoir to provide additional capacity.

Replenishing Groundwater. A groundwater conjunctive use program is a storage program to provide dry-year yield. Fourteen conjunctive use programs are implemented by local water agencies. Metropolitan has 10 conjunctive use programs within its service area.

Eleven dams were constructed as part of the San Gabriel River and Montebello Forebay water conservation system to impound storm water runoff for groundwater recharge. The Vern Freeman Diversion and Pumping Trough Pipeline in Ventura County provides a means to capture high flows in the Santa Clara River and provide recharge to groundwater basins on the Oxnard Plain.

Desalting Brackish Supplies. Nineteen brackish groundwater recovery programs are being implemented in the region. Some of these programs have multiple facilities in operations. The Calleguas MWD Salinity Management Project is a 35-mile brine pipeline that provides disposal of tertiary treated effluent for five WWTPs and brine disposal for seven groundwater desalters. SAWPA's 30-MGD capacity SARI pipeline conveys desalter brine to Orange County Sanitation District for treatment and then discharges to the ocean. Further, several agencies within the South Coast are pursuing design, engineering, and environmental review for seawater desalination facilities.

Recycling Water. Progress continues on the start-up or augmentation of water recycling programs in the region. The Inland Empire Utilities Agency (IEUA) has completed and is on track in implementing a five-year business plan to expand the use of recycled water supplies within its service area to 50,000 acre-feet per year by 2015 (70,000 acre-feet per year by 2025). West Basin MWD's Edward Little Water Recycling Facility in El Segundo recently completed its Phase IV Expansion, which increased production of recycled water. LADWP has begun development of a Recycled Water Master Plan to expand its existing recycled water deliveries for an estimated $1 billion in construction cost. Irvine Ranch Water District (IRWD) is planning for expansion of its recycled water treatment and delivery system to meet expected recycled water demand at buildout. Further, IPR is being pioneered through various groundwater recharge and reservoir augmentation projects—the San Diego City Council recently authorized a demonstration IPR/reservoir augmentation project.

Controlling NPS Pollution. Local agencies are continuing to collaborate with Regional Water Boards on NPS pollution prevention, including development of public outreach campaigns to reduce pollutant loading as well as LID for more sustainable storm water management.

Hazard Mitigation Plans. The federal Disaster Mitigation Act of 2000 amended existing law with regards to hazard mitigation planning. The Act emphasizes pre-disaster mitigation and mitigation planning. In order to receive federal hazard mitigation funds in the future, all local jurisdictions must now adopt a hazard mitigation plan identifying hazards, risks, mitigation actions and priority and providing technical support for those efforts. Between 2004 and 2007, Kern, Los Angeles, Orange, Riverside, San Bernardino, San Diego, Santa Barbara, and Ventura counties adopted hazard mitigation plans and subsequently received Cal EMA approval.

Challenges

With the South Coast region, population growth, water supply availability and reliability, water quality, and drought will continue to be key issues for the future.

Resource Development. Water districts throughout the South Coast are engaged in integrated urban water management and groundwater planning. Decisions regarding development and expansion of other water supplies, such as recycled water and ocean desalination, will require more rigorous analysis of costs and tradeoffs between options.

Drought. Drought is a constant concern for water districts in the South Coast region. A drought simulation developed by Harding et al. (1995) indicated that, under current management practices, a severe sustained drought would heavily impact the Colorado River. In some months, stretches of river would be completely dry in order to maintain reservoir storage elsewhere in the system. Potential repercussions of drought on imported water supply reliability have led to an emphasis on the development of local supplies and implementation of demand management strategies. Further, given the uncertainty of water imports in the future, local agencies are aggressively developing local alternatives and transfer agreements.

Climate Change. Climate change is expected to impact the South Coast region through changes in Statewide precipitation and surface runoff volume. More extreme storm events may exceed reservoir storage capacity and therefore result in allocated water supplies discharged to the ocean. Sea level rise may impact local aquifers and Delta water quality through seawater intrusion, as well as impact local coastal water and wastewater infrastructure. All of these uncertainties related to climate change could potentially reduce delivery of imported supplies and the ability of local agencies to meet South Coast water demand.

Sustainability. With the recognition that water resources management is a major component to sustainable development for the State, an overarching emphasis must be placed on the concept of integration in all water resource planning efforts. As water supply development is considered, the energy and greenhouse gas emission impacts must be addressed to assure that proposed water development projects are sustainable for the future.

Environmental Concerns in Delta. Uncertainty about the availability of imported water supplies from the Delta through the SWP is of primary concern to the South Coast region. A federal court found that a 2004 biological opinion by the USFWS does not adequately protect sensitive fish populations when authorizing long-term operations of the State and federal water projects. Further, significant restrictions were placed on SWP and Central Valley Project pumping in accordance with the December 2007 federal court imposed interim rules to protect the Delta smelt (*Hypomesus transpacificus*). Metropolitan and other stakeholders are reviewing the impact of the ruling and possible future solutions.

Groundwater Overdraft. Groundwater overdraft and lower groundwater levels are further water supply challenges to the region. Historically, agricultural, industrial, and urban development has led to increased groundwater pumping from many of the region's basins. Natural recharge is typically insufficient to maintain basin water levels and current pumping levels due to the extent of impervious surfaces and the presence of clay soils. In some basins, over-extraction of groundwater has caused lowering of groundwater tables and seawater intrusion, contributed to land subsidence, and resulted in legal solutions, adjudication, to resolve disputes over pumping rights within specific basins.

Runoff Management. Surface water quality issues in the region are dominated by storm water and urban runoff, which contribute contaminants to local creeks and rivers, lagoons, beaches, and bays. Shipping can also influence water quality, especially in San Diego Bay and the Long Beach and Los Angeles harbors, where there are toxic sediment hot spots. The Chino Basin faces substantial nutrient loading impacts from dairy farming, thereby impacting groundwater quality and downstream Santa Ana River quality.

Salinity. Salinity in both local and imported supplies will continue to be a challenge for local water agencies. Salinity sources in local groundwater supplies include concentration from agricultural tailwater, imported water, seawater intrusion, discharge of treated wastewater, and recycled water. Higher levels of treatment are also needed following long-range import of water supplies, as TDS levels are increased during conveyance. High salinity levels and perchlorate contamination contribute to degraded Colorado River supplies. Seawater intrusion and agricultural drainage threatens to increase the salinity of SWP supplies. The long-term salt balance of the region's groundwater basins is an increasingly critical management issue. Abandoned groundwater basins, due to high salinity levels, have only recently been restored through brackish water desalting projects.

Water Recycling. With its expansion of water recycling programs, the region continues to work to address issues related to TDS levels and constituents of emerging concern like pharmaceuticals, household products, and other products in treated wastewater that are not known to be harmful or are not regulated. The high salinity of imported Colorado River water limits the number of times water can be reused and wastewater can only be discharged to the ocean. Additionally, some inland water districts that use recycled water also have salt accumulation problems in their groundwater basins because they lack an ocean outfall or stream discharge.

Flood Control Infrastructure. Major challenges include maintenance of 100-year flood protection where it has been provided throughout the South Coast in light of continued urbanization and climate change. Major flood control projects in the Los Angeles, San Gabriel, and Santa Ana areas are threatened as urbanization in the upper watersheds adds to storm volumes. Local funding for flood maintenance and construction projects has become less effective in recent years because of several factors: Laws enacted in response to heightened public awareness of the need to protect the environment have increased the cost of upkeep and improvement; concern for endangered species has made scheduling more complex; both environmental and endangered species conditions have made permits more difficult to obtain; measures to reduce taxation, especially on property, have rendered revenue increases difficult to achieve, and inflation has increased costs. Meeting the requirements of these new restraints has become a high-profile local challenge. Concerns related to funding include invasive species, sediment in channels and reservoirs, decreasing levels of protection as runoff rates increase with urbanization and climate change, aging infrastructure, structural deficiencies of dams, and debris basins that are too small. Finally, adequate evaluation is needed of the long-term secondary impacts of environmental enhancements proposed for integration into flood control projects.

Water Costs. SWP contractors pay for the cost of constructing and operating facilities which store and convey SWP water supply, plus a transportation charge which covers the cost of delivery facilities. Thus, contractors in the South Coast pay higher transportation charges than those near the Delta. Metropolitan's 2009 Tier 1 rates for treated water total $579 per acre-foot and recovers the costs of purchasing, pumping, and delivering SWP and CRA supplies, as well as a surcharge for purchase of additional water transfers.

Local Flooding Impacts. Recurrent flooding is a problem in many places in the South Coast region. At many locations, lives, homes, business, farm lands, and infrastructure are frequently at risk. Providing better protection for lives and property remains the definitive flood management challenge. Solutions may range from governmental regulation of occupancy and building in flood-prone areas through local or watershed-based non-structural measures to infrastructure such as levees and reservoirs, constructed with consideration of environmental needs. Development of a discharge-based standard, such as protection from the flood having a 0.5 percent, 1 percent, or 2 percent probability of occurrence (or such a standard in conjunction with land use type or other pertinent factor) would facilitate equitable distribution of State and federal support funding.

San Jacinto River. Excessive sedimentation in the San Jacinto River causes breaching onto agricultural lands in the "gap" area of the river. There are many challenges in the Upper San Jacinto Watershed area with flooding along the San Jacinto gap area. Initial feasibility studies have been completed. Additional studies will be needed to resolve this major flooding issue.

Effects of Urbanization. Throughout the state, including this region, urbanization continues. It brings greater runoff due to increases of impervious area making retention of flood protection levels a challenging issue. Urbanization often causes increases in erosion and sedimentation. Construction of flood infrastructure or changes in land use may cause subsequent undesirable vegetation growth, whether of native or invasive species. Regulation of occupancy and land use is critical for reducing the number and severity of flood damage occurrences in an era of population growth. In this region, hillside flooding and flooding of developed low areas are special concerns, as is flooding in disadvantaged communities. Increased agricultural activity, an adjunct of population growth, may also increase erosion. Another particular concern in this region is flash flooding from steep watersheds, which has increasing impact as the population grows.

Preparedness for and Response to Flood Events. Effective preparedness for flood events depends on accurate evaluation of the risk, adequate measures for mitigation of flood damage, sufficient preparation for response and recovery activities and coordination among local, State, and federal agencies. Completion of floodplain mapping, both the FEMA Flood Insurance Rate Maps and the State's complementary Awareness Floodplain Mapping, will provide much needed information for evaluating flood risk. Mitigation may take many forms, including restriction of use, floodproofing, or structural protection of vulnerable sites. Some actions that help meet the challenge of response and recovery preparedness are organization for emergency management, formal agreement on responsibilities for emergency actions and funding, and use of warning systems.

Debris Flows. Wildfires may denude steep erodible slopes in canyons and upland areas above urban development below. Ensuing winter rains may threaten these areas not only with high water, but also with debris flows. In these situations, flooding may cause greatly increased damages to structures and other installations and may leave large amounts of sediment and other detritus.

Storm Water Capture. The region's flood control systems are designed to quickly move storm flow through to the ocean. Managing these systems to retain flows to recharge aquifers where soft channel bottoms exist or diverting flow to off channel recharge basins provides an opportunity to enhance the supply of local water.

Invasive Species. Invasive species disrupt natural ecosystems by competing with native flora for limited resources and generally providing poor quality habitat for native fauna. The removal of Arundo and other invasive species offers numerous direct and indirect benefits to landowners, land managers, public agencies, and other Watershed residents. These benefits include reduction in risk of flooding and fire, improvements in water quality, increased water conservation, and restoration of habitat for native species, including several threatened and endangered species.

Drought and Flood Planning

The South Coast region is subject to severe repercussions from extreme weather events. Drought conditions both within and outside of the region can substantially limit water availability to urban and agricultural users. In contrast, extreme precipitation events can result in sudden and severe flooding and mud flows. This unusual paradox of concurrent drought and flooding is being addressed by the South Coast region's integrated regional planning efforts.

Drought Planning

Drought planning in the South Coast region is being conducted in coordination with State agencies, per the Governor's Executive Order S-06-08 declaring a statewide drought. Metropolitan's Water Supply Allocation Plan (2007) provides a formula and implementation plan for equitable regional allocation of water supplies during times of shortage. The objectives, mechanics, and policy aspects of the Allocation Plan were developed in coordination with member agencies.

In 2007, SDCWA adopted a Drought Management Plan that outlined a series of potential actions to take when faced with a shortage of imported water supplies from Metropolitan due to drought conditions. Further, SDCWA adopted a model Drought Response Ordinance in March 2008. A Drought Management Committee has been formed in the Upper Santa Clara watershed to address the need to comprehensively respond to the current drought. Water agencies and cities within Ventura County are working together to coordinate their disaster and drought preparedness efforts.

In 2008, LADWP developed a Water Supply Action Plan for creating sustainable sources of water for the future demands of Los Angeles. As a result of water shortages, Los Angeles implemented Phase III of its Emergency Water Conservation Plan Ordinance, which added restrictions on outdoor water use to existing prohibitions on water waste.

Flood Planning

Most flood control districts in the South Coast region incorporate flood planning as a component in their flood management strategy. As described above, regional flood protection is sustained through an extensive network of flood control reservoirs, debris basins, flood channels, and levees; land use regulations, flood forecasting, and SEMS; and flood insurance. All counties in the region use the Automated Local Evaluation in Real Time (ALERT) system to notify the public of impending flood hazards. The Disaster Mitigation Act of 2000 required development of Hazard Mitigation Plans, which emphasize community partnerships in planning for and responding to disasters; assessing strategies for reducing risks; and identifying capabilities and resources for addressing various hazards. Each county in the South Coast region has an adopted Hazard Mitigation Plan.

Several other groups in the South Coast are addressing flood management programs and issues at the local level. VCWPD staff is looking into an integrated surface water and groundwater model of the entire county as an element of the IRWM Plan. The model would facilitate implementation of real-time flood forecasting, alert emergency personnel on impending floodflows, and calculate the water budget for all of the county's rivers/creeks and aquifers.

All counties in this region have adopted hazard mitigation plans. For more information, see "Challenges" in this report.

FloodSAFE is a DWR strategic initiative that seeks a sustainable integrated flood management and emergency response system throughout California that improves public safety, protects and enhances environmental and cultural resources, and supports economic growth by reducing the probability of destructive floods, promoting beneficial floodplain processes, and lowering the damages caused by flooding. FloodSAFE is guiding development of regional flood management plans. These plans will encourage regional cooperation in identifying and addressing flood hazards, and will include flood-hazard identification, risk analyses, review of existing measures, and identification of potential projects and funding strategies. The plans will emphasize multiple objectives, system resiliency, and compatibility with State goals and IRWM plans.

Looking to the Future

With a growing population, drought conditions in many parts of the West, and an aging infrastructure system, water resource managers will be focusing on three important areas: protection of imported water supplies; increased development of local water resources; and creation of integrated flood control projects.

Protection of Imported Supplies. Protection of imported water supplies is essential for South Coast agencies. Continued partnerships with DWR, USBR, and other State and regional agencies are necessary to ensure that the Delta, Colorado River basin, and Owens Valley ecosystems are managed in such a way that allows for successful allocation of water supplies. Effective salinity and water quality management will also be necessary to ensure that imported supplies are usable. Further, South Coast agencies are moving forward with plans to operate conjunctive use programs in local groundwater basins. South Coast water agencies are storing discount-priced imported water during winter months into groundwater basins and increasing their groundwater use during summer and drought periods.

Development of Local Supplies. Due to uncertainties related to imported supplies, South Coast agencies are also aggressively pursuing development of local supplies. In 2002 and again in 2006, California's voters approved water bond packages to help address the state's water crisis and ensure clean, safe water for generations to come. Funding from these bonds will support a variety of local water management efforts including implementation of water conservation programs, expansion of water reclamation plants and conveyance systems, construction of desalination facilities, and restoration of streams, wetlands, and lagoons. Metropolitan and five member agencies are planning for the potential development of up to 300 MGD of desalinated seawater. Further, the Southern California Water Recycling Initiative—a joint effort by DWR, USBR, and 10 local agencies—will continue a multi-year planning study that evaluates the feasibility of a regional water-recycling plan and identifies short-term projects to increase recycled water supplies. The initiative projects recycled water demand to increase between 615,700 acre-feet in moderate reuse conditions and 1.0 million acre-feet under maximum reuse conditions by 2040.

Desalination Projects. Brackish groundwater and ocean desalination will likely serve an important role in the solution to southern California's water supply shortfall. In the Santa Clara Planning Area, the Calleguas MWD Salinity Management Project serves as a regional conveyance facility that moves saline water from areas where it is a nuisance to areas where it can be an asset for salt tolerant crops and wetlands restoration (see earlier discussion under Integrated Regional Water Management).

There are proposals for a number of desalination projects in the Metropolitan Los Angeles Planning Area. West Basin MWD is proposing to co-locate a 20 MGD desalination plant at the El Segundo Power Plant in El Segundo. The district has operated a 40 gallons-per-minute pilot plant and was awarded Proposition 50 grant funding to build a 0.5 MGD demonstration facility in May 2005 (WBMWD 2005). The Long Beach Water Department is considering a 9 MGD seawater desalination plant in Long Beach. The department, in partnership with LADWP and USBR, began operating a 0.30 MGD prototype plant at the Haynes Generating Station in early 2006. Operation of the full-scale facility is expected to commence no earlier than 2015 if the project proves to be economically, technically, and environmentally feasible (LBWD 2005b).

Poseidon Resources is proposing to co-locate a 50 MGD seawater desalination plant with the AES Power Plant in Huntington Beach. Municipal Water District of Orange County (MWDOC) is also considering building a 25 MGD seawater desalination plant in Dana Point.

SDCWA and MWDOC are considering building a 50- to 100-MGD seawater desalination plant at Camp Pendleton, using the intake and outfall structure from Unit 1 of the San Onofre Nuclear Generating Station, which is being decommissioned. A public-private partnership between the City of Carlsbad and Poseidon Resources, the 50-MGD seawater desalination plant at the Encina Power Station in Carlsbad will begin construction in 2009 and be on line by 2011. Nine water agencies have entered into long-term water purchase agreements with the Carlsbad desalination plant (Poseidon Resources 2008).

Creation of Integrated Flood Control Projects. The South Coast will continue pursuing development of integrated projects that achieve flood management, improve runoff water quality, and protect environmental resources. Flood control reservoirs are becoming valuable for their potential to provide all three benefits, as well as water supply benefits through reoperation to enhance groundwater recharge. LACDPW is completing a study, in cooperation with the USACE, to reauthorize four USACE flood control facilities in Los Angeles County for the purpose of capturing storm water and then slowly releasing the water to downstream groundwater recharge facilities after storm events. The Water Augmentation Study is a long-term research project led by the Los Angeles and San Gabriel Rivers Watershed Council to explore the challenge of capturing storm water for infiltration, in terms of groundwater quality and quantity.

Most of the South Coast's future supply projects will be designed to improve water quality as the means to develop new water supplies. These include watershed protection activities, groundwater desalination, use of highly treated recycled water, reduction of sewage spills and storm water runoff through water conservation, and surface and groundwater storage projects that implement blending and treatment strategies to reduce contaminants in treated drinking water supplies. Ground and surface water treatment and reuse are the future of water management in the South Coast.

Climate Change

Climate change is expected to impact the South Coast region through changes in statewide precipitation and surface runoff volumes, and therefore availability of local surface and imported water supplies. Additionally, sea level rise is expected to degrade Delta water quality and impact coastal water and wastewater infrastructure, requiring substantial capital investments by local agencies. All of these uncertainties related to climate change could potentially reduce the ability of local agencies to meet South Coast water demand.

Model simulations using the Intergovernmental Panel on Climate Change's 21st century climate scenarios suggest increasing temperatures in California, with greater increases in the summer (Cayan 2008). Changes in annual precipitation across California may result in changes to surface runoff timing, volume, and form. By the end of the century, the Sierra Nevada snowpack is expected to decline as warmer temperatures raise the elevation of snow levels, reduce spring snowmelt, and increase winter runoff. Locally, climate change is expected to result in hotter summer months and more extreme winter storms. Winter runoff may result in flashier flood hazards, with flows potentially exceeding reservoir storage capacity and resulting in discharges to the ocean. Higher flow volumes may scour stream and flood control channels, degrading aquatic and riparian habitats already impacted by shifts in climate. Further, hotter summer temperatures would increase wildfire hazards in the arid South Coast region. Additionally, changes in climate and runoff patterns may create competition between sectors. The agricultural industry's demand could increase due to higher evapotranspiration rates caused by increased temperatures. Environmental water supplies would need to be retained in reservoirs for management of instream flows necessary to maintain habitat for aquatic species throughout the dry season. For the South Coast, this would likely result in reduced supplies available for import through the SWP during the non-winter months (California Climate Change Portal 2008; Cayan 2008; Hayhoe 2004).

LADWP has initiated a climate change study to evaluate the effects of climate change on the LAA watershed. This study will identify possible adaptation measures that can be implemented to mitigate the potential negative effects of climate change on the hydrology of the region as well as the potential negative impact to water quality.

Impacts resulting from extreme sea levels associated with tides, winter storms, and other episodic events would be superimposed on the higher sea level. This rise could heavily impact the South Coast through inundation of low lying areas, causing severe coastal flooding and erosion, increased salinity in the Delta, damage to coastal structures, and damage to coastal marshes and wildlife reserves (Cayan 2008; California Climate Change Portal 2008). Additionally, higher sea levels would exacerbate current seawater

Box SC-4 Scenario Descriptions

Update 2009 uses three baseline scenarios to better understand the implications of future conditions on water management decisions. The scenarios are referred to as baseline because they represent changes that are plausible and could occur without additional management intervention beyond those currently planned. Each scenario affects water demands and supplies differently.

- **Scenario 1 – Current Trends.** For this scenario, recent trends are assumed to continue into the future. In 2050, nearly 60 million people live in California. Affordable housing has drawn families to the interior valleys. Commuters take longer trips in distance and time. In some areas where urban development and natural resources restoration has increased, irrigated crop land has decreased. The state continues to face lawsuits: from flood damages to water quality and endangered species protections. Regulations are not comprehensive or coordinated, creating uncertainty for local planners and water managers.
- **Scenario 2 – Slow & Strategic Growth.** Private, public, and governmental institutions form alliances to provide for more efficient planning and development that is less resources intensive than current conditions. Population growth is slower than currently projected—about 45 million people live here. Compact urban development has eased commuter travel. Californians embrace water and energy conservation. Conversion of agricultural land to urban development has slowed and occurs mostly for environmental restoration and flood protection. State government implements comprehensive and coordinated regulatory programs to improve water quality, protect fish and wildlife, and protect communities from flooding.
- **Scenario 3 – Expansive Growth.** Future conditions are more resource intensive than existing conditions. Population growth is faster than currently projected with 70 million people living in California in 2050. Families prefer low-density housing, and many seek rural residential properties, expanding urban areas. Some water and energy conservation programs are offered but at a slower rate than trends in the early century. Irrigated crop land has decreased significantly where urban development and natural restoration have increased. Protection of water quality and endangered species is driven mostly by lawsuits, creating uncertainty.

intrusion issues in South Coast groundwater aquifers. A USGS study on the vulnerability of the West Coast to sea level rise shows the South Coast area as being in the moderate to very high vulnerability range (Thieler 2001).

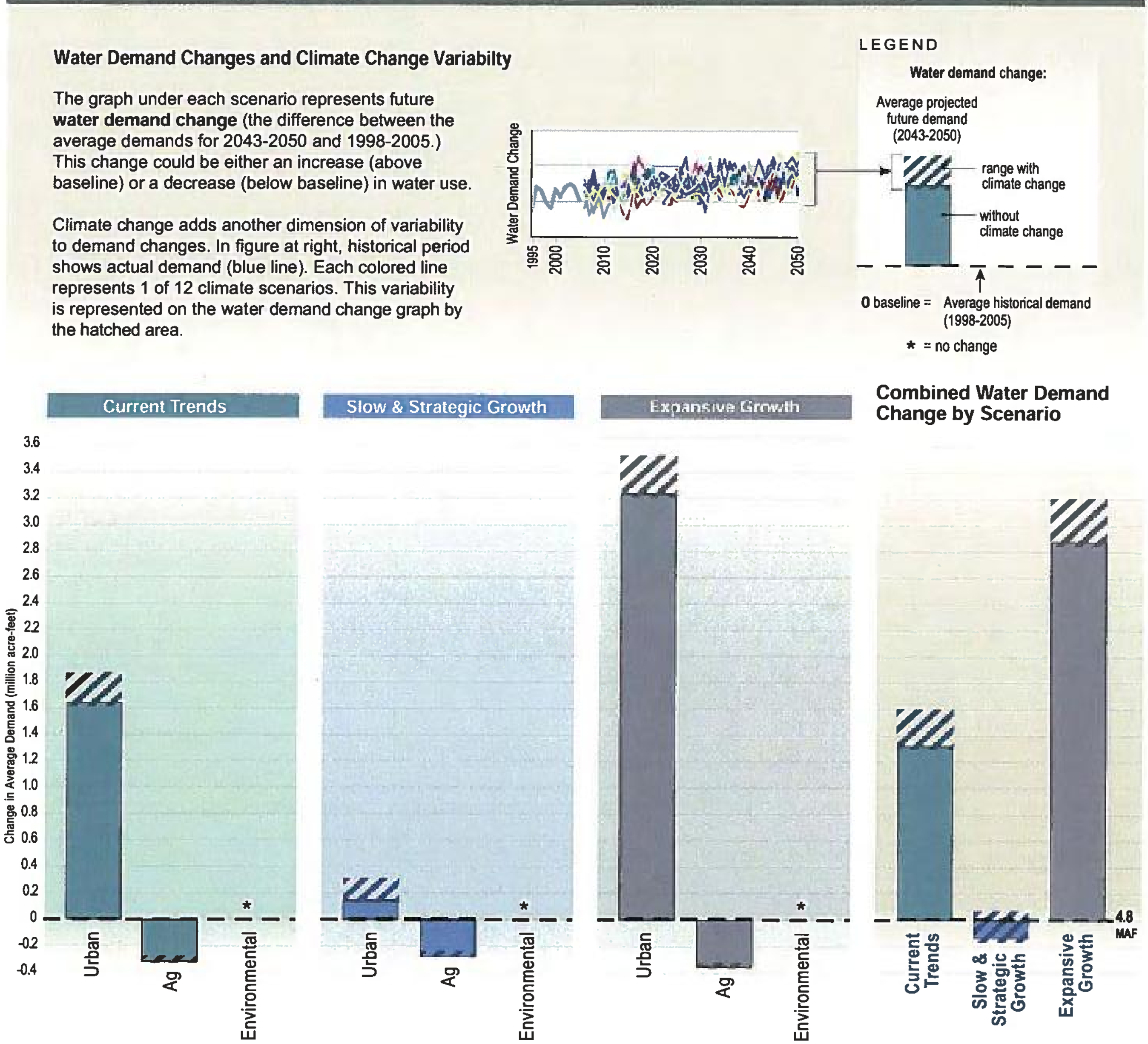
Future Scenarios

For Update 2009, we evaluated different ways of managing water in California depending on alternative future conditions and different regions of the state. The ultimate goal is to evaluate how different regional response packages, or combinations of resource management strategies from Volume 2, perform under alternative possible future conditions. The alternative future conditions are described as future scenarios. Together the response packages and future scenarios show what management options could provide for sustainability of resources and ways to manage uncertainty and risk at a regional level. See Box SC-4 scenario descriptions.

Total Demand

Change in total water demand in the South Coast Hydrologic Region for the three scenarios, Current Trends, Slow & Strategic Growth and Expansive Growth is shown in Figure SC-9. The change in water demand is based on the difference between the historical average (1998-2005) and future average (2043-2050) water demands. Future demand is shown with and without climate change. The change in water demand

Figure SC-9 Water demand changes by scenario, South Coast Hydrologic Region



without climate change is shown with solid bars and those with climate change is shown with hatched bars. As shown in the figure, there is considerable variation in the magnitude in demand increases across the three scenarios. Equally noticeable, Slow & Strategic Growth shows a dramatic reduction in demand when compared with Current Trends; from 1,325 thousand acre-feet down to a reduction of 140 thousand acre-feet. Considering 12 climate change alternatives (hatched bar), pronounced range of water demand change are observed under all three scenarios.

Urban Demand Change

Figure SC-9 shows urban water demand change in the South Coast region with and without climate under the Current Trends, Slow & Strategic Growth, and Expansive Growth scenarios. Without climate change, all three scenarios show an increase in urban water demand. Expansive Growth, however, shows marked increase in water demand when compared with Current Trends; an increase from 1,645 thousand acre-feet with Current Trends to 3,240 thousand acre-feet with Expansive Growth scenario. This shows urban growth and expansion in the South Coast area dramatically increases demand for water. The Slow & Strategic Growth scenario, however, shows a smaller relative increase in water demand (145 thousand acre-feet). When climate change is considered, all three scenarios showed an increase in urban water demand across most future climate sequences.

Agricultural Demand Change

Change in agricultural water demand in the South Coast region is shown in Figure SC-9. Future agricultural water demand is generally reduced due to reduction in irrigated acreage from urbanization and increased background water conservation. Without climate change (solid bar), Expansive Growth shows a slightly larger reduction (360 thousand acre-feet), followed by Current Trends scenario (320 thousand acre-feet). Under the Slow & Strategic Growth scenario, however, agricultural demand shows a slightly lower reduction of about 285 thousand acre-feet. When climate change is considered (hatched bar), water demand reductions are the same or less than demand reductions without climate change.

Environmental Demand Change

Figure SC-9 shows a base environmental water demand of about 130 thousand acre-feet in South Coast region. No additional environmental water demands are assumed for the South Coast beyond current commitments.

Appendix A. Flood Management

Historic Floods

Flood Parameters

Table SCA-1, Record floods for selected streams, is based on US Geological Survey records. The stations were selected from all USGS gaging stations in the hydrologic region, according to the criteria in Box SCA-1. (The table is supplemented with four additional sites. See Table note 6.)

Box SCA-1 Selection Criteria

- The watercourse must be a natural stream with a watershed of at least 100 square miles.
- The station must have a reasonably continuous record of discharge from 1996 to the present.
- The station must be far enough from other stations on the same river to reasonably represent a separate condition.
- Stations in well defined watercourse locations such as deep canyons are omitted, unless particularly important to the overall flood situation.

Flood Descriptions

Early Floods. The South Coast region has seen many floods over the past 198 years. One of the earliest recorded floods occurred along the Santa Ana River in 1810 and washed away adobes.

One of the more prominent floods in California history was the "Great Flood" of 1861-62. Heavy flooding during this event inundated large areas of the west coast and transformed much of Orange County into an inland sea. This flood event was unusual in that it occurred during the severe drought of 1856-64 and floodwaters did not recede for 20 days.

In 1884 the region experienced an unusually long wet season, receiving rains well into June and more than doubling the seasonal average. The second of two floods that occurred inundated the towns of Santa Ana and Orange, and caused the Santa Ana River to cut a new channel to the sea.

Two floods occurring in 1914 and 1916 provided significant insight on the relationship between urban development in the Los Angeles Basin and the flood damage potential of the surrounding rivers. In 1914 floodwaters caused over $10 million in damages and took the lives of many people. In 1916 a similar flood event caused significant damage to the Los Angeles area when inadequately sized bridges acted as debris plugs. Following these floods in 1920 the Los Angeles County Flood Control District built Devil's Gate Dam, the first flood control dam in Los Angeles County.

Another significant flood in 1925 was so severe that it altered the course of both the Santa Ana and Los Angeles rivers.

In 1928, the St. Francis Dam, located 40 miles northwest of Los Angeles, catastrophically failed and the resulting flood killed more than 600 people. The collapse of the St. Francis Dam remains the second-greatest loss of life in California's history, after the 1906 San Francisco earthquake and fire. The concrete dam was part of the Los Angeles Aqueduct system.

Table SCA-1 Record floods for selected streams, South Coast Hydrologic Region

Stream	Location	Mean annual runoff (taf)	Peak stage of record (ft)	Peak discharge of record (cfs)
Cottonwood Cr.	above Tecate Creek, near Dulzura[5]	11	11.2	11,700
San Diego R.	at Fashion Valley, at San Diego	28[2]	13.5	9,430
San Diego R.	at Mast Road, near Santee	18	18.1	45,400
Santa Ysabel Cr.	near Ramona	8	14.3	28,400
San Luis Rey R.	at Oceanside	26	21.7	25,700
Santa Margarita R.	at Ysidora	45[2]	20.5	44,000
Santa Margarita R.	near Temecula	21[2]	22.5	31,000
Temecula Cr.	near Aguanga	6	14.6	8,100
Murrieta Cr.	at Temecula	15[2]	17.2	25,000
San Juan Cr.	at La Novia Street Bridge, at San Juan Capistrano	16	20.7[1]	28,500
Santa Ana R.	at Santa Ana	57[2]	9.0	31,700
Temescal Cr.	above Main Street, at Corona	24[2]	6.7	4,720
San Jacinto R.	near Elsinore	12	11.8	16,000
Salt Cr.	at Murrieta Road, near Sun City	2	11.23[1]	4,120
San Jacinto R.	near San Jacinto	14	5.3[1]	45,000
Santa Ana R.	at MWD Crossing, near Arlington	115[2]	16.6	47,800
Lytle Cr.	at Colton	6	14.8	17,500
San Timoteo Cr.	near Loma Linda	3	8.2	15,000
San Gabriel R.	below Santa Fe Dam, near Baldwin Park	47	22.2	30,900
Rio Hondo	below Whittier Narrows Dam	125	13.8	38,800
Rio Hondo	at South Gate[6]	38	15.4	48,100
Big Tujunga Cr.	below Hansen Dam	18[2]	7.6	15,200
Los Angeles R.	at Long Beach[6]	194	18.3	128,700
Los Angeles R.	at Sepulveda Dam	39	12.1[1]	14,700
Ballona Cr.	at Culver City[6]	36	16.0	32,500
Malibu Cr.	at Malibu Canyon[6]	21	21.4	33,800
Calleguas Cr.	near Camarillo	37	10.5[1]	25,900
Santa Clara R.	at Montalvo[3]	122	17.4	165,000
Sespe Cr.	near Fillmore	93	25.0[1,4]	85,300
Piru Cr.	above Frenchmans Flat	31	n/a	36,000
Santa Clara R.	near Piru	55	12.7[1]	32,000
Ventura R.	near Ventura	51[2]	29.3[1]	63,600

Note: taf = thousand acre-feet; ft = feet; cfs = cubic feet per second

1 Different date than peak discharge

2 Most recent but less than period of record

3 Gage discontinued 2004

4 Resulting from a debris wave

5 Gage discontinued 2007

6 Data source not USGS

In 1938 a flood inundating over 250,000 acres in Orange, Riverside, San Bernardino, Los Angeles, and Ventura Counties caused an estimated $78.5 million in damages and killed 87 people.

1969. Flooding in 1969 took the lives of 103 people and caused more than $160.1 million in damages to the South Coast Hydrologic Region. Due to increased development, the 1969 flood was the worst on record for the counties of Ventura, Orange, San Bernardino, and Riverside.

1978. In 1978 intense storms combined with inadequate drainage systems caused widespread street flooding and forced the evacuation of homes and businesses residing in lower elevations in Ventura, Los Angeles, Orange, San Bernardino, and Riverside counties. Damages caused by this event were estimated to be $86 million.

1980. In 1980 a powerful series of storms left the region with destroyed homes, washed out bridges and roads, and disrupted utilities. Thousands of people were evacuated from the area, and 29 people lost their lives. Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura counties were declared disaster areas by President Carter.

1992. A heavy downpour led to spill at the Las Llajas Dam near Simi Valley, resulting in considerable erosion on Las Llajas Creek and bridge damage in Moorpark.

Flood Governance

Many federal, State, and local agencies have responsibilities in the overall effort to manage floods. The principal participants in the South Coast Hydrologic Region and their activities are listed in Table SCA-2, Flood management participants. Most listed activities are self-explanatory. Descriptions of some are:

- **Flood project development.** Performing feasibility studies, planning, and design of constructed facilities.
- **Encroachment control.** Establishing, financing, and operating a system of permitting and enforcing permits to encroach on constructed facilities.
- **Floodplain conservation or restoration.** Any overt activity causing part of a floodplain to remain in effect or to be reinstated as a watercourse overflow area.
- **Flood insurance administration or participation.** Contribution to the management of or acting as a sponsor and cooperator in the National Flood Insurance Program including the Community Rating System.
- **Hydrologic analysis.** Hydrologic or statistical analysis of collected hydrometeorological data.
- **Flood education.** Informing the general public about any aspect of flood management; publishing or broadcasting collected hydrometeorological data or other flood-related material.
- **Recovery operations.** Financing or performing any activity intended to return flood-impacted facilities or persons to normal status.

- **Event management system administration.** Oversight of the National Incident Management System/Standardized Emergency Management System (NIMS/SEMS) as applied to California.

In the Santa Clara, the Ventura County Watershed Protection District provides flood management to 1,670 square miles. The agency divides the county into four zones; each zone is managed separately to protect aquatic ecosystems, human life and health, and other natural resources.

In the Metropolitan Los Angeles Planning Area, the Los Angeles County Flood Control District (LACFCD) was created in 1915 to provide for the control and conservation of flood, storm, and other waste waters. LACDPW's Watershed Management Division was created in 2000 to evaluate and address flood control needs from an integrated watershed management approach taking into account flood protection, water quality and conservation, and enhancement of habitat, open space, and recreational opportunities.

In the Santa Ana Planning Area, the Orange County Flood Control District manages 790 square miles and more than 350 miles of flood channels, dams, pump stations, flood control basins and other infrastructure. The San Bernardino County Flood Control District is responsible for providing flood protection, water conservation, and storm drain construction. The district is divided into six planning zones that cover an area of 21,105 square miles; each zone functions independently. The Riverside County Flood Control and Water Conservation District provides flood management to 2,700 square miles in the western region of the county. The district divides its jurisdiction into seven management zones; each zone is managed separately.

In the San Diego Planning Area, the San Diego County Flood Control District is responsible for flood management in 4,200 square miles of unincorporated San Diego County. Individual municipalities are responsible for flood management within their jurisdictions. Although flood management is a top priority, the agency's other responsibilities include water supply, watershed-based recreation, water quality enforcement, and watershed rehabilitation.

Flood Risk Management

Structural Approaches

Construction of several major flood control projects in the South Coast region has been the responsibility of US Army Corps of Engineers with the Natural Resources Conservation Service and other public agencies participating on a much smaller scale. Maintenance of these flood control facilities is primarily left to local agencies, with the exception of a few structures under the purview of the USACE.

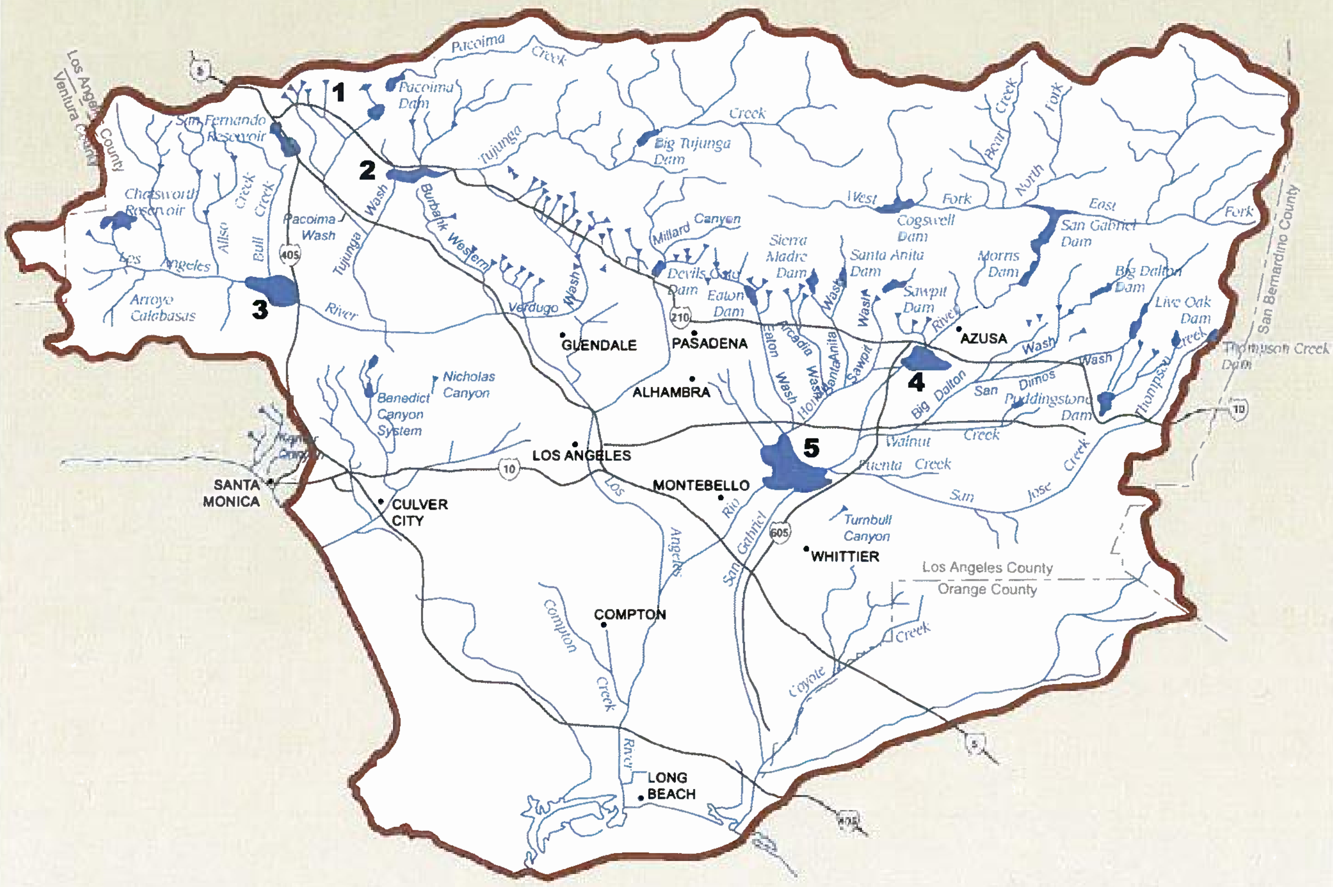
Two of the most extensive individual flood control systems in California are found in the region. These are:

- The Los Angeles County Drainage Area Project, principally in the watersheds of Los Angeles and San Gabriel Rivers and the Rio Hondo. The local sponsor is the

Table SCA-2 Flood management participants, South Coast Hydrologic Region

	Structural approaches						Land use management								Preparedness, response and recovery										
	Flood projects						Floodplains			Flood insurance			Regulation		Data management				Event management						
	Financing	Development	Construction	Operation	Encroachment control	Maintenance	Conservation	Restoration	Delineation	Administration	Participation	FIRM mapping	Building permits	Designated floodways	Data collection	Hydrologic analysis	Data station maintenance	Flood education	Preparedness	Response management	Response personnel	System administration	Recovery funding	Recovery operations	Mitigation
Federal agencies																									
Federal Emergency Management Agency										●		●											●		●
National Weather Service															●	●	●	●	●	●	●				
Natural Resources Conservation Service	●	●	●															●							
US Geological Survey															●	●	●								
US Army Corps of Engineers	●	●	●	●	●	●									●	●	●	●	●	●	●		●	●	●
State agencies																									
California Conservation Corps																				●	●				
Department of Corrections																					●				
Department of Forestry and Fire Protection																				●					
Department of Water Resources	●	●	●	●	●	●			●	●		●			●	●	●	●	●	●	●		●	●	
Office of Emergency Services																			●	●	●	●	●		●
Local agencies																									
County emergency services units																			●	●	●				
County planning departments														●											
County building departments													●												
Local flood maintenance organizations				●	●	●																			
Local conservation corps																				●	●				
Local initial responders to emergencies																			●	●	●				
Los Angeles County Flood Control District	●	●	●	●	●	●	●	●	●			●													
Orange County Flood Control District	●	●	●	●	●	●	●	●	●			●													
Riverside County Flood Control and Water Conservation District	●	●	●	●	●	●	●	●	●			●													
San Bernardino County Flood Control District	●	●	●	●	●	●	●	●	●			●													
San Diego County Flood Control District	●	●	●	●	●	●	●	●	●			●													
Ventura County Watershed Protection District	●	●	●	●	●	●	●	●	●		●	●							●	●					

Figure SCA-1 Los Angeles County Drainage Area Project



Multipurpose Projects

1 Lopez Dam

2 Hansen Dam

3 Sepulveda Dam

4 Santa Fe Dam

5 Whittier Narrows

— Drainage area boundary

Debris basin

Los Angeles County Flood Control District (LACFCD). The project, depicted in Figure SCA-1, Los Angeles County Drainage Area Project, includes 20 dams, 90 debris basins, and 458 miles of improved channels.

- The Santa Ana River Project and Santa Ana Main Stem Project, implemented successively on the Santa Ana River, also include multiple dams and many miles of new or improved channels. Figure SCA-2, Santa Ana River Basin and Orange County projects, illustrates these facilities.

The principal reservoirs and non-storage facilities contributing to flood control are listed in Table SCA-3, Flood control facilities.

Disaster Preparedness, Response, and Recovery

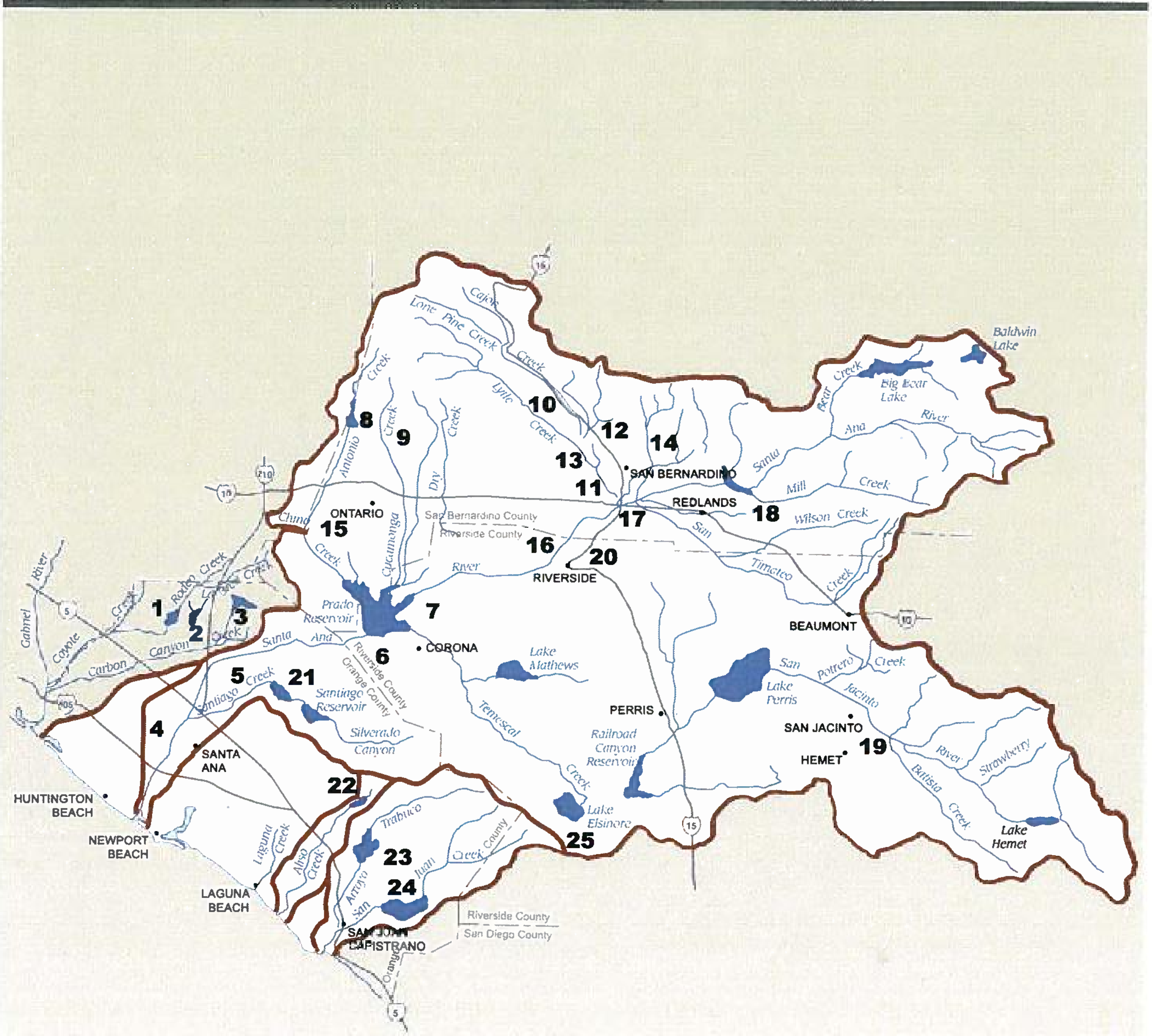
Management of flood emergencies is the responsibility of many organizations and individuals. Response is required by law to conform to the Standardized Emergency Management System, under which action is taken by levels of organization. It is begun by the person or organization on the site. That entity resists personal injury and property damage to the best of its ability, only calling on the next level when its resources become insufficient, and succeeding levels follow the same procedure. Table SCA-4, Flood emergency responders indicates the responsible entities at successive levels of response.

Table SCA-5, Advanced Hydrologic Prediction Service stream forecast points, is a list of forecast points that can be used in the Advanced Hydrologic Prediction Service of NWS.

Integrated Regional Water Management

The South Coast Region has a high density of integrated regional water management plans covering the hydrologic region. Of 14 plans, five have incorporated flood control and/or floodplain management components. The San Diego IRWMP discusses the integration of floodplain management into the plan, but does not elaborate on specific projects. The Central Orange County IRWMP discusses the Orange County Flood Control District and the role it serves as a participating flood control entity in the plan. The Watersheds Coalition of Ventura County IRWMP is coordinated with the Integrated Watershed Protection Program, allowing for county-wide planning of flood reduction measures over a 20 year horizon. For example, in the Calleguas Creek basin, which is a 341 square mile watershed, one of the ongoing projects is the Calleguas Creek IWPP Phase II Management Strategy Study. This project will provide multi-purpose outcomes including flood control, sedimentation balance and control, water quality improvement, land use management, groundwater recharge, ecosystem mitigation and restoration, and recreational opportunities. When and where opportunities become available, projects of this type will be proposed, planned, and implemented on a collaborative basis in all four zones within Ventura County. The San Jacinto River Watershed Management Plan discusses a strategy that incorporates multi-objective projects for storm water and flood management. The RCWD/Upper Santa Margarita plan discusses floodplain management and the important role it plays in protecting public and private property.

Figure SCA-2 Santa Ana River Basin and Orange County projects



— Drainage area boundary

Table SCA-3 Flood control facilities, South Coast Hydrologic Region

Facility	Stream	Owner (Sponsor)	Description	Protects
RESERVOIRS AND LAKES				
Big Dalton Res.	Big Dalton Cr.	LA Co. DPW	1,000 AF flood control	Cities of eastern Los Angeles Co.
Santa Anita Res.	Trib. Rio Hondo	LA Co. DPW	800 AF	Cities of eastern Los Angeles Co.
Big Tujunga Res.	Big Tujunga Cr.	LA Co. DPW	6,000 AF flood control	Urban areas in Tujunga Canyon
Cogswell Res.	W. Fork San Gabriel R.	LA Co. DPW	11,100 AF flood control	Urban areas in W. Fork San Gabriel R.
Devils Gate Res.	Arroyo Seco	LA Co. DPW	1600 AF flood control	Pasadena, Alhambra & E. Los Angeles
Live Oak Res.	Live Oak Cr.	LA Co. DPW	200 AF flood control	Cities of E. Los Angeles Co.
Eaton Wash Res.	Eaton Wash	LA Co. DPW	900 AF flood control	Pasadena. ther cities of metro Los Angeles
Pacoima Res.	Pacoima Cr.	LA Co. DPW	3,600 AF flood control	Cities of San Fernando Valley
San Dimas Res.	San Dimas Wash	LA Co. DPW	1,300 AF flood control	Cities of eastern Los Angeles Co.
Puddingstone Diversion Res.	San Dimas Wash	LA Co. DPW	200 AF flood control	Cities of eastern Los Angeles Co.
Puddingstone Res.	Walnut Cr.	LA Co. DPW	16,400 AF flood control	Cities of eastern Los Angeles Co.
San Gabriel Res.	San Gabriel R.	LA Co. DPW	43,600 AF flood control	Cities of eastern Los Angeles Co.
Thompson Creek Res.	Thompson Cr.	LA Co. DPW	500 AF flood control	Cities of eastern Los Angeles Co.
Hansen Dam (LACDA project)	Tujunga Wash	USACE	29,700 AF flood control	Lower Part of San Fernando Valley & City of Los Angeles
Sepulveda Dam (LACDA project)	Los Angeles R.	USACE	17,300 AF flood control	Cities in western Los Angeles Co.
Lopez Dam (LACDA project)	Pacoima Wash	USACE	200 AF flood control	Cities in San Fernando Valley
Santa Fe Dam (LACDA project)	San Gabriel R.	USACE	32,600 AF flood control	Cities of eastern Los Angeles Co.
Whittier Narrows Dam (LACDA project)	Rio Hondo San Gabriel R.	USACE	36,200 AF flood control	Cities in central Los Angeles metro area
Alessandro Dam	Alessandro Cr.	RCFCWCD	400 AF flood control	City of Riverside
Box Springs Dam	Box Springs Cr.	RCFCWCD	400 AF flood control	City of Riverside
Harrison Street Dam	Harrison Cr.	RCFCWCD	200 AF flood control	City of Riverside
Pigeon Pass Dam	Pigeon Pass Cr.	RCFCWCD	1,400 AF flood control	City of Moreno Valley
Prenda Dam	Prenda Cr.	RCFCWCD	200 AF flood control	City of Riverside
Sycamore Dam	Sycamore Cyn.	RCFCWCD	900 AF flood control	City of Riverside
Woodcrest Dam	Woodcrest Cr.	RCFCWCD	400 AF flood control	City of Riverside
Mockingbird Dam	Mockingbird Cyn.	City of Riverside	1,000 AF flood control	City of Riverside
Lake Elsinore Res.	L. Elsinore	USACE (EVMWD)	61,200 AF flood control	City of Lake Elsinore
Brea Dam (SAROC projects)	Brea Cr.	USACE (OCFCD)	4,000 AF flood control	Fullerton & Buena Park
Fullerton Dam (SAROC projects)	East Fullerton Cr.	USACE (OCFCD)	800 AF flood control	Fullerton, Buena Park, and La Palma
Prado Dam (SAROC projects)	Santa Ana R.	USACE	196 taf flood control	Urban areas in Lower Orange County

Table SCA-3 Flood control facilities, South Coast Hydrologic Region (continued)

Facility	Stream	Owner (Sponsor)	Description	Protects
Villa Park Dam (SAROC projects)	Santiago Cr.	OCFCD	15,600 AF flood control	Cities of Orange, Santa Ana and other urban areas of Orange County
Seven Oaks Dam (SAROC projects)	Santa Ana R.	OCFCD, RCFCWCD, SBCFCD, USACE	146 taf flood control	Urban Orange County
Carbon Canyon Dam (SAROC projects)	Carbon Canyon Cr.	USACE	6,600 AF flood control	Anaheim, Los Alamitos, Placentia Naval Air Station
San Antonio Dam (SAROC projects)	San Antonio Cr.	USACE	7,600 AF flood control	Pomona, Claremont, Chino, Ontario & Upland
Beardsley Wash	Beardsley Wash	Ventura Co. Watershed Mgmt. Dist. (NRCS)	Debris basin, drop spillways, channels	Oxnard plain
NON-STORAGE FLOOD CONTROL FACILITIES				
Los Angeles County Drainage Area (LACDA) project	Los Angeles R., San Gabriel R., Rio Hondo, Ballona Cr., and tributaries	USACE (LA Co. DPW)	Improved channels	Los Angeles metropolitan area, San Fernando Valley
Santa Ana River Basin and Orange County (SAROC) projects	Santa Ana R., San Jacinto R., Carbon Cr., Cucamonga Cr. and tributaries, Devil Cr., East Twin Cr., Warm Cr., Lytle Cr., Cajon Cr., Mill Cr., Chino Cr., San Antonio Cr., Bautista Cr.	USACE (OCFCD, SBCFCD, RCFCWCD)	Levees, improved channels, bypasses, debris basins, detention basins, revetment, groins, floodplain management, bank stabilization	Anaheim, Los Alamitos, Upland, Ontario, Cucamonga, Alta Loma, San Antonio Heights, San Bernardino and vicinity, Rialto, Bloomington, Colton, Redlands, Mentone, Corona, Rubidoux, Pomona, Claremont, Chino, San Jacinto, Hemet, Valle Vista
Kenter Canyon Conduit and Channel	Local drainage	USACE (LA Co. DPW)	Conduit and channel	Los Angeles, Santa Monica
San Diego River	San Diego R.	USACE (City of San Diego)	Levee, channel improvements	San Diego
Santa Clara River Basin	Santa Clara R., Santa Paula Cr.	USACE (Ventura Co. WPD)	Levees, improved channel	Oxnard, Port Hueneme, Santa Paula
Stewart Canyon	Stewart Cr.	USACE (Ventura Co. WPD)	Debris basin, channel	Ojai
Sweetwater River	Sweetwater R.	USACE (Caltrans, San Diego Co. FCD)	Improved channel	San Diego, Chula Vista, National City
Tijuana River	Tijuana R.	USACE	Levees, Improved channel	Tijuana, Mexico
Ventura River	Ventura R.	USACE (Ventura Co. WPD)	Levee	Ventura and vicinity
San Luis Rey River	San Luis Rey R.	USACE (San Diego Co. FCD)	Levee	San Luis Rey River valley
Santiago Creek	Santiago Cr.	USACE (OCFCD)	Improved channel, storage basin	Santa Ana
City Creek	City Cr.	USACE (SBCFCD)	Levee, revetment, improved channel	San Bernardino
Los Coches Creek	Los Coches Cr.	USACE (San Diego Co. FCD)	Channel	Lakeside

Table SCA-3 Flood control facilities, South Coast Hydrologic Region (continued)

Facility	Stream	Owner (Sponsor)	Description	Protects
Rose Creek	Rose Cr.	USACE San Diego Co. FCD)	Improved channel	San Diego
Telegraph Canyon Creek	Telegraph Canyon Cr.	USACE (San Diego Co. FCD)	Channels, culverts	Chula Vista
Aliso Creek	Aliso Cr.	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Arroyo Calabasas	Arroyo Calabasas	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Bell Creek	Bell Cr.	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Browns Creek	Browns Cr.	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Bull Creek	Bull Cr.	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Limekiln Creek	Limekiln Cr.	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Lower East Canyon	Lower East Canyon	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Santa Susana Creek	Santa Susana Cr.	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Upper East Canyon	Upper East Canyon	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Wilbur Creek	Wilbur Cr.	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Main Street Canyon	Main Street Canyon	Riverside Co. FCWCD (NRCS)	Small flood control project	Riverside Co.
Buena Vista Creek	Buena Vista Cr.	City of Vista (NRCS)	Channels	Vista
Beardsley Wash	Beardsley Wash	Ventura Co. Watershed Mgmt. Dist. (NRCS)	Debris basin, drop spillways, channels	Oxnard plain
Revolon Slough	Revolon Slough	Ventura Co. Watershed Mgmt. Dist. (NRCS)	Channels	Oxnard Plain

taf = thousand acre-feet

Table SCA-4 Flood emergency responders

Responder	Level	Comment
Person(s) or organization(s) on the site	0	Any emergency
Emergency services units of the 179 cities in the region	1	Any emergency
Emergency services units of the eight counties in the region	1 or 2	Any emergency, and by request from Level 1 responders
Department of Water Resources	2	Flood Operations Center, flood fight and Corps liaison
Office of Emergency Services, Inland Region	3	Any emergency, Kern County, by request of county (operational area)
Office of Emergency Services, Southern Region	3	Any emergency, Los Angeles, Orange, Riverside, San Bernardino, San Diego, Santa Barbara, and Ventura Counties, by request of county (operational area)
U. S. Army Corps of Engineers	3	Specified water-related emergencies, by request of DWR
California Conservation Corps	3	Personnel and equipment for flood fight
Department of Forestry and Fire Protection	3	Personnel and equipment for flood fight
Office of Emergency Services Headquarters	4	All emergencies, entire hydrologic region, by request of OES Region

Table SCA-5 Advanced Hydrologic Prediction Service stream forecast points

River Basin	Stream	Location
Calleguas Creek	Calleguas Creek	CSU Channel Islands
San Diego River	San Diego River	El Capitan Reservoir
San Luis Rey River	San Luis Rey River	Lake Henshaw
San Luis Rey River	San Luis Rey River	Oceanside
San Diego River	San Vicente Creek	San Vicente Reservoir
Santa Ana River	Santa Ana River	Seven Oaks Reservoir
Santa Clara River	Santa Clara River	Freeman Diversion
Santa Clara River	Santa Clara River	Piru
Santa Margarita River	Santa Margarita River	Ysidora
Santa Clara River	Sespe Creek	Fillmore
Ventura River	Ventura River	Foster Park

Appendix B. Water Quality

Water Supplies

State Water Project

Legal decisions regarding environmental concerns in the Delta, however, have recently limited the volume of water that can be delivered south of the Sacramento-San Joaquin Bay Delta through the State Water Project (SWP). The potential impact of further declines in ecological indicators in the Delta system on SWP water deliveries is unclear. Additionally, the SWP is subject to extreme variability in hydrology due to a lack of storage, with full deliveries in only the wettest years. Other obstacles that must be overcome in importing water through the SWP include limitations on the movement of water across the Delta system, constraints related to water quality, and the cost of the water. The Governor's Delta Vision Strategic Plan (2008) recently recommended two co-equal goals and associated actions: (1) restore the Delta ecosystem and (2) create a reliable water supply for California. The plan recommends improving the existing channel through the Delta, developing a second conveyance channel, increasing storage capacity, and expanding local supplies to reduce dependence on imports. The Bay-Delta Conservation Plan, under development by a collaboration of State, federal, and local water agencies, will further address the recovery of endangered and sensitive fisheries in the Delta.

Colorado River System

The Metropolitan Water District of Southern California (Metropolitan) diverts Colorado River supplies based on the agreements in the 1931 California Seven-Party Agreement and the Colorado River Water Delivery Agreement: Federal Quantification Settlement Agreement of 2003 (QSA), which further quantifies priorities established in the 1931 document. Metropolitan's diversions, although within its legal entitlements, are less now than they were in the early 2000s. Surplus supplies which existed then have been reduced as other states increased their diversions in accord with their authorized entitlements. Since 2003, Metropolitan's annual deliveries have varied from a low of 633,000 acre-feet in 2006 to a high of 897,000 acre-feet in 2005. The QSA also identifies measures to conserve and transfer water through the lining of existing earthen canals. The San Diego County Water Authority has further developed conservation and transfer agreements with Imperial Irrigation District to augment its Colorado River Aqueduct supply. With full implementation of the programs identified in the QSA, Metropolitan plans to divert 852,000 acre-feet per year of Colorado River water annually plus any unused agricultural water that may be available. Additional conjunctive use agreements that Metropolitan have in operation to manage its Colorado River Aqueduct supply include the Hayfield, Chuckwalla, and Lower Coachella Valley groundwater storage programs.

Local Surface Water

Surface water in the Santa Clara Planning Area is obtained from Lake Casitas (254,000 acre-feet), Lake Piru (100,000 acre-feet), and from diversion projects along the Santa Clara River, Ventura River, Santa Paula Creek, Piru Creek, Sespe Creek, and Conejo Creek. Natural surface flows from these diversions are also directed to spreading basins to replenish local aquifers. Local surface water provides approximately 8.5 percent of the total water utilized in Ventura County. The most southern reservoir on the West Branch of the SWP California Aqueduct is Castaic Lake (320,000 acre-feet). Metropolitan and CLWA both receive water from Castaic Lake and distribute it to retail water purveyors following treatment. Bouquet Reservoir (33,000 acre-feet) is a part of the Los Angeles Aqueduct (LAA) system built by the City of Los Angeles in 1934.

Originally, the Los Angeles River was the primary water source for the Metropolitan Los Angeles Planning Area. Following several catastrophic floods, the U.S. Army Corps of Engineers (USACE) lined most of the riverbed with concrete and constructed several dams to manage storm flows. The USACE continues to oversee Hansen, Lopez, and Sepulveda Dams in the Los Angeles River watershed, as well as Santa Fe and Whittier Narrows Dams in the San Gabriel River watershed. LACDPW oversees several surface water storage facilities, including Big Tujunga and Pacoima dams, which further improve flood protection and store runoff for subsequent diversion to 27 groundwater spreading basins. Eleven dams were constructed as part of the San Gabriel River and Montebello Forebay water conservation system to impound runoff for groundwater recharge. Three dams in San Gabriel Canyon (Cogswell, San Gabriel, and Morris dams) capture runoff for diversion to the Santa Fe, Rio Hondo, or San Gabriel Coastal Basin spreading grounds. Las Virgenes MWD uses Las Virgenes Reservoir (9,800 acre-feet) to store treated water it has purchased from Metropolitan. The Los Angeles Reservoir (10,000 acre-feet), operated by the LADWP, is a primary water source of the San Fernando Valley area.

The Santa Ana Planning Area has water storage reservoirs, including Lake Perris (124,000 acre-feet), which stores State Water Project water Lake Mathews (182,000 acre-feet) which stores Colorado River water, and Big Bear Lake (74,000 acre-feet). Additionally, several flood control projects, including Prado Dam (383,500 acre-feet) and Seven Oaks Dam (145,600 acre-feet) have been created to retain surface water during storm season. Although not a drinking water supply, Lake Elsinore is the only natural freshwater lake in the watershed with a surface area of five square miles. Surface water accounts for approximately five-percent of the total water supply to serve demands in the Santa Ana watershed.

In the San Diego Planning Area, a total of 25 reservoirs with a combined capacity of 594,000 acre-feet are located within the SDCWA's service territory. Major supply reservoirs include San Vicente (90,200 acre-feet), El Capitan (112,800 acre-feet), Lake Henshaw (50,000 acre-feet), and Lake Morena (50,200 acre-feet). Seventeen (17) of these reservoirs are connected to the SDCWA's aqueduct system. SDCWA plans to raise the existing dam at San Vicente Reservoir from 220 feet to 337 feet to provide an additional 100,000 acre-feet capacity for carryover storage (63 feet per Carryover

Storage Project) and 52,000 acre-feet capacity for emergency storage (54 feet per Emergency Storage Project). The increased reservoir capacity will also require construction of two auxiliary saddle dams and a three-year reservoir draw down. RCWD's surface storage system is comprised of Vail Lake (51,000 acre-feet). RCWD meets Temecula Gorge flow requirements of 2,500 acre-feet per year, as set by the Cooperative Water Resource Management Agreement between Camp Pendleton and RCWD, by discharging untreated imported water into Murrieta Creek, a tributary of the Santa Margarita River. Metropolitan owns and operates Diamond Valley Lake (800,000 acre-feet) and Lake Skinner (44,000 acre-feet) within the planning area.

Groundwater

In the South Coast region, natural recharge is typically insufficient to maintain groundwater basin water levels and current pumping levels due to the extent of impervious surfaces and the presence of clay soils. In some groundwater basins, as the demand for groundwater exceeded supply, landowners and other parties have turned to the courts to determine how much groundwater can rightfully be extracted. Most basin adjudications have resulted in either a reduction or no increase in the amount of groundwater extracted. Watermasters are further recognizing that they must also manage groundwater extraction to protect water quality and/or to prevent the spread of contaminants in groundwater. Adjudicated groundwater basins include: Central, Chino, Cucamonga, Main San Gabriel, Puente, Raymond, San Bernardino, Santa Margarita River, Santa Paula, Six Basins, Upper Los Angeles River, and the West Coast. Additional management of groundwater has been afforded through legislation to: Fox Canyon Groundwater Management Agency (GMA), Ojai GMA, Water Replenishment District of Southern California (WRD), and OCWD.

Groundwater production within the greater Metropolitan service area is estimated at 1.6 million acre-feet annually, employing nearly 5,000 acres of spreading basins and 36 injection wells (Metropolitan 2007). The discussion below provides examples of the larger basins, as there are too many small groundwater basins to name.

Groundwater is the largest single source of water in the Santa Clara Planning Area. The 66,200-acre Upper Santa Clara River Valley basin is comprised of two aquifers (an alluvial aquifer and a Saugus Formation aquifer) totaling approximately 1.9 million acre-feet of storage capacity. Due to extensive pumping by private well owners and by a majority of the 166 public water purveyors within Ventura County, overdraft and seawater intrusion problems were occurring to local groundwater basins. Established in 1982 by State legislation, the Fox Canyon GMA now manages some of the basins and is implementing actions to mitigate these issues. The 125,300-acre Lower Santa Clara River Valley basin is subdivided into five smaller basins: Oxnard, Mound, Santa Paula, Fillmore, and Piru. The largest of the sub-basins is the 58,000-acre Oxnard basin, which contains approximately 7.1 million acre-feet of storage capacity and is managed by the Fox Canyon GMA. Conjunctive use projects underway in Ventura County include Calleguas Conjunctive Use Program (North Las Posas Basin).

Many agencies in the Metropolitan Los Angeles Planning Area rely on artificial recharge, by diverting local supplies from rivers or creeks when flow conditions are optimal, to spreading grounds (or basins) which typically contain sandy soils that promote infiltration. LADWP, in partnership with the Los Angeles County Flood Control District, is moving forward with several storm water capture projects with the goal of increasing long-term groundwater recharge by a minimum 20,000 acre-feet per year. In addition, recycled water is infiltrated in spreading grounds and injected (along with imported water) along the coast to form barriers to seawater intrusion at three locations (the Alamitos, Dominguez Gap, and West Coast barriers). The 310,900-acre Coastal Plain of Los Angeles County basin is subdivided into 4 sub-basins: Santa Monica, Hollywood, Central, and West Coast. The Central and West Coast sub-basins represent almost 90 percent of the storage of the Coastal Plain basin and are both adjudicated for allowed pumping of up to 281,000 acre-feet per year. These sub-basins have a combined total storage capacity estimated at 20.3 million acre-feet and up to 450,000 acre-feet set aside for the development of future conjunctive use projects. Conjunctive use projects underway in Los Angeles County include Long Beach Conjunctive Use Storage Project (Central Basin).

Groundwater continues to be the primary water supply source in the Santa Ana Planning Area. Groundwater production is supported by incidental and artificial recharge of recycled water, imported water, and storm water supplies. On average, about 80,000 acre-feet per year of imported supplies from Metropolitan are recharged each year to support groundwater production. The 466,900-acre Upper Santa Ana Valley basin has nine sub-basins: Chino, Cucamonga, Rialto-Colton, Riverside-Arlington, Cajon, Bunker Hill, Yucaipa, San Timoteo, and Temescal. Total combined storage of the sub-basins is estimated at 21 million acre-feet. Groundwater pumping operations in the Chino, Bunker Hill, and Rialto-Colton sub-basins are managed under adjudication judgments. The 224,000-acre Coastal Plain of Orange County basin has a storage capacity of 37.7 million acre-feet. The Orange County groundwater basin, managed by OCWD, provides a majority of the water used by north and central Orange County cities. Conjunctive use of surface water and groundwater is a long-standing practice in the region, with numerous spreading grounds developed to recharge the basins. Phase I construction has been completed for OCWD and Orange County Sanitation District's Groundwater Replenishment System, which purifies 72,000 acre-feet per year of wastewater for groundwater storage either by injection along the seawater barrier or by percolation near the Santa Ana River. Conjunctive use programs underway in San Bernardino County include IEUA Cyclic Storage Agreement (Chino Basin) and Three Valley Municipal Water District Cyclic Storage Agreement (Main San Gabriel Basin).

Groundwater production in the San Diego Planning Area is limited by lack of storage capacity in local aquifers, availability of groundwater recharge, and degraded water quality. RCWD stores local runoff in Vail Lake via a surface water storage permit (up to 40,000 acre-feet from November 1 to April 30) and then releases available water to spreading basins for groundwater recharge. SDCWA does not utilize groundwater extraction to meet member agency needs. The proposed El Monte Valley Groundwater Recharge project, a joint effort between Padre Dam MWD and Helix WD in San Diego

County, would recharge the El Monte Valley Basin using highly treated recycled water. The Santa Margarita Conjunctive Use Project, by the Fallbrook PUD, provides for recharge of the groundwater basin underlying Camp Pendleton through diversions from the Santa Margarita River.

Recycled Water

Within Metropolitan's service area, there are approximately 355,000 acre-feet of planned and permitted uses of recycled water supplies. Actual use is approximately 209,000 acre-feet, which includes golf course, landscape, and cropland irrigation; industrial uses; construction applications; and groundwater recharge, including maintenance of seawater barriers in coastal aquifers. Metropolitan projects the development of 500,000 acre-feet of recycled water supplies (including groundwater recovery) by 2025 (Metropolitan 2004). A necessary component of water recycling is providing a means of disposal or storage for excess recycled water supplies during wet weather periods (other than discharge via regional ocean outfalls). Discharge of treated wastewater flows into streams and rivers can help satisfy environmental water demands and provide for incidental groundwater recharge. IPR through release of recycled water to groundwater spreading basins or surface storage reservoirs can further augment local drinking water supplies. By utilizing reclaimed water, agencies can more efficiently allocate their potable water and increase the reliability of water supplies in the region.

Recycled water in the Santa Clara Planning Area holds great potential as an alternative water source and a means to improve water supply reliability, particularly for agricultural irrigation. Four WWTPs in Ventura County currently reclaim a portion of their effluent. The Camrosa Water District recycles water from its own facilities, the City of Thousand Oaks' Hill Canyon WWTP, and Camarillo Sanitary District for agricultural and landscape irrigation demands. In the upper watershed, Santa Clarita Valley Sanitation District owns and operates two water reclamation plants (Saugus and Valencia) within the CLWA service area. A third reclamation plant is proposed as part of the Newhall Ranch project. Accordingly, CLWA has constructed an initial phase (Phase 1A) of the recycled water system and proposes to construct an additional phase in the near future.

Current average annual recycled water production in the Metropolitan Los Angeles Planning Area is approximately 225 million gallons per day (MGD), which represents approximately 25 percent of the current average annual effluent flows. WRD is permitted to recharge up to 50,000 acre-feet per year (45 MGD) of Title 22 recycled water from CSDLAC for replenishment of the Central sub-basin through use of the Montebello Forebay spreading grounds. West Basin MWD's Edward Little Water Recycling Facility in El Segundo, which produced approximately 24,500 acre-feet in 2004-2005, recently completed its Phase IV Expansion Project. Approximately 12,500 acre-feet per year of the water produced at this facility is purchased by WRD and injected into the West Coast Barrier by LACDPW. The use of recycled water by LADWP is projected to be approximately 50,000 acre-feet per year by 2019.

Recycled water currently represents approximately 4 percent of the total water demands in the Santa Ana Planning Area. Eastern MWD recycles effluent from four WWTPs. EMWD is reusing the majority of the treated wastewater. EMWD is also investigating the feasibility of indirect potable reuse through groundwater recharge, The Irvine Ranch Water District (IRWD) has developed an extensive recycled water treatment and delivery system and will expand capacity through 2013 to meet expected recycled water demand at buildout. Inland Empire Utilities Agency (IEUA) is expanding its water recycling with a goal of meeting 20 percent of their demand or 50,000 acre-feet with recycled water. The Western Water Recycling Facility, owned and operated by Western Municipal Water District, is currently being upgraded and expanded. Eastern Municipal Water District has Perris Valley and Moreno Valley Water Reclamation Facilities and recycled water is available through the OCWD's Green Acres Project and the El Toro Water District. As infrastructure is further developed, recycled water is projected to surpass surface water as a water supply source for the planning area. OCWD and Orange County Sanitation District's Groundwater Replenishment System provides 72,000 acre-feet per year of recycled water for groundwater recharge and injection along the seawater barrier.

The San Diego Planning Area contains a number of recycled water facilities. In Riverside County, water reclamation facilities include Santa Rosa and Temecula Valley which provide non-potable supplies for local use. Seventeen recycled water tertiary treatment facilities are located within San Diego County. The use of tertiary treated recycled water within the San Diego area is projected to increase from 11,500 acre-feet per year in 2005 to 47,600 acre-feet per year in 2030 (SDCWA 2007). In September 2008, the City of San Diego approved funding for an IPR demonstration project that releases advanced treated wastewater to San Vicente Reservoir for blending and subsequent additional treatment prior to redistribution.

Desalination

In the Metropolitan Los Angeles Planning Area, the 3 MGD Goldsworthy Desalter, owned and operated by WRD, provides brackish groundwater desalination for the dual purposes of remediation of a saline plume located within the West Coast sub-basin and provision of a reliable local water source to Torrance.

The potential for groundwater banking in the Santa Ana Planning Area is substantial, but the volume of clean water that can be stored may be hindered by high salt concentrations in the existing groundwater. In the Santa Ana watershed, three groundwater desalination plants have been constructed by SAWPA (in the Arlington and Chino areas) and are producing a total of 24 MGD. The Arlington Desalter is now owned and operated by Western Municipal Water District. The Temescal plant, constructed and operated by the City of Corona, has a capacity of 15 MGD. The Menifee and Perris Desalters, owned and operated by Eastern MWD, are producing 7 MGD. A third desalter (Perris II with a 5 MGD capacity is in design. The Chino Basin Desalter Authority operates Chino 1 and Chino II Desalters, which are producing 24 MGD (26,000 acre-feet per year).

The Irvine Desalter Project, a joint groundwater quality restoration project by IRWD and OCWD, yields 7,700 acre-feet per year of potable drinking water and 3,900 acre-feet per year of non-potable water. The Tustin Seventeenth Street Desalter, owned and operated by the City of Tustin yields approximately 2,100 acre-feet per year. The Arlington Desalter, managed by Western MWD, delivers approximately 6,400 acre-feet of treated groundwater annually to the City of Norco. Brine from local desalters is effectively transported from the watershed by SAWPA's 30 MGD capacity Santa Ana Regional Interceptor (SARI) brine pipeline to OCSD for treatment and then discharge to the ocean. As described above, groundwater extraction is limited in the San Diego Planning Area. Brackish groundwater desalination facilities in the planning area include the City of Oceanside's Mission Basin Desalter (6.37 MGD) and Sweetwater Authority's Reynolds Groundwater Desalination Facility (4 MGD).

Urban Water Conservation

Water conservation programs are coordinated in the Santa Clara Planning Area by a variety of agencies. Calleguas MWD, the local wholesaler of SWP supplies, administers programs with its member agencies in the southeastern portion of Ventura County. A regional agricultural interest group, the Ventura County Farm Water Coalition, was recently formed to collaborate on implementation of agricultural efficient water management practices. CLWA acts as the information clearinghouse for water conservation efforts in the upper watershed by purchasing advertising time in all media types and funding conservation programs by its member water retailers.

In the Metropolitan Los Angeles Planning Area, Metropolitan assists member agencies with implementation of water conservation programs. Additionally, LADWP implements public outreach and school education programs to encourage conservation ethics; seasonal water rates that are approximately 20 percent greater during the summer high use period; and free water conservation kits. As a result of these conservation efforts by LADWP, the water demand for Los Angeles is about the same as it was 25 years ago, despite a population increase of more than 1 million people. LADWP projects an additional savings of at least 50,000 acre-feet per year by 2030 through additional water conservation programs. The Central and West Basin MWDs recently completed water conservation master plans to coordinate and prioritize conservation efforts and identify enforcement protocols.

OCWD implements several water use efficiency programs in the Santa Ana Planning Area, including a hotel/motel water conservation program, an annual Children's Water Festival and a Water Heroes program and water saving tips and tools. Eastern Municipal Water District has a strategic goal to reduce per capita water use and has several programs to replace existing inefficient water devices and encourage water efficiency in new development. IEUA provides multiple rebate programs, including turf removal and water efficient fixtures, and has established the Inland Empire Landscape Alliance to promote the use of water efficiency landscaping by its cities and retail agencies. Western Municipal Water District operates the preeminent water conservation demonstration center in the southland, Landscapes Southern California Style, which has been educating the public about water efficient planting and irrigation for over 15 years.

In the San Diego Planning Area, significant SDCWA and member agency funding has been directed toward implementing water conservation programs. Major programs include water efficient purchase incentives, efficiency standards, residential surveys, residential retrofits, landscape/irrigation improvements, and commercial/industrial/institutional retrofits. These programs resulted in 53,400 acre-feet of water savings during 2005; water savings are projected to annually exceed 100,000 acre-feet by year 2025. Numerous partnerships have also been developed to implement retail agency projects supported by external funding. For example, the 2007 Blueprint for Water Conservation is a partnership of SDCWA, member agencies, Cuyamaca College's Water Conservation Garden, and private stakeholders dedicated to increasing regional water conservation to 80,000 acre-feet per year by 2010 and further to 108,000 acre-feet per year by 2030.

Table SCB-1 Water Suppliers in the South Coast Hydrologic Region

Entity	Local Supply					
	Surface	Groundwater	Desalination	Recycle	Imported	Imported Supplier
Metropolitan Water District of Southern California (MWDSC)					•	SWP
Calleguas Municipal Water District (MWD)		•	•	•	•	MWDSC
Academy MWC, Arroyo Las Posas MWC, Balcolm Bixby MWA, Berylwood Heights MWC, Brandeis-Bardin MWC, Butler Ranch MWC, California Water Service Company, California-American Water Company, City of Camarillo, Camrosa Water District, Crestview MWC, Golden State Water Company, Del Norte MWC, Epworth MWC, Fuller Falls MWC, La Loma Ranch MWC, Lake Sherwood CSD, Las Lomas Water System, Mesa Water Co., Oak Park Water Service, City of Oxnard, Pleasant Valley MWC, Rancho Canada Water Company, Thermic MWC, City of Simi Valley, Solano Verde MWC, City of Thousand Oaks, Ventura County Waterworks District No. 1, Ventura County Waterworks District No. 8, Ventura County Waterworks District No. 17, Ventura County Waterworks District No. 19, Zone MWC	•	•	•	•	•	Calleguas MWD, United Water Conservation District
Central Basin MWD		•		•	•	MWDSC
City of Bell Gardens, City of Downey, City of Montebello, City of Norwalk, City of Vernon, City of La Habra Heights, City of La Mirada, City of Pico Rivera, City of Santa Fe Springs, City of Whittier, City of Bell, City of Commerce, City of Huntington Park, City of Maywood, City of Walnut Park, City of Lynwood, City of South Gate, City of Florence-Graham, City of Willowbrook, City of Artesia, City of Bellflower, City of Cerritos, City of Hawaiian Gardens, City of Lakewood, City of Paramount, City of Signal Hill, Water Replenishment District of Southern California (WRD)						Central Basin MWD
Eastern MWD		•		•	•	MWDSC
City of Hemet, City of Perris, City of San Jacinto, City of Menifee, Nuevo MWC, Moreno Valley MWC, Lake Hemet MWD, Rancho California Water District	•	•		•	•	Eastern MWD, Western MWD
Foothill MWD	•	•			•	MWDSC
Crescenta Valley Water District, La Canada Irrigation District, Mesa Crest Water Company, Valley Water Company, Las Flores Water Company, Lincoln Avenue Water Company, Rubio Canon Land and Water Association, Kinneloa Irrigation District		•			•	Foothill MWD
Inland Empire Utilities Agency (IEUA)				•	•	MWDSC
City of Chino, City of Chino Hills, City of Upland, Cucamonga Valley Water District, City of Fontana, City of Montclair, City of Ontario, City of Upland, Monte Vista Water District, Fontana Water Co., San Antonio Water Co.,	•	•		•	•	IEUA
Las Virgenes MWD					•	MWDSC
Municipal Water District of Orange County (MWDOC)		•			•	MWDSC
City of Brea, City Buena Park, East Orange County Water District (EOCWD), City of Fountain Valley, City Garden Grove, Golden State Water Co-Orange County District, City of Huntington Beach, City of La Habra, City of La Palma, Mesa Consolidated Water District, City of Orange, Orange County Water District (OCWD), City of Newport Beach, Santa Margarita Water District, City of Seal Beach, Serrano Water District, City of Tustin, City of Westminster, Yorba Linda Water District, El Toro Water District, Emerald Bay Service District, Irvine Ranch Water District (IRWD), Laguna Beach County Water District, Moulton Niguel Water District, City of San Clemente, South Coast Water District, City of San Juan Capistrano, Trabuco Canyon Water District, City of Laguna Beach	•	•	•	•	•	MWDOC, OCWA, EOCWD, IRWD, Cal Domestic
San Diego County Water Authority (SDCWA)	•	•	•	•	•	MWDSC, IID Transfer, Canal Lining
Carlsbad MWD, City of Del Mar, City of Escondido, Fallbrook PUD, Helix Water District, Lakeside Water District, City of Oceanside, Olivenhain MWD, Otay Water District, Padre Dam MWD, Camp Pendleton, City of Poway, Rainbow MWD, Ramona MWD, Rincon Del Diablo MWD, City of San Diego, San Dieguito Water District, Santa Fe Irrigation District, Sweetwater Authority (incl City of National City, South Bay Irrigation District), Vallecitos Water District, Valley Center MWD, Vista Irrigation District, Yuima MWD	•	•	•	•	•	SDCWA

Table SCB-1 Water Suppliers in the South Coast Hydrologic Region (continued)

Entity	Local Supply: Surface	Local Supply: Groundwater	Local Supply: Desalination	Local Supply: Recycle	Imported	Imported Supplier
Three Valleys MWD		•		•	•	MWDSC
City of La Verne, City of Covina, City of Glendora, City of Pamona, Southern California Water Co, Rowland Water District, Walnut Valley Water District, California State Polytechnic University-Pamona, Mount San Antonio College, Boy Scouts of America-Firestone Reservation	•	•		•	•	Three Valleys MWD, Covina Irrigating Co
Upper San Gabriel Valley MWD		•			•	MWDSC
Golden State Water Company, City of South Pasadena, Main San Gabriel Basin Watermaster, Suburban Water Systems, City of Alhambra, City of Arcadia, City of Monrovia, City of Azusa, Valley County Water District	•	•			•	Upper San Gabriel Valley MWD, Covina Irrigating Co, Cal Domestic
West Basin MWD	•	•	•	•	•	MWDSC
City of El Segundo, City of Inglewood, City of Lomita, City of Los Angeles, City of Manhattan Beach, City of Torrance, Water Replenishment District of Southern California, Los Angeles County Waterworks District #29, California American Water Company, California Water Service Company, Golden State Water Company		•	•	•	•	MET, West Basin MWD, LADWP
Western MWD		•			•	MWDSC
Box Springs MWC, City of Corona, City of Norco, City of Riverside, City of Wildomar, Eagle Valley MWC, Elsinore Valley MWD, Lee Lake Water District, Rancho California Water District	•	•		•	•	Eastern MWD, Western MWD
City of Anaheim		•			•	MWDSC
City of Beverly Hills		•			•	MWDSC
City of Burbank		•		•	•	MWDSC
City of Compton		•			•	MWDSC
City of Fullerton		•			•	MWDSC
City of Glendale		•		•	•	MWDSC
City of Long Beach		•		•	•	MWDSC
City of Pasadena		•			•	MWDSC
City of San Fernando		•			•	MWDSC
City of San Marino		•			•	Cal-American, City of Pasadena
City of Santa Monica		•		•	•	MWDSC
City of Torrance		•		•	•	MWDSC, WBMWD
Castaic Lake Water Agency (CLWA)	•	•		•	•	SWP, Buena Vista WSD, Rosedale-Rio Bravo WSD
Los Angeles County Water District #36, Newhall County Water District, Santa Clarita Water Division, Valencia Water Company	•	•		•	•	CLWA
San Bernardino Valley MWD		•			•	SWP
City of Redlands, City of Rialto, City of Colton, City of Loma Linda, City of San Bernardino, Terrace Water Co.,Western Heights Co, Marygold Mutual Water Co. Riverside Highland Water Co. Muscoy Mutual Water Co. East Valley Water District, Fontana Water Co., Yucaipa Valley Water District, West Valley Water District	•	•			•	
San Gorgonio Pass Water Agency (SGPWA)		•			•	SWP
City of Banning, Beaumont-Cherry Valley Water District, Yucaipa Valley Water District, South Mesa Water Company		•			•	SGPWA

Table SCB-1 Water Suppliers in the South Coast Hydrologic Region (continued)

Entity	Local Supply: Surface	Local Supply: Groundwater	Local Supply: Desalination	Local Supply: Recycle	Imported	Imported Supplier
San Gabriel Valley MWD						SWP
Casitas MWD	•	•			•	SWP (Ventura County allocation)
Casitas MWC, City of Buenaventura, Dennison Park Water System, Gridley Road Water Group, Hermitage MWC, Meiners Oaks CWD, North Fork Springs MWC, Ojala, Old Creek Road MWC, Oviatt Water Association, Rancho del Cielo MWC, Rancho Matilija MWC, Rincon Water and Roadworks, Ojai Water Conservation District, Senior Canyon MWC, Siete Robles MWC, Sisar MWC, Golden State Water Company, Sulphur Mountain Road Water Association, Tico MWC, Tres Condados, Ventura River CWD, Villanova Road Water Well Association	•	•			•	Casitas MWD
City of Ventura	•	•		•	•	SWP (Ventura County allocation)
United Water Conservation District	•	•			•	SWP (Ventura County allocation)
Aliso MWC, Alta MWC, Beedy Street Well, Brownstone MWC, Camarillo Airport Utility, Channel Islands Beach CSD, City of Fillmore, City of Port Hueneme, Cloverdale MWC, Community MWC, Cypress MWC, Dempsey Road MWC, Seacoast Cooling, Elkins Ranch Co., Farmer's Irrigation Co., Fillmore Irrigation Co., Goodenough MWC, Hailwood Inc., CB South, Poinsettia Stock Farm, Lake Piru Recreation Area, Limoneira Assoc., Middle Road MWC, Montalvo MWC, Nyeland Acres NWC, Oxnard Lemon MWC, Pleasant Valley CWD, Rio Manor MWC, Rio Plaza Water Company, San Cayetand MWC, City of Santa Paula, Saviers Road MWC, South Mountain MWC, Storkel MWC, Strickland MWC, Thermal Belt MWC, Timber Canyon MWC, Tobock Rock MWC, USNAS Point Mugu, USNCBC Port Hueneme, United MWC, Ventura County Waterworks District #16, Vineyard Avenue Acres MWC, Vineyard MWC, Warring Water Service, Piro MWC, Hardscrabble MWC, Sespe Agricultural Water, Guadalasca MWC, Citrus MWC, Lloyd-Butler MWC, Onard MWC, Toland Road Water System, Thornhill MWC	•	•			•	United Water Conservation District

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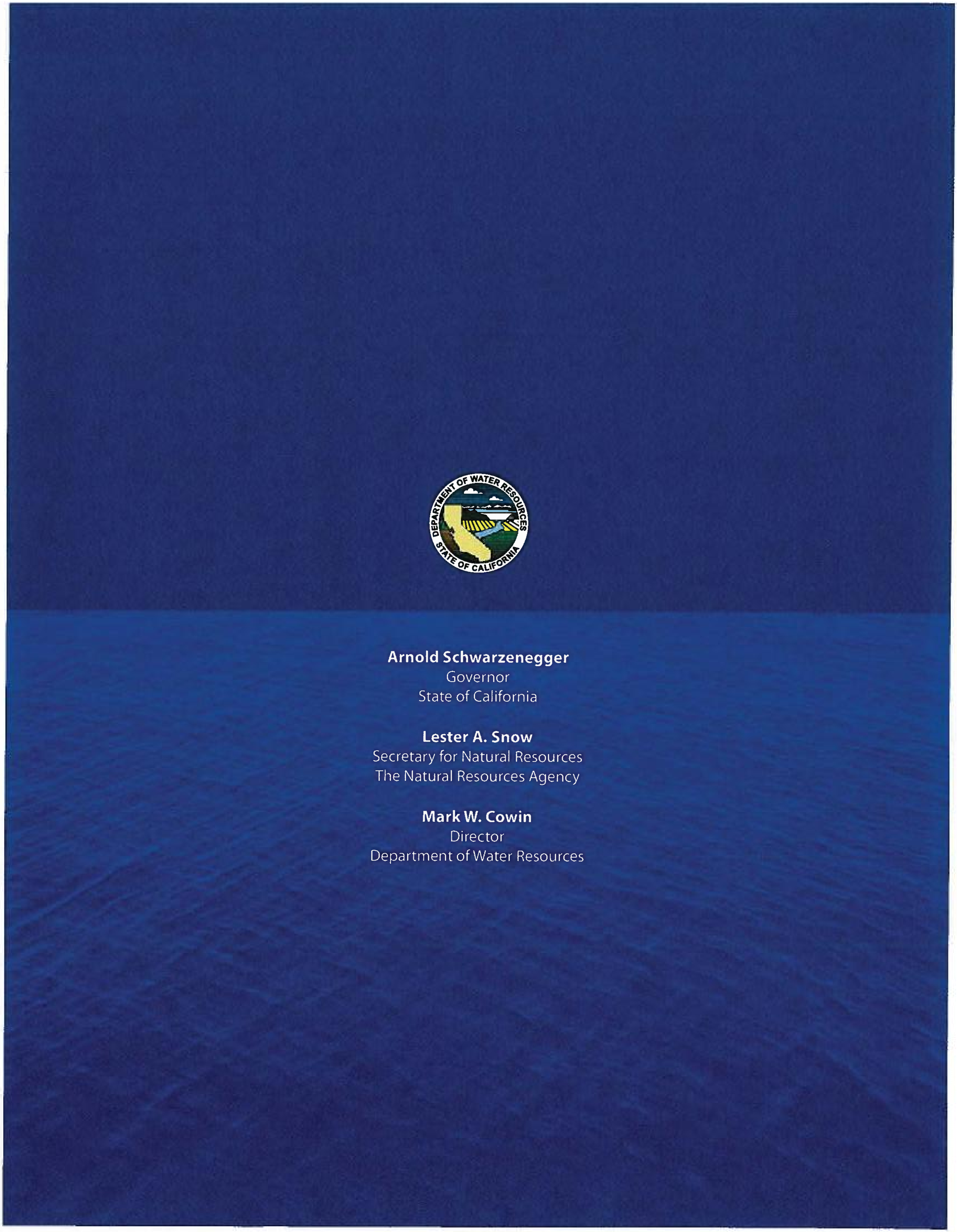
The California Water Plan provides a framework for resource managers, legislators, Tribes, other decision-makers, and the public to consider options and make decisions regarding California's water future. Our goal is that this document meet Water Code requirements, receive broad support among those participating in California's water planning, and be a useful document. With its partners, DWR completed the final Update 2009 volumes and Highlights in December 2009.

The first four volumes of the update and the Highlights booklet are contained on the CD attached below. All five volumes of the update and related materials are also available online at *www.waterplan.water.ca.gov.*

Volume 1: The Strategic Plan
Volume 2: Resource Management Strategies
Volume 3: Regional Reports
Volume 4: Reference Guide
Volume 5: Technical Guide

For printed copies of the Highlights, Volume 1, 2, or 3, call 1-916-653-1097.
If you need this publication in alternate form, contact the Public Affairs Office at 1-800-272-8869.

Insert holder for CD inside of back cover



Arnold Schwarzenegger
Governor
State of California

Lester A. Snow
Secretary for Natural Resources
The Natural Resources Agency

Mark W. Cowin
Director
Department of Water Resources

APPENDIX D

SWRCB Antidegradation Policy
(Resolution No. 68-16)

STATE WATER RESOURCES CONTROL BOARD

RESOLUTION NO. 68-16

STATEMENT OF POLICY WITH RESPECT TO MAINTAINING HIGH QUALITY OF WATERS IN CALIFORNIA

WHEREAS the California Legislature has declared that it is the policy of the State that the granting of permits and licenses for unappropriated water and the disposal of wastes into the waters of the State shall be so regulated as to achieve highest water quality consistent with maximum benefit to the people of the State and shall be controlled so as to promote the peace, health, safety and welfare of the people of the State; and

WHEREAS water quality control policies have been and are being adopted for waters of the State; and

WHEREAS the quality of some waters of the State is higher than that established by the adopted policies and it is the intent and purpose of this Board that such higher quality shall be maintained to the maximum extent possible consistent with the declaration of the Legislature;

NOW, THEREFORE, BE IT RESOLVED:

1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

2. Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

3. In implementing this policy, the Secretary of the Interior will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act.

BE IT FURTHER RESOLVED that a copy of this resolution be forwarded to the Secretary of the Interior as part of California's water quality control policy submission.

CERTIFICATION

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on October 24, 1968.

Dated: October 28, 1968

Kerry W. Mulligan
Executive Officer
State Water Resources
Control Board

California Antidegradation Policy

Resolution No.

68-16

Overview of Presentation

- What is the state policy?
- How does it differ from the federal policy?
- How is it implemented in California?

State Antidegradation Policy

- "Statement of Policy with Respect to Maintaining High Quality Waters in California" (Resolution No. 68-16)
- Part of state policy for water quality control
- Incorporated into all regional water quality control plans

State Antidegradation Policy

- Applies to high quality waters only
- Requires that existing high quality be maintained to the maximum extent possible
- Allows lowering if:
  - Change is consistent with maximum benefit to people of state, will not unreasonably affect present and potential beneficial uses, and will not result in water quality lower than applicable standards, and
  - Waste discharge requirements for proposed discharge will result in the best practicable treatment or control of the discharge necessary to assure:
    - No pollution or nuisance
    - Highest water quality consistent with maximum benefit to people of the State

State Policy v. Federal Policy

- State policy differs from federal policy in that it applies to:
  - all waters, including surface waters and groundwater
  - water quality lowerings since 1968
  - all uses, both existing and potential uses, instream and offstream
  - only high quality (i.e. Tier 2) waters
- But, state policy incorporates the federal policy where applicable

Activities subject to state policy

- Both state and federal policies apply to point and nonpoint activities that could lower surface water quality, e.g.
  - Permits, waste discharge requirements and waivers for surface water discharges
  - Basin planning and policies affecting surface waters
  - 401 certifications
  - Surface water cleanups

Activities – Part 2

- Only state policy applies to activities that could lower groundwater quality, e.g.
  - Waste discharge requirements and waivers for discharges that could impact groundwater quality
  - Basin planning and cleanups related to groundwater

Implementation Methods for State Policy

- State uses informal guidance to implement policy
  - NPDES permitting: APU 90-004; EPA's Questions & Answers on Antidegradation; 1987 legal memorandum, entitled "Federal Antidegradation Policy;" EPA Region 9 "Guidance on Implementing the Antidegradation Provisions of 40 CFR 131.12"
  - State only activities: Memoranda on Resolution No. 68-16 and State Water Boards Orders, e.g. Order WQ 86-8

Res. No. 68-16 as Applied to Groundwater/ Non-federal Waters

- Applies only to high quality waters
- Use pollutant-by-pollutant approach to determine if water is high quality
- If existing activity would lower existing high water quality, apply test in Res. No. 68-16
- Existing means the best quality since 1968 unless subsequent lowering was due to regulatory action consistent with Res. No. 68-16

Res. No. 68-16 as Applied to Waters of the United States

- State uses pollutant-by-pollutant approach to determine whether water is in Tier 1 or Tier 2
- If Tier 1, must protect existing instream uses
  - Use 1975 or best quality since then as baseline
  - Example: Mono Lake Decision 1631

Res. No. 68-16 as Applied to Waters of United States – Tier 2

- California uses qualitative approach to determine whether an activity will lower water quality
  - Focus on whether activity will result in significant increase in mass emissions, substantial relocation of outfall
  - Rigor of analysis tied to degree of water quality lowering
  - Complete analysis not required where water quality lowering is spatially localized, temporally limited, or minor

Res. No. 68-16 as Applied to Waters of the United States –Tier 2

- If complete analysis required, must find that lowering is “necessary” for “important economic or social development”
- Must also make Res. No. 68-16 findings
- Discharger has the burden

Res. No. 68-16 as Applied to Waters of the United States –Tier 3

- California has 2 ONRWs – Lake Tahoe and Mono Lake
- California treats ASBS, marine areas of special biological significance, similarly to ONRWs

APPENDIX E

SWRCB Suggested Elements

DRAFT
SALT/NUTRIENT MANAGEMENT PLANS
— SUGGESTED ELEMENTS —

I. BACKGROUND

- Purpose
  - Protection of Beneficial Use
  - Sustainability of Water Resources
  - Problem Statement
- Salt/Nutrient Management Objectives
- Regulatory Framework
- Groundwater Beneficial Uses
- ***Stakeholder Roles and Responsibilities***
- Process to Develop Salt/Nutrient Management Plan

II. GROUNDWATER BASIN CHARATERISTICS

1. GROUNDWATER BASIN OVERVIEW

- Physiographic Description
- Groundwater Basin and/or Sub-Basin Boundaries
- Watershed Boundaries
- Geology
- Hydrogeology/Hydrology
- Aquifers
- Recharge Areas
- Hydrologic Areas Tributary to the Groundwater Basin
- Climate
- Land Cover and Land Use
- Water Sources

2. GROUNDWATER INVENTORY

- Groundwater Levels
  - Historical, Existing, Regional Changes
- Groundwater Storage
  - Historical, Existing, Changes
- Groundwater Production
  - Historical, Existing, Spatial and Temporal Changes, Safe Yield
- Groundwater Mixing and Movement
  - Subsurface Inflow/Outflow
  - Horizontal and Vertical Movement and Mixing

3. ***BASIN WATER QUALITY***

- ***Groundwater Quality***
  - Background, Historical, Existing
  - Water Quality Objectives
- Surface Water Quality
- Delivered Water Quality
- Imported Water Quality
- Recycled Water Quality

Bold = Required by the Recycled Water Policy

III. BASIN EVALUATION

1. WATER BALANCE

- Conceptual Model
- Basin Inflow/Outflow
- Groundwater, Surface Water, Imported Water, Water Transfers, Recycled Water Irrigation, Waste Water Discharges, Agricultural Runoff, Stormwater Runoff (Urban, Agriculture, Open Space), Precipitation
- Infiltration, Evaporation, Evapotranspiration, Recharge, Surface Water and Groundwater Connectivity

2. ***SALT AND NUTRIENT BALANCE***

- Conceptual Model
- ***Salt and Nutrient Source Identification***
- ***Salt and Nutrient Loading Estimates***
  - Historical, Existing, Projected
- Import/Export
- ***Basin/Sub-Basin Assimilative Capacity for Salt and Nutrients***
- ***Fate and Transport of Salt and Nutrients***

3. ***CONSTITUENTS OF EMERGING CONCERNS (CECs)****

* - Requirements for monitoring CECs will be determined following State Water Board review of the CEC Advisory Panel's report due in June 2010.

- Constituents
- CEC Source Identification

4. PROJECTED WATER QUALITY

IV. SALT AND NUTRIENT MANAGEMENT STRATEGIES

- Load Reduction Goals
- Future Land Development and Use
- Salt/Nutrient Management Options
- Salt/Nutrient Management Strategies and Modeling
  - Management Strategy Model Results
  - Feasibility
  - Cost

V. BASIN MANAGEMENT PLAN ELEMENTS

1. GROUNDWATER MANAGEMENT GOALS

- Groundwater Management Goals
- ***Recycled Water and Stormwater Use/Recharge Goals and Objectives***

2. ***BASIN MONITORING PROGRAMS***

- ***Identify Responsible Stakeholder(s) Implementing the Monitoring***
- Monitoring Program Goals
- Sampling Locations
- ***Water Quality Parameters***
- ***Sampling Frequency***
- Quality Assurance/Quality Control
- Database Management

Bold = Required by the Recycled Water Policy

- Data Analysis and Reporting
- Groundwater Level Monitoring
- ***Basin Water Quality Monitoring***
- ***Groundwater Quality Monitoring***
  - ***Areas of Surface Water and Groundwater Connectivity***
  - ***Areas of Large Recycled Water Projects***
  - ***Recycled Water Recharge Areas***
- Surface Water Quality Monitoring
- Stormwater Monitoring
- Wastewater Discharge Monitoring
- Recycled Water Quality Monitoring
- Salt and Nutrient Source Loading Monitoring
- Other Constituents of Concern
- Water Balance Monitoring
  - Climatological Monitoring
  - Surface Water Flow Monitoring
  - Groundwater Production Monitoring

3. SALT AND NUTRIENT LOAD ALLOCATIONS

VI. ***CEQA ANALYSIS***

VII. ***ANTIDEGRADATION ANALYSIS***

VIII. PLAN IMPLEMENTATION

1. ***SALT AND NUTRIENT MANAGEMENT PROGRAM***

- Organizational Structure
- ***Stakeholder Responsibilities***
- ***Implementation Measures to Manage Salt and Nutrient Loading***
- Salt/Nutrient Management
  - Water Supply Quality
  - Regulations of Salt/Nutrients
  - Load Allocations
  - Salt and Nutrient Source Control
  - CEC Source Control
  - Site Specific Requirements
- Groundwater Resource Protection
- Additional Studies

2. PERIODIC REVIEW OF SALT/NUTRIENT MANAGEMENT PLAN

- Adaptive Management Plan
- Performance Measures
- Performance Evaluation

3. COST ANALYSIS

- CWC § 13141, "…prior to implementation of any agricultural water quality control program, an estimate of the total cost of such a program, together with an identification of potential sources of funding, shall be indicated in any regional water quality control plan."

4. IMPLEMENTATION SCHEDULE

Bold = Required by the Recycled Water Policy

5. PUBLIC HEARING AND ADOPTION

Bold = Required by the Recycled Water Policy

Appendix E
List of Definitions

Below is a list of terms that provide an overall understanding of the Salt and Nutrient Management Plan (SNMP), including those used in this document.

Activated Sludge Biological Treatment – A treatment process that uses aeration tanks to bubble air through primary treated wastewater to supply air to microorganisms that feed on the organic materials in these tanks. The water is sent to settling tanks, where the microorganisms clump together and settle to the bottom, where they are removed and recycled back into the treatment process (Also called Secondary Treatment).

Added Salts and Nutrients – Salt and nutrients that are added through the use of water sources, including fertilizers and amendments, leaching from dry deposition, and dissolution from formation media.

Advanced Oxidation – A chemical oxidation process that relies on the hydroxyl radical for the destruction of trace organic constituents found in water.

Advanced Water Treatment (AWT) – Wastewater treatment technologies used to remove total dissolved solids and or trace constituents for specific reuse applications.

Allowable Pumping Allocations – The Courts adjudicated maximum groundwater pumping rights for an individual or entity under the Central Basin Judgment and West Coast Basin Judgment.

Anti-degradation – California's Anti-Degradation Policy requires that existing high quality water be maintained to the maximum extent possible. Lowering of the quality is allowed only if the change is consistent with maximum benefit to people of State, will not unreasonably affect present and potential beneficial uses, will not result in water quality lower than applicable standards. Waste discharge requirements for proposed discharges will result in the best practicable treatment or control of the discharge necessary to assure no pollution or nuisance and the highest water quality consistent with maximum benefit to people of the State.

Aquifer – A geologic formation under the ground that is saturated with groundwater and sufficiently permeable to allow movement of quantities of water to wells and springs.

Aquifer Storage and Recovery – The injection of water into an aquifer for later recovery and use.

Artificial Recharge – The process of adding a water source such as recycled water, stormwater, or imported water to aquifers under controlled conditions for withdrawal at a later date, or used as a barrier to prevent seawater or other contaminants from entering the aquifer. Water can be recharged by a number of methods including infiltration via basins or galleries or by the use of injection wells. See definition for Managed Aquifer Recharge.

Assimilative Capacity – The condition in which existing water quality is better than that required to support the most sensitive beneficial use(s) of the basin, e.g. existing salt and nutrient concentrations in groundwater are below Water Quality Objectives. See Current Assimilative Capacity and Future Assimilative Capacity.

Base Case (same as baseline and historical period) – The average source water and salt and nutrient inflows and outflows during the baseline/historical period (Water Year 2000-01 to 2009-10). The average of the Base Case is used for predicting the future 15-year water balances with adjustments in inflow and outflow based solely on future projects. See definition for future planning period.

Baseline (same as Base Case and historical period) – The average source water and salt and nutrient inflows and outflows during the historical period (Water Year 2000-01 to 2009-10). The average of the Baseline is used for predicting the future 15-year water balances with adjustments in inflow and outflow based solely on future projects. See definition for future planning period.

Basin Plan – Water Quality Control Plan that was issued by the Los Angeles Regional Water Quality Control Board (LARWQCB) in 1994 to preserve and enhance water quality and protect the beneficial uses of all regional waters in the Los Angeles Region. Specifically, the Basin Plan designates the beneficial uses for surface water and groundwater, establishes numerical objectives (referred to as Water Quality Objectives [WQOs]) that must be attained or maintained to protect the designated beneficial uses and conform to the State's Anti-Degradation Policy, and describes implementation programs to protect all waters in the region. The Basin Plan can be downloaded from this website: http://www.waterboards.ca.gov/losangeles/water_issues/programs/basin_plan/basin_plan_documentation.shtml.

Basin Plan Objective (BPO) – Numerical limits established for various constituents in groundwater. BPOs, also referred to as Water Quality Objectives (WQOs), are set forth in the Basin Plan that was issued by the Los Angeles Regional Water Quality Control Board. See definition for Basin Plan.

Best Management Practices (BMPs) – BMPs for stormwater address the increased volume and rate of runoff from impervious surfaces and the concentration of pollutants in the runoff. BMPs can include structural systems and non-structural programs.

Calibration – For the existing United States Geological Services (USGS) groundwater flow model of the Central Basin and West Coast Basin, calibration is the process of adjusting hydraulic properties to better simulate observed groundwater levels and trends. A calibration process was also conducted for the salt and nutrient loading analysis for the Salt and Nutrient Management Plan, whereby historical groundwater quality trends were compared with the mixing model predicted groundwater quality trends. Adjustments to loading assumptions were made to more closely match observed data.

California Environmental Quality Act (CEQA) – The State Water Resources Control Board (SWRCB) Recycled Water Policy requires that the Salt and Nutrient Management Plan (SNMP) comply with the applicable CEQA requirements. CEQA requires State and local agencies to determine the potential significant environmental impacts of proposed projects and identify measures to avoid or mitigate these impacts where feasible. The CEQA Guidelines, which provide the protocol by which State and local agencies comply with CEQA requirements, are detailed in California Code of Regulations, Title 14 § 15000 et seq. The basic purposes of CEQA are to: 1) inform decision makers and the public about the potential significant environmental effects of a proposed project; 2) identify ways that environmental damage may be mitigate; 3) prevent significant, avoidable damage to the environment by requiring changes in projects, through the selection of alternative projects or the use of mitigation measures when feasible; and 4) disclose to the public why an agency approved a project if significant effects are involved (California Code Regulations, Title 14, § 15002(a)). CEQA analysis is a required part of the SNMP adoption process in accordance with the SWRCB's certified regulatory program. As such, for the purpose of Regional Water quality Control Board (RWQCB) adoption of a Basin Plan amendment, the RWQCB will be the lead agency for purposes of CEQA and stakeholders will fund SNMP development including any necessary analysis and documentation to comply with CEQA.

Central Basin – The California Department of Water Resources (DWR) defines the Central Subbasin (Basin Number: 4-11.04) as occupying a substantial portion (277 square miles) of the Coastal Plain of the Los Angeles Groundwater Basin. In the SNMP, the Central "Subbasin" is referred to as the Central "Basin". The WRD boundaries include a portion, but not all of the DWR Central Basin extent.

Chemicals of Concern – Specific constituents identified at environmental release sites to be the focus of monitoring and potential remediation.

Chloride – A common inorganic salt that is naturally-occurring and is commonly expressed in terms of milligrams per liter (mg/L). High concentrations of chloride near the coast may indicate seawater influence. Elevated chloride concentrations above the Secondary Maximum Contaminant Level of 500 mg/L are undesirable for aesthetic reasons related to taste, odor, or appearance of the water and not for health reasons; however, elevated chloride concentrations in water can damage crops, affect plant growth, and damage municipal and industrial equipment. For the Salt and Nutrient Management Plan (SNMP), chloride, total dissolved solids (TDS), and nitrate have been determined to be the most appropriate indicators of salts and nutrients in the Central Basin and West Coast Basin (CBWCB). See definition for Salt and Nutrients.

Coastal Areas – Groundwater basin areas seaward of the seawater intrusion barriers and near the coast that have very high concentrations of total dissolved solids (TDS) and chloride and a lack of significant production. These areas were both included and excluded from calculation of Central Basin and West Coast Basin salt and nutrient (S/N) water quality averages.

Confined Aquifer – Confined aquifers are located below confining units or aquitards and contain groundwater that is under pressure greater than atmospheric.

Confining Unit or Aquitard – A layer of sediments of low hydraulic conductivity located adjacent to an aquifer.

Conservative – Conservative with respect to a constituent means a constituent that does not significantly interact with subsurface media (vadose zone and saturated zone) and therefore, is not readily attenuated in the subsurface.

Constituents of Emerging Concern (CECs) – CECs are generally chemicals for which there are no established water quality standards or Notification Levels (see definition below). These chemicals may be present in waters at very low concentrations and are now detected as the result of more sensitive analytical methods. Information regarding their health significance is evolving with the development of acceptable daily intake levels and drinking water equivalent levels; however, information is lacking on the full spectrum of potential CECs and their health significance in mixtures. CECs include several types of chemicals such as (i) pesticides, (ii) pharmaceuticals and ingredients in personal care products, (iii) veterinary medicines, (iv) endocrine disruptors, and others. The State Water Resources Control Board (SWRCB) Recycled Water Policy states that Salt and Nutrient Management Plan shall include a *". . . provision for annual monitoring of Emerging Constituents of Emerging Concern (e.g. endocrine disrupters, personal care products or pharmaceuticals) (CECs) consistent with recommendations by CDPH and consistent with any actions by the State Water Board taken pursuant to paragraph 10(b) of this Policy."* (SWRCB, 2009 and 2013)

Contaminated Sites – See Environmental Release Sites.

Current Assimilative Capacity – The difference between Basin Plan Water Quality Objectives and average ambient groundwater quality in the individual groundwater basins.

Delivered Water – Blend of various waters that are delivered to the seawater intrusion barriers for injection or to the MFSG and San Gabriel River for groundwater recharge. At the seawater intrusion barriers, a blend/mix of recycled and treated imported water is used for injection and at the MFSG and San Gabriel River, a blend/mix of recycled, untreated imported, and local surface water is used for recharge.

Desalters – Treatment facilities that extract and treat high chloride and TDS groundwater from areas impacted by seawater intrusion.

Dry Deposition or Atmospheric Deposition – The process by which airborne pollutants are deposited to the earth. These pollutants include, but are not limited to, sulfur dioxide, nitrogen oxides, ammonia, and mercury and represent a source of salt and nutrient (S/N) loading to groundwater.

Environmental Release Sites – Commercial and industrial sites where activities (e.g., leaking aboveground and underground storage tanks, leaking sewer and oil pipelines, and illegal discharges) have contaminated groundwater with localized plumes of petroleum fuels, solvents, and other hazardous substances.

Existing Water Quality – Current quality of groundwater in the basin over the most recent 5-year averaging period of 2007 through 2012. See definition for water quality averaging period.

Fate and Transport – The movement and attenuation of constituents in the environment. Salt and nutrient fate and transport is based on groundwater flow directions and rates and on the characteristics of individual salts and nutrients and subsurface media.

First Flush – Stormwater sample collected immediately following the first significant rainfall event of the year.

Fiscal Year – The period from July 1 to June 30 of the following year.

Forebay – An area where large volumes of surface water recharge the regional aquifers.

Future Assimilative Capacity – The difference between the predicted future groundwater quality at the end of the future planning period and basin water quality plan objectives in the individual groundwater basins.

Future Planning Period – Period of time over which future loading will be assessed. Since the historical period covers water years 2000-01 through 2009-10, the future planning period encompasses water years 2010-11 through 2024-25. See definition for historical period. While water year 2010-11 has passed, it is not included in the historical period because reporting tends to lag data collection and some data collected during water year 2010-11 that is required to support the historical period analysis may not be available or published yet.

Gaining Reach – A gaining reach of a river or stream is where groundwater recharges surface water.

Goals and Objectives – Goals and objectives for this project are related to plans for recharge and use of recycled water, stormwater/surface water, and imported water.

Greater Los Angeles County (GLAC) Integrated Regional Water Management Plan (IRWMP) – A regional project with the goal of optimizing local water resources to reduce the Region's reliance on imported water.

Groundwater – Water found in the spaces between soil particles and cracks in rocks underground (located in the saturation zone). Groundwater is a natural resource that is used for drinking, recreation, industry, and growing crops.

Groundwater Basins Master Plan (GBMP) – The Water Replenishment District of Southern California (WRD), in coordination with other basin stakeholders, has developed a Draft GBMP. The intent of this plan is to provide a single reference document for parties operating within and maintaining the Central Basin and West Coast Basin (CBWCB). This GBMP complements the efforts of the Water Independence Now (WIN) program by identifying projects and programs to enhance basin replenishment, increase the reliability of groundwater resources, improve and protect groundwater quality, and ensure that the groundwater supplies are suitable for beneficial uses.

Groundwater Reliability Improvement Program (GRIP) – The Water Replenishment District of Southern California (WRD), in coordination with the Sanitation Districts of Los Angeles County (SDLAC) is developing the GRIP recycled water project as a part of WRD's Water Independence Now (WIN) strategy. The overall goal of GRIP is to offset the current use of imported water with recycled water for groundwater replenishment in the Central Basin. Specifically, GRIP objectives include: 1) provide a sustainable and reliable source of recycled water for groundwater basin replenishment via the Montebello Forebay, 2) implement a cost-effective and environmentally sound project, 3) protect the groundwater quality of the basin, 4) comply with pertinent regulatory requirements employing an institutionally feasible approach, and 5) provide up to 21,000 acre-feet per year (AFY) of recycled water consistent with current and future needs within approximately 10 years. As a result of multiple studies over a number of years to evaluate of a wide spectrum of potential water supply reliability improvement projects, two different GRIP projects, as described below, were determined to be the best alternatives to completely replace imported water (up to 21,000 AFY) for recharge at the Montebello Forebay Spreading Grounds. Potential water quality impacts of both GRIP alternatives were simulated by the SNMP mixing model. GRIP Recycled Water Project A (GRIP A) – A combination of tertiary-treated (11,000 acre-feet per year [AFY]) and AWT (10,000 AFY) recycled water to replace imported water. GRIP Recycled Water Project B (GRIP B) – 100% tertiary-treated recycled water (21,000 AFY) to replace imported water.

Historical Period – The period of time for assessment of baseline or base case salt and nutrient inflows and outflows, which covers Water Years 2000-01 through 2009-10.

Historical Sources of Salt and Nutrients – Includes historical agriculture, livestock, septic systems, and other sources that have contributed to salt and nutrient loading in the Central Basin and West Coast Basin.

Implementation Measures – Strategies, projects, and programs that were developed by stakeholders in the Central Basin and West Coast Basin to control, reduce, or manage (mitigate) salt and nutrient loading to the groundwater basin on a sustainable basis.

Imported Water – Water that is imported to the Central Basin and West Coast Basin (CBWCB) from three major sources: the Sacramento-San Joaquin Delta (northern California), Colorado River, and Owens Valley/Mono Basin (eastern Sierra Nevada Mountains). Metropolitan Water District of Southern California (MWD) imports surface water from northern California (State Water Project) and the Colorado River (via the 242-mile Colorado River Aqueduct) to the CBWCB. The Los Angeles Department of Water and Power (LADWP) imports water from the Owens Valley/Mono Basin to the City of Los Angeles via the Los Angeles Aqueduct.

Inflow – A type of water or constituent (or water balance components) that is flowing into the groundwater basin or subarea within the basin. See definition for water budget/balance.

In-Lieu Program – Program established by the Water Replenishment of Southern California to offset the pumping in the Central Basin and West Coast Basin to lower the annual overdraft and reduce artificial replenishment needs. It helps provide an alternate means of replenishing the groundwater supply by encouraging basin pumpers to purchase surplus imported water when available instead of pumping groundwater. This can help raise water levels in areas that are otherwise more difficult to address.

Irrigation and Precipitation Return Flows – The portion of precipitation and applied irrigation volume that percolates to groundwater.

Local Water – Local water includes stormwater and base surface water flow.

Losing Reach – A losing reach of a river or stream is where surface water recharges groundwater.

Low Impact Development (LID) – Design techniques that infiltrate, filter, store, evaporate, and detain surface water runoff close to its source. LID can include management measures such as maintenance practices, street sweeping, public education, and outreach programs. The main goals of LID are to increase groundwater recharge and improve stormwater quality.

Managed Aquifer Recharge – The process of adding a water source such as recycled water, stormwater, or imported water to aquifers under controlled conditions for withdrawal at a later date, or used as a barrier to prevent seawater or other contaminants from entering the aquifer. Water can be recharged by a number of methods including infiltration via basins or galleries or by the use of injection wells. See definition for artificial recharge.

Managed Safe Yield – The amount of groundwater that can be withdrawn from the Central Basin and West Coast Basin without long-term adverse effects assuming natural managed aquifer recharge.

Maximum Contaminant Levels (MCL) – The highest level of a contaminant that is allowed in drinking water and is protective of human health. Primary MCLs are established by the United States Environmental Protection Agency and the State Water Resources Control Board, Division of Drinking Water (formerly the California Department of Public Health) and reflect not only the chemicals' health risks but also factors such as their detectability and treatability, as well as the cost of treatment.

Microfiltration (MF) – A treatment system that passes liquid through semi-permeable membranes to exclude particles ranging in size from 0.005-2.0 micrometer (µm).

Mixing Model – A spreadsheet model that was developed for the Salt and Nutrient Management Plan to estimate salt and nutrient concentrations in groundwater. Future salt and nutrients inflows and outflows are mixed (instantaneously) with baseline concentrations to estimate future water quality.

Natural Safe Yield – The amount of groundwater that can be withdrawn from the Central Basin and West Coast Basin without adverse effect, assuming natural groundwater replenishment.

Nitrification/Denitrification (NdN) – A biological treatment process used for nitrogen removal that converts ammonia to nitrate, and nitrate to nitrogen gas.

Nitrate (NO_3) – A colorless, odorless, and tasteless compound that is present in some groundwater and is commonly expressed in terms of milligrams per liter (mg/L). Nitrate is the primary form of nitrogen detected in groundwater. High levels of nitrate in groundwater are associated with agricultural activities, septic systems, confined animal facilities, landscape fertilization, and wastewater treatment facilities. In the Central Basin and West Coast Basin (CBWCB), natural nitrate levels in groundwater are generally very low (typically less than the Maximum Contaminant Level of 10 mg/L as nitrogen) and well below the Basin Plan Objective of 45 mg/L. For the CBWCB Salt and Nutrient Management Plan, nitrate chloride, and TDS have been determined to be the most appropriate indicators of salts and nutrients in the CBWCB. See definition for salt and nutrients.

Notification Levels (NLs) – Health-based advisory levels established by the State Water Resources Control Board, Division of Drinking Water (formerly the California Department of Public Health) for chemicals in drinking water that lack Maximum Contaminant Levels. When chemicals are found at concentrations greater than their NLs, certain requirements and recommendations apply to drinking water purveyors.

Nutrient Plant Uptake – The process by which plants absorb nutrients from applied water and surrounding soil.

Outflow – A type of water or constituent (or water balance component) that is flowing out of the groundwater basin or subarea within the basin. See definition for water budget/balance.

Ozonation – A chemical oxidation treatment process that uses ozone to react with contaminants in water. It is also used for disinfection.

Public Health Goals (PHGs) – Levels of contaminants in drinking water that would not be expected to pose a significant health risk to individuals consuming an average of two liters a day of that water over a 70-year lifetime. PHGs are established by the Office of Environmental Health Hazard Assessment (OEHHA). They are based solely on health risk considerations and do not consider costs or technical feasibility. Public water systems do not have to meet public health goals. However, water systems with more than 10,000 service connections are legally required to prepare an exceedance report every three years if one or more chemical contaminants exceed PHG levels.

Primary Treatment – A treatment process that allows for heavier solids in raw sewage to settle to the bottom of a tank and for the lighter materials, like plastic and grease, which float to the top, to be skimmed and removed and recycled back into the treatment process.

Priority Sites – Environmental release sites in the Central Basin and West Coast Basin (CBWCB) that were selected by the Water Replenishment District of Southern California (WRD), with input from regulatory agencies, based on certain criteria, such as hydrogeology, depth and concentration of the contaminants, fate and transport of the constituents of concern, distance to nearby water supply wells, presence of contaminated drinking water wells in the site vicinity, proximity to recharge areas, and status of site characterization/remediation. WRD has been tracking and working in close consultation with the regulatory agencies to provide data and technical support to expedite investigations and cleanups at priority groundwater contaminated sites within the CBWCB. See definition for environmental release sites.

Project Contact – Email where comments, suggested edits, and questions on the Technical Memoranda, other project materials, or Salt and Nutrient Management Plan process may be directed (WRD@saltnutrient.com).

Projected Future Inflows and Outflows – The projected salt and nutrient inflows and outflows will be based on the average of the past ten years (2000-01 through 2009-10) of flows with changes based on future projects planned to be implemented in the next 15 years (2010-11 through 2024-25).

Project Website – The website established to disseminate information related to the Central Basin and West Coast Salt and Nutrient Management Plan and includes a calendar of events and meetings, meeting agendas and minutes, meeting presentations, project schedules, contact information, deliverables, data, graphics and other materials (www.WRD.saltnutrient.com).

Public Drinking Water System – A public drinking water system means a system for the provision of water for human consumption through pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year. Private domestic wells are not regulated by the State Water Resources Control Board, Division of Drinking Water (formerly California Department of Public Health).

Quality Assurance/Quality Control (QA/Q) – Quality Assurance (QA) is a procedure or set of procedures intended to ensure that a product or service under development (before work is complete, as opposed to afterwards) meets specified requirements. Quality Control (QC) is a procedure or set of procedures intended to ensure that a manufactured product or performed service adheres to a defined set of quality criteria or meets the requirements of the client or customer. Due to the large size of the Central Basin and West Coast Basin and numerous managed recharge projects, a large amount of data collected from many agencies and entities is required to support the Salt and Nutrient Management development effort. Generally, the data will be accepted as correct and reliable; however, data will be evaluated for inconsistencies and outliers.

Recharge Area – An area where surface water can infiltrate downward to reach the water table and contribute to the groundwater supply. A recharge area can also refer to an injection well that pumps water down and into an aquifer thereby replenishing the aquifer.

Recycled Water – Domestic or municipal wastewater which has been treated to a quality suitable for a beneficial use.

Replenishment Operations – Managed aquifer recharge operations including spreading grounds and seawater intrusion barriers.

Reverse Osmosis (RO) – A treatment process where pressure greater than the osmotic pressure is applied to water to drive the more concentrated solution to the other side of the membrane and the membrane acts as a barrier to contaminants, such as salts. The Permeate (product) water passes through the membrane and has reduced contaminant concentration. A reject flow stream is produced that contains salts and other constituents rejected by the membrane process.

Review Period – The 30-day period allocated for comments from stakeholders on project Technical Memoranda. The review period for the California Environmental Quality Act Substitute Environmental Document (SED) is 45 days.

Saline Plumes – Seawater-impacted areas in the groundwater basin that were caused by historical over-pumping which created a hydraulic gradient that resulted in seawater intrusion. These large plumes of saline water are trapped inland of the barrier injection wells, thereby degrading significant volumes of groundwater with high concentrations of chloride and decreasing the ability of affected aquifers to provide groundwater storage.

Salt and Nutrient Management Plan (SNMP) Assistance Document – On June 28, 2012, the Los Angeles Regional Water Quality Control Board issued the *Regional Water Board Assistance in Guiding Salt and Nutrient Management Plan Development in the Los Angeles Region* (SNMP Assistance Document), which provided guidance for preparation of SNMPs within the Los Angeles region.

Salts and Nutrients – The dissolved ions in water that reflect its salts and nutrients and include calcium, magnesium, sodium, potassium, chloride, fluoride, nitrate, bicarbonate, carbonate, iron, boron, manganese, and phosphate. For the SNMP, total dissolved solids (TDS), chloride, and nitrate have been determined to be the most appropriate indicators of salts and nutrients in the Central Basin and West Coast Basin. See definition for TDS.

Salt and Nutrients Inflows and Outflows – Salt and nutrient inflows and outflows are developed based on the assigning water quality concentrations to the inflows and outflows in the water balance (see definition below). Additional salt and nutrient loading may occur as a result of various water uses, such as fertilizer application. Salt and nutrient loading may also be reduced due to fate and transport processes, e.g. reduction in nitrate due to denitrification and plant uptake.

Secondary Maximum Contaminant Level (SMCL) – Water quality standard established by the State Water Resources Control Board, Division of Drinking Water (formerly the California Department of Public Health) to manage drinking water for aesthetic considerations, such as taste, color, and odor. Contaminants with only SMCLs are not considered to pose a risk to human health.

Self Regenerating Water Softener (SRWS) – A water conditioning device that removes hardness (primarily calcium and magnesium) from water by ion exchange. The calcium and magnesium ions replace sodium or potassium ions on the ion exchange resin. The water softener ion exchange resin is regenerated using salt and results in a brine solution that is flushed to sewers.

Sensitivity Analysis – An analysis that can be performed to provide the uncertainty or range of possible future predicted water quality conditions.

Soil Aquifer Treatment – Natural processes that occur in the soil and aquifer that act to filter particulate matter and to remove or reduce chemical and biological constituents of concern to improve groundwater quality.

Source Water – Waters that recharge or flow out of the Central Basin and West Coast Basin and include precipitation, subsurface groundwater inflow from adjacent basins and the ocean, local surface water/stormwater, imported water, recycled water, and wastewater.

Specific Yield – Specific yield is the ratio of the volume of water the aquifer will yield by gravity drainage to the total volume of aquifer

Stakeholders – Local water and wastewater entities, parties contributing salts and nutrients to groundwater, and parties with an interest in the SNMP process and findings.

Storage Coefficient – The volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head.

Streamlined Permitting for Irrigation Projects – The Recycled Water Policy sets forth criteria for irrigation projects that establish eligibility for streamlined permitting including compliance with the requirements for recycled water established in Title 22 of the California Code of Regulations, including; application of recycled water at agronomic rates; development and implementation of a site operations and maintenance plan; compliance with any applicable salt and nutrient management plan; and appropriate use of fertilizers.

Study Area – The area of analysis for the Salt and Nutrient Management Plan; it includes all of the Central Basin and West Coast Basin, as defined by the California Department of Water Resources.

Subarea – Smaller areas designated within the groundwater basin to more accurately define the water quality of the basin.

Tertiary Treatment – A treatment process where wastewater that has undergone secondary treatment is processed using granular media or carbon filters and then disinfected.

Time /Concentration Charts – Graphs that show constituent concentrations on the x axis and sampling concentrations on the y axis of an x-y plot and are used to illustrate changes in water quality concentrations over time.

Todd Groundwater Team – Staff from Todd Groundwater (formerly Todd Engineers), RMC Water and Environment, Nellor Environmental Associates Inc., and Environmental Science Associates assisting the Central Basin and West Coast Basin stakeholders in preparing the SNMP.

Total Dissolved Solids (TDS) – An overall measure of the minerals in water. Total salinity is commonly expressed in terms of TDS as milligrams per liter (mg/L). Elevated TDS concentrations above the Secondary Maximum Contaminant Level of 1,000 mg/L are undesirable for aesthetic reasons related to taste, odor, or appearance of the water and not for health reasons; however, elevated TDS concentrations in water can damage crops, affect plant growth, and damage municipal and industrial equipment. For the SNMP, TDS, chloride, and nitrate have been determined to be the most appropriate indicators of salts and nutrients in the CBWCB. See definition for salt and nutrients.

Total Maximum Daily Load (TMDL) – The maximum amount of a pollutant from point sources and nonpoint sources that an impaired water body can receive and still meet water quality standards, within a margin of safety and considering seasonal variation.

Ultraviolet (UV) – UV irradiation is the process by which chemical bonds of the contaminants are broken by the energy associated with UV light (photolysis). UV also has germicidal properties and is used for disinfection.

Unconfined Aquifer – An aquifer in which there are no confining beds between the aquifer and the ground surface. The groundwater surface or water table in an unconfined aquifer is at atmospheric pressure.

Unconformities – A break or gap in the geologic record, such as a break between older eroded bedrock and overlying younger sedimentary units.

Urban Water Management Plans (UWMPs) – Plans prepared by California's urban water suppliers to support their long-term resource planning and ensure adequate water supplies are available to meet existing and future water demands over a 20-year planning horizon considering normal, dry, and multiple dry years. UWMPs are required to be prepared every 5 years and submitted to the California Department of Water Resources.

Vadose Zone – The depth between the land surface and the regional water table. Generally, water in this zone is under less than atmospheric pressure, and some of the voids may contain air or other gases at atmospheric pressure.

Wastewater – Liquid waste discharged from municipal activities, including residential, commercial, and industrial activities. Once treated and discharged from a water reclamation plant, this water becomes recycled water. See definition of Recycled Water.

Water Budget/Balance – An estimate of specific inflows and outflows for each individual basin or sub area and the entire Central Basin and West Coast Basin (CBWCB). Water budgets are extracted from the existing groundwater model of the CBWCB that was previously developed by the United States Geological Services and was recently updated for the Groundwater Basins Master Plan.

Water Quality Averaging Period – The period of time used to determine the existing water quality or representative current concentration of salts and nutrients in groundwater. In accordance with the State Water Resources Control Board Recycled Water Policy, it is the most recent five years of data, which is the period from mid-2007 to mid-2012 or from January 2007 to January 2012, depending on the data source.

Water Quality Objective (WQO) – Also referred to as Basin Plan Objective (see definition).

Water Year (WY) – The period from October 1 through September 30 of the following year.

West Coast Basin – The California Department of Water Resources (DWR) defines the West Coast Subbasin (Basin Number: 4-11.03) as occupying a portion (142 square miles) of the Coastal Plain of the Los Angeles Groundwater Basin. In the SNMP, the West Coast "Subbasin" is referred to as the West Coast "Basin." The WRD boundaries encompass all of the DWR-defined West Coast Basin extent.

Workplan – In 2011, the *Workplan of the Salt/Nutrient Management Plan* [SNMP]*, Central Basin and West Coast Basin* was prepared by the Central Basin and West Coast Basin stakeholders and was subsequently approved by the California Regional Water Quality Control Board, Los Angeles Region, on December 13, 2011. The Workplan described the key components and approach for preparation of the SNMP.

Appendix F

Stakeholder Process

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1 Introduction

This Appendix F describes the stakeholder process for the development of the Salt and Nutrient Management Plan (SNMP) for the Central Basin and West Coast Basin (CBWCB or Study Area). Key components of this appendix include:

- Summary of stakeholder roles and responsibilities,
- Description of the stakeholder communication and participation process, and
- Summary of the stakeholder meetings/workshops.

The State Water Resources Control Board (SWRCB) Recycled Water Policy (provided as Appendix A to the SNMP) states, "*. . . local water and wastewater entities, together with local salt/nutrient contributing stakeholders, will fund locally driven and controlled, collaborative processes open to all stakeholders that will prepare salt and nutrient management plans for each basin/sub-basin in California, including compliance with CEQA* [California Environmental Quality Act] *and participation by Regional Water Board staff.*" (SWRCB, 2009 and 2013) As a result, development of a SNMP through a collaborative process is the most reasonable approach, since groundwater basins are a common resource shared by different entities all of whom should have a voice in determining how beneficial use of the basin can be sustained.

The *Regional Water Board Assistance in Guiding Salt and Nutrient Management Plan Development in the Los Angeles Region* (SNMP Assistance Document), issued by the Los Angeles Regional Water Quality Control Board (LARWQCB) on June 28, 2012, states, "*Key stakeholders include local agencies involved in groundwater management, owners and operators of recharge facilities, water purveyors, water districts, watermasters, and salt and nutrient contributing dischargers. These agencies have access to basin-specific data and information that is essential to the development of successful SNMPs. Private well owners may also have essential water quality information. Nongovernmental entities may have information about ecosystems associated with groundwater exfiltration. Other parties from regulatory agencies, environmental groups, industry, and interested persons may also provide important support. No single entity is wholly responsible for SNMP development. While a lead agency is necessary to coordinate the development effort, the point of a collaborative process is to take advantage of the collective expertise, resources and information of the participating entities. Therefore, there should be participation to varying degrees by all stakeholders.*" (LARWQCB, 2012a).

2 CBWCB SNMP Stakeholders

The CBWCB stakeholder process was conducted in accordance with the Recycled Water Policy and LARWQCB's SNMP Assistance Document and considerable efforts were made to identify, engage, and include appropriate stakeholders in the CBWCB SNMP process. Other regional water planning groups in the area were contacted, the CBWCB SNMP process was presented at their stakeholder meetings, and these stakeholders were incorporated into the CBWCB SNMP notification list, as appropriate.

Stakeholders in the CBWCB that participated in the SNMP process and collaborated to prepare the SNMP (including the SNMP *Monitoring Plan*) and *Substitute Environmental Document* (SED) include water and wastewater entities, parties contributing salt and nutrients to groundwater, the LARWQCB, water purveyors, water associations, environmental groups, and parties with an interest in the SNMP process. **Table F-1** lists the key stakeholders, describes their roles in the development of the CBWCB SNMP, and provides a summary of their overall responsibilities in the CBWCB.

3 Stakeholder Communication and Participation

Participation and technical input from all stakeholders played a key role in the development of a comprehensive and technically sound SNMP. An e-mail address (wrd@saltnutrient.com) and a SNMP website (http://www.wrd.saltnutrient.com/) were established by the CBWCB stakeholders to promote communication, allow sharing of SNMP-related documents, and allow the submittal of comments and questions throughout the SNMP development process. Stakeholders and other interested parties could use the website to learn more about the CBWCB SNMP, sign up to be on the distribution list for upcoming stakeholder workshops, or submit comments/questions. In addition, a File Transfer Protocol (FTP) site was created to allow data to be shared easily amongst the CBWCB SNMP stakeholders.

The CBWCB stakeholders were notified via e-mail of the posting of technical documents for public review and upcoming SNMP workshops/meetings. All CBWCB SNMP stakeholder workshops were open to the public. Each workshop included a presentation with ample time allocated for comments, questions, and answers. Stakeholder participation was tracked via sign-in sheets. After each CBWCB SNMP workshop and the October 21, 2013 CEQA Scoping Meeting, the presentation, a meeting summary documenting the presentation and discussion, and the sign-in sheet were posted on the CBWCB SNMP website. Other CBWCB SNMP information such as technical memoranda, reports, and guidance documents were also posted on the CBWCB SNMP website.

The LARWQCB also maintains a website containing information related to SNMPs in the Los Angeles Region: http://www.swrcb.ca.gov/losangeles/water_issues/programs/salt_and_nutrient_management/index.shtml. The LARWQCB's SNMP website provides notices, agenda, and presentations for their workshops, as well as information related to the CBWCB SNMP, including the October 21, 2013 CEQA Scoping Meeting and a link to the CBWCB SNMP website. The LARWQCB also maintains an e-mail subscription list to provide notifications to interested parties.

During development of the SNMP, interim documents such as the SNMP Workplan and technical memoranda were posted on the CBWCB SNMP website for downloading by interested parties. Stakeholders were notified via email when technical documents were posted and the scheduled 30-day public review period (for technical memoranda). Once finalized, the SNMP, SED, and any other related documents will be available on the CBWCB SNMP website for downloading.

Table F-1 CBWCB Stakeholder Roles and Responsibilities

Stakeholder	Roles and Responsibilities
Water Replenishment District of Southern California (WRD)	• Managed and facilitated development of the SNMP, SED, and associated documents and hosted CBWCB SNMP stakeholder meetings/workshops • One of the funding partners for the CBWCB SNMP • Responsible for implementing the SNMP Monitoring Program • Reviewed the SNMP, SED, technical memoranda, and other technical documents prepared in association with the SNMP • Provided groundwater data (levels, storage, production, well construction, recharge, and water quality); MODFLOW model files; spreading grounds and seawater intrusion barrier recharge volumes; recycled water quality data associated with the Alamitos Gap Seawater Intrusion Barrier (AGB); future planning period goals, objectives, and projects; and other data and information supporting SNMP development • Manages groundwater in the CBWCB and prepares and issues the annual Regional Groundwater Monitoring Report, which discusses salt and nutrient trends in groundwater in the basins • Monitors groundwater quality, water levels, seawater intrusion, and groundwater production throughout the CBWCB • Monitors spreading grounds intake and groundwater quality associated with operation of the Montebello Forebay Spreading Grounds (MFSG), the Dominguez Gap Seawater Intrusion Barrier (DGB), the AGB, and the West Coast Basin Seawater Intrusion Barrier (WCBB) • Owns the Leo J. Vander Lans Advanced Water Treatment Facility that produces advanced treated recycled water for injection at the AGB • Purchases the recycled water and imported water recharged in the MFSG, DGB, WCBB, and AGB
Los Angeles County Department of Public Works (LACDPW)	• One of the funding partners for the CBWCB SNMP • Attended and provided input at CBWCB SNMP stakeholder meetings/workshops • Reviewed the SNMP, SED, technical memoranda, and other technical documents prepared in association with the SNMP • Provided stormwater and barrier groundwater quality monitoring data; future planning period goals, objectives, and projects; and other data and information supporting SNMP development • Owns and operates the MFSG and Dominguez Gap Spreading Grounds • Owns and operates the WCBB and the DGB • Jointly owns the AGB with Orange County Water District • As a member of the Alamitos Gap Barrier Joint Management Committee, operates the AGB • Monitors receiving water quality resulting from urban runoff and during storm events in Los Angeles County • Monitors chloride concentrations in groundwater near the three seawater intrusion barriers

Table F-1 CBWCB Stakeholder Roles and Responsibilities (continued)

Stakeholder	Roles and Responsibilities
West Basin Municipal Water District (WBMWD)	• One of the funding partners for the CBWCB SNMP • Attended and provided input at CBWCB SNMP stakeholder meetings/workshops • Reviewed the SNMP, SED, technical memoranda, and other technical documents prepared in association with the SNMP • Provided recycled water quality data; recycled water flows for irrigation; future planning period goals, objectives, and projects; and other data and information supporting SNMP development • Purchases imported water from Metropolitan Water District of Southern California (MWD) and wholesales to cities and water companies/agencies in the West Coast Basin for potable and non-potable uses and for groundwater replenishment • Owns and operates the Edward C. Little Water Recycling Facility that produces recycled water for irrigation and industrial uses in the West Coast Basin and for injection at the WCBB
County Sanitation Districts of Los Angeles County (SDLAC)	• One of the funding partners for the CBWCB SNMP • Attended and provided input at CBWCB SNMP stakeholder meetings/workshops • One of the funding partners for the SNMP • Attended and provided input at the SNMP Stakeholder meetings • Reviewed the SNMP, SED, technical memoranda, and other technical documents prepared in association with the SNMP • Provided recycled water irrigation flows; recycled water quality data; future planning period goals, objectives, and projects; and other data and information supporting SNMP development • Owns and operates the Pomona, San Jose Creek, Whittier Narrows, Los Coyotes, and Long Beach Water Reclamation Plants that produce tertiary-treated recycled water that is delivered for irrigation and industrial uses throughout the Central Basin and is delivered to the MFSG for groundwater recharge
City of Los Angeles, Department of Water and Power (LADWP) and Bureau of Sanitation (LABOS)	• One of the funding partners for the CBWCB SNMP • Attended and provided input at CBWCB SNMP stakeholder meetings/workshops • Reviewed the SNMP, SED, technical memoranda, and other technical documents prepared in association with the SNMP • Provided imported water and recycled water quality data associated; future planning period goals, objectives, and projects; and other data and information supporting SNMP development • Delivers groundwater, imported water, and recycled water to residents and businesses in the City of Los Angeles • Imports water from the Mono and Owens River Basins in the Eastern Sierra Nevada Mountains to the City of Los Angeles via the Los Angeles Aqueduct • Operates the Terminal Island Water Reclamation Plant/Advanced Water Purification Facility that produces advanced treated recycled water for injection at the DGB

Table F-1 CBWCB Stakeholder Roles and Responsibilities (continued)

Stakeholder	Roles and Responsibilities
Metropolitan Water District of Southern California (MWD)	• Attended and provided input at CBWCB SNMP stakeholder meetings/workshops • Reviewed the SNMP, SED, technical memoranda, and other technical documents prepared in association with the SNMP • Provided imported water quality data; estimates of the relative volumes of State Water Project and Colorado River water used for water supply and recharge at the MFSG, DGB, AGB, and WCBB; future planning period goals, objectives, and projects; and other data and information supporting SNMP development • Imports water from northern California (State Water Project) and the Colorado River (Colorado River Aqueduct) to the CBWCB for potable and non-potable uses • Monitors water quality of the imported water, which has many uses, including water supply and groundwater replenishment at the MFSG, DGB, AGB, and WCBB
Council for Watershed Health (CWH)	• Attended and provided input at the CBWCB SNMP Stakeholder Workshops • Reviewed technical memoranda prepared in association with the SNMP • Provided surface water quality data and other data and information supporting the SNMP development • Facilitates the preservation, restoration, and enhancement of the Los Angeles River and San Gabriel River Watersheds
Los Angeles Regional Water Quality Control Board (LARWQCB)	• Facilitated interaction and information sharing within and among groundwater basin stakeholder groups by hosting annual SNMP Workshops • Attended and provided input at all CBWCB SNMP stakeholder meetings/workshops • Provided regulatory guidance throughout the CBWCB SNMP development process • Reviewed and approved the CBWCB SNMP Workplan and provided comments on all technical memoranda prepared in association with the SNMP • Lead agency for the California Environmental Quality Act (CEQA) process for the CBWCB SNMP and hosted the CEQA Scoping Meeting • Will review and approve the SNMP (includes the SNMP *Monitoring Plan*) and SED • Will prepare and adopt the Basin Plan Amendment • Provides regulatory oversight for recycled water projects in the Los Angeles Region

Table F-1 CBWCB Stakeholder Roles and Responsibilities (continued)

Stakeholder	Roles and Responsibilities
Other Stakeholders	The following entities had either attended the CBWCB SNMP Stakeholder Workshops or were on the distribution list for notification of upcoming SNMP meetings and technical documents that were available for public review: • Regulatory Agencies o California Department of Public Health (CDPH; now the SWRCB Division of Drinking Water) o California Department of Water Resources (DWR) (also historically the CBWCB Watermaster) • Water Purveyors and Water Associations o Central Basin Municipal Water District o Central Basin Water Association o City of Compton, Municipal Water Department o City of Inglewood o City of Long Beach Water Department o City of Manhattan Beach o City of Torrance o Golden State Water Company o West Basin Water Association • Environmental Groups o Heal the Bay o University of California, Los Angeles, Institute for Environment and Stability o Santa Monica Bay Restoration Commission o Natural Resources Defense Council o Friends of Los Angeles River

WRD – Water Replenishment District of Southern California
LACDPW – Los Angeles County Department of Public Works
LADWP – City of Los Angeles Department of Water and Power
WBMWD – West Basin Municipal Water District
SDLAC – County Sanitation Districts of Los Angeles County
LABOS – Los Angeles Bureau of Sanitation
MWD – Metropolitan Water District of Southern California
CWH – Council for Watershed Health
LARWQCB – Los Angeles Regional Water Quality Control Board
USGS – United States Geological Survey
CDPH – California Department of Public Health (now the SWRCB Division of Drinking Water)
SWRCB – State Water Resources Control Board
MFSG – Montebello Forebay Spreading Grounds
DGB – Dominguez Gap Seawater Intrusion Barrier
AGB – Alamitos Gap Seawater Intrusion Barrier
WCBB – West Coast Basin Seawater Intrusion Barrier
CBWCB – Central Basin and West Coast Basin
SNMP – Salt and Nutrient Management Plan
CEQA – California Environmental Quality Act
SED – Substitute Environmental Document

The CBWCB SNMP website also includes weblinks to local agencies and stakeholders and other relevant documents such as the SWRCB's Recycled Water Policy and the LARWQCB's SNMP Assistance Document.

4 Stakeholder Workshops and Meetings

In order to keep stakeholders informed of the SNMP process and findings and seek their input, multiple CBWCB stakeholder meetings were held since 2009, including seven CBWCB SNMP workshops hosted by WRD between 2011 and 2013. In addition, the LARWQCB hosted four annual SNMP workshops beginning in 2010 to provide direction for SNMP development and facilitate interaction and information sharing within and among groundwater basin stakeholder groups in the Los Angeles Region. WRD and other CBWCB stakeholders attended the LARWQCB SNMP Workshops and WRD gave presentations on the status of SNMP development efforts in the CBWCB at three of the four LARWQCB Workshops.

To further encourage stakeholder participation and promote data sharing for the SNMP, WRD presented information about the CBWCB SNMP to other regional water planning groups, including two local Integrated Regional Water Management Plan (IRWMP) Stakeholder Groups (Greater Los Angeles Region IRWMP and Los Angeles Gateway Region IRWMP) in 2012. In addition, WRD, at the request of LARWQCB, gave a presentation to the SWRCB Board on March 5, 2013 regarding the SNMP development efforts in the CBWCB. The CBWCB stakeholders have also given presentations and/or attended multiple conferences related to salt and nutrient management to elicit feedback and/or gather information that would be useful for the SNMP development.

A CEQA Scoping Meeting was held by the LARWQCB on October 21, 2013 to receive comments on the appropriate scope and content of the SED for the CBWCB SNMP. At this meeting, LARWQCB, WRD, and Environmental Science Associates (CEQA consultant for the CBWCB stakeholders) gave presentations describing the Recycled Water Policy, general CEQA process, SNMP findings, implementation measures, proposed major recycled water projects, and environmental criteria for the CEQA evaluation. As the lead agency for the CEQA process, LARWQCB prepared and issued the Notification of the CEQA Scoping Meeting to all interested parties and was designated as the entity to receive all public comments regarding the proposed SED scope and content. A 30-day public comment period was established by LARWQCB and comments also were solicited during the October 21st CEQA Scoping Meeting. No comments regarding the proposed environmental analysis were received by LARWQCB and thus, there are no responses to public comments presented in the SED. The SED has been submitted to LARWQCB under separate cover.

The dates, topics, key agenda items, and purpose of key SNMP workshops/meetings are summarized in **Table F-2** below.

Table F-2 Key SNMP Workshops and Meetings

Date	Topic	Key Agenda Items	Meeting Purpose
November 15, 2010	LARWQCB Annual SNMP Workshop	• Introduction to SNMPs • Status of recent SNMP development activities	LARWQCB summarized SNMP requirements, provided direction on SNMP development, and facilitated interaction and information sharing within and among groundwater basin stakeholder groups
November 15, 2011	LARWQCB Annual SNMP Workshop	• Overview of LARWCB's SNMP Assistance Document • SNMP development status in various groundwater basins: o Central Basin and West Coast Basin o San Fernando o San Gabriel o Ventura County, Lower Santa Clara, Oxnard, and Calleguas • Overview of the SWRCB Groundwater Ambient Monitoring and Assessment (GAMA) Program	LARWQCB provided direction on SNMP development and facilitated interaction and information sharing within and among groundwater basin stakeholder groups. WRD gave a presentation on the status of SNMP development in the CBWCB.
June 18, 2012	Introduction to SNMP (CBWCB SNMP Stakeholder Workshop hosted by WRD)	• Background of the CBWCB • SNMP tasks and schedule • Data and input needs from CBWCB stakeholders • Communications and data sharing • CBWCB SNMP approach • Potential future projects to be simulated by the SNMP mixing model	CBWCB stakeholders were informed of the SNMP process and findings and stakeholder input was solicited
July 26, 2012	Goals, Objectives, and Implementation Measures (CBWCB SNMP Stakeholder Workshop hosted by WRD)	• Goals & objectives for use of recycled water, stormwater, and imported water • Current/planned projects for controlling or reducing salts & nutrients • Identification of impediments to proposed implementation measures	CBWCB stakeholders were informed of the SNMP process and findings and their input was solicited

Table F-2 Key SNMP Workshops and Meetings (continued)

Date	Topic/Type of Meeting	Key Agenda Items	Meeting Purpose
August 9, 2012	Overview of CBWCB SNMP	• Description of: o Recycled Water Policy o SNMP key elements o CBWCB characteristics o SNMP Stakeholder process o SNMP analysis • Request for data	WRD gave a presentation to a regional planning group (Los Angeles Gateway Region Integrated Regional Water Management Plan Stakeholder Group (IRWMP)) in order to elicit feedback and promote participation in the CBWCB SNMP development process
September 13, 2012	Hydrogeologic Conceptual Model (CBWCB SNMP Stakeholder Workshop hosted by WRD)	• CBWCB hydrogeology • Current groundwater quality • Current available assimilative capacity • Salt and nutrient (S/N) loading assumptions • SNMP mixing model	CBWCB stakeholders were informed of the SNMP process and findings and their input was solicited
September 26, 2012	Overview of CBWCB SNMP	• Description of: o Recycled Water Policy o SNMP key elements o CBWCB characteristics o Stakeholder process o SNMP analysis • Request for data	WRD gave a presentation to a regional planning group (Greater Los Angeles County Region IRWMP Stakeholder Group) in order to elicit feedback and promote participation in the CBWCB SNMP development process
November 7, 2012	SNMP Monitoring Program (CBWCB SNMP Stakeholder Workshop hosted by WRD)	• Overview of existing CBWCB water quality monitoring programs • Overview of constituents of emerging concern (CEC) monitoring • Proposed SNMP water quality monitoring program, specifically with regards to S/Ns in groundwater	CBWCB stakeholders were informed of the SNMP process and findings and their input was solicited

Table F-2 Key SNMP Workshops and Meetings (continued)

Date	Topic/Type of Meeting	Key Agenda Items	Meeting Purpose
November 15, 2012	LARWQCB Annual SNMP Workshop	• Updates on SNMP development in various groundwater basins: o Central Basin and West Coast Basins o Raymond/San Gabriel Basins o San Fernando Valley o Upper Santa Clara River o Lower Santa Clara River o Calleguas Creek Watershed • Stormwater reuse/recharge in the Los Angeles Region • Described the Amendment to the Recycled Water Policy	LARWQCB summarized SNMP requirements, provided direction on SNMP development, and facilitated interaction and information sharing within and among groundwater basin stakeholder groups. WRD gave a presentation on the status of SNMP development in the CBWCB.
December 17, 2012	Future Groundwater Quality (CBWCB SNMP Stakeholder Workshop hosted by WRD)	• Current water quality and S/N loading • Future S/N loading assumptions and approach • Future groundwater quality and assimilative capacity • Anti-degradation analysis	CBWCB stakeholders were informed of the SNMP process and findings and their input was solicited
January 22, 2013	Implementation Measures and Proposed Major Recycled Water Projects (CBWCB SNMP Stakeholder Workshop hosted by WRD)	• Historical perspective • Current water quality • Planned major projects in the CBWCB and their water quality summary • S/N loading versus concentration • Implementation measures o Current o Planned o Conceptual	CBWCB stakeholders were informed of the SNMP process and findings and their input was solicited

Table F-2 Key SNMP Workshops and Meetings (continued)

Date	Topic/Type of Meeting	Key Agenda Items	Meeting Purpose
June 4, 2013	Overview and Introduction to CEQA Process (CBWCB SNMP Stakeholder Workshop hosted by WRD)	• Hydrogeologic conceptual model of the Central Basin and West Coast Basin • Existing average S/N groundwater quality and assimilative capacity (AC) • S/N sources and fate and transport • Goals and objectives (future projects) • Future groundwater quality and use of AC • Implementation measures and proposed major recycled water projects • Anti-degradation analysis • California Environmental Quality Act (CEQA) and the SED • SNMP Monitoring Program	CBWCB stakeholders were informed of the SNMP process and findings and their input was solicited
October 21, 2013	CEQA Scoping Meeting for the CBWCB SNMP	• Recycled Water Policy • General CEQA process and SED for the CBWCB SNMP • Background on Central Basin and West Coast Basin • Water quality assessment • SNMP findings, implementation measures, and proposed major recycled water projects • CEQA evaluation and environmental impacts analysis	LARWQCB hosted this meeting to receive comments on the appropriate scope and content of the SED. LARWQCB, WRD, and Environmental Science Associates (CEQA consultant for the CBWCB stakeholders) gave presentations at this meeting regarding the indicated key agenda items. As the lead agency for the CEQA process, LARWQCB was designated as the entity to receive all public comments regarding the proposed SED scope and content. A 30-day public comment period was established by LARWQCB and comments also were solicited during this CEQA Scoping Meeting. No comments regarding the proposed environmental analysis were received by LARWQCB and thus, there are no responses to public comments presented in the SED, which has been submitted to LARWQCB under separate cover.

Table F-2 Key SNMP Workshops and Meetings (continued)

Date	Topic/Type of Meeting	Key Agenda Items	Meeting Purpose
November 14, 2013	LARWQCB Annual SNMP Workshop	• Updates on SNMP development in various groundwater basins: o Central Basin and West Coast Basin o Raymond and San Gabriel Basins o San Fernando Valley o Santa Clara Calleguas o Upper Santa Clara River o Lower Santa Clara River • Increased recycled water use in the Los Angeles area • SNMP review and CEQA process	LARWQCB provided direction on SNMP development and facilitated interaction and information sharing within and among groundwater basin stakeholder groups. WRD gave a presentation on the status of SNMP development in the CBWCB.
February 12, 2015	LARWQCB Board Meeting	• Overview of the SNMP for the CBWCB, including: o Recycled Water Policy requirements o Stakeholder process to develop the SNMP o Background of the CBWCB o Water quality assessment and results o Proposed major recycled water projects o Monitoring Plan o Implementation measures o CEQA analysis	LARWQCB staff and WRD gave a joint presentation regarding the CBWCB SNMP and proposed Basin Plan Amendment. LARWQCB Board Members asked questions following the presentation and the Basin Plan Amendment was subsequently adopted (i.e. Resolution R15-001).

LARWQCB – Los Angeles Regional Water Quality Control Board
SWRCB – State Water Resources Control Board
SNMP – Salt and Nutrient Management Plan
CBWCB – Central Basin and West Coast Basin
IRWMP – Integrated Regional Water Management Plan
WRD – Water Replenishment District of Southern California
CEQA – California Environmental Quality Act
SED – Substitute Environmental Document
S/N – salt and nutrient

Appendix G

Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality

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1 Introduction

This Appendix G provides a description of the hydrogeologic setting of the Central Basin and West Coast Basin (CBWCB or Study Area). Key components of this appendix include:

- Description of the hydrogeologic setting of the CBWCB,
- Characterization of the existing average salt and nutrient (S/N) groundwater quality over the recent five-year averaging period (i.e. 2007 through 2012), and
- Calculation of the existing available assimilative capacity for S/Ns.

Section 2 of this appendix presents the background of the CBWCB and Section 3 discusses existing groundwater quality. References cited in this appendix are provided at the end of the Salt and Nutrient Management Plan (SNMP). Attachment G-A to this appendix provides a table with construction information for the Water Replenishment District of Southern California's (WRD's) nested monitoring wells.

2 Characteristics of the Central Basin and West Coast Basin

2.1 Groundwater Basin/Subbasins, Physical Setting, and Geologic Structures

Figure 1 illustrates the physiographic features of the Study Area. The Central Basin and the West Coast Basin are two groundwater subbasins within the Coastal Plain of the Los Angeles Groundwater Basin (Coastal Plain) as defined by the California Department of Water Resources (DWR, 2004). The Coastal Plain also includes the Santa Monica and Hollywood subbasins (Figure 1). For the entire SNMP, these areas are referred to as the basins rather than subbasins, consistent with the naming convention used by CBWCB stakeholders. The Coastal Plain is bounded by the Santa Monica Mountains on the north, the low-lying Elysian, Repetto, Merced, and Puente Hills on the northeast, the County Line between Los Angeles County and Orange County on the southeast, the Palos Verdes Hills on the southwest, and the Pacific Ocean on the south and west (DWR, 1961).

Geologic structures within the CBWCB are generally aligned along northwest trending uplifts and depressions. The hills that border the area have been uplifted by folding and faulting (Figure 17). The Newport-Inglewood Uplift, separating the Central Basin and the West Coast Basin, is a series of discontinuous faults and folds that form a prominent line of northwest trending hills including the Baldwin Hills, Dominguez Hills, and Signal Hill (see Figure 1).

2.1.1 Central Basin and Subareas

The Central Basin covers approximately 280 square miles and extends over most of the Coastal Plain east and northeast of the Newport-Inglewood Uplift (Figure 1). It is bounded on the north and northeast by the Hollywood Basin and low-lying Elysian, Repetto, Merced, and Puente Hills, on the southwest by the Newport-Inglewood Uplift, and on the southeast by the Los Angeles-Orange County line and the Coastal Plain of the Orange County Groundwater Basin (also referred to as a subbasin by DWR).

The Central Basin is hydrogeologically divided into four subareas including the Los Angeles Forebay, Montebello Forebay, Whittier Area, and Pressure Area (Figure 1). The forebays are areas where confining layers are thin or absent and infiltration of precipitation and surface water can recharge deeper potable production aquifers. The Montebello Forebay is the most significant area of recharge in the Central Basin. The Whittier Area was historically considered a separate basin based on the low lying Coyote Hills that bound the area to the south, but is now treated as part of the Central Basin. The Central Basin Pressure Area, largest of the four subareas, is characterized by aquifers that are generally confined by relatively impermeable clay layers over most of the area, but areas of semi-permeable confining layers allow some interaction between the aquifers (DWR, 1961).

Most of the faults in the Central Basin (Figure 17) form only minor restriction to groundwater flow. The exception is where folds and faults associated with the Newport-Inglewood Uplift form a partial barrier to movement of groundwater between the Central Basin and West Coast Basin.

2.1.2 West Coast Basin

The West Coast Basin covers approximately 140 square miles and is a northwest-southeast trending feature within the Coastal Plain (Figure 1). The West Coast Basin extends north to the Ballona Gap, which is an abandoned Los Angeles River channel. It is bounded by the Newport-Inglewood Uplift on the northeast and by the Pacific Ocean and Palos Verdes Hills on the west and south.

The Newport-Inglewood Uplift is broken by ancestral stream-cut channels that form the Dominguez Gap and Alamitos Gap. Most of the basin is comprised of a poorly drained plain. A wide belt of sand dunes form the El Segundo Sand Hills on the northwest edge of the basin.

Aquifers in the West Coast Basin are generally confined and receive the majority of their natural recharge from adjacent groundwater basins or from the Pacific Ocean (seawater intrusion).

As described above, the Newport-Inglewood Uplift and associated faulting acts as a partial barrier to groundwater flow between the Central Basin and West Coast Basin. The Charnock Fault also acts as a barrier to groundwater flow in the deeper water bearing zones.

2.2 Climatic Conditions and Climate Change

The climate in the Los Angeles area ranges from subtropical along the Pacific Ocean to arid in the Mojave Desert on the inland side of the San Gabriel Mountains. Nearly all precipitation in the region occurs during the months of December through March. During the summer months, precipitation is infrequent and dry periods can often last several months. Extended multiple years of below normal rainfall constitute drought periods. Precipitation varies considerably from year to year. At the Los Angeles County Department of Public Works (LACDPW) Downey Weather Station (located in the City of Downey in the Central Basin), precipitation measurements between 1971 and 2010 varied between 2.8 and 33.9 inches per calendar year with an average of 14.6 inches per year.

Because of the layers of low permeability materials overlying the primary water producing aquifers throughout much of the CBWCB and extensive impermeable surfaces due to urban development (i.e., pavement and buildings), large volumes of precipitation do not currently recharge the basins (United States Geological Survey [USGS], 2003). Recognizing this problem, the CBWCB stakeholders have implemented a number of programs to restore and induce recharge, such as low impact development (LID)[1], managed recharge in the Montebello Forebay Spreading Grounds (MFSG) and Dominguez Gap Spreading Grounds (DGSG), instream recharge in the San Gabriel River in the Montebello Forebay, and other stormwater capture facilities. In December 2012, the Los Angeles Regional Water Quality Control Board (LARWQCB) adopted a new MS4 Permit (Order No. R4-2012-0175; http://www.waterboards.ca.gov/rwqcb4/water_issues/programs/stormwater/municipal/index.shtml) that replaced the 2001 MS4 Permit. The MS4 Permit encourages permittees to infiltrate stormwater as a fundamental aspect of permit implementation. It is anticipated that the MS4 Permit will lead to increase stormwater capture in the CBWCB.

The effects of climate change in California present many water supply challenges and unknowns. The sustainability of water supply sources will likely be impacted by warmer winter storms, reduced precipitation, winter snowpack, and surface water flows, significant dips in groundwater levels, more intense winter and spring runoff (due to precipitation occurring as rain instead of snow), and more extreme hydrologic variability between drier drought periods and wetter winter periods. Rainfall patterns locally are also likely to change with heavier rainfall periods (but reduced events) that potentially could overwhelm the flood control system, leading to less conserved stormwater, more property damage, and greater maintenance and operational demands (USBOR, LACFCD, and LACDPW, 2013). In addition, sea level along the Southern California Coast is projected to rise 5 to 25 inches above 2000 levels by 2025 due to global climate change (NRCC, 2012). Rising sea water levels have the potential to increase seawater intrusion along the coastal areas of the CBWCB.

It is noted that 7 of the last 10 seasonal years (July 1 to June 30) (2003-04, 2005-06, 2006-07, 2007-08, 2008-09, 2011-12, 2012-13) have seen below normal rainfall in Los Angeles, resulting in a lower than expected stormwater capture for recharge at the MFSG. This has led the LARWQCB to approve a longer, from 5 years to 10 years, averaging period for calculation of the relative contribution of recycled water for recharge at the MFSG (LARWQCB, 2013). Additionally, the LARWQCB increased the permitted maximum quantity of recycled water recharged at the MFSG from 35% to 45% of the total inflow from all sources (i.e., imported water, recycled water, and stormwater) in any 10-year period (LARWQCB, 2014).

2.2.1 Drought

Historically, California has experienced frequent periods of prolonged drought. Based on scientific projections, drought is expected to occur more frequently and for longer intervals due to climate change. With significant below-normal rainfall since 2012, the current drought is

[1] Design techniques that infiltrate, filter, store, evaporate, and detain surface water runoff close to its source. The main goals of LID are to increase groundwater recharge and improve stormwater quality.

being described as the driest period in the State's recorded history. There was less rain in 2013 than in any year since California became a state in 1850. Locally, there has been approximately 5.6 inches of rain since October 1, 2013 (when the "water year" starts from a record-keeping standpoint), approximately 37% of the normal precipitation for this period. A Sierra Mountain snow survey conducted by the DWR at the end of February and March 2014 found the snowpack's statewide water content at about 25% of average. According to the United States Drought Monitor, a majority of the State is designated in either Exceptional Drought (including the CBWCB) or Extreme Drought (http://droughtmonitor.unl.edu/Home/StateDroughtMonitor.aspx?CA).

The current drought, as a result of the lack of precipitation, has impacted the following areas, which has affected imported water and groundwater supplies in the CBWCB:

- San Gabriel Mountains and Valley which feed runoff to rivers leading to recharge at the Montebello Forebay Spreading Grounds;
- Sierra Nevada Mountains which feed the Owens River, the Los Angeles Aqueduct, Northern California, the Sacramento-San Joaquin River Delta, and the California Aqueduct;
- Western United States and the Rocky Mountains which feed the Colorado River; and
- Groundwater – In the Montebello Forebay, which supplies many production wells and also serves as the conduit to supply groundwater to "downstream" areas of the Central Basin and West Coast Basin, groundwater levels have fallen over 50 feet since 2011 due to the extended drought. Water levels have dropped to their lowest levels in over 35 years, causing some production wells to have lowered pumps to keep up with the decline.

2.3 Land Use and Population Growth

The CBWCB covers approximately 420 square miles in southern Los Angeles County and consists of 43 cities with a population of nearly 4 million residents. According to the California Department of Finance, the State's population as a whole is projected to increase by more than 35% while Los Angeles County's population is projected to increase by approximately 18% by 2050 (USBOR, LACFCD, LACDPW, 2013). Although the population in the CBWCB is predicted to increase, use of potable supplies (imported water and groundwater) is projected to remain near 2010 levels through the end of the SNMP future planning period, i.e., 2025 (see Appendix H *Baseline and Future Water Balances* for further details). This is due to the increased use of recycled water (replacing and supplementing imported water) and overall reduced water demand due to conservation.

Figure 18 shows the cities in the Study Area and outside the Study Area in Los Angeles County. As shown in Figure 19, the Study area is highly developed and land uses are predominantly urban residential, commercial, and industrial. As a result, the CBWCB ground surface is mostly covered with buildings and paved surfaces, which limit natural groundwater recharge. Since the Study Area is mostly urbanized and essentially fully developed, additional population growth will likely occur through development outside the Study Area. Growth within the Study area would be through redevelopment and infill development.

2.4 Water Sources

Sources of water for use and recharge in the CBWCB include surface water/stormwater, imported water, groundwater, and recycled water.

2.4.1 Surface Water/Stormwater

Three main stream channels, the Los Angeles River, San Gabriel River, and Rio Hondo flow into the Study Area from interior valleys (Figure 1). There are three main watersheds in the Study Area including the Los Angeles River, San Gabriel River, and Santa Monica Bay as shown in Figure 20. The LARWQCB has further divided the watersheds into five major watershed management areas (WMAs) (Figure 21): Los Angeles River, San Gabriel River, South Santa Monica Bay, Dominguez Channel, and Los Cerritos Channel and Alamitos Bay (LARWQCB, 2007).

The Los Angeles River drains the San Fernando Valley and groundwater basin and flows southward across the Central Basin and West Coast Basin prior to discharging into San Pedro Bay. The Los Angeles River is lined throughout most of the Study Area except for a small stretch in the West Coast Basin near San Pedro Bay (Figure 20).

The Rio Hondo drains the San Gabriel Valley and groundwater basin and flows southeasterly across the Central Basin and converges with the Los Angeles River just west of the Montebello Forebay. Flows in the Rio Hondo can be diverted into the Rio Hondo Spreading Grounds in the Montebello Forebay. The Rio Hondo is lined throughout the Study Area.

The Los Angeles River is hydraulically connected to the San Gabriel River via the Rio Hondo through a cross over channel between the San Gabriel River and the Rio Hondo located behind the Whittier Narrows Dam in the San Gabriel Basin, although diversions occur primarily during large storm events. In addition, water can be diverted from the San Gabriel River to the Rio Hondo via a ditch (referred to as the Zone 1 Ditch) also located behind the Whittier Narrows Dam to facilitate spreading operations in the Montebello Forebay. There is also an interconnection pipeline between the San Gabriel River Spreading Grounds and the Rio Hondo Spreading Grounds, through which water can be transferred from one spreading grounds to the other. The Los Angeles River, which once flowed freely over the Coastal Plain, was channelized between 1914 and 1970 to control runoff and reduce the impacts of major flood events in the region. Today, over 90% of the Los Angeles River is concrete-lined.

The San Gabriel River drains the San Gabriel Valley and groundwater basin. The San Gabriel River flows southerly across the Central Basin and West Coast Basin and discharges into San Pedro Bay. Coyote Creek converges with the San Gabriel River above the Alamitos Gap Barrier. The San Gabriel River is unlined through most of the Montebello Forebay and becomes lined approximately nine miles downstream of the Whittier Narrows Dam just before entering the Central Basin Pressure Area. The unlined portion of San Gabriel River in the Montebello Forebay is a losing reach and instream facilities (inflatable dams) have been installed along its length to promote groundwater recharge as part of the Montebello Forebay spreading operations.

The South Santa Monica Bay Watershed is located in the southwest portion of Los Angeles County along the Pacific Ocean (Figure 20). The watershed is bounded by the Santa Monica Mountains and Ventura-Los Angeles County line on the north and extends south to the Palos Verdes Peninsula. The Dominguez Channel is the main surface water drainage feature in the watershed. The watershed is mostly urbanized.

The Dominguez Channel Watershed is defined by a complex network of storm drains and smaller flood control channels. The Dominguez Channel is located in the West Coast Basin (Figure 20) and extends from the Los Angeles International Airport to the San Pedro Bay and drains a predominantly urbanized area. The Los Cerritos Channel is concrete-lined above the tidal prism and drains a relatively small, densely urbanized area of east Long Beach.

Surface water/stormwater is not used for direct water supply in the Study Area; however, it is actively captured and recharged through replenishment operations conducted by LACDPW at the MFSG, instream recharge in the San Gabriel River in the Montebello Forebay, and at the Dominguez Gap Spreading Grounds (DGSG) (Figure 4). There are also a number of stormwater retention basins and LID projects in the Study Area, which also recharge runoff and stormwater. Surface water and stormwater may also be naturally recharged along unlined stream stretches; however, most streams in the CBWCB are concrete lined. Figure 4 shows the lined and unlined portions of major rivers and streams in the Study Area. Stormwater is also recharged naturally at unpaved areas (parks, golf courses, landscaped areas, dirt lots, residential lawns and gardens, etc.) where the geology promotes deep percolation.

2.4.2 Imported Water

Imported water is used for water supply (i.e. drinking water, irrigation, commercial/industrial activities, etc.) and replenishment in the CBWCB (i.e., MFSG and seawater barriers). A small amount of the imported water used for irrigation recharges the basins through deep percolation. Water is imported to the CBWCB by the Metropolitan Water District of Southern California (MWD), the City of Los Angeles, City of Whittier, Suburban Water Company, California Domestic Water Company, and San Gabriel Valley Water Company.

MWD imports water from the Colorado River (CR) and State Water Project (SWP); untreated imported water is delivered to the Montebello Forebay spreading facilities and treated imported water is injected into the three seawater intrusion barriers and used for water supply. The City of Los Angeles imports water from the Owens Valley-Mono Basin and the treated water is used for water supply in the CBWCB. The City of Whittier, Suburban Water Company, California Domestic Water Company, and San Gabriel Valley Water Company import groundwater that is extracted from the San Gabriel Basin and used for water supply in the Study Area. Historically, a small amount of groundwater extracted from the Whittier Narrows Area north of the Whittier Narrows Dam in the San Gabriel Basin (see Figure 1) was also delivered to the Montebello Forebay for replenishment.

2.4.3 Groundwater

The Central Basin and the West Coast Basin are two of the most important groundwater basins in Southern California. Groundwater in the CBWCB meets approximately a third of the overall water supply needs of nearly 4 million residents and businesses in the 43 cities overlying the basins. Groundwater is extracted from the CBWCB and used for water supply (i.e. drinking water, irrigation, commercial/industrial activities, etc.). A small percentage of groundwater used for irrigation recharges the CBWCB through deep percolation. There are currently over 400 active production wells in the CBWCB.

2.4.4 Recycled Water

In the CBWCB, recycled water has many uses, primarily groundwater recharge, urban landscape irrigation, industrial and commercial process water, recreational facilities, and wildlife habitat maintenance. Recycled water has been utilized for groundwater recharge at the MFSG for over 50 years. Thus, use of recycled water in the CBWCB has proven to be a safe and reliable resource that has played a vital role in increasing the sustainability of the overall water supply. Treatment plants in the CBWCB that produce recycled water are owned and operated by the Sanitation Districts of Los Angeles County (SDLAC), West Basin Municipal Water District (WBMWD), City of Los Angeles, and WRD.

Tertiary-treated recycled water produced by the Pomona, San Jose Creek, and Whittier Narrows Water Reclamation Plants (WRPs), which are owned and operated by the SDLAC, is used for groundwater recharge in the Montebello Forebay. Tertiary-treated recycled water from SDLAC's Long Beach, Los Coyotes, and San Jose Creek WRPs is used for irrigation and commercial/industrial applications in the Central Basin.

The Leo J. Vander Lans Advanced Water Treatment Facility (Vander Lans AWTF), owned by WRD, produces recycled water that has undergone advanced water treatment (AWT). This AWT recycled water is injected at the Alamitos Gap Seawater Intrusion Barrier (AGB), which is located in the Central Basin and adjacent Orange County Basin.

The Edward C. Little Water Recycling Facility (WRF), owned by WBMWD, receives secondary effluent from the City of Los Angeles' Hyperion Wastewater Treatment Plant (WTP) as source water to produce five different recycled water quality levels, including tertiary-treated and AWT recycled water. Recycled water produced by the Edward C. Little WRF is used for irrigation (tertiary-treated) in the West Coast Basin, injected (AWT) at the West Coast Basin Seawater Intrusion Barrier (WCBB), and used for industrial purposes (treatment level depends on application).

AWT recycled water produced by the Terminal Island Water Reclamation Plant/Advanced Water Purification Facility (TIWRP), owned and operated by the City of Los Angeles, Bureau of Sanitation, is injected at the Dominguez Gap Seawater Intrusion Barrier (DGB) located in the West Coast Basin and a small amount of tertiary-treated recycled water is used for local irrigation at the TIWRP. A description of the treatment plant processes at the recycled water facilities are presented in Appendix E *Simulated Baseline and Future Salt and Nutrient Groundwater Quality.*

2.5 Geology, Aquifers, and Groundwater Occurrence

The CBWCB is comprised of northwest-trending structural basins underlain by Quaternary-age (less than 1.8 million years old) sedimentary deposits of gravel, sand, silt, and clay. These materials were deposited from the erosion of nearby hills and mountains, and from ancient beaches and shallow ocean floors that covered the area in the past (WRD, 2004). Underlying these Quaternary sediments are basement rocks such as the Pliocene Pico Formation that generally do not provide sufficient quantities of groundwater for pumping.

Groundwater occurs in the pore spaces of the sediments in the groundwater basins. Where these sediments are thick and transmissive enough to supply sufficient quantities of water to wells for potable use, they are termed aquifers. An aquitard or confining unit is the less permeable (low hydraulic conductivity) silt and clay layers that separate the aquifers. In the forebay or recharge areas, confining layers are thin or absent, and thus surface water can readily recharge deeper aquifers because unconfined conditions exist. An unconfined aquifer is one in which a water table or groundwater surface is at atmospheric pressure. Confined aquifers located below confining units or aquitards contain groundwater that is typically under pressure greater than atmospheric.

The Central Basin and West Coast Basin are characterized by a layered aquifer/aquitard system. **Table G-1** summarizes the aquifers and aquitards of the CBWCB, age, and associated formations as defined by the DWR (1961). The aquifers are illustrated in cross section on Figure 22. This cross section runs from west to east across the West Coast and Central basins as shown in the small map inset in the lower right corner of the figure. The aquifers include the following, from shallowest to deepest: the Semi-Perched and Gaspur aquifers of the Holocene Alluvium Formation; the Exposition, Artesia, Gage, and Gardena aquifers of the Upper Pleistocene Lakewood Formation; the Hollydale, Jefferson, Lynwood, and Silverado aquifers of the Lower Pleistocene Upper San Pedro Formation; and the Sunnyside Aquifer of the Lower Pleistocene Lower San Pedro Formation. Aquifer depths can reach more than 2,200 feet in the Central Basin and 1,500 feet in the West Coast Basin, although production wells generally do not need to be constructed this deep to extract sufficient water.

2.5.1 Central Basin DWR-Defined Aquifers

In the Central Basin, the Semi-Perched Aquifer is a relatively thin layer of coarse sand and gravel near the ground surface. In most of the Central Basin, with the exception of the Los Angeles Forebay and Montebello Forebay, the Semi-Perched Aquifer is separated from the underlying Gaspur Aquifer by the Bellflower Aquitard. In the forebays, the Bellflower Aquitard is absent or relatively more coarse-grained, providing hydraulic continuity between the surface and deeper aquifers, i.e. recharge areas. In contrast, mostly confined conditions exist in the Central Basin Pressure Area.

In vertical section, the Gaspur Aquifer is generally medium- to coarse-grained in the upper part while the lower part consists of sand, gravel, and cobbles. There is also lateral variation in lithology based on the locations of the original stream deposition.

The Lakewood Formation includes Pleistocene deposits other than the Older Dune Sand described in Bulletin 104 as including the Exposition-Artesia and Gardena-Gage aquifers (DWR, 1961). The Garden-Gage Aquifer is also referred to as the 200-Foot Sand Aquifer.

Table G-1 Aquifer Systems in the Central Basin and West Coast Basin

Age	Formation	Aquifer/Aquitard
Holocene (Recent)	Active Dune Sand	Semi-Perched Aquifer
	Alluvium	Bellflower Aquitard (mostly absent in the Montebello Forebay)
		Gaspur Aquifer
Upper Pleistocene	Older Dune Sand	Semi-Perched Aquifer
	Lakewood	Exposition-Artesia Aquifer
		Gardena-Gage Aquifer (also referred to as 200-Foot Sand Aquifer)
Lower Pleistocene	San Pedro	Hollydale Aquifer
		Jefferson Aquifer
		Lynwood Aquifer (also referred to as 400-Foot Gravel Aquifer)
		Silverado Aquifer
		Sunnyside Aquifer
		Lower San Pedro
Upper Pliocene	Pico	

The San Pedro Formation underlies most, if not all, of the Central Basin and West Coast Basin and essentially includes all strata of lower Pleistocene age (DWR, 1961). Sand and gravel fragments are mainly granitic, indicating a common source area, probably the San Gabriel Mountains. The Lynwood Aquifer is also referred to as the 400-Foot Gravel Aquifer. The Hollydale Aquifer is more coarse-grained in the northeast part of the Central Plain and becomes more fine-grained toward the Newport-Inglewood Uplift. The Jefferson Aquifer is generally fine-grained. Neither the Hollydale Aquifer nor Jefferson Aquifer are considered an important source of water supply (USGS, 2003). By contrast the Lynwood Aquifer is an important source of water and consists of continental and marine deposits. The Silverado Aquifer, also an important source of water, is of mixed origin consisting of non-marine deposits of sand and gravel that interbed with silt and clay, and marine deposits of sand, gravel, silt, and clay. The Silverado Aquifer merges with overlying aquifers in the Montebello Forebay and Whittier Area.

The Lower San Pedro Aquifer System contains the Sunnyside Aquifer, which extends throughout the Central Basin. The materials comprising this aquifer are coarse-grained sands and gravels separated by fine-grained interbeds of sandy clay and clay. The Sunnyside Aquifer becomes very shallow and merges with the Upper San Pedro Aquifer System in the Montebello Forebay. The coarsest part of the aquifer system is at its base.

Underlying the aquifers described herein is the Pico hydrostratigraphic unit, which defines the base of the groundwater basins.

The main source of potable groundwater in the Central Basin is the deeper aquifers of the San Pedro Formation (including from top to bottom: the Lynwood, Silverado, and Sunnyside aquifers). The shallower aquifers of the Alluvium and Lakewood Formation (includes the Gaspur, Exposition, Gardena-Gage, Hollydale, and Jefferson aquifers) locally produce smaller volumes of water.

The sedimentary deposits in the Los Angeles Forebay and Montebello Forebay generally thicken and deepen toward the south toward the pressure area of the Central Basin.

2.5.2 West Coast Basin DWR-Defined Aquifers

The West Coast Basin is underlain by the same general sequence of deposits described above for the Central Basin and summarized in Table G-1. In the West Coast Basin, Active Dune Sand is found inland from and along the Santa Monica Bay. Recent Alluvium is found throughout the basin, but primarily occurs within the Dominguez Gap. The Older Dune Sand extends three to four miles inland from Santa Monica Bay forming the El Segundo Sand Hills.

The West Coast Basin has a layered aquifer/aquitard system similar to that found in the Central Basin and exhibits generally confined conditions in the deeper aquifers. The Semi-Perched Aquifer is unconfined and only found in the Dominguez and Alamitos gaps. The Bellflower Aquitard and Gaspur Aquifer are only found in the Dominguez Gap (DWR, 1961). The Ballona Aquifer is located along the Ballona Gap.

The aquifer system is off-set and deformed as it crosses the Newport-Inglewood Uplift. The Silverado Aquifer is the most productive aquifer in the West Coast Basin and yields 80 to 90% of the groundwater extracted annually (DWR, 2004). Minor yield also comes from the Gage, Lynwood, and Sunnyside aquifers.

2.5.3 USGS-Defined Aquifer Systems and Model Layers

In 2003, the United States Geological Survey (USGS) developed a regional groundwater flow (MODFLOW) model of the CBWCB. As part of this groundwater conceptual model used for flow modeling, the USGS simplified the DWR-defined aquifers into four aquifer systems. These four aquifer systems constitute the four model layers simulated in the USGS and recent Groundwater Basins Master Plan (GBMP) (CH2MHILL, 2012b) modeling work. The USGS considered geophysical logs, unconformities, lithology, depositional characteristics, geochemistry, and vertical water level differences in defining the aquifer systems. The USGS-designated aquifer systems and model layers as they relate to the DWR-designated aquifers are shown in **Table G-2** and Figure 23.

The aquifers were grouped into the Recent (Model Layer 1), Lakewood (Model Layer 2), Upper San Pedro (Model Layer 3), and Lower San Pedro (Model Layer 4). These model layers are used throughout the SNMP to describe the movement and quality of groundwater.

Table G-2 CBWCB Aquifer Systems and Model Layers

<table>
<tr><th>Age</th><th>Formation</th><th>DWR-Defined Aquifer/Aquitard</th><th>USGS Model Layer and Aquifer System [a]</th></tr>
<tr><td rowspan="3">Holocene (Recent)</td><td>Active Dune Sand</td><td>Semi-Perched Aquifer</td><td rowspan="3">1 - Recent Aquifer System</td></tr>
<tr><td rowspan="2">Alluvium</td><td>Bellflower Aquitard (mostly absent in the Montebello Forebay)</td></tr>
<tr><td>Gaspur Aquifer</td></tr>
<tr><td rowspan="3">Upper Pleistocene</td><td>Older Dune Sand</td><td>Semi-Perched Aquifer</td><td rowspan="3">2 - Lakewood Aquifer System</td></tr>
<tr><td rowspan="2">Lakewood</td><td>Exposition-Artesia Aquifer</td></tr>
<tr><td>Gardena-Gage Aquifer</td></tr>
<tr><td rowspan="6">Lower Pleistocene</td><td rowspan="6">San Pedro</td><td>Hollydale Aquifer</td><td rowspan="4">3 - Upper San Pedro Aquifer System</td></tr>
<tr><td>Jefferson Aquifer</td></tr>
<tr><td>Lynwood Aquifer</td></tr>
<tr><td>Silverado Aquifer</td></tr>
<tr><td>Sunnyside Aquifer</td><td rowspan="2">4 - Lower San Pedro Aquifer System</td></tr>
<tr><td>Lower San Pedro Aquifer</td></tr>
<tr><td>Upper Pliocene</td><td>Pico</td><td></td><td>Pico Unit</td></tr>
</table>

a – In 2003, the United States Geological Survey (USGS) developed a regional groundwater flow model (MODFLOW) of the CBWCB. As part of the groundwater conceptual model used for flow modeling, the USGS simplified the DWR-defined aquifers into four aquifer systems based on review of geophysical logs along with ancillary information; these four aquifer systems constitute the four model layers simulated in the USGS and recent Groundwater Basins Master Plan (GBMP) (CH2MHILL, 2012b) modeling work, which served as the basis for layers used in the SNMP mixing model.

The Recent Aquifer System (Model Layer 1) is composed of Semi-Perched Aquifer and Gaspur Aquifer. The Recent Aquifer System is relatively thin and does not exist in all areas of the CBWCB as shown in Figure 24. The Semi-Perched Aquifer occurs near the land surface and is underlain by the Gaspur Aquifer. The DWR-defined extent of the Gaspur Aquifer is limited to two lobes in the Montebello and Los Angeles forebays merging near the city of Downey and extending along the current Los Angeles River channel through the Dominguez Gap to the ocean. In the Los Angeles Forebay, the unit is typically unsaturated. As a result, there are no monitoring or production wells screened in Model Layer 1 in the Los Angeles Forebay. As shown in Figure 24, Model Layer 1 extends to a very small extent into the Whittier Area. As in the Los Angeles Forebay, there are no monitoring or production wells screened in Model Layer 1 in the Whittier Area. Because of its limited extent in the Whittier Area, unsaturated condition in the Los Angeles Forebay, and lack of monitoring data in both areas, Model Layer 1 was not considered as part of the hydrogeologic conceptual model for the Los Angeles Forebay and Whittier Area for the SNMP water quality analysis. This assumption had almost no effect on the estimation of average groundwater quality because Model Layer 1 is very thin and contains a very small volume of water relative to the other model layers. Similarly, Model Layer 1 does not exist in other portions of the Central Basin Pressure Area and West Coast Basin as shown in Figure 24. In areas where Model Layer 1 does not exist, is unsaturated, or is of very limited extent, S/N loading was assumed to be directly into Model Layer 2.

Many monitoring wells associated with environmental release sites tap thin units of shallow perched groundwater, typically of limited lateral extent, across the Study Area. In most cases, this shallow perched groundwater is not considered to be part of Model Layer 1 or Model Layer 2 (where Model Layer 1 does not exist). Contaminated shallow perched groundwater near environmental release sites is actively characterized and/or remediated under various ongoing programs as described in Section 3.2 *Environmental Release Sites in the CBWCB.*

As discussed above, where the Recent Aquifer System is absent, the Lakewood Aquifer System (Model Layer 2) exists at the ground surface. The main aquifers of the Lakewood Aquifer System include the Exposition, Artesia, Gardena, and Gage. The Lakewood Aquifer System ranges in thickness from 150 to 400 feet. The Upper San Pedro Aquifer System (Model Layer 3) incorporates the Hollydale, Jefferson, Lynwood, and Silverado aquifers. The majority of groundwater pumping in the CBWCB is from Model Layer 3. The Lower San Pedro Aquifer System consists of the Sunnyside Aquifer. Underlying these four aquifer systems is the Pico Unit. The top of this unit defines the base of the aquifers modeled by the USGS and CH2MHILL (USGS, 2003; CH2MHILL, 2012b).

2.5.4 Aquifer Properties

Aquifer properties describe the ease with or rate at which groundwater travels through the subsurface and how much water is contained within an aquifer or confining unit. Transmissivity is the rate at which groundwater is transmitted through a unit width of aquifer under a unit hydraulic gradient. Hydraulic conductivity is the rate at which water can move through the aquifer. Transmissivity divided by the aquifer saturated thickness is equal to hydraulic conductivity. Vertical hydraulic conductivity or conductance describes the vertical component of conductivity. Specific yield is the ratio of the volume of water that the aquifer yields by gravity drainage to the total volume of aquifer and is a measure of the volume of water in the formation. Storage coefficient is the volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head. Transmissivities for the various aquifers in the Central Basin as described by DWR (1961) are provided in **Table G-3**.

Table G-3 Transmissivities of Aquifers

Aquifer	Transmissivity (ft^2/d)	
	Central Basin	West Coast Basin
Gaspur	7,000 to 50,000	7,000 to 20,000
Artesia-Exposition	1,500 to 4,000	NA
Gage-Gardena	1,500 to 8,000	1,500 to 16,000
Hollydale	<1,500 to 3,000	NA
Jefferson	<1,500 to 5,000	NA
Lynwood	3,000 to 13,000	7,000
Silverado	5,000 to 27,000	30,000 to >50,000

ft^2/d - square feet per day
NA - not applicable

The USGS (2003) calculated hydraulic conductivities used in their modeling by summing the DWR transmissivities for relevant aquifers in each model layer and dividing by the layer thickness. The values were then smoothed and calibrated. Calibration is the process of adjusting hydraulic properties to better simulate observed groundwater levels. The USGS model aquifer parameters, including hydraulic conductivity, specific yield, and specific storage used to simulate groundwater movement in the Study Area, are presented in **Table G-4**.

The USGS (2003) performed particle tracking to simulate the movement of groundwater near the Montebello Forebay and seawater intrusion barriers. Based on flow paths presented by the USGS, the groundwater velocity in the vicinity of the Montebello Forebay is about 3 feet per day (ft/d), while the USGS reported average velocities of from 0.1 to 2.1 ft/d along Santa Monica Bay and from 0.1 to 1.0 ft/d along San Pedro Bay in the West Coast Basin.

Due to the significant pumping depressions in the Central Basin and West Coast Basin, the dominant vertical groundwater flow direction is downward. Groundwater moves downward from Layer 1 to Layer 4 in the forebays and the Central Basin Pressure Area. In the West Coast Basin, groundwater moves downward from Layer 1 to Layer 3 and there is some upward and some downward movement between Layers 3 and 4 depending on the year.

Table G-4 Hydraulic Properties of Aquifers in the USGS Model Layers

Model Layer	Hydraulic Conductivity (ft/d)	Vertical Conductance Between Layers (per day)	Specific Yield / Storage Coefficient [a]	Specific Storage (per foot)
1	13 to 800		0.075 to 0.25	
1 to 2		8×10^{-6} to 0.22		
2	0.1 to 130		0.0006 to 0.003	5.0×10^{-6}
2 to 3		7×10^{-7} to 7×10^{-2}		
3	0.6 to 140		0.00015 to 0.0018	2.0×10^{-6}
3 to 4		2×10^{-6} to 4×10^{-2}		
4	1.0 to 50		0.00015 to 0.0016	2.0×10^{-6}

ft/d - feet per day USGS – U.S. Geological Survey

a – The USGS assigned a constant specific yield of 0.075 to Model Layers 2 through 4; a value of 0.075 is used for all layers to calculate the basin mixing volumes used in estimating average groundwater quality

2.6 Basin Adjudications and Management

Prior to the adjudication of the Central Basin and West Coast Basin in the early 1960s, annual production (pumping) reached levels as high as 292,000 acre-feet (AF) in the Central Basin and 94,000 AF in the West Coast Basin. This was more than double the 173,400 AF of natural safe yield of the basins determined by DWR in 1962. The natural safe yield is the amount of groundwater that can be withdrawn from the aquifer without adverse impacts (DWR, 2011), assuming natural replenishment of the aquifer generally from runoff and precipitation. Due to this serious overdraft, water levels declined, groundwater was lost from storage, and seawater intruded into the aquifers along the coast. To remedy this problem, the courts adjudicated the Central Basin and West Coast Basin to put limits on pumping. The West Coast Basin adjudicated pumping was set at 64,468 acre-feet per year (AFY). The Central Basin adjudicated pumping was set at 267,900 AFY; although, the judgment set a lower allowed pumping allocation (APA) at 217,367 AFY to impose stricter control. As a result, the current amount allowed to be pumped from both basins is 281,835 AFY (WRD, 2012).

The adjudicated pumping amounts are greater than the natural replenishment of the groundwater aquifers, creating an annual deficit or annual overdraft, under natural recharge conditions. Accordingly, WRD was established in 1959 under the California Water Code to purchase and recharge additional water to make up the overdraft, which is known as artificial replenishment or managed aquifer recharge.

2.7 Storage Capacity and Groundwater in Storage

DWR has estimated that the total storage in the Central Basin is approximately 13.8 million AF (1961). Unused storage is estimated to be approximately 1.1 million AF, resulting in 330,000 AF of available storage, assuming that the basin can be filled to within 75 feet of the ground surface (WRD, 2006). DWR has estimated that total storage in the West Coast Basin is approximately 6.5 million AF (1961). Unused storage is approximately 1.1 million AF, resulting in approximately 120,000 AF of available storage, assuming that the basin can be filled to within 75 feet of the ground surface.

The groundwater currently in storage in the CBWCB was estimated for the SNMP using the USGS/GBMP model and surface areas of the subareas, model layer thickness, and corresponding specific yields for water year[2] (WY) 2009-10. **Table G-5** presents the estimated groundwater in storage. The total estimated groundwater in storage capacity in the Central Basin and West Coast Basin are estimated to be approximately 13.6 million AF and 5.3 AF, respectively, for WY 2009-10. This is a total of 18.9 million AF for the CBWCB. These estimates are a reasonable match with DWR estimates.

2.8 Water Levels and Flow

Groundwater level monitoring, groundwater elevation contour maps, groundwater level change maps, and groundwater change in storage estimates are presented by WRD's annual *Regional Groundwater Monitoring Report and Engineering Survey and Report*. These are used to indicate:

- Amount of storage in the basins and need for replenishment,
- Areas of recharge and discharge,
- Groundwater flow direction and hydraulic gradients, and
- Effectiveness of the seawater intrusion barriers.

2.8.1 Groundwater Levels and Horizontal Flow

In order to obtain accurate data for specific aquifers from which to infer localized water level (and water quality conditions), depth-specific (nested) monitoring wells that tap discrete aquifer zones were previously installed by WRD and currently are evaluated as part of WRD's Regional Groundwater Monitoring Program (RGWMP). **Attachment G-A** contains a table showing construction information for over 300 nested monitoring wells at more than 55 locations in the CBWCB, which are depicted in Figure 25. Currently, the WRD nested wells are used to assess groundwater quality and water levels. WRD plans to construct additional nested monitoring wells, as depicted in Figure 25, to better monitor regional groundwater and address groundwater management issues.

The *SNMP Monitoring Plan,* provided as Appendix K in the SNMP, describes the SNMP Monitoring Program that includes seventy (70) WRD nested groundwater monitoring wells (referred to as SNMP monitoring wells) at 13 key locations throughout the critical areas of the CBWCB. These wells were selected based on their location in proximity to water supply wells and groundwater recharge projects that utilize recycled water, including the seawater intrusion barriers and the MFSG. Figure 25 shows the locations of the SNMP monitoring wells.

[2] A water year is the period from October 1 through September 30 of the following year.

Table G-5 Groundwater in Storage

Model Layer	CENTRAL BASIN				WEST COAST BASIN
	Los Angeles Forebay	Montebello Forebay	Whittier Area	Central Pressure	
1	19,233	264,293	4,499	141,875	42,424
2	226,610	259,911	127,017	1,367,366	666,458
3	998,880	973,500	453,036	4,780,524	2,673,528
4	407,376	476,028	163,068	2,970,648	1,901,064
Total	1,652,099	1,973,732	747,620	9,260,413	5,283,474
Basin Totals	13,633,864				5,283,474
Total CBWCB	18,917,338				

All values in acre-feet

CBWCB - Central Basin and West Coast Basin

Estimated values calculated based on surface area of subarea, saturated thickness in water year 2009-10, and a specific yield of 0.075 used for all layers (see Table G-4)

Before the 20th century, groundwater flowed from the CBWCB south and westward, toward the Santa Monica Bay and San Pedro Bay. Prior to development of the CBWCB, approximately 30% of the area exhibited flowing artesian conditions (USGS, 1905). Discharge from the groundwater flow systems occurred offshore, at some fault zones, or in wetlands. Since then, discharge has been dominated by pumping from wells. By the 1920s, owing to development and excessive use of groundwater resources, water levels were below sea level in much of the CBWCB, resulting in seawater intrusion along the coastal areas (USGS, 2004).

Injection into what is now the WCBB began in the 1950s on an experimental basis. The success of the program led to the expansion of the WCBB as it appears today, as well as the construction of the DGB and AGB. Operation of these barriers has increased local groundwater levels, reducing the inland flow of seawater past the barriers.

WRD presents groundwater elevation contour maps for the major water supply aquifers, which include those within Model Layer 3, in their annual *Regional Groundwater Monitoring Reports* and *Engineering Survey and Report*. These maps represent seasonal low groundwater levels measured in the Fall, i.e. at the end of the summer dry season.

Figure 5 shows the Fall 2010 groundwater elevation contour map based on monitoring of nested wells along with other selected wells screened in the Model Layer 3. Features that potentially control the regional pattern of groundwater movement in the basins include topographic highs and lows, faults, areas of recharge, and groundwater pumping (discharge). The general direction of groundwater flow is shown by the arrows depicted on Figure 5. Both the Newport-Inglewood Uplift and the Charnock Fault (in the West Coast Basin) are partial barriers to groundwater flow, causing differences in water levels on opposite sides of each fault system; although some subsurface groundwater flows between the Central Basin and the West Coast Basin across the Newport-Inglewood Uplift.

In the Central Basin, groundwater levels are highest in the Montebello Forebay, where the San Gabriel Basin groundwater flows into the Central Basin and significant groundwater recharge occurs. Due to the significant aquifer recharge occurring via the MFSG, there is a mound in the groundwater table and a radial pattern of flow away from the forebay. Groundwater elevations range from a high of about 170 feet above mean sea level (msl) in the northeast portion of the Central Basin above the MFSG in the Whittier Narrows to a low of about 120 feet below msl in the Long Beach area and about 130 feet below msl in the Gardena area (based on the Fall 2010 groundwater elevation contour map, Figure 5). With the exception of the Montebello Forebay and along the WCBB, the majority of groundwater levels in the Study Area are below sea level, which is why continued injection at the seawater intrusion barriers is needed to prevent saltwater intrusion and replenish the basin.

The Los Angeles Forebay historically was recharged by the Los Angeles River, but this recharge has been substantially reduced since the river channel was concrete lined. Groundwater in the Los Angeles Forebay flows generally from east to west toward a pumping depression in the Central Basin Pressure Area. In the Whittier Area, groundwater flows southward from the edge of the Puente Hills into the Central Basin Pressure Area.

In the West Coast Basin, groundwater levels are highest along the WCBB (about 10 feet msl) and decreasing inland reaching the lowest elevation of more than 100 feet below msl near the Newport-Inglewood Uplift (based on the Fall 2010 groundwater elevation contour map, Figure 5). Groundwater flow in the West Coast Basin is generally from west to east. Both the Charnock Fault and Newport-Inglewood Uplift restrict groundwater movement and produce marked discontinuities in groundwater levels.

The groundwater flow patterns, based on the Fall 2010 groundwater elevation contour map (Figure 5), are generally representative of recent and predicted future conditions because managed aquifer recharge operations and groundwater pumping are relatively stable influences on the flow regime. Nonetheless, groundwater pumping in the Central Basin can fluctuate seasonally, as discussed in the next section.

2.8.2 Long-Term Water Level Trends

Figure 5 shows the locations of key wells in the CBWCB, for which long-term records of groundwater levels (hydrographs) are presented in WRD's *Engineering Survey and Report*. These hydrographs depict long-term trends and help monitor overall groundwater conditions in both basins.

As discussed in WRD's *Engineering Survey and Report*, key Well 2S/13W-10A01 is used to represent the overall water level conditions of the Los Angeles Forebay (Figure 26). The maximum water level was measured in 1938 and by 1962 water levels had fallen nearly 180 feet due to basin over-pumping and lack of sufficient natural recharge. Since then, basin adjudication and managed aquifer recharge by LACDPW, WRD, and others have improved water levels in this area by over 80 feet. Over the past 10 years, groundwater levels in this well have remained relatively constant with only minor fluctuations.

Figure 27 shows water levels recorded in six key wells located in the Montebello Forebay. The top chart in Figure 27 shows water levels from three wells located in the northern Montebello Forebay. The middle chart depicts water levels from two wells in the central Montebello Forebay, and the lower chart depicts one well in the southern Montebello Forebay. For some charts, different wells are depicted because some older wells were destroyed or replaced with a newer monitoring point. Operation of the MFSG has had a significant effect on long-term water levels.

Based on available records, groundwater was at its highest levels in the 1940s and reached its lowest levels in the late 1950s due to over-pumping and insufficient natural and managed aquifer recharge. Recharge of recycled water in the Montebello Forebay beginning in the early 1960s and adjudication of the basins have resulted in increased and a general stabilization of groundwater levels. Dips in water level trends since the 1960s are due to drought (lack of local stormwater for recharge) and/or availability of replenishment water (imported water). This condition was observed in 2009 when water levels in some wells in the Montebello Forebay reached a 32-year low. In WY 2009-10, water levels recovered somewhat due to precipitation recharge and availability of imported water for replenishment.

Because groundwater pumping in the Whittier Area is very limited, there are no available wells with a long-term record of groundwater level monitoring. Water level measurements taken since 2000 from the WRD's nested monitoring well Whittier #1 located in the Whittier Area are very stable with little change over the past 12 years.

Figure 28 shows water levels recorded in two key wells located in the Central Basin Pressure Area. Groundwater level highs were measured in these wells in 1935 and then water levels began dropping (over 110 feet) by 1961 due to over-pumping and insufficient natural recharge. Groundwater levels recovered substantially during the early 1960s as a result of replenishment operations in the Montebello Forebay and reduced pumping. Between 1995 and 2007 there have been 100-foot swings in water levels each year from winter to summer. These swings were due to pumping pattern changes by some of the Central Basin water purveyors who operate with more groundwater in the summer months and less groundwater in the winter months, and took advantage of the WRD's In-Lieu Program[3]. However, since May 2007 the in-lieu water has not been made available by MWD, so pumping has remained more constant throughout the year and water levels remain depressed as shown in the two hydrographs in Figure 28.

Figure 29 shows water levels recorded in five key wells located throughout the West Coast Basin. In 1955, the control of groundwater extractions in the West Coast Basin (i.e.,

[3] The basic premise of WRD's In-Lieu Program is to offset the pumping in the basins to lower the annual overdraft and reduce the artificial replenishment needs. The program helps provide an alternate means of replenishing the groundwater supply by encouraging basin pumpers to purchase surplus imported water, when available, instead of pumping groundwater. This can help raise water levels in areas that are otherwise more difficult to address.

adjudication) resulted in the stabilization and reversal of declining water levels in the central area of the basin (top chart in Figure 29), whereas at the southeastern area near the DGB, water levels continued to decline until about 1971, when a recovery began due mostly to the startup of injection at the DGB. For most wells, water levels along the coast have been rising since the early 1970s in response to injection at the seawater intrusion barriers and reduced pumping (USGS, 2003).

2.8.3 Vertical Groundwater Flow

The USGS/GBMP modeling work describes the vertical movement of groundwater between model layers and subareas. Because most (about 80%) of the active groundwater extraction is from the Upper San Pedro (Model Layer 3) aquifers (Table G-2 and Figure 4), vertical groundwater flow directions are downward from Model Layer 1 to Model Layer 2 to Model Layer 3 in all basins and subareas. In the Montebello Forebay, Los Angeles Forebay, Whittier Area, and Central Basin Pressure Area, there is also a downward vertical gradient from Model Layer 3 to Model Layer 4. In the West Coast Basin, the vertical gradient between Model Layer 3 and 4 is mixed depending on the year, but the net vertical gradient is typically upward from Layer 4 to Layer 3. Because of the significant volume of recharge in the Montebello Forebay, there is large horizontal and vertical movement of water emanating from this subarea (USGS, 2003).

2.9 Water Balance

In order to estimate the baseline and future planning period S/N balances in the CBWCB, it is necessary to have an understanding of the associated volumes of groundwater inflow and outflow (i.e., the water balances). The baseline period covers WY 2000-01 to 2009-10, as established in the LARWQCB-approved *SNMP Workplan* (CBWCB Stakeholders, 2011). The future planning period covers WY 2010-11 to 2024-25. A 10-year future planning period was originally established in the *SNMP Workplan,* but the planning period was extended to 15 years through WY 2024-25 at the recommendation of the LARWQCB. The water balance changes from year to year based on a number of factors, including replenishment activities, precipitation, availability of imported water supplies, subsurface inflow and outflow, and groundwater extraction. The difference between the basin inflow and outflow is the change in groundwater storage.

The baseline period water balances provide estimates of specific inflows and outflows for each basin. The various historical groundwater inflows and outflows are reported by WRD in their annual *Engineering Survey and Report* (available on their website: http://www.wrd.org/engineering/groundwater-engineering-reports.php), by the Central Basin and West Coast Basin Watermaster[4] in their annual *Watermaster Service* reports (available on

[4] As a result of the Judgment issued on December 18, 2013, the California Department of Water Resources is no longer Watermaster of the Central Basin. Beginning July 1, 2014, the Watermaster is now comprised of three entities: 1) Administrative Body, 2) Water Rights Panel, and 3) Storage Panel. The Water Replenishment District of Southern California has been designated as the Administrative Body and will be responsible for preparing the annual *Watermaster Service* reports and submitting them to the Water Rights Panel. The Water Rights Panel is

their website: http://www.water.ca.gov/watermaster/aboutwatermaster/index.cfm), and in the USGS/GBMP modeling reports (USGS, 2003; CH2MHILL, 2012b). The baseline and future planning period water balances are discussed in more detail in Appendix D *Baseline and Future Water Balances.*

2.9.1 Groundwater Recharge (Inflows)

Major sources of groundwater replenishment in the Study Area include:

- Managed aquifer recharge in the spreading grounds, instream facilities, and at the seawater intrusion barriers;
- Deep percolation of precipitation;
- Irrigation return flows;
- Percolation of runoff from surrounding uplands (mountain front recharge); and
- Subsurface groundwater inflow from adjacent groundwater basins.

Other minor potential sources of groundwater recharge include leaking pipes, septic systems, and stream losses (not associated with managed aquifer recharge).

The largest volume of recharge in the Central Basin occurs in the Montebello Forebay via the MFSG and instream facilities in the San Gabriel River. Other sources of recharge include injection at the AGB, subsurface inflows, deep percolation of rainfall, irrigation return flows, and mountain front recharge.

Recharge in the West Coast Basin includes injection at the WCBB and DGB, subsurface inflow, deep percolation of rainfall, mountain front recharge, irrigation return flows, and the DGSG.

In the CBWCB, losses from leaking pipes and septic systems are believed to be small in comparison to the major sources. Stream recharge (other than in the Montebello Forebay) is limited, as most streams are concrete lined.

2.9.2 Groundwater Discharge (Outflows)

Groundwater can leave the CBWCB by:

- Pumping/extraction,
- Subsurface outflow to adjacent basins and the ocean, and
- Groundwater discharge to surface water.

Of these, groundwater pumping is the most significant outflow from both the Central Basin and West Coast Basin. Due to the large pumping depressions in both basins, very little groundwater leaves the Study Area as subsurface outflow and while there is some outflow to adjacent areas, the overall net subsurface flow is into the Study Area. Similarly, as discussed above, because

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ultimately responsible for submitting the final *Watermaster Service* reports to the Superior Court of the State of California for filing.

most streams are concrete lined, there is little opportunity for groundwater discharge to surface water and thus, this source of discharge is assumed to be negligible.

3 Groundwater Quality

In general, groundwater in the main producing aquifers of the CBWCB is of good quality. Localized areas of marginal to poor quality water do exist, primarily at the basin margins where seawater intrusion occurred in the past and also in shallow groundwater near environmental release sites, as discussed further in Section 3.2 *Environmental Release Sites in the CBWCB*.

Between 1900 and the 1950s, groundwater was an important factor in accelerating the urbanization of the CBWCB, which led to increasing demand for groundwater that far exceeded natural freshwater recharge. Excessive over-pumping in the basins caused severe overdraft and created a hydraulic gradient that resulted in seawater intrusion, which contaminated the coastal groundwater aquifers. To address this problem and halt the intrusion, three seawater intrusion barriers were constructed by LACDPW: the WCBB in the mid-1950s, the AGB in the early 1960s, and the DGB in the early 1970s.

While the water injection activities at the barriers were successful in halting further seawater intrusion, these efforts could not address the seawater which had already intruded into the CBWCB before the barriers were constructed. These plumes of saline water, referred to as "saline plumes," are trapped inland of the injection wells, thereby degrading significant volumes of groundwater with high concentrations of chloride and TDS and decreasing the ability of affected aquifers to provide groundwater storage for potable use. These saline plumes are discussed in Section 3.5 *Salt and Nutrient Groundwater Quality*.

Groundwater quality in the CBWCB also reflects current land uses. Environmental release sites are commercial and industrial properties where improper activities (e.g., leaking aboveground and underground storage tanks, leaking pipelines, spills, and illegal discharges, etc.) have contaminated groundwater with localized plumes of petroleum fuels, solvents, and other constituents of concern. In general, these plumes are predominantly limited to shallow groundwater. However, as the aquifers and confining layers in the CBWCB are typically inter-fingered, the quality of groundwater in the deeper production aquifers is threatened by the migration of pollutants from the upper aquifers. This is particularly true in the forebay areas. Environmental release sites in the CBWCB have been or are being investigated/remediated under the oversight of Federal and State regulatory agencies, including the United States Environmental Protection Agency, the LARWQCB, and the California Department of Toxic Substances Control.

TDS, chloride, and nitrate were selected as appropriate representative constituents of salt and nutrients in the CBWCB, as further described in Section 3.1 *Selection of Indicator Parameters of Salt and Nutrients*. The criteria and section process are presented in the following section. Common constituents associated with environmental release sites, special recycled water studies for 1,4-dioxane and n-nitrosodimethylamine (NDMA), and constituents of emerging concern (CECs) are also discussed below.

3.1 Selection of Indicator Parameters of Salt and Nutrients

The LARWQCB-approved SNMP Workplan (CBWCB Stakeholders, 2011) included a list of constituents with Water Quality Objectives (WQOs), per the Basin Plan (LARWQCB, 1994), to be included for discussion in the SNMP. In this SNMP, WQOs are also referred to as Basin Plan Objectives (BPOs). **Table G-6** shows the list of potential constituents[5] for evaluation in the SNMP and the applicable regulatory limit and/or WQO.

To determine the constituents that would be most representative of salt and nutrients in the CBWCB, the following criteria/questions were developed to evaluate the constituents for evaluation in the SNMP:

1. Is the constituent regularly monitored and detected in source waters?
2. Is the constituent a salt or nutrient representative of other salts and nutrients?
3. Is the constituent conservative and mobile in the environment?
4. Is the constituent found in source waters at concentrations above those found in ambient groundwater?
5. Does the constituent have high toxicity for human health?
6. Is the constituent a known contaminant in groundwater in the Study Area?
7. Does the constituent have an effluent limit in a National Pollution Discharge Elimination System (NPDES) permit or a recycled water limit in Waste Discharge Requirements or Water Recycling Requirements issued by the LARWQCB?

Each selected indicator constituent of salt and nutrients is not required to meet all the criteria listed above, but as a group, at least one should meet each criterion. Based on the criteria described above and as further explained below, TDS, chloride, and nitrate are the most representative indicator constituents of salt and nutrients in the CBWCB. In considering constituents of concern, water quality in the MFSG was the primary focus of discussion because it is the largest single source of recycled water recharge in the Study Area.

Other constituents listed in Table G-6 occur naturally in groundwater and typically are not found at elevated concentrations in source waters. TDS, chloride, and nitrate satisfy the indicator selection criteria and are representative of other salts and nutrients. **Table G-7** summarizes the section criteria matrix for TDS, chloride, and nitrate as well as the constituents described in the following sections.

3.1.1 Total Dissolved Solids (TDS)

Total salinity is commonly expressed in terms of TDS as milligrams per liter (mg/L). Because TDS monitoring data are widely available for source waters (both inflows and outflows) in the

[5] Constituents identified in Final Revised Workplan Salt/Nutrient Management Plan (CBWCB Stakeholders, 2011) for preliminary consideration for the SNMP.

CBWCB and because TDS is a general indicator of total salinity, it is appropriate to designate TDS as an indicator for other salts and nutrients.

Table G-6 Regulatory Limits and/or Basin Plan Objectives for Potential Constituents of Concern in Groundwater in the CBWCB

Constituent	Primary MCL	SMCL	Basin Plan Objective	
			Central Basin	West Coast Basin
TDS	NA	1,000 mg/L	700 mg/L	800 mg/L
Sulfate	NA	500 mg/L	250 mg/L	250 mg/L
Chloride	NA	500 mg/L	150 mg/L	250 mg/L
Boron	NA	NA	1.0 mg/L	1.5 mg/L
Nitrate as Nitrate (NO_3)	45 mg/L	NA	45 mg/L	45 mg/L
Nitrate as Nitrogen (NO_3-N) [a,b]	10 mg/L	NA	10 mg/L	10 mg/L
Nitrite as Nitrogen (NO_2-N) [b]	1 mg/L	NA	1 mg/L	1 mg/L
Nitrate plus Nitrite, sum as Nitrogen (NO_3-N + NO_2-N) [b]	10 mg/L	NA	10 mg/L	10 mg/L
Arsenic	10 mg/L	NA	10 µg/L	10 µg/L
Iron	NA	300 µg/L	NA	NA
Manganese	NA	50 µg/L	NA	NA
Color	NA	15 Units	NA	NA
Odor	NA	3 TON	NA [c]	NA [c]

MCL – Maximum Contaminant Level
SMCL – Secondary Maximum Contaminant Level
NA – not applicable
mg/L – milligrams per liter
µg/L – micrograms per liter
TON – Threshold Odor Number
a – MCL based on NO_3-N plus NO_2-N
b – NO_3-N was used to represent nitrogen compounds for the SNMP (see Section 3.1.3 *Nitrate* for discussion)
c – The Basin Plan states, "*Ground waters shall not contain taste or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses." (LARWQCB, 1994)*

Table G-7 Salt and Nutrient Selection Criteria

Criteria/Questions	Potential Constituents of Concern in Groundwater for Evaluation in the SNMP										
	TDS	Sulfate	Chloride	Boron	Nitrate-N Nitrate-NO_3	Nitrite-N	Arsenic	Iron	Manganese	Color	Odor
1. Is the constituent regularly monitored and detected in source waters?	X	X	X	X	X	X	X	X	X		
2. Is the constituent a salt or nutrient representative of other salts and nutrients?	X				X						
3. Is the constituent conservative and mobile in the environment?		X		X	X						
4. Is the constituent found in source waters at concentrations above those found in ambient groundwater?			X								
5. Does the constituent have high toxicity for human health?					X	X	X				
6. Is the constituent a known contaminant in groundwater?			X								
7. Does the constituent have an effluent limit in a National Pollutant Discharge Elimination (NPDES) permit or a recycled water limit in Waste Discharge Requirements or Water Recycling Requirements issued by the LARWQCB?	X	X		X	X		X	X	X	X	

TDS – total dissolved solids Nitrate-N – nitrate as nitrogen Nitrate-NO_3 – nitrate as nitrate Nitrite-N – nitrite as nitrogen
LARWQCB – Los Angeles Regional Water Quality Control Board

For the San Jose Creek WRP, the NPDES effluent limit is 750 mg/L (monthly average), based on the BPO[6] for the San Gabriel River watershed (eastern portion of the Study Area [see Figure 20], specifically between Ramona Boulevard and Firestone Boulevard in the City of Los Angeles). In comparison, the recycled water limit for irrigation is 800 mg/L and the limit for recycled water recharged in the Montebello Forebay is 700 mg/L. The Basin-Specific Basin Plan Objective (BSBPO)[7] for TDS in the Central Basin is 700 mg/L and 800 mg/L in the West Coast Basin.

As established by the SWRCB Division of Drinking Water (formerly California Department of Public Health [CDPH]), the Recommended Secondary Maximum Contaminant Level[8] (SMCL) for TDS is 500 mg/L, with an upper limit of 1,000 mg/L and a short-term limit of 1,500 mg/L. While TDS can be an indicator of anthropogenic impacts, there are also natural background TDS levels in groundwater. The background TDS concentrations in groundwater can vary considerably based on purity and crystal size of the minerals, rock texture and porosity, the regional structure, origin of sediments, the age of the groundwater, and many other factors (Hem, 1989). TDS is generally detected below the SMCL of 1,000 mg/L in production wells (i.e. ambient groundwater) in the CBWCB.

Elevated TDS concentrations are undesirable for aesthetic reasons related to taste, odor, or appearance of the water and not for health reasons; however, elevated TDS concentrations in water can damage crops, affect plant growth, and damage municipal and industrial equipment. Reduced salinity (lower TDS concentrations) increases the life of plumbing systems and appliances, increases equipment service life, decreases industrial costs for water treatment, increases agricultural yields, reduces the amount of water used for leaching, reduces brine disposal costs and improves the usability of recycled water (MWD and USBOR, 1999). TDS is conservative and mobile in the environment. Conservative, in this context, means a constituent that does not interact with subsurface media (vadose zone and saturated zone) and therefore, is not readily attenuated in the subsurface.

3.1.2 Chloride

Chloride is an inorganic salt that is naturally-occurring in groundwater and is commonly expressed in terms of mg/L. High concentrations of chloride near the coast may indicate seawater influence. Historical seawater intrusion is a significant groundwater contamination problem in the West Coast Basin and Central Basin. Chloride is the constituent used in the

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[6] Basin Plan Objectives (BPOs), also referred to as Water Quality Objectives (WQOs), are numerical limits established for various constituents in groundwater. BPOs are set forth in the Basin Plan that was issued by the LARWQCB in 1994 (LARWQCB, 1994).

[7] Basin-Specific Basin Plan Objectives (BSBPOs) are numerical limits unique to a particular basin or subbasin, as set for in the Basin Plan.

[8] A Secondary Maximum Contaminant Level (SMCL) is a water quality standard established by the State Water Resources Control Board, Division of Drinking Water (formerly California Department of Public Health) to manage drinking water for aesthetic considerations, such as taste, color, and odor. Contaminants with only SMCLs are not considered to pose a risk to human health.

CBWCB to provide a general indicator of seawater intrusion and is therefore an appropriate indicator of salt. The chloride concentration of seawater is about 19,000 mg/L.

As established by the SWRCB Division of Drinking Water (formerly CDPH), the recommended SMCL for chloride is 250 mg/L, with an upper limit of 500 mg/L and a short-term limit of 600 mg/L. The BSBPO for chloride is 150 mg/L and 250 mg/L in the Central Basin and West Coast Basin, respectively. Chloride is generally detected below the SMCL of 500 mg/L in production wells (i.e. ambient groundwater) in the CBWCB.

Similar to TDS, elevated chloride concentrations are undesirable for aesthetic reasons related to taste, odor, or appearance of the water and not for health reasons; however, elevated chloride concentrations in water can damage crops, affect plant growth, and damage municipal and industrial equipment. Reduced salinity (lower chloride concentrations) increases the life of plumbing systems and appliances, increases equipment service life, decreases industrial costs for water treatment, increases agricultural yields, reduces the amount of water used for leaching, reduces brine disposal costs and improves the capability to use recycled water (MWD and USBOR, 1999). Chloride is conservative and mobile in the environment. Conservative, in this context, means a constituent that does not interact with subsurface media (vadose zone and saturated zone) and therefore, is not readily attenuated in the subsurface.

3.1.3 Nitrate

Nitrate is a colorless, odorless, and tasteless compound that is present in some groundwater and is commonly expressed in terms of mg/L. Nitrate is a health concern due to methemoglobinemia, or "blue baby syndrome," which affects infants. Elevated levels may also be unhealthy for pregnant women (SWRCB, 2010). High levels of nitrate in groundwater are associated with agricultural activities, septic systems, confined animal facilities, landscape fertilization, and wastewater treatment facilities. Additionally, airborne nitrogen compounds discharged from industry and automobiles are deposited on the land in precipitation and as dry particles, referred to as dry deposition. These sources also contribute to nitrate loading to groundwater.

The fate and transport of nitrogen compounds in the environment is very complex. Nitrate is the primary form of nitrogen detected in groundwater. It is soluble in water and can easily pass through soil to the groundwater table. It can also be added to percolating water through dissolution of formation media. Nitrate can persist in groundwater for decades and accumulate to high levels as more nitrogen is applied to the land surface every year in basins with significant sources of nitrate loading. Nitrate can be removed naturally from water through denitrification.

The BPOs for nitrate and other nitrogen compounds are equivalent to their respective primary Maximum Contaminant Levels[9] (MCLs). Natural nitrate as nitrate (nitrate-NO_3) levels in

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[9] The primary Maximum Contaminant Level (MCL) is the highest level of a contaminant that is allowed in drinking water and is protective of human health. Primary MCLs are established by the United States Environmental Protection Agency and the State Water Resources Control Board (SWRCB), Division of Drinking Water (formerly

groundwater in the CBWCB, are generally very low (typically less than 10 mg/L as NO_3) and well below the MCL/BPO of 45 mg/L. Nitrate as nitrogen (nitrate-N) plus nitrite as nitrogen (nitrite-N) has an MCL/BPO of 10 mg/L.

Based on this discussion, nitrate-N was selected as the most representative indicator chemical for nitrogen compounds and other nutrients in the CBWCB.

3.1.4 Other Nitrogen Compounds

Table G-6 lists other nitrogen compounds in addition to nitrate-N, and includes nitrate-NO_3, nitrite-N, and nitrate-N plus nitrite-N. Nitrate-NO_3 is equivalent to nitrate-N and a simple calculation can be used to convert one to the other (nitrate-NO_3 = nitrate-N x 4.425). In reviewing the data, it was determined that more of the source water data was reported in nitrate-N, so it was selected as the constituent to represent nitrogen/nutrient loading. In cases where only nitrate-NO_3 data are available, it was converted to nitrate-N for use in the SNMP loading analysis. As nitrate is the primary form of oxidized nitrogen found in groundwater, it was selected to represent all other nitrogen compounds and other nutrients in the CBWCB.

3.1.5 Boron

Boron is a naturally occurring element in soil and groundwater; concentrations depend on the local geology. Other boron sources include industrial waste discharges, particularly from tallow manufacturing. Boron in excess of its Notification Level (NL)[10] of 1 mg/L may have an increased risk of fetal developmental effects, based on studies in laboratory animals.

For the San Jose Creek WRP, the NPDES effluent limit is 1.0 mg/L (monthly average), based on the BPO for the San Gabriel River watershed (eastern portion of the Study Area [see Figure 20], specifically between Ramona Boulevard and Firestone Boulevard in the City of Los Angeles). The limit for recycled water recharged in the Montebello Forebay is 1.0 mg/L, equivalent to the Central Basin BPO. In the West Coast Basin, the BPO for boron is 1.5 mg/L.

The average ambient boron concentration in production wells in the Central Basin Pressure Area[11] (0.9 mg/L, which is just below the BPO of 1.0 mg/L) is slightly higher than the average recycled water concentration of 0.3 mg/L in the effluent of WRPs recharging the MFSG, based on the recent five years of data. Hence, boron detections in the Central Basin Pressure Area are naturally occurring and not related to recycled water recharge. Because of the relatively low

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California Department of Public Health) and reflect not only the chemicals' health risks but also factors such as their detectability and treatability, as well as the cost of treatment.

[10] Notification levels (NLs) are health-based advisory levels established by the SWRCB Division of Drinking Water (formerly California Department of Public Health) for chemicals in drinking water that lack maximum contaminant levels (MCLs). When chemicals are found at concentrations greater than their notification levels, certain requirements and recommendations apply to water purveyors.

[11] The average concentration in production wells the Central Basin Pressure Area is thought to be most representative of ambient groundwater conditions compared with other areas because the production wells tap the deeper confined aquifers unlikely to be influenced by surface releases from irrigation return flows or managed aquifer recharge from the Montebello Forebay Spreading Grounds or the three seawater barriers.

levels detected in the effluent of WRPs and the comparable but higher average levels observed in groundwater, boron was not designated as an indicator compound for S/Ns in the CBWCB and was not selected for further evaluation in the SNMP.

3.1.6 Arsenic

Arsenic is an element found in the earth's crust and thus, can occur naturally in groundwater. Natural sources of arsenic in groundwater include weathering and erosion of rocks. Groundwater contamination with arsenic can also result from industrial releases from wood preserving, semiconductor manufacturing, petroleum refining, animal feed additives, and herbicide use. Arsenic is classified as a known human carcinogen and also causes other health effects, such as high blood pressure, diabetes, and vascular and skin effects. The primary MCL and accordingly, the BPO for arsenic is 10 micrograms per liter (µg/L).

In WY 2010-11, arsenic was detected at concentrations greater than the BPO in 20% of WRD's nested monitoring wells in the Central Basin and 21% of the nested wells in the West Coast Basin (WRD, 2012). The widespread distribution of arsenic detections indicates it is predominantly naturally occurring as a result of leaching from formation deposits and is unrelated to managed aquifer recharge operations in the CBWCB. Accordingly, arsenic does not appear to be a chemical of concern for recycled water use and groundwater recharge projects as discussed below.

If there is no reasonable potential to exceed the arsenic water quality criterion, wastewater treatment plant NPDES permits (for example, the San Jose Creek WRP NPDES Permit) do not include an effluent limitation for arsenic. In contrast, recycled water permits for groundwater recharge and seawater intrusion barrier projects include arsenic limits based on the MCL/BPO of 10 µg/L. The average ambient arsenic concentration in production wells in the Pressure Area of the Central Basin (13 µg/L, which is above the BPO of 10 µg/L) is greater than the average recycled water concentration of 1.1 µg/L in the effluent of WRPs recharging the MFSG, based on the recent five years of data. Because of the relatively low levels detected in recycled water and the higher concentrations observed in groundwater, it is clear that arsenic is naturally occurring and not the result of recharged recycled water.

In 2011, arsenic was detected in the shallowest aquifer zone (Recent Aquifer) near the AGB at a maximum concentration of 27 µg/L, above the MCL/BPO of 10 µg/L. Since recycled water is not delivered to the Recent Aquifer, this excursion cannot be attributed to recycled water recharge. Since injection of recycled water began at the AGB, arsenic in the Recent Aquifer occasionally has been detected above the MCL/BPO; however, arsenic has not been detected in the water (i.e., blend of recycled and treated imported water) delivered to AGB for injection, nor in the deeper aquifers receiving the injected water. Thus, naturally-occurring arsenic levels in groundwater are higher than the relatively low concentrations detected in recycled water used for recharge.

Based on the discussion above, arsenic was not designated as an indicator compound for S/Ns in the CBWCB and was not selected for further evaluation in the SNMP.

3.1.7 Iron

Iron is a naturally-occurring constituent in groundwater and can also be leached from steel pipes. Elevated iron concentrations can affect the water's suitability for domestic or industrial uses. The SMCL for iron, based on aesthetic concerns, is 300 µg/L. High concentrations of iron in water can stain plumbing fixtures and clothing, encrusts well screens, clogs pipes, and may affect taste and odor. It is considered an essential nutrient for human health and does not pose significant health effects except in special cases. Some industrial processes cannot tolerate more than 100 µg/L of iron in water. Iron is occasionally detected in production wells (i.e. ambient groundwater) in the CBWCB at concentrations above the SMCL.

If there is no reasonable potential to exceed the iron water quality criterion, NPDES permits do not include an effluent limitation for iron (for example, the San Jose Creek WRP NPDES Permit). In contrast, recycled water permits for groundwater recharge and seawater intrusion barrier projects include iron limits based on the SMCL. The average iron concentration in production wells in the Pressure Area of the Central Basin[10] (131 µg/L, which is significantly below the SMCL of 300 µg/L) is higher than the average recycled water concentration of 97 µg/L in the effluent of WRPs recharging the MFSG, based on the recent five years of data. Thus, iron detections in groundwater are naturally occurring and not related to recycled water use or recharge.

Because the iron concentrations in recycled water are lower than the average concentration in ambient groundwater, iron was not designated as an indicator compound for S/Ns in the CBWCB and was not selected for further evaluation in the SNMP.

3.1.8 Manganese

Manganese is a naturally occurring constituent in groundwater. The SMCL for manganese, based on aesthetic concerns, is 50 µg/L. Similar to iron, elevated manganese concentrations are objectionable in water. Manganese in water can cause black staining of fixtures and laundry and affect taste and odor. Like iron, manganese is considered an essential nutrient for human health. Manganese is sometimes detected in production wells (i.e. ambient groundwater) in the CBWCB at concentrations above the SMCL.

Recycled water permits for groundwater recharge and seawater intrusion barrier projects include manganese limits based on the SMCL. The average manganese concentration in production wells in the Pressure Area of the Central Basin[10] (88 µg/L, which is greater than the SMCL of 50 µg/L) is higher than the average recycled water concentration of 13 µg/L in the effluent of WRPs recharging the MFSG, based on the recent five years of data. Hence, elevated manganese detections in the CBWCB are naturally occurring and not related to recycled water use or recharge.

Because of the relatively low manganese levels detected in recycled water and the fact that the concentrations in groundwater are higher than in recycled water, manganese was not designated as an indicator compound for S/Ns in the CBWCB and was not selected for further evaluation in the SNMP.

3.1.9 Color

Many constituents found in water can affect the color. Colored water is often the result of natural conditions (e.g., from plants and minerals) or from rusty pipes or air entrainment. Color is primarily an aesthetic concern, so it has a SMCL of 15 units. Groundwater samples from production wells in the CBWCB frequently exceed the color SMCL.

Color does not have an NPDES effluent limit. Recycled water permits for groundwater recharge and seawater intrusion barrier projects include color limits based on the SMCL (although the groundwater replenishment permits issued to SDLAC in 2011 have eliminated color from the list of regulated constituents[12]). The average color measurement in production wells in the Pressure Area of the Central Basin[9] (16 units, which is just above the SMCL of 15 units) is higher than the average recycled water measurement of 10 units in the effluent of WRPs recharging the MFSG, based on the recent five years of data. Hence, elevated color levels in the CBWCB are naturally occurring and not related to recycled water use or recharge.

Because the color levels in recycled water are lower than in ambient groundwater, color was not designated as an indicator compound for S/Ns in the CBWCB and was not selected for further evaluation in the SNMP.

3.2 Environmental Release Sites in the CBWCB

Environmental release sites are commercial and industrial properties where improper activities (e.g., leaking aboveground and underground storage tanks, leaking pipelines, spills, illegal discharges, etc.) have contaminated groundwater with localized plumes of petroleum fuels, solvents, and other hazardous substances. In general, these plumes are predominantly limited to shallow groundwater. However, as the aquifers and confining layers in these alluvial basins are typically inter-fingered, the quality of groundwater in the deeper production aquifers is threatened by the migration of pollutants from the upper aquifers. This is particularly true in the Forebay areas. Environmental release sites in the CBWCB have been or are being investigated/remediated under the oversight of Federal and State regulatory agencies, including the United States Environmental Protection Agency (USEPA), the LARWQCB, and the California Department of Toxic Substances Control (DTSC).

Figure 30 shows all active and inactive environmental release sites in the Study Area, including land disposal sites, military sites, cleanup program sites, and active or proposed Superfund sites. Active sites refer to properties currently being investigated or cleaned up under regulatory agency review or oversight. Inactive sites indicate cases that have been closed by the relevant regulatory agency. As shown in Figures 30 and 31, there are thousands of environmental release sites in the Study Area. Nonetheless, relatively few sites have impacted deeper water supply aquifers in the CBWCB.

For Superfund sites and active land disposal sites, call-out boxes show the name of the site and the main constituents of concern (COCs). Chemicals commonly associated with the environmental release sites in the CBWCB are trichloroethylene (TCE), tetrachloroethylene

[12] Information provided by Monica Gasca, SDLAC.

(PCE), metals, perchlorate, and hexavalent chromium. While 1,4-dioxane is not identified as a COC at any contaminated sites listed in the SWRCB's Geotracker online database (http://geotracker.waterboards.ca.gov/), 1,4-dioxane is known to be a COC at some environmental release sites. Figure 31 shows active and inactive leaking underground storage tank (LUST) sites. The primary COCs associated with LUST sites are petroleum hydrocarbons and gasoline additives, including benzene, toluene, ethylbenzene, xylenes, and methyl tertiary butyl ether (MTBE).

In an effort to minimize or eliminate threats to groundwater supplies, WRD established the Groundwater Contamination Prevention Program. As part of this program, WRD created and administers the CBWCB Groundwater Contamination Forum, a data-sharing and discussion forum with key stakeholders that include the United States Environmental Protection Agency (USEPA), California Department of Toxic Substances Control (DTSC), LARWQCB, CDPH (now the SWRCB Division of Drinking Water), USGS, and various cities and drinking water purveyors. In 2005, these stakeholders drafted and signed a Memorandum of Understanding, agreeing to meet regularly and share data on groundwater contaminated sites within the CBWCB. As a key stakeholder, WRD has been tracking and working in close consultation with the regulatory agencies to provide data and technical support to expedite investigations and cleanups at priority groundwater contaminated sites within the CBWCB.

Priority environmental release sites in the CBWCB were selected by WRD, with input from the other members of the CBWCB Groundwater Contamination Forum, based on certain criteria such as hydrogeology, depth and concentration of the contaminants, fate and transport of the COCs, distance to nearby water supply wells, presence of contaminated drinking water wells in the site vicinity, proximity to recharge areas, and status of site characterization/remediation. **Table G-8** is a list of WRD's current priority groundwater contaminated sites, principle constituents of concern, and weblinks to where information regarding these sites can be found in online agency databases that are accessible to the public**.** Figure 32 provides the locations of these sites and the associated index number indicated in Table G-8. Sites are continuously added or removed from WRD's list based on ongoing evaluations of the criteria.

Currently, WRD monitors many contaminants (as well as salt and nutrients) in over 300 nested wells at more than 55 locations throughout the CBWCB and compiles and evaluates the data and Title 22 water quality data from production wells as part of their annual *Regional Groundwater Monitoring Reports*, which are available for downloading from the WRD website (http://www.wrd.org/engineering/groundwater-engineering-reports.php). Each of WRD's nested wells are screened in a specific aquifer. This monitoring and reporting is part of WRD's mission to preserve groundwater quality in the CBWCB.

Table G-8 WRD's Current List of Priority Environmental Release Sites

No.	Lead Agency	Site Name [a]	Address	City	Primary Contaminants of Concern	Agency Website for Additional Info Regarding Site
1	DTSC	AAD	2306 E. 38th Street	Vernon	VOCs, perchlorate	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=19000031
2	DTSC	Angeles Chemical Company, Inc.	8915 Sorensen Avenue	Santa Fe Springs	TPH as gasoline, VOCs, 1,4-Dioxane	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=19290306
3	RWQCB	ARCO Refinery (BP Carson Refinery)	1801 E. Sepulveda Boulevard	Carson	TPH, Oxygenates, VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL372412434
4	RWQCB	Ashland Chemical	13161 Sandoval Street	Santa Fe Springs	VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL376492472
5	RWQCB	Barken's Hardchrome	239 E. Greenleaf Blvd.	Compton	Metals, VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL204CP1893
6	DTSC	Basin By-Products	3031 I Street	Wilmington	VOCs, SVOCs, Metals	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=19290278
7	RWQCB	Boeing C-6 Facility	19503 S. Normandie Avenue	Los Angeles	VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL0603776467
8	RWQCB	BP Chemicals (Hitco)	1600 West 135th Street	Gardena	VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL204791669
9	DTSC	Chrome Crankshaft Company	6845 Florence Place	Bell Gardens	VOCs, chromium, hexavalent chromium, Oxgenates	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=19350473
10	USEPA	Cooper Drum Company	9316 Atlantic Avenue	South Gate	VOCs	http://yosemite.USEPA.gov/r9/sfund/r9sfdocw.nsf/3dec8ba3252368428825742600743733/8a19f6ae3f4f26ad88257007005e941a!OpenDocument#comm

Table G-8 WRD's Current List of Priority Environmental Release Sites (continued)

No.	Lead Agency	Site Name [a]	Address	City	Primary Contaminants of Concern	Agency Website for Additional Info Regarding Site
11	USEPA	Del Amo Facility	Del Amo Blvd & Vermont Ave	Los Angeles	VOCs	http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dec8ba3252368428825742600743733/f6f8bfd87351904d88257007005e93fd!OpenDocument
12	RWQCB	Fairchild Space - Manhattan Beach	1800 Rosecrans Avenue	Manhattan Beach	VOCs, chromium, hexavalent chromium Oxgenates	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL184091392
13	RWQCB	Former Master Sun Cleaners	2405 Rosecrans Ave	Gardena	VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100000007
14	RWQCB	Former Western Chemical Facility (a.k.a., All-Tex Inks Corporation)	14650 E Firestone Blvd	La Mirada	VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL204CA2325
15	DTSC	Foss Plating	8140 Secura Way	Santa Fe Springs	Metals, VOCs	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=71002169
16	RWQCB	Golden West Refinery	13539 Foster Road	Santa Fe Springs	TPH, VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL373412444
17	DTSC	Hard Chrome Discovery Site	Vicinity of 716 East 56th St & Avalon Blvd.	Los Angeles	Metals, VOCs	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=60000687
18	DTSC	Hard Chrome Products	617 E. 56th Street	Los Angeles	Chromium, VOCs	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=19340231

Table G-8 WRD's Current List of Priority Environmental Release Sites (continued)

No.	Lead Agency	Site Name [a]	Address	City	Primary Contaminants of Concern	Agency Website for Additional Info Regarding Site
19	RWQCB	Honeywell International Corp. (El Segundo)	850 S. Sepulveda Boulevard	El Segundo	VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL204781668
20	RWQCB	Honeywell International Corp. (Sepulveda)	9851 S. Sepulveda Blvd	Los Angeles	VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL184101393
21	RWQCB	Industrial Polychemical Serv.	17109 S. Main Street	Gardena	VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0603704654
22	DTSC	J&S Chrome Plating	6863 E. Florence Place	Bell Gardens	Chromium, VOCs	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=19340358
23	DTSC	Jefferson New Middle School #1 (Los Angeles)	644 E. 56th Street	Los Angeles	VOCs, Metals	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=19820012
24	USEPA	Jervis B. Webb		Southgate	VOCs	http://www.epa.gov/superfund/sites/npl/nar1846.htm
25	DTSC	LAUSD South Region High School #8	NE Corner of Randolf St & Walker Ave	Maywood	TPH and VOCs	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=60000820
26	DTSC	Martin Metal Finishing	12150 South Alameda Street	Lynwood	VOCs	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=80001435
27	DTSC	McKesson Chemical Company	9005 Sorenson Avenue	Santa Fe Springs	VOCs	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=19280440
28	RWQCB	Mobil - Torrance Refinery (Torrance)	3700 W. 190th Street	Torrance	VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL372452438

Table G-8 WRD's Current List of Priority Environmental Release Sites (continued)

No.	Lead Agency	Site Name [a]	Address	City	Primary Contaminants of Concern	Agency Website for Additional Info Regarding Site
29	DTSC	Montrose Chemical Corp.	20201 Normandie Avenue	Torrance	DDT	http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/7508188dd3c99a2a8825742600743735/b7db9903773ec74188257007005e93ed!OpenDocument
30	USEPA	Omega Chemical Corp.	12504 and 12512 E. Whittier Boulevard	Whittier	VOCs	http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dec8ba3252368428825742600743733/00664a6e0727ce2788257007005e93f1!OpenDocument
31	USEPA	Operating Industries, Inc. Landfill	900 Potrero Grande Drive	Monterey Park	VOCs	http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/7508188dd3c99a2a8825742600743735/5f20edf449dd900688257007005e9415!OpenDocument
32	USEPA	Pemaco Maywood	5973 S. District Blvd.	Maywood	VOCs	http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/7508188dd3c99a2a8825742600743735/8fe2b4e33364497e88257007005e9404!OpenDocument
33	DTSC	Phibro-Tech, Inc.	8851 Dice Road	Santa Fe Springs	Chromium, Cadmium, VOCs	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=80001582
34	RWQCB	Powerine Oil Co.	12345 Lakeland Road	Santa Fe Springs	VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL372492442
35	USEPA	Seam Master Industires		Southgate	VOCs	http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dc283e6c5d6056f88257426007417a2/207ef63b57099ae388257913007fe21e!opendocument
36	RWQCB	Shell Los Angeles Refinery (Wilmington)	2101 E. Pacific Coast Hwy	Wilmington	TPH, Oxygenates, VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL372432436

Table G-8 WRD's Current List of Priority Environmental Release Sites (continued)

No.	Lead Agency	Site Name [a]	Address	City	Primary Contaminants of Concern	Agency Website for Additional Info Regarding Site
37	DTSC	Montrose Chemical Corp.	20201 Normandie Avenue	Torrance	DDT	http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/7508188dd3c99a2a8825742600743735/b7db9903773ec74188257007005e93ed!OpenDocument
38	USEPA	Omega Chemical Corp.	12504 and 12512 E. Whittier Boulevard	Whittier	VOCs	http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dec8ba3252368428825742600743733/00664a6e0727ce2788257007005e93f1!OpenDocument
39	USEPA	Operating Industries, Inc. Landfill	900 Potrero Grande Drive	Monterey Park	VOCs	http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/7508188dd3c99a2a8825742600743735/5f20edf449dd900688257007005e9415!OpenDocument
40	USEPA	Pemaco Maywood	5973 S. District Blvd.	Maywood	VOCs	http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/7508188dd3c99a2a8825742600743735/8fe2b4e33364497e88257007005e9404!OpenDocument
41	DTSC	Phibro-Tech, Inc.	8851 Dice Road	Santa Fe Springs	Chromium, Cadmium, VOCs	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=80001582
42	RWQCB	Powerine Oil Co.	12345 Lakeland Road	Santa Fe Springs	VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL372492442
43	USEPA	Seam Master Industires		Southgate	VOCs	http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dc283e6c5d6056f88257426007417a2/207ef63b57099ae388257913007fe21e!opendocument
44	RWQCB	Shell Los Angeles Refinery (Wilmington)	2101 E. Pacific Coast Hwy	Wilmington	TPH, Oxygenates, VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL372432436

Table G-8 WRD's Current List of Priority Environmental Release Sites (continued)

No.	Lead Agency	Site Name [a]	Address	City	Primary Contaminants of Concern	Agency Website for Additional Info Regarding Site
45	DTSC	Vernon-Commerce Discovery Project		Cities of Vernon, Commerce, Huntington Park, and Maywood	VOCs	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=60001403
46	USEPA	Waste Disposal, Inc.	12731 E. Los Nietos Road	Santa Fe Springs	VOCs	http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/7508188dd3c99a2a8825742600743735/5e5db014c58fd78088257007005e9419!OpenDocument
47	RWQCB	Whittier ARCO	10802 Whittier Boulevard	Whittier	VOCs	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0603793017
48	DTSC	Wilmington/ Gramercy Right-of-Way	East & adjacent to I-110 Fwy	Los Angeles	VOCs, SVOCs, Metals	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=19490245
49	USEPA	Southern Avenue Industrial Area	Firestone Blvd. and Rayo Ave.	Southgate	VOCs	http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dec8ba3252368428825742600743733/d9acef4a71cbca01882579130078b555!OpenDocument

VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
TPH - total petroleum hydrocarbons
RWQCB - Regional Water Quality Control Board
DTSC - Department of Toxic Substances Control
USEPA - United States Environmental Protection Agency
a - Sites are listed in alphabetical order, with the exception of Site No. 49

Contamination from environmental release sites is generally localized and limited to shallow aquifers. The fate and transport of the constituents associated with these sites is dependent on local site-specific characteristics such as lithology. Typically, the volumes of chemicals released from contaminated sites are not known and cannot be accurately estimated. Also, the timing and duration of the releases are typically unknown. Therefore, loading analyses for these sites and associated COCs are infeasible. As stated earlier, environmental release sites in the CBWCB are actively investigated, monitored, and remediated under existing programs managed by the LARWQCB, DTSC, USEPA, and other local regulatory agencies. Accordingly, detailed analysis of releases and loading from contaminated sites was not conducted as part of the SNMP. However, a brief overview discussion of key chemicals associated with environmental release sites is provided below, largely based on WRD's *WY 2010-2011 Regional Groundwater*

Monitoring Report (WRD, 2012), as well as databases/websites maintained by regulatory agencies, including the LARWQCB, DTSC, and USEPA.

3.2.1 Trichloroethylene (TCE)

TCE is a solvent used in metal degreasing, textile processing, and dry cleaning. Because of its potential health effects, it has been classified as a probable human carcinogen. TCE contamination is associated with point sources and is not widely detected in groundwater in the CBWCB at concentrations above the primary MCL of 5 µg/L. In 2010-11, TCE was below the MCL in 90% of WRD's nested monitoring wells in the Central Basin and 95% of the nested wells in the West Coast Basin. No Central Basin or West Coast Basin nested wells screened in the Silverado Aquifer, the main producing aquifer in the Study Area, contained a detectable TCE concentration in 2010-11 (WRD, 2012).

For production wells sampled between 2008 and 2011, TCE was mostly undetected or detected below the MCL in most wells located in the CBWCB. Of the 279 CBWCB production wells that were sampled, only 17 wells contained TCE above the MCL; these wells are located in the northern portion of the Central Basin, within or near the Montebello Forebay and Los Angeles Forebay. TCE was not detected in any production wells located in the West Coast Basin (WRD, 2012).

3.2.2 Tetrachloroethylene (PCE)

PCE is a solvent used commonly in the dry cleaning industry, as well as in metal degreasing and textile processing. Like TCE, PCE is a probable human carcinogen. During 2010-11, PCE was not detected above its primary MCL of 5 µg/L in any of WRD's nested monitoring wells in the CBWCB.

For production wells sampled between 2008 and 2011, PCE was mostly undetected or detected below the MCL in most wells located in the CBWCB. Of the 279 CBWCB production wells that were sampled, only 17 wells contained PCE above the MCL; these wells are located in the northern portion of the Central Basin, within or near the Montebello Forebay. PCE was not detected in any production wells located in the West Coast Basin (WRD, 2012).

3.2.3 Perchlorate

Major sources of perchlorate contamination in California groundwater include facilities manufacturing rockets, missiles, road flares, and fireworks. Perchlorate contamination of groundwater has also been attributed to the use of Chilean fertilizer. Perchlorate can occur naturally in the environment; although, typically at very low concentrations. Perchlorate is rarely detected above its primary MCL of 6 µg/L in WRD's monitoring wells or production wells within the CBWCB (WRD, 2012). However, perchlorate has been detected at elevated concentrations in groundwater beneath some contaminated sites located in the Los Angeles Forebay.

3.2.4 Hexavalent Chromium

Hexavalent chromium, along with trivalent chromium, are two forms of the metal chromium. Together, these forms of chromium are designated as "total chromium." Hexavalent chromium is a known carcinogen, while trivalent chromium is much less toxic. The respiratory tract is the major target organ for hexavalent chromium toxicity. Both forms of chromium occur naturally in groundwater and are also introduced to soil and groundwater through disposal practices from commercial and industrial operations.

The primary MCL for hexavalent chromium is 10 μg/L; the total chromium MCL is 50 μg/L. Groundwater monitoring in WY 2010-11 indicated that relatively low concentrations of hexavalent chromium, below 5 μg/L, are generally widespread and observed in many of WRD's nested monitoring wells throughout the CBWCB, likely the result of naturally-occurring conditions. Concentrations detected above 5 μg/L were limited to the shallowest zones at three Central Basin and one West Coast Basin nested well locations. Hexavalent chromium was not detected above the MCL in any CBWCB production wells sampled between 2008 and 2011 (WRD, 2012).

3.2.5 1,4-Dioxane

1,4-Dioxane is used primarily as a solvent in the manufacture of chemicals and as a laboratory reagent. It is frequently found at contaminated sites where 1,1,1-trichloroethane (1,1,1-TCA) was used for degreasing. 1,4-Dioxane is also a trace chemical found in cosmetics, detergents, and shampoos. It is highly soluble and mobile in groundwater. On November 22, 2010, the CDPH (now the SWRCB Division of Drinking Water) revised the NL for 1,4-dioxane from 3 μg/L to a more stringent NL of 1 μg/L, to reflect an update in the risk analysis announced by the USEPA in August 2010.

For production wells sampled between 2008 and 2011, 1,4-dioxane was mostly undetected or detected below the NL in most wells located in the CBWCB. Of the 238 CBWCB production wells that were sampled, 45 wells contained 1,4-dioxane above the NL. 1,4-Dioxane was not detected in any production wells located in the West Coast Basin. The SWRCB's Geotracker database identified no contaminated sites with 1,4-dioxane as a primary COC. It is likely that additional sites with 1,4-dioxane as a COC would be identified if individual site data and reports were compiled. Nonetheless, 1,1,1-TCA was identified as a COC at 16 sites in the Central Basin and 4 sites in the West Coast Basin, indicating the potential for 1,4-dioxane contamination.

As discussed in Section 3.3.2, special recycled water studies of 1,4-dioxane in the CBWCB, conclude that it is not likely that recycled water is a source of 1,4-dioxane in groundwater. Because detections in groundwater are widespread, it is likely the result of numerous point source environmental release sites and not likely associated with recycled water use or recharge.

3.3 Special Recycled Water Studies

Multiple special studies associated with recycled water and its influence on groundwater have been conducted in the CBWCB. The SDLAC has conducted extensive studies of the fate and transport of NDMA near its WRPs and in the Montebello Forebay. SDLAC also prepares data tables summarizing the concentrations of NDMA and 1,4-dioxane in recycled water and monitoring wells in their *Montebello Forebay Groundwater Recharge Annual Monitoring*

Reports. WRD has also conducted a special study of 1,4-dioxane in groundwater in the CBWCB. Below is a further discussion of each of these studies and chemicals.

3.3.1 N-Nitrosodimethylamine (NDMA)

High levels of NDMA in groundwater in California is typically related to the disposal of liquid rocket fuels associated with the aerospace industry. NDMA is also generated as a byproduct of wastewater treatment, in particular disinfection using chloramines. NDMA is a probable human carcinogen. It has no MCL, but has a NL of 10 nanograms per liter (ng/L). NDMA has been detected in recycled water used for recharge at the MFSG at concentrations above the NL. Nonetheless, it has rarely been detected in monitoring or production wells in the Montebello Forebay due to its significant attenuation in surface water during transport to the spreading grounds through ultraviolet irradiation (UV) exposure and soil aquifer treatment (SAT) as the water percolates through the top most inches of soil and the vadose zone. The SDLAC previously conducted a comprehensive multi-year study of NDMA fate and transport at the Montebello Forebay (Kennedy/Jenks/Todd, 2008). The study found that NDMA in recycled water is significantly attenuated through the following processes: 1) in surface water likely through UV attenuation processes as the water travels from the WRP effluent discharge locations to the spreading grounds and 2) through soil aquifer treatment (likely bioattenuation processes) in the subsurface. The study concluded that NDMA in recycled water recharged at the MFSG does not impact nearby water supply wells.

3.3.2 1,4-Dioxane

Regulations for groundwater replenishment using recycled water (California Code of Regulations, Title 22, Division 4, Chapter 3, Articles 5.1 and 5.2) specify that tests for 1,4-dioxane can be used to demonstrate a sufficient oxidation treatment process for full advanced treatment of recycled water. While 1,4-dioxane monitoring is not required in the permit for groundwater recharge at the MFSG, the SDLAC has been conducting semiannual monitoring of the effluent from the San Jose Creek, Pomona, and Whittier Narrows WRPs as part of NPDES requirements. Since the SDLAC began 1,4-dioxane monitoring in 2002, the annual average concentrations at these WRPs have ranged from 1.1 to 2.0 µg/L and have been consistently below the former 1,4-dioxane NL of 3 µg/L (SDLAC, 2011). The current NL is 1 µg/L.

In May, June, and July 2011, the SDLAC monitored effluent samples at the San Jose Creek, Pomona, and Whittier Narrows WRPs as part of a 3-month study to investigate the occurrence of 1,4-dioxane in the influent and its fate through the WRP treatment processes. There appears to be a consistent low level of 1,4-dioxane in all WRP effluent. Previous research indicated that samples collected over a 2-year period during the *Montebello Forebay Attenuation and Dilution Study* (Kennedy/Jenks/Todd, 2008) showed no detections of 1,4-dioxane at the spreading grounds headworks or production wells. There was only one detection in a shallow monitoring well at a concentration of 1.5 µg/L.

Another regional groundwater investigation conducted by WRD in the Montebello Forebay during 2002 through 2003 showed that 1,4-dioxane was not detected in any of its routinely monitored nested monitoring wells or production wells, except in one production well. 1,4-Dioxane appears to be reduced during river transport of recycled water from the WRPs to the spreading grounds and during percolation. Therefore, it is not likely that recycled water is a source of the widespread detections of 1,4-dioxane in groundwater in the Study Area. Because 1,4-dioxane is almost never detected in groundwater near the MFSG, widespread detections in groundwater are likely the result of point source environmental release sites.

3.4 Constituents of Emerging Concern (CECs)

CECs generally have no established water quality standards or NLs. These chemicals may be present in various waters at very low concentrations and are now detected as the result of more sensitive analytical methods. Information regarding their health significance is evolving with the development of acceptable daily intake levels and drinking water equivalent levels; however, information is lacking on the full spectrum of potential CECs and their health significance in mixtures. CECs include several types of chemicals, such as (i) pesticides, (ii) pharmaceuticals and ingredients in personal care products, (iii) veterinary medicines, (iv) endocrine disruptors, and others.

A Science Advisory Panel (Panel) was formed to identify a list of CECs for monitoring recycled water used for groundwater recharge and landscape irrigation. The Panel completed its report titled, "Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water – Recommendations of a Science Advisory Panel," (Panel Report; http://www.waterboards.ca.gov/water_issues/programs/water_recycling_policy/docs/cec_monitoring_rpt.pdf) on CECs in June 2010 and recommended monitoring of selected health-based and treatment performance indicator CECs and surrogates in recycled water used for groundwater recharge projects. No CEC monitoring was recommended for landscape irrigation due to the low risk for ingestion of the water. The CEC monitoring recommendations were directed at surface spreading using tertiary-treated recycled water (specifically, recycled water and groundwater monitoring) and injection projects using recycled water that has undergone reverse osmosis and advanced oxidation (specifically, recycled water monitoring). The Panel did not address or make recommendations related to CEC monitoring for SNMPs.

Draft amendments to the SWRCB's Recycled Water Policy were released in May 2012, September 2012, October 2012 (SWRCB hearing change sheets), and January 2013. The May 2012 draft amendment proposed, in accordance with the Panel's recommendations, 1) monitoring requirements for CECs and surrogates in recycled water used for groundwater recharge; and 2) a reduction of priority pollutant monitoring of recycled water used for landscape irrigation. In the September and October 2012 draft amendments, language was included that provided three exceptions for Regional Water Quality Control Boards to impose additional CEC monitoring requirements: 1) if recommended by CDPH (now the SWRCB Division of Drinking Water); 2) if requested by a project sponsor; and 3) required in an adopted SNMP. Stakeholders submitted written comments to the SWRCB asking that until such time as a SWRCB expert panel specifically makes recommendations regarding CEC monitoring for SNMPs, this issue should be left to stakeholders preparing SNMPs and the Basin Plan amendment process. In response, the SWRCB deleted exception No. 3. The Recycled Water Policy Amendment was adopted by the SWRCB on January 22, 2013 and was approved by the Office of Administrative Law on April 25, 2013.

Regulations regarding groundwater replenishment (both surface and subsurface applications) using recycled water are specified in California Code of Regulations, Title 22, Division 4, Chapter 3, Articles 5.1 and 5.2. These regulations establish monitoring requirements for indicator compounds that will be selected by the project sponsor based on several factors, including the indicator compound's ability to characterize the presence of CECs. Project sponsors must conduct studies at initial operation of the groundwater recharge project and at 5-year intervals thereafter to determine the occurrence of indicator compounds in the recycled water. The protocol for the occurrence study, the study's results, and the indicator compounds to be monitored shall be reviewed and approved by the SWRCB Division of Drinking Water (formerly CDPH).

The LARWQCB has taken actions to begin to address CECs and has begun to include requirements for CEC Special Studies in NPDES permits for Publicly Owned Treatment Works (POTWs) in the region. The development of a CEC monitoring strategy for the region was identified as a priority project during the project selection phase of the 2011-13 Basin Plan triennial review. The SDLAC has begun monitoring effluent for CECs at the water reclamation plants that supply recycled water to the Central Basin. For the West Coast Basin, there are no POTWs that discharge to inland surface water. CEC monitoring requirements have been included in permits issued for the injection of recycled water at the AGB, DGB, and WCBB. The list of CECs is based on prior versions of the CDPH (now the SWRCB Division of Drinking Water) draft groundwater recharge regulations (designated as the Endnote 5 compounds).

The USGS (2009) has conducted some groundwater monitoring for CECs in the CBWCB under the Groundwater Ambient Monitoring and Assessment (GAMA) program (http://pubs.usgs.gov/ds/387/). No CECs were detected at concentrations higher than health-based thresholds. In addition, the Southern California Coastal Water Research Project (SCCWRP) with the David and Lucile Packard Foundation has sponsored an expert panel to provide the State with recommendations on appropriate monitoring and management strategies for CECs to limit the impact of CECs on oceans, estuaries and coastal wetlands, and freshwater ecosystems (SCCWRP, 2012). To vet the initial recommendation from the expert panel, SCCWRP is developing a proposed CEC pilot surface water monitoring plan to address which CECs to monitor, where and how often they should be monitored, and quality assurance/quality control guidelines. The draft plan will be reviewed by the expert panel and stakeholders in Spring 2014 with a goal of finalizing the plan by the end of 2014. Once finalized, 3-year pilot monitoring programs will be conducted at 6 locations throughout the State. The expert panel and stakeholders will review the data from the pilot monitoring and will develop recommendations for NPDES surface water-specific CEC monitoring programs.

The SWRCB Recycled Water Policy states, *"Each salt and nutrient management plan shall include . . . [a] provision for annual monitoring of Emerging Constituents/Chemicals of Emerging Concern (e.g., endocrine disruptors, personal care products or pharmaceuticals) (CECs) consistent with recommendations by CDPH and consistent with any actions by the State Water Board taken pursuant to paragraph 10(b) of this Policy."* (SWRCB, 2009). Existing monitoring for CECs, as well as special studies that are investigating CECs, are discussed in detail in Appendix K *Monitoring Plan* of the SNMP. As discussed further in Appendix K of the SNMP, monitoring for CECs in the Study Area is being conducted for the groundwater recharge projects that utilize recycled water, wastewater treatment plants that discharge to surface water, and for special studies. There are also ongoing leading edge research efforts to further develop analytical methods and understand the health implications of low level detections of CECs. As such, no additional CEC monitoring was found to be warranted in the CBWCB and thus, not proposed as part of the SNMP Monitoring Program.

3.5 Salt and Nutrient Groundwater Quality

As discussed in Section 3.1, TDS, chloride, and nitrate-N were selected as the most appropriate indicators of S/Ns in the CBWCB. These three constituents were used to characterize existing S/N groundwater quality and assimilative capacities of the basins.

BPO/BSBPOs for the CBWCB were established by the LARWQCB and are provided in Chapter 3 of the Basin Plan (LARWQCB, 1994). The BPO/BSBPOs for TDS, nitrate-N, and chloride are listed in **Table G-9**. There are BSBPOs for TDS and chloride in the Central Basin and West Coast Basin and a single BPO for nitrate-N in both basins.

The BPO and BSBPOs are the criteria used to evaluate the existing assimilative capacity of the CBWCB. The existing assimilative capacity is the difference between average groundwater quality and the BPO/BSBPO.

Table G-9 Water Quality Objectives for Salt and Nutrients in Groundwater in the CBWCB

Indicator Constituent for Salt and Nutrients	Central Basin	West Coast Basin
TDS	700 mg/L	800 mg/L
Chloride	150 mg/L	250 mg/L
Nitrate as Nitrogen (NO_3-N)	10 mg/L	10 mg/L

Source: LARWQCB Basin Plan
mg/L – milligrams per liter

3.5.1 TDS, Chloride, and Nitrate Fate and Transport

Fate and transport describes the way a salt or nutrient move through an environment or media. Groundwater flow directions and rates, the characteristics of the constituent, and the characteristics of the aquifer determine fate and transport of any given constituent. Vertical and horizontal groundwater flow direction and velocity were described in Section 2.9 *Water Levels and Flow.*

S/Ns in source waters recharging the CBWCB may be increased through use and movement through the vadose zone and aquifer. This can occur through fertilizer use, which adds nitrogen that is not completely removed by plant uptake. S/Ns in irrigation water can also be concentrated by evapotranspiration (ET). Additionally, dry deposition, the process by which airborne pollutants are deposited to the earth, can contribute to increased S/Ns in percolating water. As precipitation and irrigation water infiltrates, S/Ns in the shallow soils can be picked up from the surface soils. S/Ns also exist in subsurface materials and can be leached via dissolution as water percolates.

Some S/Ns, such as TDS and chloride are considered conservative in that they are not readily attenuated in the environment. In contrast, processes that affect the fate and transport of nitrogen compounds are complex, with transformation, attenuation, uptake and leaching in various environments. Nitrate is the primary form of nitrogen detected in groundwater. It is soluble in water and can easily pass through soil to the groundwater table. Nitrate can persist in groundwater for decades and accumulate to high levels as more nitrogen is applied to the land surface every year.

Assumptions regarding fate and transport processes and potential chemical reaction rates for S/Ns are described in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality*.

3.5.2 Water Quality Analysis Methodologies

The methodologies used to calculate average groundwater quality and assimilative capacity are described in this section.

3.5.2.1 Subareas/Layers for Water Quality Assessment

In addition to the water quality assessment of each of the basins as a whole, the Central Basin was divided into distinct hydrogeologic subareas for purposes of characterizing groundwater quality and assimilative capacity, as listed in **Table G-10** and illustrated in Figure 2**,** and into four layers as listed in Table G-2. These subareas and layers are equivalent to those defined in the existing USGS groundwater model of the basins. The division of the basins into subareas/layers was performed to better understand the lateral and vertical distribution of S/Ns and help inform and prioritize potential implementation measures.

Areas seaward of the seawater intrusion barriers (referred to as coastal areas) have very high concentrations of TDS and chloride and lack groundwater production for potable use. S/N average concentrations and assimilative capacities of the Central Basin and West Coast Basin, both including and excluding the coastal areas are provided for comparison. The saline plume located inland of the WCBB[13] is shown in Figure 2. This is an area of high TDS and chloride associated with historical seawater intrusion prior to construction and operation of the WCBB. Average groundwater quality and available assimilative capacity were estimated for the West Coast Basin with the WCBB-inland saline plume area removed and without the coastal areas. This analysis without this saline plume was only performed for the current basin average water quality and assimilative capacity calculations. The saline plume could not be removed from the future water quality assessment because the baseline period calibration process and the future

[13] Inland saline plumes associated with the AGB and the DGB are much less extensive and therefore, not removed from the calculations for average groundwater quality.

groundwater quality predictions (described in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality)* rely on the water balances generated by the USGS groundwater flow model, which does not consider the WCBB-inland saline plume to be a subarea. The average groundwater quality in the coastal areas were also calculated to illustrate the very poor quality water (i.e. no assimilative capacity for TDS and chloride) in these areas and the impact of including these areas in the basin averages. S/N average concentrations and assimilative capacities were also calculated for the following subareas in the Central Basin: Montebello Forebay, Los Angeles Forebay, Whittier Area, Pressure Area including the coastal area, and Pressure Area excluding the coastal area. The USGS flow model subareas shown in Figure 2 look slightly different than the basin subareas presented in Figure 1 due to the gridded nature of the model domain and the inclusion of a small portion of Orange County near the AGB.

Table G-10 CBWCB Areas Assessed for Water Quality and Assimilative Capacity

Groundwater Basin	Subareas in the Central Basin
Central Basin (area seaward of AGB excluded)	Montebello Forebay
Central Basin (area seaward of AGB included)	Los Angeles Forebay
West Coast Basin (area seaward of DGB and WCBB excluded)	Whittier Area
West Coast Basin (area seaward of DGB and WCBB included)	Pressure Area (area seaward of AGB excluded)
West Coast Basin (area seaward of DGB & WCBB and WCBB-inland saline plume excluded) [a]	Pressure Area (area seaward of AGB included)
Coastal Areas (i.e. areas seaward of the AGB, DGB, and WCBB) [b]	

AGB – Alamitos Gap Seawater Intrusion Barrier
DGB – Dominguez Gap Seawater Intrusion Barrier
WCBB – West Coast Basin Seawater Intrusion Barrier

a – This basin area only used for current basin average and assimilative capacity calculations
b – Average groundwater quality and assimilative capacities for the coastal areas were calculated for both the West Coast Basin and Central Basin

It should be noted that two coastal areas in the West Coast Basin have been "de-designated" by the LARWQCB, which means these areas are no longer considered to have municipal beneficial uses due to degradation from historical seawater intrusion (LARWQCB, 1998 and 2011). Figure 3 shows the two de-designated areas; one is in the area underlying Terminal Island and portions of the Los Angeles and Long Beach Harbors and the second is in the El Segundo area. The groundwater in these areas is characterized by the LARWQCB as tidally-influenced in elevation and brackish to saline (LARWQCB, 2009). The de-designation of these coastal areas supports the conclusion that other coastal areas seaward of the barriers are impacted to the extent that groundwater production for potable use is unlikely in the foreseeable future.

3.5.2.2 Average S/N Groundwater Quality

In accordance with the SWRCB Recycled Water Policy, the average S/N concentrations of the basin or subbasin will be estimated using the most recent five years of available data, unless an alternate time period is approved by the local RWQCB. At the time the SNMP analysis was initiated[14], the last available sampling event for some wells occurred in 2011; thus, sampling results from wells during the most recent five years of data (January 2007 through mid-2012) were used to calculate current groundwater quality. The water quality data set for the Study Area is very extensive and includes semi-annual monitoring of the network of WRD nested wells and other data sets such as the SWRCB Division of Drinking Water (formerly CDPH) drinking water well database. Water quality from a small number of wells associated with environmental release sites were used to help establish Model Layer 1 water quality concentrations near the DGB and AGB, where nested and production well data were not available. **Table G-11** presents the quantity and type of wells used to estimate average groundwater quality in the Study Area.

The median TDS, chloride, and nitrate-N concentrations in wells in each model layer for the most recent 5-year water quality averaging period was plotted on maps. Figure 9 depicts different size and color circles representing median concentrations (dots maps). Wells were assigned to model layers based on the elevations of their screened intervals. Some wells (particularly production wells) are screened over multiple model layers and thus, were represented on more than one model layer map. For wells screened in multiple layers, water quality data from all layers screened were included in the averaging process. Wells with water quality but no well completion information were not included in the averaging analysis.

Medians were used instead of arithmetic averages because:

1. Well medians can be reliably calculated for datasets with mixed censored and non-censored data (i.e. detects and not detects), which was common in the nitrate dataset; and
2. Well medians allow for use of the entire water quality dataset while minimizing the skewing effect of potential data outliers and do not rely on parametric statistical methods that assume normal data distribution to remove potential outliers.

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[14] The CBWCB SNMP data collection and analysis process began in May 2012.

Table G-11 Summary of Wells Used for Water Quality Evaulation

Well Type	Total	Central Pressure	West Coast Basin	Los Angeles Forebay	Montebello Forebay	Whittier Area
Model Layer 1						
TDS						
# of WRD Nested MWs	8	4	0	NA	4	NA
# of Production Wells	5	0	0	NA	5	NA
# of other MWs	8	0	0	NA	8	NA
TOTAL	**21**	**4**	**0**	**NA**	**17**	**NA**
Chloride						
# of WRD Nested MWs	8	4	0	NA	4	NA
# of Production Wells	5	0	0	NA	5	NA
# of other MWs	10	0	0	NA	10	NA
TOTAL	**23**	**4**	**0**	**NA**	**19**	**NA**
Nitrate as N						
# of WRD Nested MWs	8	4	0	NA	4	NA
# of Production Wells	2	0	0	NA	2	NA
# of other MWs	10	0	0	NA	10	NA
TOTAL	**20**	**4**	**0**	**NA**	**16**	**NA**
Model Layer 2						
TDS						
# of WRD Nested MWs	48	19	14	3	11	1
# of Production Wells	65	25	3	2	35	0
# of other MWs	2	0	0	0	2	0
TOTAL	**115**	**44**	**17**	**5**	**48**	**1**
Chloride						
# of WRD Nested MWs	48	19	14	3	11	1
# of Production Wells	65	25	3	2	35	0
# of other MWs	2	0	0	0	2	0
TOTAL	**115**	**44**	**17**	**5**	**48**	**1**
Nitrate as N						
# of WRD Nested MWs	48	19	14	3	11	1
# of Production Wells	36	12	1	1	22	0
# of other MWs	2	0	0	0	2	0
TOTAL	**86**	**31**	**15**	**4**	**35**	**1**

Table G-11 Summary of Wells Used for Water Quality Evaluation (continued)

Well Type	Total	Central Pressure	West Coast Basin	Los Angeles Forebay	Montebello Forebay	Whittier Area
Model Layer 3						
TDS						
# of WRD Nested MWs	144	42	59	12	28	3
# of Production Wells	175	96	15	16	48	0
# of other MWs	5	0	5	0	0	0
TOTAL	**324**	**138**	**79**	**28**	**76**	**3**
Chloride						
# of WRD Nested MWs	144	42	59	12	28	3
# of Production Wells	173	96	15	15	47	0
# of other MWs	5	0	5	0	0	0
TOTAL	**322**	**138**	**79**	**27**	**75**	**3**
Nitrate as N						
# of WRD Nested MWs	144	42	59	12	28	3
# of Production Wells	71	27	5	9	30	0
# of other MWs	2	0	2	0	0	0
TOTAL	**217**	**69**	**66**	**21**	**58**	**3**
Model Layer 4						
TDS						
# of WRD Nested MWs	53	21	20	1	10	1
# of Production Wells	57	39	3	14	1	0
# of other MWs	0	0	0	0	0	0
TOTAL	**110**	**60**	**23**	**15**	**11**	**1**
Chloride						
# of WRD Nested MWs	53	21	20	1	10	1
# of Production Wells	57	39	3	14	1	0
# of other MWs	0	0	0	0	0	0
TOTAL	**110**	**60**	**23**	**15**	**11**	**1**
Nitrate as N						
# of WRD Nested MWs	53	21	20	1	10	1
# of Production Wells	22	12	2	7	1	0
# of other MWs	0	0	0	0	0	0
TOTAL	**75**	**33**	**22**	**8**	**11**	**1**

MWs - monitoring wells WRD - Water Replenishment District of Southern California
TDS - total dissolved solids N - nitrogen # - Quantity
NA - not applicable; Model Layer 1 of limited extent or unsaturated in these areas (see Section 2.5.3 - USGS-Defined Aquifer System and Model Layers)"
Data from wells screened across multiple model layers are included in the analysis for all layers screened

Box plots were prepared to illustrate the distribution of the median well concentrations in each layer and subarea (Figure 33). Box plots illustrate the minimum, maximum, median, and 25th and 75th percentile concentrations for TDS, chloride, and nitrate-N in wells used to calculate the median concentration of each layer and subarea.

The TDS, chloride, and nitrate-N dots maps were then used to develop concentration contour maps for each layer and subarea using geographical information system (GIS) spatial analysis tools (Figure 10). Chloride concentration contour maps previously prepared by the LACDPW for each seawater instrusion barrier were also considered in developing the chloride concentration contours in the vicinity of the seawater barriers. The average TDS/chloride ratio of wells located in the vicinity of the barriers were used to incorporate the LACDPW chloride map information into the TDS concentration contour map prepared for the analysis. GIS spatial analysis tools were then used to extract the average concentrations for each subarea and layer.

In addition, the average water quality for all layers in each subarea was calculated by weighting the average concentration in each layer by the volume of water in each layer (in 2010). The volume of water in each subarea/layer was determined by calculating the volume of water in each model cell based on its size (2,640 feet x 2,640 feet), saturated thickness based on the 2010 groundwater surface elevation, and cell specific yield as assigned in the USGS/GBMP model. Cell volumes were then aggregated by subarea/layer. Finally, the water quality from all subareas and layers within each basin were amalgamated into a single average value for the Central Basin and West Coast Basin.

For each basin, two average concentrations were calculated: one average includes the coastal areas seaward of the seawater barriers and the other average excludes these coastal areas. For the West Coast Basin, a third average groundwater quality estimate was calculated excluding the WCBB-inland saline plume and coastal area (see Figure 17) in order to evaluate the impact of the plume on overall basin groundwater quality.

3.5.2.3 Available Existing Assimilative Capacity

The average TDS, chloride, and nitrate-N concentrations for each subarea/layer and for the Central Basin and West Coast Basin both with and without the coastal areas were compared to the BPO/BSBPO to determine the current existing available assimilative capacity. The available assimilative capacity is the difference between the average groundwater quality and the BPO or BSBPO.

3.5.3 TDS in Groundwater

3.5.3.1 TDS Concentrations

Figure 9 (dot maps) shows median TDS, chloride, and nitrate-N concentrations for monitoring wells and production wells in each model layer for the recent 5-year water quality averaging period (2007 through 2012). Note that Model Layer 1 does not exist across the entire Study Area and its extent is shown by gray shading in the figures in the top row of maps in Figure 9. As shown on Figure 24 and discussed in Section 2.5.3, Model Layer 1 extends into a very small portion of the Whittier Area where no water quality data exists. Similarly in the Los Angeles Forebay, Model Layer 1 is typically unsaturated and therefore, there are no monitoring well or production well data for this layer in this area. In some portions of the Central Basin Pressure Area and the West Coast Basin, Model Layer 1 also does not exist. Accordingly, for the SNMP analysis, loading was directed into Model Layer 2 in the areas where Model Layer 1 does not exist, as shown on the top row of maps in Figure 9. Not including Model Layer 1 in the Whittier Area and Los Angeles Forebay had almost no effect on the estimation of average groundwater quality because Model Layer 1 is very thin and contains a very small volume of water relative to the other model layers (2, 3, and 4). Circles of various sizes and colors representing the TDS medians are shown in the maps along the left column of the figure with Layer 1 on top and Layer 4 on the bottom.

In the Central Basin, TDS was detected above the BSBPO of 700 mg/L in some wells in all four layers; although the majority of wells are below the BSBPO. Elevated concentrations were detected in isolated wells in all of the subareas.

In the West Coast Basin, elevated TDS concentrations above the BSBPO of 800 mg/L were detected more frequently in Model Layers 2, 3, and 4 due to saline plumes caused by historical seawater intrusion. There were no nested monitoring wells or production wells screened in Model Layer 1 in the West Coast Basin. To address this data gap, TDS data from shallow monitoring wells (screened in Layer 1) associated with several environmental release sites were considered in the areas near the DGB and AGB.

Figure 33 shows the statistical distribution of the well medians as box plots for TDS, chloride, and nitrate-N for each subarea/layer. TDS box plots are shown along the left column of the figure with Layer 1 on the top and Layer 4 on the bottom. Box plots were prepared to illustrate the distribution of well median concentrations. The box plots illustrate the minimum, maximum, and 25th, 50th (median), and 75th percentile of well median concentrations in each subarea and model layer. Where only a dash is shown (i.e., no box plot), only one well median was available. Note that the West Coast Basin exhibits the widest distribution of TDS median concentrations, which is expected given that wells within and outside saline plumes represent a wide range of concentrations. Other areas show a narrower distribution of well median concentrations.

Figure 10 shows the TDS concentration contour maps along the left column of the figure. In order to further augment the contouring data set, annual depth-discrete chloride concentration contour maps previously prepared by LACDPW for each of the barriers were considered based on the observed relationship between chloride and TDS concentrations in wells located in the vicinity of the barriers.

As shown in Figure 10, there are a few hot spots of TDS concentrations above the BSBPO of 700 mg/L in the Central Basin, but the majority of the groundwater in the basin is below the BSBPO. In the West Coast Basin, large areas of elevated TDS concentrations above the BSBPO are observed near and inland of the seawater intrusion barriers and elsewhere as isolated hot spots.

3.5.3.2 Average TDS Concentrations and Assimilative Capacity

Based on the concentration contour maps (Figure 10), the average TDS concentrations were calculated in each subarea/layer. Volume-weighted concentrations for combined layers for each subarea, and for the Central Basin and West Coast Basin both with and without the coastal areas were calculated. In addition, averages were calculated for the West Coast Basin without the coastal areas and the WCBB-inland saline plume. The averages for just the coastal areas seaward of the barriers were calculated to illustrate the very poor quality water in these areas with respect to TDS and chloride and the impact of including these areas in the basin averages. **Table G-12** and Figure 11 present the average TDS concentrations, BSBPOs, and available assimilative capacity.

For the Central Basin, average TDS concentrations in all layers and the volume-weighted total average for the entire basin, both including and excluding the coastal area, are below the BSBPO of 700 mg/L. For the Central Basin, Model Layer 2 within the Los Angeles Forebay exceeds the TDS BSBPO; the average TDS concentration is weighted by the existence of only one well with a relatively high TDS concentration. Similarly, there is only one data point in the Whittier Area and as a result, Model Layers 3 and 4 and the overall subarea average exceed the TDS BSBPO. The distribution of higher TDS levels with depth in the Whittier Area indicates that the cause is likely naturally occurring conditions at depth, not a surface release. If a surface release were the source of the elevated TDS, one would expect higher TDS concentrations in the shallowest zones, which is not observed. Dissolution of formation materials high in silts and clays and/or of marine origin in the Whittier Area can result in naturally high TDS concentrations in ambient groundwater. The Puente Hills located north of the Whittier Area provide some of the source materials for the Whittier Area aquifers as well as for the Puente Subbasin located north of the Puente Hills. These source materials are relatively fine-grained and have resulted in high ambient TDS concentrations in the Puente Subbasin.

The Montebello Forebay, Central Basin Pressure Area (with and without the coastal area), and the entire Central Basin (with and without the coastal area), are all below the TDS BSBPO in all layers and in the overall average of all layers. The average TDS concentrations for the entire Central Basin both including and excluding the coastal area are below the BSBPO. There is 162 mg/L of available existing assimilative capacity for TDS in the Central Basin when the coastal area is included and 171 mg/L of available capacity when the coastal area is excluded.

For the West Coast Basin, average TDS concentrations in all layers and the volume-weighted total average for the entire basin, both including and excluding the coastal areas, exceed the BSBPO of 800 mg/L. With the coastal areas excluded, the average TDS concentration in Model Layer 3 is just below the BSBPO, while all other layers and the combined layers exceed the BSBPO. There is -624 mg/L of assimilative capacity in the West Coast Basin when the coastal areas are included and -90 mg/L of assimilative capacity when the coastal areas are excluded. The negative numbers indicate that there is no existing available assimilative capacity for TDS in the West Coast Basin as a result of historical seawater intrusion. Nonetheless, existing implementation measures including the seawater barriers and desalters are reducing overall TDS levels in the basin and additional proposed projects described in Appendix J *Implementation Plan,* including increased AWT recycled water recharge at the barriers and expanded desalter operations, will likely further reduce TDS levels in the future. When the coastal areas and the WCBB-inland saline plume are removed from the West Coast Basin average, there is 53 mg/L of available assimilative capacity for TDS, illustrating the significant impacts of saline plumes on the overall basin average.

Table G-12 Average TDS, Chloride, and Nitrate Concentrations in Subareas/Layers and in the Central Basin and West Coast Basin

Model Layer	GROUNDWATER QUALITY IN SUBAREAS/MODEL LAYERS AND IN THE CBWCB (all concentrations in mg/L)																																
	Los Angeles Forebay			Montebello Forebay			Whittier Area			Central Pressure Area (including coastal area)			Central Pressure Area (no coastal area)			Central Basin (including coastal area)			Central Basin (no coastal area)			West Coast Basin (including coastal area)			West Coast Basin (no coastal area)			West Coast Basin (no coastal area & no saline plume)			Coastal Area [a] (seaward of seawater barriers)		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS [b]	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
1	NA	NA	NA	486	79	1.94	NA	NA	NA	658	130	0.17	619	107	0.18	555	100	1.23	538	90	1.25	2,150	851	0.04	1,223	293	0.01	1,223	293	0.01	2,427	1,028	0.05
2	788	105	0.08	482	80	1.95	636	73	1.81	621	108	0.08	602	96	0.08	623	102	0.43	610	93	0.44	2,067	884	0.15	1,072	365	0.20	1,052	371	0.20	4,029	1,904	0.03
3	672	83	0.22	551	86	1.18	966	111	0.42	470	59	0.15	459	50	0.15	540	69	0.31	533	63	0.32	1,247	646	0.04	781	276	0.05	676	179	0.05	2,170	1,379	0.00
4	479	63	0.02	555	102	0.13	1,410	184	0.00	435	51	0.02	417	42	0.02	493	64	0.03	480	57	0.03	1,396	585	0.00	972	327	0.00	729	233	0.00	2,252	1,099	0.00
Average of all layers	640	81	0.15	534	88	1.13	1,007	121	0.57	485	65	0.10	470	55	0.10	538	73	0.28	529	67	0.28	1,424	660	0.04	890	306	0.05	747	224	0.05	2,464	1,343	0.01
BPO/BSBPO	700	150	10.00	700	150	10.00	700	150	10.00	700	150	10.00	700	150	10.00	700	150	10.00	700	150	10.00	800	250	10.00	800	250	10.00	800	250	10.00	700/ 800	150/ 250	10.00
Assimilative Capacity	60	69	9.85	166	62	8.87	-307	29	9.43	215	85	9.90	230	95	9.90	162	77	9.72	171	83	9.72	-624	-410	9.96	-90	-56	9.95	53	26	9.95	-1,764/ -1,664	-1,193/ -1,093	9.99

TDS - total dissolved solids

Cl - chloride

NO_3-N - nitrate as nitrogen

NA - not applicable; no Model Layer 1 in these areas

Averages based on groundwater concentration contour maps; average of all layers is a weighted average based on area and aquifer thickness

Negative numbers indicate there is no available assimilative capacity

BPO/BSBPO - Basin Plan Objective or Basin Specific Basin Plan Objective

(orange shading) - Average concentration indicated exceeds BPO

(grey shading) - Model Layer 1 not included; typically unsaturated within the Los Angeles Forebay and of very limited extent Whittier Area (see explanation in Section 2.5.3)

a - Includes both Central Basin and West Coast Basin

b - Elevated TDS and chloride concentrations in the Whittier Area are likely naturally occurring as discussed in Section 3.5.3.2

For the coastal areas, average TDS concentrations in all layers and the volume-weighted total average for all layers exceed the BSBPOs of 700 mg/L and 800 mg/L in the Central Basin and West Coast Basin, respectively. There is -1,764 and -1,664 mg/L of assimilative capacity in the coastal areas in the Central Basin and West Coast Basin, respectively. The negative number indicates that there is no existing available assimilative capacity for TDS in the coastal areas as a result of seawater intrusion. The results for the coastal areas also illustrate the significant impact that the coastal areas have on overall basin averages. Based on the high TDS levels, groundwater production for potable use is unlikely to occur in the foreseeable future in the coastal areas.

3.5.1 Chloride in Groundwater

3.5.1.1 Chloride Concentrations

The middle column of plots on Figure 9 show median chloride concentrations (dots maps) for wells in each model layer, with Model Layer 1 on top and Model Layer 4 on the bottom.

In the Central Basin, chloride was detected below the BSBPO of 150 mg/L in most wells in all four layers. Elevated chloride concentrations were detected in one well near the coast in Model Layer 1, likely due to historical seawater intrusion.

In the West Coast Basin, elevated chloride concentrations above the 250 mg/L BSBPO are detected more frequently in Model Layers 2, 3, and 4, due to saline plumes. There are no nested monitoring wells or production wells screened in Model Layer 1 in the West Coast Basin. To address this data gap, chloride data from shallow monitoring wells (screened in Layer 1) associated with several environmental release sites with were considered in the areas near the DGB and AGB.

Figure 33 shows the statistical distribution of the chloride medians as box plots for each subarea/layer. Chloride box plots are shown in the middle column of charts, with Model Layer 1 on the top and Model Layer 4 on the bottom. Note that the West Coast Basin exhibits the widest distribution of chloride median concentrations, which is expected given that wells within and outside saline plumes are represented. Other areas show a smaller distribution of values.

Figure 10 shows the contoured chloride maps in the middle column of the figure. In order to further augment the contouring data set, annual depth-discrete chloride concentration contour maps previously prepared by LACDPW for each of the barriers were also considered. As shown in Figure 10, chloride concentrations in most of the Central Basin are below the BSBPO of 150 mg/L. In the West Coast Basin, large areas of elevated chloride concentrations are detected near and inland of the seawater intrusion barriers, as well as in isolated hot spots.

3.5.1.2 Average Chloride Concentrations and Assimilative Capacity

Based on the groundwater quality contour maps (Figure 10), the average chloride concentration in each model subarea/layer was calculated. The combined volume-weighted average concentration in all four layers was calculated for each subarea and for the Central Basin and West Coast Basin (both including and excluding the coastal areas). Table G-12 and

Figure 12 present the average chloride concentrations, the BSBPO, and available assimilative capacity.

For the Central Basin, average chloride concentrations in all layers and the volume-weighted total average for the entire basin, both including and excluding the coastal area, are below the BSBPO of 150 mg/L. Model Layer 4 in the Whittier Area exceeds the BSPO; although, the average of all layers in the Whittier Area is below the BSBPO. Similar to the results for TDS, elevated chloride at depth in the Whittier Area is likely due to naturally occurring conditions, not a surface release. If a surface release were the source of the elevated chloride, one would expect higher chloride concentrations in the shallowest zones, which is not observed. Dissolution of formation materials of marine origin in the Whittier Area can result in naturally high chloride concentrations in ambient groundwater. The adjacent Puente Hills are comprised of a thick sequence of sedimentary marine bedrock units. These marine source rocks for the aquifers in the Whittier Area are fine-grained and a potential source of the elevated chloride observed at depth. The amalgamated Central Basin layer averages, both including and excluding the coastal area, are also below the BSBPO. There is 77 mg/L of available assimilative capacity in the Central Basin when the coastal area is included and 83 mg/L of available assimilative capacity when the coastal area is excluded.

For the West Coast Basin, average chloride concentrations in all layers and the volume-weighted total average for the entire basin, both including and excluding the coastal areas, exceed the BSBPO of 250 mg/L. There is -410 mg/L of assimilative capacity in the West Coast Basin when the coastal area is included and -56 mg/L of assimilative capacity when the coastal areas are excluded. The negative numbers indicate that there is no existing available assimilative capacity for chloride in the West Coast Basin due to seawater intrusion. Nonetheless, existing implementation measures including the seawater barriers and desalters are reducing overall chloride levels in the basin and additional proposed projects described in Appendix J *Implementation Plan,* including increased AWT recycled water recharge at the barriers and expanded desalter operations, will likely further reduce chloride levels in the future. When the coastal areas and the WCBB-inland saline plume are removed from the West Coast Basin average, there is 26 mg/L of available assimilative capacity for chloride, illustrating the significant impacts of saline plumes on the overall basin average.

For the coastal areas, average chloride concentrations in all layers and the volume-weighted total average for all layers exceed the BSBPOs of 150 mg/L and 250 mg/L in the Central Basin and West Coast Basin, respectively. There is -1,193 and -1,093 mg/L of assimilative capacity in the coastal areas in the Central Basin and West Coast Basin, respectively. The negative numbers indicate that there is no existing available assimilative capacity for chloride in the coastal areas as a result of seawater intrusion. The results for the coastal areas also illustrate the significant impact that the coastal areas have on overall basin averages. Based on the high chloride levels, groundwater production for potable use is unlikely to occur in the foreseeable future in the coastal areas.

3.5.2 Nitrate in Groundwater

3.5.2.1 Nitrate-N Concentrations

The right column of maps on Figure 9 shows median nitrate-N concentrations for wells in each model layer, with Model Layer 1 on top and Model Layer 4 on the bottom.

In the Central Basin, nitrate-N is below the MCL/BPO of 10 mg/L in most wells in all four layers, with a few exceptions. A few wells with higher nitrate-N concentrations but below the MCL were observed in the Montebello Forebay (Model Layers 1, 2, and 3), Los Angeles Forebay (Model Layers 2 and 3), and Whittier Area (Model Layer 2). Two wells with elevated concentrations above the MCL were observed in the Central Basin Pressure Area (Model Layer 3) and in the Los Angeles Forebay (Model Layer 3).

In the West Coast Basin, a few wells with elevated nitrate-N concentrations but below the 10 mg/L MCL were observed in Model Layers 2 and 3; only two of the wells (in Layer 2) have median concentrations that exceed the MCL.

Figure 33 shows the statistical distribution of the nitrate-N median concentrations as box plots in each subarea/layer. Nitrate-N box plots are shown along the right column in the figure, with Model Layer 1 on the top and Model Layer 4 on the bottom. While there are a few wells containing nitrate-N above the MCL of 10 mg/L, the box plots show the majority of wells have low nitrate-N median concentrations significantly below the MCL.

Figure 10 shows the nitrate-N concentration contour maps along the right column in the figure. As shown in the figure, only isolated hot spots of elevated nitrate-N concentrations are detected in Model Layers 1, 2, and 3 in both the Central Basin and West Coast Basin.

3.5.2.2 Average Nitrate-N Water Quality and Assimilative Capacity

Based on the groundwater quality contour maps (Figure 10), the average nitrate-N concentration in each subarea/layer was calculated. The combined volume-weighted average concentration in all four layers was calculated for each subarea and for the Central Basin and West Coast Basin (both including and excluding the coastal areas). Table G-12 and Figure 13 present the average nitrate-N concentrations, the MCL/BPO of 10 mg/L, and available assimilative capacity. Overall, nitrate-N concentrations in the CBWCB are significantly below the MCL/BPO and thus, nitrate is not considered a constituent of concern in the CBWCB and there is available assimilative capacity in both basins.

In the Central Basin, average nitrate-N concentrations in all subareas/layers are significantly below the MCL of 10 mg/L. The amalgamated average nitrate-N concentrations in the Central Basin, both including and excluding the coastal area, are also below the MCL. There is 9.72 mg/L of available assimilative capacity in the Central Basin whether the coastal area is excluded or included.

For the West Coast Basin, average nitrate-N concentrations in all layers and the volume-weighted total average for the entire basin, both including and excluding the coastal areas, are significantly below the MCL of 10 mg/L. There is 9.96 mg/L of available assimilative capacity in the West Coast Basin when the coastal areas are included and 9.95 mg/L of available assimilative capacity when the coastal areas are excluded.

Attachment G-A

Construction Information for WRD Nested Groundwater Monitoring Wells

Below is a table summarizing the construction information for over 300 nested groundwater monitoring wells at more than 55 locations in the Central Basin and West Coast Basin. These wells are owned by the Water Replenishment District of Southern California (WRD) and sampled semi-annually as part of WRD's Regional Groundwater Monitoring Program (RGWMP). Each nested well is screened in a specific aquifer, which helps to monitor regional groundwater quality and water levels. These nested monitoring wells are depicted in Figure 25.

CONSTRUCTION INFORMATION FOR WRD NESTED GROUNDWATER MONITORING WELLS

Well Name	Zone	WRD ID Number	Depth of Well (feet)	Top of Screen (feet)	Bottom of Screen (feet)	Aquifer Designation
Bell #1	1	102041	1750	1730	1750	Pico Formation
	2	102042	1215	1195	1215	Sunnyside
	3	102043	985	965	985	Silverado
	4	102044	635	615	635	Silverado
	5	102045	440	420	440	Hollydale
	6	102046	270	250	270	Gage
Bell Gardens #1	1	101954	1795	1775	1795	Sunnyside
	2	101955	1410	1390	1410	Sunnyside
	3	101956	1110	1090	1110	Sunnyside
	4	101957	875	855	875	Silverado
	5	101958	575	555	575	Lynwood
	6	101959	390	370	390	Gage
Carson #1	1	100030	1010	990	1010	Sunnyside
	2	100031	760	740	760	Silverado
	3	100032	480	460	480	Lynwood
	4	100033	270	250	270	Gage
Carson #2	1	101787	1250	1230	1250	Sunnyside
	2	101788	870	850	870	Silverado
	3	101789	620	600	620	Silverado
	4	101790	470	450	470	Lynwood
	5	101791	250	230	250	Gage

CONSTRUCTION INFORMATION FOR WRD NESTED GROUNDWATER MONITORING WELLS						
Well Name	**Zone**	**WRD ID Number**	**Depth of Well (feet)**	**Top of Screen (feet)**	**Bottom of Screen (feet)**	**Aquifer Designation**
Carson #3	1	102075	1800	1600	1620	Pico Formation
	2	102076	1240	1220	1240	Sunnyside
	3	102077	1100	1080	1100	Sunnyside
	4	102078	890	870	890	Silverado
	5	102079	640	620	640	Silverado
	6	102080	380	360	380	Lynwood
Cerritos #1	1	100870	1215	1155	1175	Sunnyside
	2	100871	1020	1000	1020	Sunnyside
	3	100872	630	610	630	Lynwood
	4	100873	290	270	290	Gage
	5	100874	200	180	200	Artesia
	6	100875	135	125	135	Artesia
Cerritos #2	1	101781	1470	1350	1370	Sunnyside
	2	101782	935	915	935	Silverado
	3	101783	760	740	760	Silverado
	4	101784	510	490	510	Jefferson
	5	101785	370	350	370	Gage
	6	101786	170	150	170	Gaspur
Chandler #3B	1	100082	363	341	363	Gage/Lynwood/Silverado
Chandler #3A	2	100083	192	165	192	Gage/Lynwood/Silverado
Commerce #1	1	100881	1390	1330	1390	Pico Formation
	2	100882	960	940	960	Sunnyside
	3	100883	780	760	780	Sunnyside
	4	100884	590	570	590	Silverado
	5	100885	345	325	345	Hollydale
	6	100886	225	205	225	Exposition/Gage
Compton #1	1	101809	1410	1370	1390	Sunnyside
	2	101810	1170	1150	1170	Sunnyside
	3	101811	820	800	820	Silverado
	4	101812	480	460	480	Hollydale
	5	101813	325	305	325	Gage

CONSTRUCTION INFORMATION FOR WRD NESTED GROUNDWATER MONITORING WELLS						
Well Name	**Zone**	**WRD ID Number**	**Depth of Well (feet)**	**Top of Screen (feet)**	**Bottom of Screen (feet)**	**Aquifer Designation**
Compton #2	1	101948	1495	1475	1495	Sunnyside
	2	101949	850	830	850	Sunnyside
	3	101950	605	585	605	Silverado
	4	101951	400	380	400	Hollydale
	5	101952	315	295	315	Gage
	6	101953	170	150	170	Exposition
Downey #1	1	100010	1190	1170	1190	Sunnyside
	2	100011	960	940	960	Silverado
	3	100012	600	580	600	Silverado
	4	100013	390	370	390	Hollydale/Jefferson
	5	100014	270	250	270	Gage
	6	100015	110	90	110	Gaspur
Gardena #1	1	100020	990	970	990	Sunnyside
	2	100021	465	445	465	Silverado
	3	100022	365	345	365	Lynwood
	4	100023	140	120	140	Gage
Gardena #2	1	101804	1335	1275	1335	Sunnyside
	2	101805	790	770	790	Silverado
	3	101806	630	610	630	Silverado
	4	101807	360	340	360	Lynwood
	5	101808	255	235	255	Gardena
Hawthorne #1	1	100887	990	910	950	Sunnyside
	2	100888	730	710	730	Silverado
	3	100889	540	520	540	Silverado
	4	100890	420	400	420	Silverado
	5	100891	260	240	260	Lynwood
	6	100892	130	110	130	Gage
Huntington Park #1	1	100005	910	890	910	Silverado
	2	100006	710	690	710	Jefferson
	3	100007	440	420	440	Gage
	4	100008	295	275	295	Exposition
	5	100009	134	114	134	Gaspur

CONSTRUCTION INFORMATION FOR WRD NESTED GROUNDWATER MONITORING WELLS						
Well Name	**Zone**	**WRD ID Number**	**Depth of Well (feet)**	**Top of Screen (feet)**	**Bottom of Screen (feet)**	**Aquifer Designation**
Inglewood #1	1	100091	1400	1380	1400	Pico Formation
	2	100092	885	865	885	Pico Formation
	3	100093	450	430	450	Silverado
	4	100094	300	280	300	Lynwood
	5	100095	170	150	170	Gage
Inglewood #2	1	100824	860	800	840	Pico Formation
	2	100825	470	450	470	Sunnyside
	3	100826	350	330	350	Silverado
	4	100827	245	225	245	Lynwood
Inglewood #3	1	102138	1940	1900	1940	Pico Formation
	2	102139	1460	1440	1460	Pico Formation
	3	102140	1275	1255	1275	Pico Formation
	4	102141	910	890	910	Pico Formation
	5	102142	560	540	560	Silverado
	6	102143	390	370	390	Lynwood/Silverado
	7	102144	265	245	265	Gage/Lynwood
Lakewood #1	1	100024	1009	989	1009	Sunnyside
	2	100025	660	640	660	Silverado
	3	100026	470	450	470	Lynwood
	4	100027	300	280	300	Gage
	5	100028	160	140	160	Artesia
	6	100029	90	70	90	Bellflower
Lakewood #2	1	102151	2000	1960	2000	Sunnyside
	2	102152	1760	1740	1760	Sunnyside
	3	102153	1320	1300	1320	Sunnyside
	4	102154	1015	995	1015	Silverado
	5	102155	710	690	710	Lynwood
	6	102156	575	555	575	Jefferson
	7	102157	275	255	275	Gage
	8	102158	120	110	120	Artesia

CONSTRUCTION INFORMATION FOR WRD NESTED GROUNDWATER MONITORING WELLS						
Well Name	**Zone**	**WRD ID Number**	**Depth of Well (feet)**	**Top of Screen (feet)**	**Bottom of Screen (feet)**	**Aquifer Designation**
La Mirada #1	1	100876	1150	1130	1150	Sunnyside
	2	100877	985	965	985	Silverado
	3	100878	710	690	710	Lynwood
	4	100879	490	470	490	Jefferson
	5	100880	245	225	245	Gage
Lawndale #1	1	102171	1400	1360	1400	Pico Formation
	2	102172	905	885	905	Pico Formation
	3	102173	635	615	635	Pico Formation
	4	102174	415	395	415	Silverado
	5	102175	310	290	310	Lynwood
	6	102176	190	170	190	Gardena
Lomita #1	1	100818	1340	1240	1260	Sunnyside
	2	100819	720	700	720	Sunnyside
	3	100820	570	550	570	Silverado
	4	100821	420	400	420	Silverado
	5	100822	240	220	240	Gage
	6	100823	120	100	120	Gage
Long Beach #1	1	100920	1470	1430	1450	Sunnyside
	2	100921	1250	1230	1250	Sunnyside
	3	100922	990	970	990	Silverado
	4	100923	619	599	619	Lynwood
	5	100924	420	400	420	Jefferson
	6	100925	175	155	175	Gage
Long Beach #2	1	101740	1090	970	990	Sunnyside
	2	101741	740	720	740	Sunnyside
	3	101742	470	450	470	Silverado
	4	101743	300	280	300	Lynwood
	5	101744	180	160	180	Gage
	6	101745	115	95	115	Gaspur
Long Beach #3	1	101751	1390	1350	1390	Sunnyside
	2	101752	1017	997	1017	Silverado
	3	101753	690	670	690	Silverado
	4	101754	550	530	550	Silverado
	5	101755	430	410	430	Lynwood

CONSTRUCTION INFORMATION FOR WRD NESTED GROUNDWATER MONITORING WELLS						
Well Name	**Zone**	**WRD ID Number**	**Depth of Well (feet)**	**Top of Screen (feet)**	**Bottom of Screen (feet)**	**Aquifer Designation**
Long Beach #4	1	101759	1380	1200	1220	Pico Formation
	2	101760	820	800	820	Sunnyside
Long Beach #6	1	101792	1530	1490	1510	Pico Formation
	2	101793	950	930	950	Sunnyside
	3	101794	760	740	760	Sunnyside
	4	101795	500	480	500	Silverado
	5	101796	400	380	400	Lynwood
	6	101797	240	220	240	Gage
Long Beach #8	1	101819	1495	1435	1455	Pico Formation
	2	101820	1040	1020	1040	Sunnyside
	3	101821	800	780	800	Silverado
	4	101822	655	635	655	Silverado
	5	101823	435	415	435	Lynwood
	6	101824	185	165	185	Gage
Los Angeles #1	1	100926	1370	1350	1370	Pico Formation
	2	100927	1100	1080	1100	Sunnyside
	3	100928	940	920	940	Silverado
	4	100929	660	640	660	Lynwood
	5	100930	370	350	370	Gage
Los Angeles #2	1	102003	1370	1330	1370	Pico Formation
	2	102004	730	710	730	Sunnyside
	3	102005	525	505	525	Sunnyside
	4	102006	430	410	430	Silverado
	5	102007	265	245	265	Lynwood
	6	102008	155	135	155	Exposition
Los Angeles #3	1	102069	1570	1210	1230	Sunnyside
	2	102070	895	875	895	Silverado
	3	102071	725	705	725	Lynwood
	4	102072	570	550	570	Hollydale
	5	102073	350	330	350	Gage
	6	102074	210	190	210	Expo

CONSTRUCTION INFORMATION FOR WRD NESTED GROUNDWATER MONITORING WELLS						
Well Name	**Zone**	**WRD ID Number**	**Depth of Well (feet)**	**Top of Screen (feet)**	**Bottom of Screen (feet)**	**Aquifer Designation**
Los Angeles #4	1	102131	1780	1740	1780	Pico Formation
	2	102132	1230	1190	1230	Pico Formation
	3	102133	740	720	740	Sunnyside
	4	102134	510	490	510	Silverado
	5	102135	375	355	375	Lynwood
	6	102136	255	235	255	Gage
Lynwood #1	1	102211	2900	2880	2900	Pico Formation
	2	102212	2450	2430	2450	Pico Formation
	3	102213	1670	1650	1670	Pico Formation
	4	102214	1465	1445	1465	Pico Formation
	5	102215	1220	1200	1220	Pico Formation
	6	102216	900	880	900	Sunnyside
	7	102217	660	640	660	Lynwood/Silverado
	8	102218	335	315	335	Gardena
	9	102219	180	160	180	Gaspur
Manhattan Beach #1	1	102081	1990	1950	1990	Pico Formation
	2	102082	1590	1570	1590	Pico Formation
	3	102083	1270	1250	1270	Sunnyside
	4	102084	885	865	885	Silverado
	5	102085	660	640	660	Silverado
	6	102086	340	320	340	Lynwood
	7	102087	200	180	200	Gage
Montebello #1	1	101770	980	900	960	Pico Formation
	2	101771	710	690	710	Sunnyside
	3	101772	520	500	520	Silverado
	4	101773	390	370	390	Lynwood
	5	101774	230	210	230	Gage
	6	101775	110	90	110	Exposition
Norwalk #1	1	101814	1420	1400	1420	Sunnyside
	2	101815	1010	990	1010	Silverado
	3	101816	740	720	740	Lynwood
	4	101817	450	430	450	Jefferson
	5	101818	240	220	240	Gage

CONSTRUCTION INFORMATION FOR WRD NESTED GROUNDWATER MONITORING WELLS						
Well Name	**Zone**	**WRD ID Number**	**Depth of Well (feet)**	**Top of Screen (feet)**	**Bottom of Screen (feet)**	**Aquifer Designation**
Norwalk #2	1	101942	1480	1460	1480	Sunnyside
	2	101943	1280	1260	1280	Sunnyside
	3	101944	980	960	980	Silverado
	4	101945	820	800	820	Lynwood
	5	101946	500	480	500	Gardena
	6	101947	256	236	256	Exposition
Pico #1	1	100001	900	860	900	Pico Formation
	2	100002	480	460	480	Silverado
	3	100003	400	380	400	Silverado
	4	100004	190	170	190	Gardena
Pico #2	1	100085	1200	1180	1200	Sunnyside
	2	100086	850	830	850	Sunnyside
	3	100087	580	560	580	Sunnyside
	4	100088	340	320	340	Silverado
	5	100089	255	235	255	Lynwood
	6	100090	120	100	120	Gaspur
PM-1 Columbia	1	100042	605	555	595	Sunnyside
	2	100043	510	460	500	Silverado
	3	100044	290	240	280	Lynwood
	4	100045	210	160	200	Lynwood
PM-3 Madrid	1	100034	685	640	680	Sunnyside
	2	100035	525	480	520	Silverado
	3	100036	285	240	280	Lynwood
	4	100037	190	145	185	Gage
PM-4 Mariner	1	100038	720	670	710	Sunnyside
	2	100039	550	500	540	Silverado
	3	100040	390	340	380	Lynwood
	4	100041	250	200	240	Lynwood

CONSTRUCTION INFORMATION FOR WRD NESTED GROUNDWATER MONITORING WELLS						
Well Name	**Zone**	**WRD ID Number**	**Depth of Well (feet)**	**Top of Screen (feet)**	**Bottom of Screen (feet)**	**Aquifer Designation**
PM-5 Columbia Park	1	102047	1480	1360	1380	Pico Formation
	2	102048	960	940	960	Pico Formation
	3	102049	790	770	790	Sunnyside
	4	102050	600	580	600	Sunnyside
	5	102051	340	320	340	Silverado
	6	102052	160	140	160	Gage
PM-6 Madrona Marsh	1	102053	1235	1195	1235	Pico Formation
	2	102054	925	905	925	Sunnyside
	3	102055	790	770	790	Sunnyside
	4	102056	550	530	550	Silverado
	5	102057	410	390	410	Lynwood
	6	102058	260	240	260	Gage
Rio Hondo #1	1	100064	1150	1110	1130	Sunnyside
	2	100065	930	910	930	Sunnyside
	3	100066	730	710	730	Sunnyside
	4	100067	450	430	450	Silverado
	5	100068	300	280	300	Lynwood
	6	100069	160	140	160	Gardena
Seal Beach #1	1	102062	1485	1345	1365	Sunnyside
	2	102063	1180	1160	1180	Sunnyside
	3	102064	1040	1020	1040	Sunnyside
	4	102065	795	775	795	Silverado
	5	102066	625	605	625	Lynwood
	6	102067	235	215	235	Gage
	7	102068	70	60	70	Gaspur
South Gate #1	1	100893	1460	1440	1460	Pico Formation
	2	100894	1340	1320	1340	Sunnyside
	3	100895	930	910	930	Silverado
	4	100896	585	565	585	Lynwood
	5	100897	250	220	240	Exposition

CONSTRUCTION INFORMATION FOR WRD NESTED GROUNDWATER MONITORING WELLS						
Well Name	**Zone**	**WRD ID Number**	**Depth of Well (feet)**	**Top of Screen (feet)**	**Bottom of Screen (feet)**	**Aquifer Designation**
South Gate #2	1	102180	1760	1740	1760	Pico Formation
	2	102181	1430	1410	1430	Pico Formation
	3	102182	1082	1062	1082	Sunnyside
	4	102183	690	670	690	Silverado
	5	102184	430	410	430	Hollydale
	6	102185	225	205	225	Gaspur
Westchester #1	1	101776	860	740	760	Pico Formation
	2	101777	580	560	580	Sunnyside
	3	101778	475	455	475	Silverado
	4	101779	330	310	330	Lynwood
	5	101780	235	215	235	Gage
Whittier #1	1	101735	1298	1180	1200	Sunnyside
	2	101736	940	920	940	Sunnyside
	3	101737	620	600	620	Silverado
	4	101738	470	450	470	Lynwood
	5	101739	220	200	220	Gage
Whittier #2	1	101936	1390	1370	1390	Sunnyside
	2	101937	1110	1090	1110	Sunnyside
	3	101938	675	655	675	Silverado
	4	101939	445	425	445	Silverado
	5	101940	335	315	335	Lynwood
	6	101941	170	150	170	Gardena
Whittier Narrows #1	1	100046	810	749	769	Sunnyside
	2	100047	810	609.5	629	Sunnyside
	3	100048	810	462.5	482.5	Sunnyside
	4	100049	810	392.5	402	Silverado
	5	100050	810	334	343.5	Silverado
	6	100051	810	272.5	282.5	Lynwood
	7	100052	810	233.5	243	Jefferson
	8	100053	810	163	173	Gardena
	9	100054	810	95	104.5	Gaspur

CONSTRUCTION INFORMATION FOR WRD NESTED GROUNDWATER MONITORING WELLS						
Well Name	**Zone**	**WRD ID Number**	**Depth of Well (feet)**	**Top of Screen (feet)**	**Bottom of Screen (feet)**	**Aquifer Designation**
Whittier Narrows #2	1	100055	720	659.3	678.4	Pico Formation
	2	100056	720	579.1	598.2	Pico Formation
	3	100057	720	469.0	488.2	Pico Formation
	4	100058	720	418.6	428.2	Pico Formation
	5	100059	720	328.7	338.3	Pico Formation
	6	100060	720	263.2	273.3	Not Interpreted
	7	100061	720	213.7	223.3	Not Interpreted
	8	100062	720	135.7	145.3	Not Interpreted
	9	100063	720	90.8	100.3	Gardena
Willowbrook #1	1	100016	905	885	905	Sunnyside
	2	100017	520	500	520	Silverado
	3	100018	380	360	380	Lynwood
	4	100019	220	200	220	Gage
Wilmington #1	1	100070	1040	915	935	Sunnyside
	2	100071	800	780	800	Sunnyside
	3	100072	570	550	570	Silverado
	4	100073	245	225	245	Lynwood
	5	100074	140	120	140	Gage
Wilmington #2	1	100075	1030	950	970	Sunnyside
	2	100076	775	755	775	Silverado
	3	100077	560	540	560	Lynwood
	4	100078	410	390	410	Lynwood
	5	100079	140	120	140	Gage

Appendix H

Baseline and Future Water Balances

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1 Introduction

This Appendix H describes the baseline and future water balances in the Central Basin and West Coast Basin (CBWCB). Key components of this appendix include:

- A description of CBWCB annual water balances for the baseline period from Water Year (WY) 2000-01 to 2009-10,
- Based on goals and objectives for projects and water use, a prediction of CBWCB annual water balances for the future planning period from WY 2010-11 to 2025-25, and
- Estimation of changes in groundwater levels due to implementation of projects in the future planning period.

Section 2 describes the baseline and future planning period water balances in the CBWCB. All sources of inflow and outflow from the basins are described. Future planning period changes in inflows and outflows are based on various planning documents, goals and objectives for recycled water use and stormwater capture, and input from the CBWCB stakeholders. Section 3 describes changes in groundwater levels due to implementation of proposed projects in the future planning period. References cited in this appendix are provided at the end of the Salt and Nutrient Management Plan (SNMP).

2 Baseline and Future Planning Period Water Balance

2.1 Baseline Period Data Sources

In order to estimate the baseline period salt and nutrient (S/N) balance in the CBWCB, it is necessary to have an understanding of the baseline period groundwater inflows and outflows (i.e., the water balances). The baseline period covers WY 2000-01 to 2009-10, as established in the LARWQCB-approved *SNMP Workplan* (CBWCB Stakeholders, 2011). The water balance changes from year to year based on a number of factors, including replenishment activities, precipitation, availability of imported water supplies, subsurface inflow and outflow (e.g., groundwater flow directions and gradients), and groundwater extraction. The difference between the basin inflow and outflow is the change in groundwater storage in the basin.

The water balance consists of estimates of specific inflows and outflows for each basin. The various groundwater inflows and outflows are reported by the Water Replenishment District of Southern California (WRD) in their annual *Engineering Survey and Report* (accessed at: http://www.wrd.org/engineering/groundwater-engineering-reports.php), by the Central Basin and West Coast Basin Watermaster[1] in their annual *Watermaster Service* reports for each basin

[1] As a result of the Judgment issued on December 18, 2013, the California Department of Water Resources is no longer Watermaster of the Central Basin. Beginning July 1, 2014, the Watermaster is now comprised of three entities: 1) Administrative Body, 2) Water Rights Panel, and 3) Storage Panel. The Water Replenishment District of Southern California has been designated as the Administrative Body and will be responsible for preparing the annual *Watermaster Service* reports and submitting them to the Water Rights Panel. The Water Rights Panel is

(accessed at: http://www.water.ca.gov/watermaster/aboutwatermaster/index.cfm). Imported water deliveries and groundwater pumping volumes are also provided in the *Watermaster Service* reports. Volumes of replenishment (managed aquifer recharge) water, groundwater pumping, and imported water and recycled water use are provided in WRD's annual *Engineering Survey and Reports*.

A calibrated groundwater flow model previously developed for the Study Area by the United States Geological Survey (USGS) was recently updated as part of the Groundwater Basins Master Plan (GBMP) (USGS, 2003; CH2MHILL, 2012b). Water balances developed as part of these groundwater modeling efforts were relied upon for some components of the SNMP water balances. Additionally, the USGS/GBMP modeling reports provided estimates of percolation of precipitation including irrigation return flows and other minor sources, mountain front recharge, and subsurface groundwater flow (USGS, 2003; CH2MHILL, 2012b).

2.2 Future Planning Period Data Sources

In conformance with the SWRCB Recycled Water Policy, estimated (known and/or predicted) potable and non-potable water recycling and stormwater recharge/use goals and objectives were developed as part of the SNMP. Projections were also provided for other components of the future planning period water balances.

The SNMP *Workplan* approved by the LARWQCB (Stakeholders, 2011) established a 10-year future planning horizon of WY 2010-11 to 2019-20. The CBWCB stakeholders agreed to extend the future planning ending date from WY 2019-20 to 2024-25 based on a suggestion by LARWQCB staff at the July 26, 2012 SNMP Stakeholder meeting. As a result, the future planning period was extended to 15 years, so from WY 2010-11 to 2024-25.

The characterization of future water balance components was facilitated by several ongoing planning efforts in the region. The 2012 update to the 2006 Greater Los Angeles County (GLAC) Integrated Regional Water Management Plan (IRWMP) (RMC, 2012b) provided information regarding water supply target volumes, which were obtained from regional planning documents and stakeholder review/input from the same agencies participating as stakeholders for the SNMP. Information was also obtained from the July 2012 Draft GBMP (CH2MHILL, 2012b), permits and planning documents for groundwater recharge projects, and other planning documents. Target volumes and objectives developed for the SNMP were coordinated with work being conducted as part of the Los Angeles Gateway Region IRWMP.[2] Preliminary water balance component goals and objectives developed for the SNMP were reviewed and refined with information provided by the CBWCB stakeholders.

One of the key goals of the GLAC IRWMP is to optimize local water supplies to reduce reliance on imported water. The 2012 update refined the target volumes established in the 2006 GLAC IRWMP. The GLAC IRWMP Region includes the CBWCB and consists of over 10 million

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ultimately responsible for submitting the final *Watermaster Service* reports to the Superior Court of the State of California for filing.

[2] The Los Angeles Gateway Region includes 26 mainland cities and small portions of unincorporated areas in Southeastern Los Angeles County, a subset of the Central Basin. See http://www.gatewayirwmp.org/.

residents, portions of 4 counties, 92 cities, and hundreds of agencies and districts. To manage stakeholder outreach and data input, the GLAC IRWMP Region is divided into five subregions: 1) the South Bay Watershed; 2) the North Santa Monica Bay Watersheds; 3) the Lower San Gabriel River and Lower Los Angeles River Watersheds; 4) the Upper Los Angeles River Watersheds; and 5) the Upper San Gabriel River and Rio Hondo Watersheds (Figure 34). Two of the subregions essentially conform to the SNMP Study Area: 1) the Lower San Gabriel River and Lower Los Angeles River Subregion is comprised of the Central Basin and portions of abutting hills and 2) the South Bay Subregion is comprised of the West Coast Basin, Santa Monica Basin, Hollywood Basin, and portions of abutting hills. Information for the South Bay Subregion that is directly related to only the West Coast Basin was extracted to estimate future water balances for the SNMP.

Initial target volumes in the 2012 GLAC IRWMP were established using representative 2010 Urban Water Management Plans (UWMPs) from each subregion, groundwater adjudication documents, annual *Watermaster Service* reports, and recycled water master plans. The target volumes were refined through input from meetings of each Subregional Steering Committee and subsequently with input from a working group made up of water suppliers from each subregion. While the planning horizon for the 2012 GLAC IRWMP update is 2035, information was extracted or estimated to conform to the 2025 SNMP future planning horizon.

Development of the Draft GBMP was initiated by WRD to provide the CBWCB stakeholders with a roadmap for collaborative and strategic development of potential future projects and programs that will more effectively use groundwater in the basins to increase water supply reliability. Increased reliability is based on two scenarios: 1) pumping the maximum amount of the adjudicated water rights each year (the Allowable Pumping Allocation), and 2) pumping groundwater beyond adjudicated rights. Based on a long-term planning horizon, the Draft GBMP identified a range of projects to ensure that additional replenishment water will be supplied to meet pumping rights and to reduce reliance on imported water. Because the GBMP planning horizon is beyond 2025 and many of the potential projects are uncertain and conceptual, some of the projects identified in the Draft GBMP were not used to develop the SNMP water budget targets.

For the SNMP target volumes, additional information that was considered include existing LARWQCB permits, environmental documents, and information/input from the CBWCB stakeholders. It is important to acknowledge that work on the 2012 GLAC IRWMP and finalization of target volumes will continue beyond the completion of the SNMP and thus, there may be some difference in the final target volumes referenced in the GLAC IRWMP and SNMP. Some future planning period water balance components identified in the SNMP are not expected to change significantly and are projected to remain at the baseline period average throughout the future planning period.

2.4 Groundwater Recharge (Inflows)

Major sources of groundwater inflows to the CBWCB include:

- Managed aquifer recharge in spreading grounds, instream facilities, and at the seawater intrusion barriers;
- Deep percolation of precipitation;
- Irrigation return flows;
- Percolation of runoff from surrounding uplands (mountain front recharge); and
- Subsurface groundwater inflow from adjacent groundwater basins.

Other minor potential sources of groundwater recharge include leaking pipes, septic systems, and stream losses (not associated with managed aquifer recharge). In the CBWCB, losses from leaking pipes and septic systems are believed to be small in comparison to the major sources. Natural stream recharge (other than the managed aquifer recharge in the San Gabriel River in the Montebello Forebay) is also limited, as most major rivers and streams are concrete lined.

The largest volume of recharge in the Central Basin occurs in the Montebello Forebay via the spreading grounds and instream facilities (i.e., check dams) in the San Gabriel River. Other major sources of recharge include injection at the Alamitos Gap Seawater Intrusion Barrier (AGB), subsurface groundwater inflow, deep percolation of precipitation, irrigation return flows, and mountain front recharge. Additionally, the City of Long Beach has four aquifer storage and recovery (ASR) wells that can be used to inject imported water available in wet years into the Central Basin and have the capacity to extract water when needed. For the SNMP future planning period, the City of Long Beach only plans to use the wells for extraction[3].

In the West Coast Basin, aquifers are generally confined and natural replenishment is dominated by subsurface inflows (CH2MHILL, 2012b). Sources of recharge in the West Coast Basin includes injection at the seawater intrusion barriers including the West Coast Basin Seawater Intrusion Barrier (WCBB) and Dominguez Gap Seawater Intrusion Barrier (DGB), subsurface groundwater inflow, deep percolation of precipitation, mountain front recharge, irrigation return flows, and the Dominguez Gap Spreading Grounds (DGSG).

2.4.1 Spreading Grounds and Instream Recharge

Managed aquifer recharge (MAR) in the CBWCB occurs through:

1) Three spreading grounds – Includes the Rio Hondo Spreading Grounds (RHSG) and San Gabriel River Spreading Grounds (SGRSG) in the Montebello Forebay and the DGSG near the southern border between the Central Basin and West Coast Basin; and
2) Multiple instream recharge facilities – Includes instream check dam facilities along the San Gabriel River in the Montebello Forebay.

[3] Personal communication from Ted Johnson, WRD, August 6, 2012.

These groundwater replenishment activities directly recharge Model Layer 1 (shallowest layer) with subsequent movement to lower model layers and other subareas.

2.4.1.1 Montebello Forebay Spreading Grounds and Instream Recharge

The MFSG, consisting of both the RHSG and SGRSG and located downstream of the Whittier Narrows Dam, recharge a significant amount of water in the Montebello Forebay (Figure 1). The MFSG are owned, operated, and maintained by the Los Angeles County Department of Public Works (LACDPW). The RHSG consist of spreading basins on both the east and west sides of the Rio Hondo. The recharge basins of the SGRSG are located on the west side of the San Gabriel River. Instream infiltration along the unlined stretch of the San Gabriel River in the Montebello Forebay is enhanced by the presence of inflatable rubber dams (Figure 4). These dams can be inflated to restrict flow in the unlined channel to promote recharge within the Montebello Forebay.

Currently, water delivered to the MFSG includes a mix of tertiary-treated recycled water, imported water, and local stormwater. Managed aquifer recharge in the Montebello Forebay was first implemented in WY 1937-38 and the first full year of recharge with recycled water began in WY 1962-63. The recycled water is produced by the San Jose Creek, Whittier Narrows, and Pomona Water Reclamation Plants (WRPs), which are owned and operated by the Sanitation Districts of Los Angeles County (SDLAC). Untreated imported water from the Colorado River (CR) and State Water Project (SWP) is provided by the Metropolitan District of Southern California (MWD). Local water and stormwater recharged in the Montebello Forebay includes natural runoff and controlled releases from upstream dams. In addition, a small amount of groundwater imported from the San Gabriel Basin was historically recharged at the MFSG. WRD purchases the recycled water and imported water recharged in the Montebello Forebay.

The volumes and sources of water recharged in the Montebello Forebay between WY 2000-01 and 2009-10, the SNMP baseline period, are shown in **Table H-1**. Data from the SNMP baseline period was used for assessment of water balances and S/N balances, and provide the basis for calibration to observed groundwater quality trends discussed in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality*. The average annual amount of water recharged in the Montebello Forebay during the baseline period was about 118,000 acre-feet per year (AFY).

During the future planning period, a recycled water project under WRD’s Groundwater Reliability Improvement Program (GRIP) is expected to be implemented to supply advanced treated and/or increased tertiary-treated recycled water recharge at the MFSG to completely replace imported water (up to 21,000 AFY). Two project alternatives, GRIP Recycled Water Project A (GRIP A) and GRIP Recycled Water Project B (GRIP B), are being considered for implementation. For GRIP A, up to 11,000 AFY of additional tertiary-treated recycled water from the San Jose Creek WRP and up to an additional 10,000 AFY of advanced treated recycled water will be recharged in the Montebello Forebay to replace imported water. For GRIP B, up to 21,000 AFY of additional tertiary-treated recycled water from the San Jose Creek WRP will be recharged in the Montebello Forebay to replace imported water. Both proposed project

Table H-1 Volume and Sources of Recharge Water in the Montebello Forebay – Baseline Period

WATER YEAR	IMPORTED WATER [abc]				RECYCLED WATER [ac]				LOCAL WATER [ac]	TOTAL [h]
	SWP	CR	USEPA Ground water	TOTAL	Whittier WRP	San Jose Creek WRP	Pomona WRP	TOTAL	Stormwater and River Baseflow	
2000-01	16,001	7,450	0	23,451	8,253	35,165	2,925	46,343	39,725	109,519
2001-02	24,566	16,702	1,607 [d]	42,875	8,474	50,194	1,928	60,596	17,000	120,471
2002-03	12,460	4,837	5,069 [e]	22,366	5,156	35,320	2,320	42,796	58,202	123,364
2003-04	25,996	1,524	0	27,520 [f]	8,195	34,033	2,697	44,925	30,467	102,912
2004-05	18,197	7,099	0	25,296 [f]	6,741	20,547	2,215	29,503	148,674	203,473
2005-06	24,402	8,827	0	33,229	8,868	30,180	2,973	42,022	60,377	135,628
2006-07	33,004	7,211	0	40,214	7,334	34,823	2,882	45,039	11,495	96,748
2007-08	1,219	291	0	1,510 [g]	6,212	29,131	4,424	39,767	54,518	95,795
2008-09	0	0	0	0	5,202	29,999	4,410	39,611	35,348	74,959
2009-10	7,892	18,394	0	26,286	5,431	45,538	4,762	55,731	35,398	117,415
Average	16,374	7,233	668	24,275	6,987	34,493	3,154	44,633	49,120	118,028

All values in acre-feet per year
USEPA - United States Environmental Protection Agency
WRP - Water Reclamation Plant
WRD - Water Replenishment District of Southern California
MWD - Metropolitan Water District of Southern California
SWP - State Water Project
CR - Colorado River
AF - acre-feet

a - Data from: WRD, March 4, 2011, Engineering Survey and Report
b - Relative volume of water from SWP and CR provided by Kathy Kunysz of MWD, numbers are best approximation
c - Imported and recycled water from the Whittier and San Jose Creek WRPs are purchased; local water and Pomona WRP efffleunt are incidental recharge; purchased water may have losses to San Gabriel Basin before reaching the Montebello Forebay Spreading Grounds
d - USEPA extracted groundwater from Whittier Narrows, considered imported water
e - USEPA extracted groundwater from the Whittier Narrows, considered imported water
f - Includes 13,000 AF of water banked by Long Beach under a storage agreement with WRD (792 AF in Feb 2003 and 12,210 AF in March 2004)
g - CBMWD purchased 1,510 AF imported water for spreading for Cities of Downey, Lakewood, and Cerritos
h - Includes the Rio Hondo Spreading Grounds, Whittier Narrows Conservation Pool, San Gabriel River Spreading Grounds and unlined portion of the San Gabriel River

alternatives have the same total recharge volumes; however, GRIP B is projected to start in WY 2014-15, while GRIP A would not start until WY 2017-18 and the water quality of the recharge water would be different under the different scenarios.

The GRIP A and GRIP B alternatives are the end result of a long process of analysis of many different alternatives including consideration of different levels of recycled water treatment and blending, different wastewater treatment facilities providing the recycled water, continued imported water deliveries, alternative imported water supplies, desalination, and increased stormwater capture (MWH, 2009a through 2009l; RMC, 2011b; SDLAC, 2012; and CH2MHILL, 2012c). At this time, GRIP A and GRIP B are being further evaluated by WRD in terms of feasibility and cost and a Draft Environmental Impact Report was issued for public review in March 2014 (accessed at: http://www.wrd.org/business/water-replenishment-grip.php). In the Draft EIR, GRIP A was identified as the "proposed project," while GRIP B was identified as an "alternative" to the "proposed project" (AECOM, 2014). As a result, it is anticipated that GRIP A likely would be the project to be implemented by WRD. However, this is subject to change until the Final EIR is prepared and certified by WRD.

Table H-2 presents the sources of water and target volumes for MAR in the Montebello Forebay from WY 2010-11 through 2024-25 (SNMP future planning period) based on implementation of GRIP B. **Table H-3** presents the sources of water and target volumes for MAR in the Montebello Forebay from WY 2010-11 through 2024-25 (SNMP future planning period) based on implementation of GRIP A. While the sources of recharge water are different, the total volume of water recharged is the same for both alternatives. As indicated in Tables H-2 and H-3, the total volume of water recharged in the Montebello Forebay is projected to increase slightly from the baseline period average of about 118,000 AFY to about 125,000 AFY by WY 2024-25 due to improvements in stormwater capture and increased use of recycled water, which is a more reliable supply compared to imported water.

The Draft GBMP discusses the potential to fully utilize SDLAC's San Jose Creek WRP and Los Coyotes WRP with the possibility to provide up to an additional 66,800 AFY of recycled water for spreading and injection in the Montebello Forebay (including the proposed GRIP Recycled Water Project). With the exception of the proposed GRIP Recycled Water Project, these future projects were projected to occur beyond the SNMP 2025 planning horizon and therefore, were not discussed in the SNMP.

Several projects, presented below, were identified by LACDPW that also provide additional flexibility for MFSG recharge operations, but will not specifically expand recycled water or imported water recharge and thus do not affect recharge target volumes[4].

- Rio Hondo Spreading Grounds Basin 6E to 8E Connection – The connection will allow for increased flexibility to capture 1,200 AFY of recycled water.
- San Gabriel River Levee Repair – The loss of the levee could temporarily suspend all recharge activities at the San Gabriel River Spreading Grounds and San Gabriel River.

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[4] Personal communication, Greg Jaquez, LACDPW, August 16, 2012.

Table H-2 GRIP B - Recycled Water, Imported Water, and Local Target Volumes for Recharge in the Montebello Forebay – Future Planning Period

WATER YEAR	BASELINE AVERAGE VOLUMES OF RECHARGE AT MONTEBELLLO FOREBAY SPREADING GROUNDS (in acre-feet per year)								
	IMPORTED WATER [ab]			TERTIARY RECYCLED WATER [ac]				LOCAL WATER [c]	
	SWP	CR	Total	Whittier WRP	San Jose Creek WRP	Pomona WRP	Total	Stormwater and River Baseflow	Total [g]
Baseline Average 2001-2010	16,374	7,233	24,275	6,987	34,493	3,154	44,633	49,120	118,028
Water Year	PROJECTED VOLUMES OF RECHARGE AT MONTEBELLLO FOREBAY SPREADING GROUNDS (in acre-feet per year)								
2010-11	11,421	4,579	16,000	7,827	38,641	3,533	50,000 [d]	54,000	120,000
2011-12	11,421	4,579	16,000	8,609	42,505	3,886	55,000 [e]	54,000	125,000
2012-13	11,421	4,579	16,000	8,609	42,505	3,886	55,000	54,000	125,000
2013-14	11,421	4,579	16,000	8,609	42,505	3,886	55,000	54,000	125,000
2014-15	0	0	0	8,609	58,505	3,886	71,000 [f]	54,000	125,000
2015-16	0	0	0	8,609	58,505	3,886	71,000	54,000	125,000
2016-17	0	0	0	8,609	58,505	3,886	71,000	54,000	125,000
2017-18	0	0	0	8,609	58,505	3,886	71,000	54,000	125,000
2018-19	0	0	0	8,609	58,505	3,886	71,000	54,000	125,000
2019-20	0	0	0	8,609	58,505	3,886	71,000	54,000	125,000
2020-21	0	0	0	8,609	58,505	3,886	71,000	54,000	125,000
2021-22	0	0	0	8,609	58,505	3,886	71,000	54,000	125,000
2022-23	0	0	0	8,609	58,505	3,886	71,000	54,000	125,000
2023-24	0	0	0	8,609	58,505	3,886	71,000	54,000	125,000
2024-25	0	0	0	8,609	58,505	3,886	71,000	54,000	125,000
Δ 2025 [h]	(16,374)	(7,233)	(24,275)	1,623	24,012	732	26,367	4,880	6,972

USEPA - United States Environmental Protection Agency
WRP - Water Reclamation Plant
WRD - Water Replenishment District of Southern California
MWD - Metropolitan Water District of Southern California
CBMWD - Central Basin Municipal Water District
GRIP B - GRIP Recycled Water Project B
SWP - State Water Project Water
CR - Colorado River Water
SJCWRP - San Jose Creek Water Reclamation Plant
af - acre-feet
GRIP - Groundwater Reliability Improvement Program

a - Information provided by Ted Johnson, WRD, August 17, 2012 and Jim McDavid, WRD, December 12, 2012

b - Relative volume of water from SWP and CR for baseline provided by Kathy Kunysz of MWD; numbers are best approximation; relative volume of SWP and CR water for future planning period based on baseline distribution

c - Imported and recycled water from the Whittier Narrows and San Jose Creek WRPs are purchased; local water and Pomona WRP effluent are incidental recharge; purchased water may have losses to San Gabriel Basin before reaching the Spreading Grounds; distribution between plants for future planning period based on baseline averages; after 2014, additional increased flow is from SJCWRP; local water capture for future planning period is based on 30-year average using data from WRD Annual Engineering Survey and Reports

d - WRR (Order No. 91-100), which was amended in April 2009 via Order No. R4-2009-048, allows the maximum quantity of recycled water spread to be 35 percent based on the combined total inflow (imported water, stormwater, precipitation, and underflow) during a period of five years; LARWQCB (2013) approved increase in compliance averaging period to ten years due to below normal rainfall for seven of the last ten years

e - The projected increase reflects the ability to increase the recycled water replenishment as a result of using the five-year averaging period and thus counting larger stormwater inputs; compliance averaging period increased to ten years (LARWQCB, 2013)

f - This increase reflects the start of GRIP B (21,000 AFY of tertiary-treated recycled water)

g - Includes the Rio Hondo Spreading Grounds, Whittier Narrows Conservation Pool, San Gabriel River Spreading Grounds and unlined portion of San Gabriel River

h - This is the increase or decrease between the baseline period average and WY 2025

Table H-3 GRIP A - Recycled Water, Imported Water, and Local Target Volumes for Recharge in the Montebello Forebay – Future Planning Period

WATER YEAR	BASELINE AVERAGE VOLUMES OF RECHARGE AT MONTEBELLLO FOREBAY SPREADING GROUNDS (in acre-feet per year)									
	IMPORTED WATER [ab]			RECYCLED WATER [ac]					LOCAL WATER [c]	
					TERTIARY	ADVANCED TREATED				
	SWP	CR	Total	Whittier WRP	San Jose Creek WRP		Pomona WRP	Total	Stormwater and River Baseflow	Total [g]
Baseline Average 2001-2010	16,374	7,233	24,275	6,987	34,493	0	3,154	44,633	49,120	118,028
Water Year	**PROJECTED VOLUMES OF RECHARGE AT MONTEBELLLO FOREBAY SPREADING GROUNDS (in acre-feet per year)**									
2010-11	11,421	4,579	16,000	7,827	38,641	0	3,533	50,000 [d]	54,000	120,000
2011-12	11,421	4,579	16,000	8,609	42,505	0	3,886	55,000 [e]	54,000	125,000
2012-13	11,421	4,579	16,000	8,609	42,505	0	3,886	55,000	54,000	125,000
2013-14	11,421	4,579	16,000	8,609	42,505	0	3,886	55,000	54,000	125,000
2014-15	7,138	2,862	10,000	8,609	48,505	0	3,886	61,000	54,000	125,000
2015-16	7,138	2,862	10,000	8,609	48,505	0	3,886	61,000	54,000	125,000
2016-17	7,138	2,862	10,000	8,609	48,505	0	3,886	61,000	54,000	125,000
2017-18	0	0	0	8,609	48,505	10,000	3,886	71,000 [f]	54,000	125,000
2018-19	0	0	0	8,609	48,505	10,000	3,886	71,000	54,000	125,000
2019-20	0	0	0	8,609	48,505	10,000	3,886	71,000	54,000	125,000
2020-21	0	0	0	8,609	48,505	10,000	3,886	71,000	54,000	125,000
2021-22	0	0	0	8,609	48,505	10,000	3,886	71,000	54,000	125,000
2022-23	0	0	0	8,609	48,505	10,000	3,886	71,000	54,000	125,000
2023-24	0	0	0	8,609	48,505	10,000	3,886	71,000	54,000	125,000
2024-25	0	0	0	8,609	48,505	10,000	3,886	71,000	54,000	125,000
Δ 2025 [h]	(16,374)	(7,233)	(24,275)	1,623	14,012	10,000	732	26,367	4,880	6,972

USEPA - United States Environmental Protection Agency
WRP - Water Reclamation Plant
WRD - Water Replenishment District of Southern California
MWD - Metropolitan Water District of Southern California
CBMWD - Central Basin Municipal Water District
GRIP A - GRIP Recycled Water Project A
SWP - State Water Project Water
CR - Colorado River Water
SJCWRP - San Jose Creek Water Reclamation Plant
af - acre-feet
GRIP - Groundwater Reliability Improvement Program

a - Information provided by Ted Johnson, WRD, August 17, 2012 and Jim McDavid, WRD, December 12, 2012

b - Relative volume of water from SWP and CR for baseline provided by Kathy Kunysz of MWD; numbers are best approximation; relative volume of SWP and CR water for future planning period based on baseline distribution

c - Imported and recycled water from the Whittier Narrows and San Jose Creek WRPs are purchased; local water and Pomona WRP effluent are incidental recharge; purchased water may have losses to San Gabriel Basin before reaching the Spreading Grounds; distribution between plants for future planning period based on baseline averages; after 2014, additional increased flow is from SJCWRP; local water capture for future planning period is based on 30-year average using data from WRD Annual Engineering Survey and Reports

d - WRR (Order No. 91-100), which was amended in April 2009 via Order No. R4-2009-048, allows the maximum quantity of recycled water spread to be 35 percent based on the combined total inflow (imported water, stormwater, precipitation, and underflow) during a period of five years; LARWQCB (2013) approved increase in compliance averaging period to ten years due to below normal rainfall for seven of the last ten years

e - The projected increase reflects the ability to increase the recycled water replenishment as a result of using the five-year averaging period and thus counting larger stormwater inputs

f - This increase reflects the start of GRIP A (10,000 AFY of advance treated recycled water)

g - Includes the Rio Hondo Spreading Grounds, Whittier Narrows Conservation Pool, San Gabriel River Spreading Grounds and unlined portion of San Gabriel River

h - This is the increase or decrease between the baseline period average and WY 2025

- San Gabriel River Recycled Water Outlet – The addition of another outlet to the San Gabriel River from the recycled water pipeline delivering water from the San Jose Creek WRP will allow for increased flexibility of spreading 400 AFY of recycled water.
- Peck Road Spreading Basin Pump Station and Pipeline – The pump station would be located at Peck Road Spreading Basin, which could spread water to the San Gabriel River or direct flows to the Rio Hondo Concrete Channel. This project would reduce the loss of imported water (and stormwater) due to evaporation and percolation at Peck Road.

Local water recharged in the Montebello Forebay includes stormwater and river base flow. There are no additional stormwater conservation projects that will be constructed by the 2025 SNMP planning horizon to add stormwater conservation capacity to the forebay. Based on WRD's recommendation, the 30-year average local water volume[5] was used to calculate the projected volumes beginning in WY 2010-11, as shown in Tables H-2 and H-3.

There are no significant future Montebello Forebay-specific projects that will increase stormwater recharge within the SNMP 2025 planning horizon; however, a number of projects have been recently constructed that enhance stormwater replenishment and are included as part of the baseline conditions:

- Spreading Grounds Interconnection Pipeline – Increases stormwater capture by about 1,300 AFY (CH2MHILL, 2012b);
- New San Gabriel River Rubber Dams – Increases stormwater capture and recharge by about 3,600 AFY (Johnson, 2011; CH2MHILL, 2012b); and
- Whittier Narrows Dam Conservation Pool Project – Operational enhancements to increase the conservation pool elevation behind the dam from 195 to 205 feet above mean sea level (ft-msl) (WRD, 2011; CH2MHILL, 2012b). The project is being implemented in phases. Beginning in 2004, the conservation pool was raised to 201.6 ft-msl, which resulted in an estimated additional capture and recharge of 3,000 AFY of stormwater (WRD, 2011).

Several projects were identified, listed below, that will provide future stormwater replenishment for the Montebello Forebay, but will be constructed beyond the SNMP 2025 planning horizon.

- The next phase of the Whittier Narrows Dam Conservation Pool Project will increase the conservation pool elevation behind the dam from 201.6 to 205 ft-msl resulting in an estimated additional capture of 1,100 AFY of stormwater.

The Montebello Forebay Increased Extraction and Intrabasin Transfer Project was described in the Draft GBMP. This potential project is proposed to provide for 25,000 AFY of groundwater extraction to reduce groundwater levels and a pipeline will be constructed to deliver water to participating pumpers as far south as Long Beach, which will allow for 17,000 AFY of additional stormwater recharge at the MFSG, if implemented.

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[5] Personal communication, Ted Johnson, WRD, August 22, 2012.

2.4.1.2 Dominguez Gap Spreading Grounds

The DGSG, located along the Los Angeles River near the southern boundary between the Central Basin and West Coast Basin (Figure 1), are owned, operated, and maintained by the LACDPW. Originally, the spreading grounds included basins on both the east and west sides of the river; the east side basins recharged the Central Basin and the west side basins recharged the West Coast Basin. In 2007, construction began for the DeForest Treatment Wetlands Project, jointly sponsored by LACDPW and the City of Long Beach. This project converted the east basins into wetlands, which provide habitat and surface water quality improvement, while essentially eliminating groundwater recharge. Thus, only the west basins remain and continue to operate as managed recharge facilities.

The source of recharge water at the DGSG is controlled flows from the Los Angeles River low-flow channel and uncontrolled flows from storm drains. The DGSG directly recharge Model Layer 1 with subsequent movement to lower model layers in the West Coast Basin. **Table H-4** shows recharge volumes during the 10-year baseline period and projected volumes for the future planning period. It is assumed that historically 50% of the recharge water went to the east basins (Central Basin) and 50% went to the west basins (West Coast Basin) through 2007. After 2007, all recharge is allocated to the West Coast Basin. Historical conservation volumes for WY 2000-01 through 2009-10 were obtained from the LACDPW.

The proposed DGSG West Basin Percolation Enhancement Project will install vertical trenches/drains through poorly draining strata underlying the bottom of the DGSG's west basins to increase their percolation capacity. It is expected that this project will allow for an additional 1,000 AFY of stormwater to replenish the West Coast Basin by WY 2017-18[6]. For WY 2010-11 through 2016-17, the 10-year baseline period average (WY 2000-01 through 2009-10) was used to estimate projected stormwater capture volumes. The average annual amount of water recharged at the DGSG during the baseline period was about 760 AFY.

2.4.2 Seawater Intrusion Barriers

There are three seawater intrusion barriers currently operating in the Study Area, including the WCBB and DGB in the West Coast Basin and the AGB located in the Central Basin and adjacent Orange County Basin. The barriers receive recycled water that has undergone advanced water treatment (AWT) from different treatment facilities and imported water that is a blend of treated water from the CR and SWP supplied by the MWD's Jensen and Diemer Water Treatment Plants (WTP). The source water at the Jensen WTP is only from the SWP. The source water at the Diemer WTP is from both the CR and SWP. The blend of water from the CR and SWP varies considerably from year to year.

Based on USGS' groundwater model, all water injected at the seawater barriers (in the Central Basin and West Coast Basin) recharges the basins, or at a minimum up to 20% of the injected water stays seaward of the barriers at any one time as a freshwater buffer that would quickly decay if the barriers were shut down (USGS, 2003).

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[6] Personal communication, Greg Jaquez, LACDPW, August 16, 2012.

Table H-4 Dominguez Gap Spreading Grounds Recharge Volumes for Central Basin and West Coast Basin – Baseline and Future Planning Periods

Water Year	Stormwater Recharge Volumes [a] AFY		
	Total	**Central Basin**	**West Coast Basin**
2000-01	926	460	460
2001-02	1,342	670	670
2002-03	374	190	190
2003-04	353	180	180
2004-05	552	280	280
2005-06	135	70	70
2006-07	0	0	0
2007-08	1,273	0	1,273
2008-09	2,085	0	2,085
2009-10	562	0	562
10-yr Avg.	**760**		
	Projected Recharge Volumes		
2010-11	760[2]	0	760
2011-12	760	0	760
2012-13	760	0	760
2013-14	760	0	760
2014-15	760	0	760
2015-16	760	0	760
2016-17	760	0	760
2017-18	1,760[c]	0	1,760[b]
2018-19	1,760	0	1,760
2019-20	1,760	0	1,760
2020-21	1,760	0	1,760
2021-22	1,760	0	1,760
2022-23	1,760	0	1,760
2023-24	1,760	0	1,760
2024-25	1,760	0	1,760

AFY – acre-feet per year DGSG – Dominguez Gap Spreading Grounds

a - Historical conservation volumes for water years 2000-01 through 2009-10 were obtained from the LACDPW

b - Reflects annual 10-year average

c - Reflects the startup of the DGSG West Basin Percolation Enhancement Project

AWT recycled water will replace imported water at all three barrier locations during the SNMP future planning period, and overall injection volumes are projected to increase.

2.4.2.1 Alamitos Gap Seawater Intrusion Barrier

The AGB is located at the southern end of the Central Basin, specifically at the Los Angeles-Orange County border about two miles inland from the mouth of the San Gabriel River (Figure 2). In 1964, LACDPW and Orange County Water District (OCWD) constructed the AGB, partially in Orange County and partially in Los Angeles County. The AGB is jointly owned and maintained by the LACDPW and OCWD and operated under the direction of the AGB Joint Management Committee. WRD purchases the water for injection into the Los Angeles County side of the AGB and the OCWD purchases the water injected into the Orange County side of the AGB. Historically, the AGB received treated imported water from MWD's Jensen and Diemer WTPs. Since October 2005, AWT recycled water, produced by WRD's Leo J. Vander Lans Advanced Water Treatment Facility (Vander Lans AWTF), also has been delivered to the AGB for injection. The Vander Lans AWTF is owned by WRD and operated and maintained by the Long Beach Water Department. The source water for the Vander Lans AWTF is tertiary-treated recycled water from the SDLAC Long Beach WRP.

There are currently 43 injection wells used to provide a freshwater pressure ridge that breaks the landward gradient of intruding seawater. Most of the injection at the AGB occurs in Model Layers 2 and 3 with a small amount in the lower portion of Model Layer 1. The baseline period and future projected volumes and sources of water injected at the AGB, WCBB and DGB are provided in **Table H-5**. During the SNMP baseline period, an average of about 5,200 AFY was injected/recharged at the AGB.

AWT recycled water is projected to fully replace imported water at the AGB in WY 2014-15, since the Vander Lans AWTF was expanded at the end of 2014 to produce from 3,360 AFY to 8,960 AFY of AWT recycled water. However, minor volumes of treated imported water, supplied by MWD, may be utilized as necessary through the future due to temporary operational and maintenance issues that may be encountered at the Vander Lans AWTF or at the AGB. Table H-5 presents the recycled water and imported water target volumes for the AGB from 2010 through 2025. AWT recycled water is expected to fully replace imported water, with flow projected to increase to 7,200 AFY beginning WY 2014-15 and overall injection is expected to be approximately 2,000 AFY higher by WY 2024-25 compared with the baseline period average.

2.4.2.2 West Coast Basin Seawater Intrusion Barrier

The WCBB was expanded from the original experimental project in Manhattan Beach in 1953. It now consists of a line of 153 injection wells along the coastline extending from Los Angeles International Airport to the Palos Verdes Hills (Figure 2). The WCBB is owned, operated, and maintained by the LACDPW. Historically, treated imported water (from the SWP and CR) supplied by MWD's Jensen and Diemer WTPs, along with AWT recycled water from West Basin Municipal Water District's (WBMWD's) Edward C. Little Water Recycling Facility (Edward C. Little WRF)was injected at the WCBB. The source water to the Edward C. Little WRF is

Table H-5 Volume and Sources of Recharge at the AGB, WCBB, and DGB – Baseline and Future Planning Periods

Water Year	BASELINE VOLUME OF WATER DELIVERED TO BARRIERS FOR INJECTION (in acre-feet per year)											
	ALAMITOS GAP BARRIER				WEST COAST BASIN BARRIER				DOMINGUEZ GAP BARRIER			
	Imported [b]		AWT	Total	Imported [b]		AWT	Total	Imported [b]		AWT	Total
	SWP	CR	Recycled [d]		SWP	CR	Recycled [e]		SWP	CR	Recycled [c]	
2000-01	5,674	0	0	5,674	13,988	0	6,838	20,826	3,923	0	0	3,923
2001-02	3,871	2,322	0	6,193	10,338	2,386	7,276	20,000	3,412	2,047	0	5,459
2002-03	4,642	0	0	4,642	10,419	0	6,192	16,611	8,056	0	0	8,056
2003-04	5,968	0	0	5,968	9,304	0	3,669	12,973	6,089	0	0	6,089
2004-05	4,555	0	0	4,555	4,548	0	3,920	8,468	8,557	0	0	8,557
2005-06	1,372	0	1,175	2,547	5,997	0	4,249	10,246	7,259	0	1,450	8,709
2006-07	2,111	0	384	2,495	4,373	0	10,960	15,333	5,510	0	1,733	7,243
2007-08	1,900	2,850	1,759	6,509	1,465	2,197	10,954	14,616	1,787	2,681	2,452	6,920
2008-09	793	4,870	1,810	7,473	1,005	6,173	6,434	13,612	637	3,913	2,414	6,964
2009-10	488	2,767	2,245	5,500	5,555	4,106	7,620	17,281	824	4,671	2,037	7,532
Baseline Average 2001 to 2010 [a]	3,137	1,281	1,475	5,156	6,699	1,486	6,811	14,997	4,605	1,331	2,017	6,945
Water Year	PROJECTED VOLUME OF WATER DELIVERED TO BARRIERS FOR INJECTION [g] (in acre-feet per year)											
2010-11	2,982	1,218	2,000	6,200	6,138	1,362	7,500	15,000	3,048	881	2,363	6,292
2011-12	2,982	1,218	2,000	6,200	8,594	1,906	7,000	17,500	3,604	1,042	103 [f]	4,749
2012-13	2,982	1,218	2,000	6,200	3,581	794	13,125	17,500	2,172	628	1,300 [f]	4,100
2013-14	2,982	1,218	2,000	6,200	0	0	17,000 [i]	17,000	1,629	471	5,400	7,500
2014-15	0	0	7,200 [h]	7,200	0	0	17,000	17,000	1,629	471	5,400	7,500
2015-16	0	0	7,200	7,200	0	0	17,000	17,000	1,629	471	5,400	7,500
2016-17	0	0	7,200	7,200	0	0	17,000	17,000	1,629	471	5,400	7,500
2017-18	0	0	7,200	7,200	0	0	17,000	17,000	1,629	471	5,400	7,500
2018-19	0	0	7,200	7,200	0	0	17,000	17,000	0	0	7,500 [j]	7,500
2019-20	0	0	7,200	7,200	0	0	17,000	17,000	0	0	7,500	7,500
2020-21	0	0	7,200	7,200	0	0	17,000	17,000	0	0	7,500	7,500
2021-22	0	0	7,200	7,200	0	0	17,000	17,000	0	0	7,500	7,500
2022-23	0	0	7,200	7,200	0	0	17,000	17,000	0	0	7,500	7,500
2023-24	0	0	7,200	7,200	0	0	17,000	17,000	0	0	7,500	7,500
2024-25	0	0	7,200	7,200	0	0	17,000	17,000	0	0	7,500	7,500
Δ Baseline to 2025 [k]	(3,137)	(1,281)	5,725	2,044	(6,699)	(1,486)	10,189	2,003	(4,605)	(1,331)	5,483	555

SWP - Treated water from State Water Project supplied by MWD's Diemer or Jensen WTP
CR - Treated water from Colorado River supplied by MWD's Diemer WTP
WRD - Water Replenishment District of Southern California
MWD - Metropolitan Water District of Southern California
AWT - Advanced water treatment
WTP - Water Treatment Plant
WBMWD - West Basin Municipal Water District
LADWP - City of Los Angeles Department of Water and Power

a - Data for baseline period from: WRD, March 4, 2011, Engineering Survey and Report; Alamitos Gap Barrier and Dominguez Gap Barrier AWT recycled water average is from 2005-06 to 2009-10

b - Relative volume of water from SWP and CR for baseline period provided by Kathy Kunysz of MWD; numbers are best approximation; relative volume of water from SWP and CR for future planning period are average of baseline period distribution

c - Advanced treated recycled water supplied by City of Los Angeles Terminal Island Water Reclamation Plant/Advanced Water Treatment Facilities

d - Advanced treated recycled water supplied by WRD's Leo J. Vander Lans Advanced Water Treatment Facility

e - Advanced treated recycled water supplied by WBMWD's Edward C. Little Water Recycling Facility

f - Treatment plant not in operation due to maintenance from October 2011 to November 2012

g - Information provided by Ted Johnson, WRD, August 17, 2012; Uzi Daniel, WBMWD, August 6, 2012; and Seung Tag Oh, LADWP, August 15, 2013

h - Reflects the start date for the project expansion; AOP is applied to the full flow; under Waste Discharge and Water Recycling Requirements (WDR and WRR) Order No. R4-2005-0061, the current permit allows up to 3,360 AFY of recycled water to be used for the barrier; the permit will be amended for the expansion

i - Reflects implementation of the Phase V recycled water project expansion; under WDR (Order No. R4-2006-0009), WBMWD is allowed to use up to 14,000 AFY of advanced treated recycled water, and ultimately 19,600 AFY of advanced treated recycled water

j - Reflects the start date for the project expansion; under WRR (Order No. R4-2003-0134), LADWP is allowed to use up to 5,600 AFY of advanced treated recycled water; the permit will be amended for the expansion

k - This is the increase or decrease in recycled water and imported water use between the average baseline period and water year 2024/25 secondary effluent from the City of Los Angeles Hyperion WRP. AWT recycled water injection began in 1995 at the WCBB.

WRD purchases all the water injected into the WCBB. Most of the water injection at the WCBB occurs in Model Layers 3 and 4 with a smaller amount in Model Layer 2. The baseline period and future planning period volumes and sources of water injected at the WCBB are provided in Table H-5. During the baseline period, an average of about 15,000 AFY was injected/recharged at the WCBB.

In WY 2013-14, the Edward C. Little WRF was expanded to produce from 14,000 AFY to 19,600 AFY of AWT recycled water. It is anticipated that AWT recycled water will fully replace imported water for injection at the WCBB beginning in WY 2013-14. However, minor volumes of treated imported water, supplied by MWD, may be utilized as necessary for injection through the future due to temporary operational and maintenance issues that may be encountered at the Edward C. Little WRF or at the WCBB. Table H-5 presents the recycled water and imported water target volumes for the WCBB from 2010 through 2025. AWT recycled water is expected to fully replace imported water, with flow projected to increase to 17,000 AFY beginning WY 2013-14 and overall injection at the barrier is expected to be approximately 2,000 AFY higher by WY 2024-25 compared with the baseline period average.

2.4.2.3 Dominguez Gap Seawater Intrusion Barrier

The DGB began operating in 1971 and is currently comprised of 41 injection wells along the Dominguez Channel to the Harbor (110) Freeway in the City of Carson (Figure 2). The DGB is owned, operated, and maintained by the LACDPW. Currently, treated imported water from the SWP and/or CR supplied by MWD's Jensen and Diemer WTPs along with AWT recycled water from the City of Los Angeles' Terminal Island Water Reclamation Plant/Advanced Water Purification Facility (TIWRP) is delivered to the barrier for injection. The TIWRP capacity is currently 5,600 AFY.

Recycled water (AWT) was injected at the DGB beginning in February 2006. WRD purchases all the water injected at the DGB. The injection at the DGB is relatively evenly distributed amongst Model Layers 1, 2, and 3.

The baseline and future planning period volumes and sources of water injected at the DGB are summarized in Table H-5. During the baseline period, an average of about 7,000 AFY was injected/recharged at the DGB. AWT recycled water is projected to fully replace imported water for injection at the DGB in WY 2018-19 when the TIWRP is expanded to produce from 5,700 to 22,880 AFY of recycled water. Table H-5 presents the recycled water and imported water target volumes for the DGB from 2010 through 2025. AWT recycled water is expected to fully replace imported water, with flow projected to increase to 7,500 AFY beginning WY 2018-19 and overall injection is expected to be approximately 500 AFY higher by WY 2024-25 compared with the baseline period average.

2.4.3 Direct Percolation of Precipitation

The volume of precipitation that percolated to groundwater over the 10-year baseline period is based on estimates provided in the USGS/GBMP model (USGS, 2003; CH2MHILL, 2012b). The 10-year baseline period represents a range of precipitation conditions from very wet to very dry to normal. The model estimates are based on precipitation recorded at the LACDPW precipitation Station 107D located in the City of Downey, California. The model recharge values include the combined effects of mountain front recharge on the perimeter of the model domain and direct precipitation percolation, return flow from irrigation such as lawn watering, and other distributed negligible sources (i.e., leakage from pipes and septic systems) within the interior of the model domain. Because these individual components of the model recharge have different water quality with respect to S/N loading, estimates of each component's volume are accounted for separately in the SNMP analysis.

In order to separate out the various sources of recharge from the model estimated interior recharge, it is assumed that in very dry years, no precipitation or mountain front recharge occurs. In WY 2001-02, only 2.8 inches of precipitation were recorded at the Downey station. In that year, the model-generated interior recharge was about 14,500 AF. While about 14,500 AF of interior recharge was estimated in the model for WY 2001-02 for the entire model domain (including the Santa Monica and Hollywood model subareas outside of the CBWCB), only about 10,300 AF occurred within the CBWCB. For the SNMP study, this volume is assumed to represent sources other than deep percolation of precipitation and mountain front recharge, including return flow from irrigation and recharge at the DGSG (which was not accounted for separately in the model). Accordingly, this volume is subtracted from the model reported interior recharge for this study. **Table H-6** shows the volume of precipitation percolation in the Central Basin and West Coast Basin over the 10-year baseline period. Total average deep percolation over the 10-year baseline period is about 25,000 AFY in the CBWCB. Deep percolation of precipitation throughout the future planning period is assumed to be the average of the baseline period for each year from WY 2010-11 to 2024-25.

2.4.4 Mountain Front Recharge

Mountain front recharge is surface water runoff from the hills abutting the basins that recharges at the edges of the basins near the hills. The volumes of mountain front recharge estimated in the USGS/GBMP model in the Central Basin and West Coast Basin (assuming no mountain front recharge occurred in the driest WY [2001-02)]) are provided in **Table H-7**. The average mountain front recharge over the 10-year baseline period is about 9,000 AFY in the CBWCB. Mountain front recharge throughout the future planning period is assumed to be the average of the baseline period for each year from WY 2010-11 to 2024-25.

Table H-6 Volume of Precipitation Percolation in Central Basin and West Coast Basin

WATER YEAR	BASELINE PERIOD VOLUME OF PRECIPITATION RECHARGE (in acre-feet per year)		
	Central Basin	West Coast Basin	TOTAL
2000-01	24,846	12,407	37,254
2001-02	0	0	0
2002-03	24,944	12,825	37,769
2003-04	12,847	6,673	19,519
2004-05	25,297	12,847	38,144
2005-06	17,824	9,106	26,929
2006-07	400	252	652
2007-08	25,488	12,085	37,574
2008-09	14,625	5,862	20,487
2009-10	21,878	10,762	32,640
Baseline Average 2001-2010	16,815	8,282	25,097
WATER YEAR	**PROJECTED VOLUME OF PRECIPITATION RECHARGE (in acre-feet per year)**		
2010-11	16,815	8,282	25,097
2011-12	16,815	8,282	25,097
2012-13	16,815	8,282	25,097
2013-14	16,815	8,282	25,097
2014-15	16,815	8,282	25,097
2015-16	16,815	8,282	25,097
2016-17	16,815	8,282	25,097
2017-18	16,815	8,282	25,097
2018-19	16,815	8,282	25,097
2019-20	16,815	8,282	25,097
2020-21	16,815	8,282	25,097
2021-22	16,815	8,282	25,097
2022-23	16,815	8,282	25,097
2023-24	16,815	8,282	25,097
2024-25	16,815	8,282	25,097
Δ 2025 [a]	0	0	0

USGS - United States Geological Survey

GBMP - Groundwater Basins Master Plan

Volumes modified from USGS/GBMP Modeling Reports (USGS, 2003; CH2MHill, July 2012)

a - This is the change in precipitation recharge between the baseline period average and WY 2025

Table H-7 Volume of Mountain Front Recharge in Central Basin and West Coast Basin

WATER YEAR	BASELINE PERIOD MOUNTAIN FRONT RECHARGE (in acre-feet per year)		
	Central Basin	West Coast Basin	TOTAL
2000-01	9,225	3,421	12,647
2001-02	0	0	0
2002-03	9,226	3,472	12,697
2003-04	5,760	2,120	7,879
2004-05	9,212	3,456	12,668
2005-06	6,992	2,623	9,615
2006-07	1,797	681	2,478
2007-08	9,234	3,275	12,510
2008-09	5,895	1,861	7,756
2009-10	8,047	2,925	10,972
Baseline Average 2001-2010	6,539	2,384	8,922
WATER YEAR	**PROJECTED VOLUME OF MOUNTAIN FRONT RECHARGE (in acre-feet per year)**		
2010-11	6,539	2,384	8,922
2011-12	6,539	2,384	8,922
2012-13	6,539	2,384	8,922
2013-14	6,539	2,384	8,922
2014-15	6,539	2,384	8,922
2015-16	6,539	2,384	8,922
2016-17	6,539	2,384	8,922
2017-18	6,539	2,384	8,922
2018-19	6,539	2,384	8,922
2019-20	6,539	2,384	8,922
2020-21	6,539	2,384	8,922
2021-22	6,539	2,384	8,922
2022-23	6,539	2,384	8,922
2023-24	6,539	2,384	8,922
2024-25	6,539	2,384	8,922
Δ 2025 [a]	0	0	0

USGS - United States Geological Survey

GBMP - Groundwater Basins Master Plan

Volumes from USGS/GBMP Modeling Reports (USGS, 2003; CH2MHill, 2012)

a - This is the change in mountain front recharge between the baseline period average and WY 2025

2.4.5 Irrigation Return Flows

Source waters for irrigation in the Study Area include imported water, groundwater, and recycled water. The volume of water used for irrigation in the Study Area is estimated to be 40%[7] of the total imported water and groundwater supply plus the approximate recycled water volumes used for irrigation. **Table H-8** shows the approximate total baseline and future planning period volumes of imported water and groundwater used for the entire water supply of the CBWCB; the volumes of imported water, groundwater, and recycled water used for irrigation; and the amount of applied irrigation water that percolates to groundwater in the CBWCB after evapotranspiration (ET).

Table H-8 presents the annual baseline and future planning period projected volumes of imported water used (including potable, irrigation, and industrial uses) in the Central Basin and West Coast Basin. The Draft 2012 GLAC IRWMP shows that water agencies in the CBWCB include imported water as an integral part of their water supply portfolios through 2025. For the Central Basin, per the Draft 2012 GLAC IRWMP, 121,000 AFY of imported water is expected to be used by 2025. This value represents a 13% decrease from WY 2009-10. This results in a decrease in the volume of imported water used for irrigation and recharged to groundwater in the Central Basin. For the South Bay Subregion, the Draft 2013 GLAC IRWMP shows a 2% increase in imported water use from 2010 to 2025. Applying this percent increase to West Coast Basin, a reasonable assumption is that 155,600 AFY of imported water would be used by 2025. This results in a slight increase in imported water use for irrigation and recharge to groundwater. However, the decrease in imported water use is much greater in the Central Basin than in the West Coast Basin, so overall irrigation return flows are predicted to decline for the entire CBWCB over the future planning period.

Table H-8 shows the annual total volumes of groundwater production from the Central Basin and West Coast Basin over the 10-year baseline period. Over this period, an average of about 196,600 AFY was extracted from the Central Basin and about 44,700 AFY from the West Coast Basin, which totals 241,300 AFY for the Study Area. For the future planning period, groundwater production in the CBWCB is assumed to be the average of the baseline period (Johnson, 2012). Therefore, irrigation return flows from groundwater use in the future planning period also remain the same as in the baseline period.

Use of recycled water for irrigation is projected to increase in the future planning period. Table H-8 shows the baseline period recycled water use for irrigation and the projected volume of recycled water use for irrigation for the future planning period. This recycled water would replace imported water and groundwater for irrigation.

Overall irrigation return flows in the Central Basin are projected to decrease slightly over the future planning period while return flows in the West Coast Basin are projected to increase slightly and thus, there is a net decline for the entire CBWCB (Table H-8).

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[7] Estimate provided by Kathy Kunysz of the Metropolitan Water District of Southern California.

Table H-8 Volume of Groundwater, Imported Water, and Recycled Water Used for Irrigation and Percolated to Groundwater – Baseline and Future Planning Period

WATER YEAR	BASELINE SOURCES AND VOLUMES OF WATER USED FOR IRRIGATION AND RECHARGED TO GROUNDWATER [g] (in acre-feet per year)																	
	TOTAL WATER SUPPLY VOLUME (includes potable, irrigation, and industrial uses)									IRRIGATION VOLUME						IMPORTED, GROUNDWATER, AND RECYCLED IRRIGATION RECHARGED TO GROUNDWATER [i]		
	IMPORTED WATER [c]			TOTAL GROUNDWATER PUMPING [d]			TOTAL GROUNDWATER PUMPING LESS INDUSTRIAL REFINERY USE IN WEST COAST BASIN [e]			IMPORTED AND GROUNDWATER USED FOR IRRIGATION [f]			RECYCLED USED FOR IRRIGATION					
	CENTRAL BASIN[a]	WEST COAST BASIN[b]	TOTAL	CENTRAL BASIN	WEST COAST BASIN	TOTAL	CENTRAL BASIN	WEST COAST BASIN	TOTAL	CENTRAL BASIN	WEST COAST BASIN	TOTAL	CENTRAL BASIN [g]	WEST COAST BASIN [h]	TOTAL	CENTRAL BASIN	WEST COAST BASIN	TOTAL
2000-01	202,192	164,978	367,170	195,361	53,870	249,231	195,361	39,861	235,222	159,021	81,936	240,957	2,628	2,330	4,958	5,767	3,006	8,774
2001-02	215,919	155,694	371,613	200,168	50,063	250,231	200,168	38,256	238,424	166,435	77,580	244,015	3,074	2,661	5,735	6,048	2,863	8,910
2002-03	205,812	152,201	358,013	190,268	51,946	242,214	190,268	39,236	229,504	158,432	76,575	235,007	8,256	2,322	10,578	5,947	2,815	8,762
2003-04	209,596	157,929	367,525	200,365	48,013	248,378	200,365	36,068	236,433	163,984	77,599	241,583	8,985	3,035	12,020	6,171	2,877	9,048
2004-05	172,419	153,899	326,318	188,707	41,297	230,004	188,707	29,966	218,673	144,450	73,546	217,996	8,086	2,815	10,901	5,442	2,724	8,166
2005-06	174,813	155,476	330,289	191,030	36,809	227,839	191,030	27,291	218,321	146,337	73,107	219,444	8,992	2,945	11,937	5,542	2,713	8,255
2006-07	182,117	159,746	341,863	198,115	37,655	235,770	198,115	28,207	226,322	152,093	75,181	227,274	10,089	3,792	13,881	5,786	2,818	8,604
2007-08	164,258	148,998	313,256	206,260	38,472	244,732	206,260	29,201	235,461	148,207	71,280	219,487	9,454	3,576	13,030	5,625	2,671	8,296
2008-09	147,227	135,008	282,235	198,156	45,246	243,402	198,156	33,127	231,283	138,153	67,254	205,407	8,434	3,440	11,874	5,230	2,522	7,752
2009-10	138,812	128,702	267,514	197,387	43,942	241,329	197,387	31,803	229,190	134,480	64,202	198,682	7,651	3,538	11,189	5,071	2,417	7,488
Baseline Average 2001 to 2010	181,317	151,263	332,580	196,582	44,731	241,313	196,582	33,302	229,883	151,159	73,826	224,985	7,565	3,045	10,610	5,663	2,743	8,405
Water Year	**PROJECTED SOURCES AND VOLUMES OF WATER USED FOR IRRIGATION AND RECHARGED TO GROUNDWATER (in acre-feet per year)**																	
2010-11	137,625	130,495	268,120	196,582	44,731	241,313	196,582	33,302	229,883	133,683	65,519	199,201	7,600	4,750	12,350	5,041	2,507	7,548
2011-12	136,437	132,288	268,725	196,582	44,731	241,313	196,582	33,302	229,883	133,207	66,236	199,443	8,290	4,835	13,125	5,038	2,510	7,548
2012-13	135,250	134,082	269,332	196,582	44,731	241,313	196,582	33,302	229,883	132,733	66,953	199,686	8,980	4,920	13,900	5,036	2,537	7,573
2013-14	134,062	135,875	269,937	196,582	44,731	241,313	196,582	33,302	229,883	132,257	67,671	199,928	9,670	5,005	14,675	5,034	2,565	7,598
2014-15	132,875	137,668	270,543	196,582	44,731	241,313	196,582	33,302	229,883	131,783	68,388	200,171	10,360	5,090	15,450	5,031	2,592	7,624
2015-16	131,687	139,461	271,148	196,582	44,731	241,313	196,582	33,302	229,883	131,307	69,105	200,413	11,050	5,175	16,225	5,029	2,620	7,649
2016-17	130,500	141,254	271,754	196,582	44,731	241,313	196,582	33,302	229,883	130,833	69,822	200,655	11,740	5,260	17,000	5,027	2,647	7,674
2017-18	129,312	143,048	272,360	196,582	44,731	241,313	196,582	33,302	229,883	130,357	70,540	200,897	12,430	5,345	17,775	5,025	2,675	7,699
2018-19	128,125	144,841	272,966	196,582	44,731	241,313	196,582	33,302	229,883	129,883	71,257	201,140	13,120	5,430	18,550	5,023	2,702	7,725
2019-20	126,937	146,634	273,571	196,582	44,731	241,313	196,582	33,302	229,883	129,407	71,974	201,382	13,810	5,515	19,325	5,020	2,729	7,750
2020-21	125,750	148,427	274,177	196,582	44,731	241,313	196,582	33,302	229,883	128,933	72,691	201,624	14,500	5,600	20,100	5,018	2,757	7,775
2021-22	124,562	150,220	274,782	196,582	44,731	241,313	196,582	33,302	229,883	128,457	73,409	201,866	15,190	5,685	20,875	5,016	2,784	7,800
2022-23	123,375	152,014	275,389	196,582	44,731	241,313	196,582	33,302	229,883	127,983	74,126	202,109	15,880	5,770	21,650	5,014	2,812	7,826
2023-24	122,187	153,807	275,994	196,582	44,731	241,313	196,582	33,302	229,883	127,507	74,843	202,351	16,570	5,855	22,425	5,012	2,839	7,851
2024-25	121,000	155,600	276,600	196,582	44,731	241,313	196,582	33,302	229,883	127,033	75,561	202,593	17,200	5,940	23,140	5,008	2,866	7,875
Δ Baseline to 2025 [j]	(60,317)	4,337	(55,980)	0	0	0	0	0	0	(24,127)	1,735	(22,392)	9,635	2,895	12,530	(655)	124	(531)

All values in acre-feet
DWR - California Department of Water Resources
LADWP - City of Los Angeles Department of Water and Power
SDLAC - Sanitation Districts of Los Angeles County
WRD - Water Replenishment District of Southern California
WBMWD - West Basin Municipal Water District
GLAC IRWMP - Greater Los Anglels County Integrated Regional Water Management Plan
UWMP - Urban Water Management Plan

a - Total imported water minus imported water injected at the Alamitos Barrier and spread in Montebello Forebay for baseline period
b - Total imported water minus imported water injected at the Dominguez Gap and West Coast Basin barriers for baseline period
c - Data for baseline period from DWR, *Watermaster Service* Reports for Central and West Coast Basins, 2001 to 2011; reported in fiscal year; data for future planning period from Draft GLAC IRWMP (RMC, July 2012)
d - Baseline period data from WRD, Engineering Survey and Report , March 4, 2011; pumping in future planning period assumed to be the average of the baseline period per information provided by Ted Johnson, WRD, August 27, 2012
e - The significant voume of groundwater used for industrial supply in the West Coast Basin subtracted from total water used (see Secton 23.3.5 for explanation of calculation)
f - 40% of total water supply is assumed used for irrigation
g - Baseline data for calendar years 2001 through 2010 provided by Monica Gasca, SDLAC; information for the future planning period from Draft GLAC IRWMP (RMC, July 2012)
h - Baseline period information provided by Joe Walters, WBMWD, August 27, 2012 for use within the WBMWD service area; future planning period information provided in WBMWD 2010 UWMP (May 2011) and LADWP Non-Potable Reuse Master Planning Report (RMC, March 2012)
i - 3.6% of irrigation water percolates to groundwater (see Section 3.3.5 for explanation of 3.6% determination)
j - This is the increase or decrease between the average baseline period and Water Year 2024-25

In addition to its use for irrigation, recycled water is utilized for a variety of non-potable reuse (NPR) applications, including industrial uses; as a result, the total NPR volume is primarily comprised of these two specific usage volumes. For the SNMP, irrigation use is the primary target since it can contribute to salt and nutrient loading to the groundwater basins.

Information on total NPR and irrigation target volumes for the Central Basin was obtained from the 2012 Draft GLAC IRWMP and recycled water use data from SDLAC for calendar year 2001 through 2010. The 17,200 AFY of projected recycled water irrigation use in 2025 in the Central Basin, as shown in **Table H-9**, was based on the percentage of irrigation versus total NPR volumes in 2025 as shown in **Table H-10**.

Information on total NPR and irrigation target volumes for the West Coast Basin was obtained from the WBMWD 2010 UWMP (WBMWD, 2011) and the City of Los Angeles Department of Water and Power (LADWP) Non-Potable Reuse Master Planning Report (RMC, 2012a). Information was also provided directly from WBMWD and LADWP. The projected use of tertiary-treated recycled water (5,940 AFY) for irrigation in 2025 in the West Coast Basin, as shown in **Table H-11**, was derived based on information compiled in **Table H-12**.

2.4.6 Other Stream Recharge

As shown in Figure 2, major streams in the Study Area are mostly lined with concrete. Because of this, stream losses to groundwater are assumed to be negligible, except for recharge in the unlined portion of the San Gabriel River within the Montebello Forebay, which is accounted for in the Montello Forebay spreading operations, as discussed in Section 2.3.1.1. This assumption is consistent with the USGS/GBMP modeling water balances, which also assumed river recharge/discharge was minimal.

2.4.7 Other Distributed Sources of Recharge

Other areally distributed potential sources of recharge included leaking water and sewer pipes, stormwater capture facilities such as basins and LID projects, and septic systems. While not individually quantified in the USGS/GBMP model or for the SNMP study, these distributed sources are represented in the USGS/GBMP model's interior recharge volumes.

The City of Torrance operates a number of stormwater retention basins, some of which (the Bishop Montgomery, Del Amo and Ocean Basins) allow for stormwater replenishment. The volumes of stormwater percolated are not available, but are not considered to be significant recharge inputs for the SNMP loading analysis.

Siempre Agua is a proposed project that will create a 2-acre wetland that will use 88 AFY of Los Angeles River water. It will be located in the northernmost portion the Central Basin and implemented in the next few years[8]. It is not known at this time if the wetland will be lined or unlined, but once the wetland is created and operational, approximately 80 AF of the treated wetland water will be used to irrigate a park (effective percolation from irrigation of 4

[8] Information provided by Mark Hanna, Geosyntec Consultants, September 27, 2012.

Table H-9 Baseline Period Recycled Water NPR and Future Planning Period Target Volumes for Irrigation in the Central Basin

Year	Tertiary-Treated Recycled Water Volumes in the Central Basin [a] (acre-feet per year)		
	Total NPR	**Irrigation Use**	**Industrial Use**
2001	3,207	2,628	578
2002	3,943	3,074	870
2003	11,074	8,256	2,818
2004	11,683	8,985	2,698
2005	9,770	8,086	1,684
2006	11,486	8,992	2,494
2007	12,816	10,089	2,727
2008	12,011	9,454	2,558
2009	10,596	8,434	2,162
2010	10,100	7,651	2,450
10-Yr Avg.	**9,700**	**7,600**	**2,100**
	100%	**78%**	**22%**
Water Year	**Projected Recycled Water Volumes [b]**		
2010-11	9,700	7,600	
2011-12	N/A	8,290	
2012-13	N/A	8,980	
2013-14	N/A	9,670	
2014-15	N/A	10,360	
2015-16	N/A	11,050	
2016-17	N/A	11,740	
2017-18	N/A	12,430	
2018-19	N/A	13,120	
2019-20	N/A	13,810	
2020-21	N/A	14,500	
2021-22	N/A	15,190	
2022-23	N/A	15,880	
2023-24	N/A	16,570	
2024-25	22,100 [c]	17,200	

NPR – no-potable reuse
AFY – acre-feet per year
SDLAC – Sanitation Districts of Los Angeles County
SNMP – Salt and Nutrient Management Plan

a - Historic data for calendar years 2001 through 2010 provided by Monica Gasca, SDLAC

b - For purposes of estimating projected use of recycled water for irrigation, a linear extrapolation was applied to the Δ 9,600 AFY (see Table H-10) from 2010 to 2025; industrial projections were not derived because they are not necessary for the SNMP assessments

c - As shown in Table H-10, this is the projected total NPR use

Table H-10 Basis for Irrigation Target Volumes in the Central Basin

Year	Recycled Water Usage	Volume (AFY)	Type of Recycled Water
2010	Total NPR	9,700 [a]	Tertiary-treated
	Irrigation	7,600 [a]	Tertiary-treated
	% Irrigation	**78%**	**Tertiary-treated**
2025	Total Projected NPR [b]	22,100	Tertiary-treated
	Estimated Irrigation [c]	17,200	Tertiary-treated
	% Irrigation	**≈ 78%**	**Tertiary-treated**
Δ 2025 [d]	**Irrigation**	**9,600**	**Tertiary-treated**

AFY – acre-feet per year
SDLAC – Sanitation Districts of Los Angeles County
MWD – Municipal Water District
NPR – non-potable reuse
WY – water year
UWMP – Urban Water Management Plan
GLAC IRWMP – Greater Los Angeles County Integrated Regional Water Management Plan

a - Information provided by Monica Gasca, SDLAC; this represents 10-year average (2001 - 2010)

b - This value was derived from the 2025 target volumes in the Central Basin MWD 2010 UWMP (11,000 AFY) as reflected in the 2012 Draft GLAC IRWMP, the Long Beach 2010 UWMP (8,100 AFY) as reflected in the 2012 Draft GLAC IRWMP, and the four-year averages (WY 2006-07 through 2009-10) for the City of Lakewood (440 AFY) and City of Cerritos (2,600 AFY) from the SDLAC Annual Status Reports on Recycled Water

c - Assumes there will be no substantive change in the proportion of recycled water used for irrigation between 2010 and 2025, and thus approximately 78% of the total NPR was used to derive the amount of irrigation (22,100 AFY x 0.78 = 17,200 AFY)

d - This is the increase in recycled water irrigation use between WY 2010-11 and 2024-25

Table H-11 Baseline Period Recycled Water NPR and Future Planning Period Target Volumes for Irrigation in the West Coast Basin

Year	Tertiary-Treated Recycled Water Volumes in the West Coast Basin [a] (in AFY)			
	Total NPR	Irrigation in the WBMWD Service Area	Irrigation in the LADWP Westside Service Area	Industrial Use
2001	15,222	2,330	0	12,892
2002	20,098	2,661	0	17,437
2003	20,360	2,322	0	18,038
2004	20,618	3,035	0	17,583
2005	20,269	2,815	0	17,454
2006	19,270	2,945	0	16,325
2007	20,124	3,792	0	16,332
2008	21,080	3,576	0	17,504
2009	22,256	3,440	0	18,816
2010	22,884	3,538	0	19,346
10-yr. Avg.	20,200	3,000	0	17,200
Target Volume	**21,080**	**3,000**	**880 [b]**	---
Water Year		**Projected Recycled Water Irrigation Volumes [c] (in AFY)**		
		Tertiary-treated	**AWT**	
2010-11		3,880 [d]	0	
2011-12		4,005	0	
2012-13		4,130	0	
2013-14		4,255	0	
2014-15		4,380	0	
2015-16		4,505	0	
2016-17		4,630	0	
2017-18		4,755	0	
2018-19		4,880	0	
2019-20		5,005	0	
2020-21		5,130	0	
2021-22		5,255	0	
2022-23		5,380	0	
2023-24		5,505	0	
2024-25		5,640	160 [c]	

NPR – non-potable reuse
AFY – acre-feet per year
SNMP – Salt and Nutrient Management Plan
WBMWD – West Basin Municipal Water District
LADWP – City of Los Angeles Department of Water and Power
AWT – advanced water treatment

a - For 2001 – 2010, historical information within the WBMWD service area was provided by Joe Walters, WBMWD, August 27, 2012 for WBMWD's service area

b - Estimate for LADWP's West Side service area for irrigation provided by Todd Rother, LADWP (LADWP 2012 Non-Potable Reuse Master Planning Report)

c - For purposes of estimating projected use of recycled water for irrigation, a linear extrapolation was applied to the Δ 1,800 AFY of tertiary-treated recycled water supplied to the West Coast Basin from 2010 to 2025 as shown in Table H-12. For the Δ 160 AFY of AWT recycled water supplied by LADWP, it will be assumed that this use starts in 2025; total NPR projections were not derived because they are not necessary for the SNMP assessments

d- See Table H-12 for derivation of 2025 target volumes

Table H-12 Basis for Recycled Water Irrigation Target Volumes in the West Coast Basin

Year	Recycled Water Usage	Volume (AFY)	Type of Recycled Water
2010	Total NPR [a]	21,080	Tertiary-treated
	Irrigation in WBMWD Service Area	3,880	Tertiary-treated
	Irrigation in LADWP Service Area	0	None
	Total Irrigation	3,880	Tertiary-treated
2025	WBMWD Service Area LADWP Westside Service Area Total Projected NPR [b]	33,900 10,120 44,020	Tertiary-treated and AWT
	Estimated Irrigation in WBMWD Service Area [c]	5,100	Tertiary-treated
	Estimated Irrigation in LADWP Service Area [d]	540	Tertiary-treated
	Total Estimated Irrigation	5,640	Tertiary-treated
	Estimated Irrigation in LADWP Service Area [e]	160	AWT
	Total Estimated Irrigation in 2025	5,800	Tertiary-treated and AWT
Δ 2025 [f]	**Irrigation**	**1,800 [g]**	**Tertiary-treated**
		160	**AWT**

WBMWD – West Basin Municipal Water District
LADWP – Los Angeles County Department of Water and Power
WRF – Water Reclamation Facility
UWMP – Urban Water Management Plan
TIWRP – Terminal Island Water Reclamation Plant/Advanced Water Purification Facility
AFY – acre-feet per year
WY – water year
NPR – non-potable reuse
AWT – advanced water treatment

a - Estimated demand volumes within the WBMWD service area are based on information provided by Uzi Daniel, WBMWD (the 10-year average from 2001 to 2010 as shown in Table H-8; demand volumes within the LADWP service area assume there is a negligible amount of irrigation supplied by the TIWRP and 880 AFY of total NPR supplied by WBMWD to LADWP's West Side service area for irrigation; information regarding LADWP's service area was provided by Todd Rother, LADWP (LADWP 2012 Non-Potable Reuse Master Planning Report)

b - Estimated demand volumes within the WBMWD service area were derived from the 2025 target in the 2010 WBMWD UWMP (33,900 AFY); demands within the LADWP service area are based on the LADWP 2012 Non-potable Reuse Master Planning Report; assuming that 'planned projects' will be online by 2025, there will be 210 AFY of Total NPR supplied from TIWRP, 9,910 AFY from WBMWD's Edward C. Little WRF, for a total of 10,120 AFY inside LADWP's service area.

c - This volume assumes there will be no substantive change in the proportion of recycled water used for irrigation by WBMWD in its service area and LADWP's Westside service area between 2010 and 2025; for 2010, the WBWMD % irrigation = WBMWD service area irrigation 3,000 AFY/total NPR 20,200 AFY = 15%; thus, approximately 15% of WBMWD's 2025 total NPR (33,900 AFY) was used to derive the amount of irrigation (33,900 AFY x 0.15 = 5,100 AFY); information was provided by Uzi Daniel, WBMWD

d - This value for irrigation is obtained from the LADWP 2012 Non-Potable Reuse Master Planning Report; it includes 540 AFY of tertiary-treated recycled water supplied from WBMWD's Edward C. Little WRF; this use starts in 2025

e - This value is obtained from the LADWP 2012 Non-Potable Reuse Master Planning Report and Todd Rother, LADWP; it includes 160 AFY of AWT recycled water from the TIWRP; this use starts in 2025

f - This is the increase in recycled water irrigation use between WY 2010-11 and 2024-25

g - This value is based on 5,640 AFY minus 3,880 AFY, which equals 1,760 AFY, rounded off to 1,800 AFY

AF/year)[9]. Because water in wetland generally does not percolate into groundwater due to the silty muddy bottoms even if unlined, and the park irrigation is very small, the project is not considered a significant recharge component for the SNMP loading analysis.

Of the distributed sources, only sewer line leakage and septic system losses would have significantly different water quality than precipitation infiltration and irrigations return flows, as discussed above. Cities and agencies in the CBWCB, including the City of Los Angeles Bureau of Sanitation (LABOS) and SDLAC, generally have inspection and maintenance programs in place to quickly identify and fix any leaking sewer lines. For this reason, sewer line leakage is assumed to be negligible in terms of the overall S/N loading assumptions. Similarly, SDLAC has indicated that there are only a small number of parcels (478 parcels of approximately 859,500 parcels in the Study Area) currently relying on septic systems for wastewater handling. Accordingly, septic system recharge to groundwater in the CBWCB is assumed to be negligible.

2.4.8 Subsurface Groundwater Inflow from Adjacent Basins and Ocean

Because of the pumping depressions in the Study Area, subsurface groundwater from adjacent basins (Santa Monica, Hollywood, San Fernando, San Gabriel, and Orange County basins) and the ocean (Santa Monica Bay and San Pedro Bay) flows into and recharges the CBWCB. The locations of adjacent basins are shown in Figure 1. Groundwater also flows between the Central Basin subareas and between the Central Basin and West Coast Basin. Subsurface inflows for the 10-year baseline period were extracted from the USGS/GBMP model. **Table H-13** provides a summary of theses volumes. The average subsurface inflow over the 10-year baseline period is about 41,400 AFY in the Central Basin and about 12,600 AFY in the West Coast Basin. Throughout the future planning period, annual subsurface inflows and outflows are assumed to be the average of the baseline period.

2.5 Groundwater Discharge (Outflows)

Groundwater can leave the CBWCB by:

- Pumping, including extraction associated with the desalters,
- Subsurface outflow to adjacent basins and the ocean, and
- Groundwater discharge to surface water.

Of these, groundwater pumping is the most significant outflow from both the Central Basin and West Coast Basin. Due to the large pumping depressions in both basins, very little groundwater leaves the Study Area as subsurface outflow and while there is some outflow to adjacent areas, the overall net subsurface flow is into the Study Area. Similarly, as discussed above, because most streams are concrete-lined, there is little opportunity for groundwater discharge to surface water and thus, this source of discharge is assumed to be negligible.

[9] See http://www.lastormwater.org/blog/2012/08/what-goes-around-comes-around-again/.

Table H-13 Volume and Sources of Subsurface Inflow and Outflow from Adjacent Groundwater Basins and the Ocean

WATER YEAR	BASELINE PERIOD VOLUME SUBSURFACE INFLOW AND OUTFLOW (in acre-feet per year)								
	CENTRAL BASIN					WEST COAST BASIN			
	San Gabriel and San Fernando Basins	Hollywood Basin	Santa Monica Basin	Orange County Basin	Total	Santa Monica Basin	Central Basin	Ocean	Total
2000-01	33,751	5,842	887	-5,548	34,932	1,881	6,530	6,491	14,902
2001-02	33,608	5,733	806	1,583	41,731	1,570	6,456	6,243	14,268
2002-03	31,945	5,730	917	1,581	40,173	2,150	6,753	5,974	14,877
2003-04	35,161	5,795	933	3,909	45,799	2,105	5,444	6,980	14,529
2004-05	19,256	5,861	1,045	5,606	31,767	2,358	4,823	5,773	12,954
2005-06	25,528	5,957	1,081	4,619	37,185	2,251	4,732	4,618	11,602
2006-07	33,789	5,843	1,005	1,551	42,189	1,886	4,650	5,255	11,791
2007-08	36,236	5,762	1,109	-2,856	40,252	2,326	3,463	4,317	10,106
2008-09	41,064	5,805	1,094	2,735	50,698	2,230	3,719	6,003	11,952
2009-10	36,179	5,802	1,156	6,357	49,493	2,332	2,884	4,211	9,427
Baseline Average 2001-2010	32,652	5,813	1,003	1,954	41,422	2,109	4,945	5,587	12,641
WATER YEAR	**PROJECTED VOLUME SUBSURFACE INFLOW AND OUTFLOW (in acre-feet per year)**								
2010-11	32,652	5,813	1,003	1,954	41,422	2,109	4,945	5,587	12,641
2011-12	32,652	5,813	1,003	1,954	41,422	2,109	4,945	5,587	12,641
2012-13	32,652	5,813	1,003	1,954	41,422	2,109	4,945	5,587	12,641
2013-14	32,652	5,813	1,003	1,954	41,422	2,109	4,945	5,587	12,641
2014-15	32,652	5,813	1,003	1,954	41,422	2,109	4,945	5,587	12,641
2015-16	32,652	5,813	1,003	1,954	41,422	2,109	4,945	5,587	12,641
2016-17	32,652	5,813	1,003	1,954	41,422	2,109	4,945	5,587	12,641
2017-18	32,652	5,813	1,003	1,954	41,422	2,109	4,945	5,587	12,641
2018-19	32,652	5,813	1,003	1,954	41,422	2,109	4,945	5,587	12,641
2019-20	32,652	5,813	1,003	1,954	41,422	2,109	4,945	5,587	12,641
2020-21	32,652	5,813	1,003	1,954	41,422	2,109	4,945	5,587	12,641
2021-22	32,652	5,813	1,003	1,954	41,422	2,109	4,945	5,587	12,641
2022-23	32,652	5,813	1,003	1,954	41,422	2,109	4,945	5,587	12,641
2023-24	32,652	5,813	1,003	1,954	41,422	2,109	4,945	5,587	12,641
2024-25	32,652	5,813	1,003	1,954	41,422	2,109	4,945	5,587	12,641
Δ Baseline to 2025 a	0	0	0	0	0	0	0	0	0

USGS - United States Geological Survey

GBMP - Groundwater Basins Master Plan

Source of Data - USGS/GBMP Modeling Reports (USGS, 2003; CH2MHill, 2012)

Positive values represent inflow volumes and negative values represent outflow volumes from the basins

Indicated values represent net total volumes for Model Layers 1 through 4

a - This is the change between the baseline period average and WY 2024-25

2.5.1 Groundwater Pumping and Desalters

Groundwater production wells are the main source of groundwater extraction and usage in the CBWCB. There are currently over 400 active production wells in the CBWCB. Prior to the adjudication of the groundwater basins in the early 1960s, annual production (pumping) reached levels as high as 292,000 AF in the Central Basin and 94,000 AF in the West Coast Basin. Figure 35 shows groundwater production in the Study Area in WY 2009-10. A production map for each water year is presented in the annual *Engineering Survey and Report* prepared by WRD. The different size and color circles on the figure represent relative volumes of annual pumping. The figure shows that there are more wells and more pumping in the Central Basin than in the West Coast Basin. Production in the Central Basin is fairly well distributed. Pumping in the West Coast Basin is clustered inland of the DGB and the WCBB. Figure 36 is a chart showing historical groundwater production in the CBWCB. The chart shows a slight declining trend in groundwater production since 1960.

Table H-8 shows the annual baseline and future planning period volumes of groundwater production in the Central Basin and West Coast Basin. Over the baseline period, an average of about 196,600 AFY was extracted from the Central Basin and about 44,700 AFY from the West Coast Basin, thus totaling 241,300 AFY for both basins. Throughout the future planning period, annual groundwater production is assumed to be at the average of the baseline period (Johnson, August 2012).

There are two desalters operating in the West Coast Basin, specifically in the City of Torrance. The desalters remove salt (using reverse osmosis membranes) from seawater-impacted groundwater and the treated water is distributed for potable supply. The C. Marvin Brewer Desalter (Brewer Desalter), with a design capacity of 1,200 AFY, is owned by WBMWD and operated by California Water Service Company, who distributes the treated water to their drinking water system. The Robert W. Goldsworthy Desalter (Goldsworthy Desalter), with a design capacity of 2,800 AFY, is owned by WRD and operated and maintained by the City of Torrance, who distributes the treated water to their drinking water system. **Table H-14** shows baseline and projected desalter pumping. Annual pumping from WY 2000-2001 to 2011-2012 for both desalters were obtained from the WRD groundwater production database. WRD (verbal communication, Jim McDavid) provided estimated pumping for the Goldsworthy Desalter from WY 2012-2013 to 2013-2014. In 2015, the total plant capacity of the Goldsworthy Desalter will be expanded to 5,500 AFY[10] to allow increased groundwater pump and treat. The remaining estimated future planning period (from WY 2012-2013 to 2024-2025) volume of groundwater pumped annually for the Brewer Desalter is the average of the last five years of reported pumping (i.e. WY 2007-08 through 2011-12), which is an increase from the average baseline pumping. This five year averaging period was selected rather than the baseline period average to account for the lack of pumping from WY 2003-2004 to 2005-2006. The baseline and future planning period pumping volumes from wells associated with the desalters are included in the production listed in Table H-8 and because the desalters remove salt from groundwater, they are also accounted for separately in Table H-14.

[10] Personal communication from Ted Johnson, November 14, 2012.

Table H-14 Baseline and Future Planning Period Desalter Pumping/Operational Production Volumes

Fiscal Year	GOLDSWORTHY DESALTER [a]	BREWER DESALTER [a]
	BASELINE PERIOD VOLUME (AFY)	
2000-01	0	723
2001-02	2,454	1,160
2002-03	2,506	466
2003-04	2,909	1
2004-05	2,315	0
2005-06	2,372	0
2006-07	2,260	285
2007-08	1,460	343
2008-09	930	1,239
2009-10	1,459	336
Baseline Average FY 2001 to 2010	1,867	455
Water Year	**PROJECTED VOLUME (AFY)**	
2010-11	1,736	1,340
2011-12	2,083	1,101
2012-13	2,200	872
2013-14	2,200	872
2014-15	5,500	872
2015-16	5,500	872
2016-17	5,500	872
2017-18	5,500	872
2018-19	5,500	872
2019-20	5,500	872
2020-21	5,500	872
2021-22	5,500	872
2022-23	5,500	872
2023-24	5,500	872
2024-25	5,500	872
Δ Baseline to 2025 [b]	3,633	417

AFY - acre-feet per year

DWR - California Department of Water Resources

WRD - Water Replenishment District of Southern California

FY - Fiscal Year - July 1 through June 30 of following year

a - Data for WY 2010-11 and 2011-12 from WRD production database; Goldsworthy Desalter projections from Jim McDavid, WRD; Brewer Desalter projections are average of reported pumping WY 2007-08 to 2011-12

b - This is the change between the baseline period average and WY 2024-25

2.6 Overall Water Balance and Change in Groundwater Storage

Component-specific water balances were developed based on water balances presented in the USGS/GBMP modeling reports. **Table H-15** presents a summary of the overall baseline period water balance for the Central Basin and **Table H-16** presents the overall baseline period water balance for the West Coast Basin. The tables also provide the annual and cumulative change in groundwater storage. Water balances are extracted from the USGS/GBMP groundwater model and due to rounding errors, model gridding, distribution of flows into and out of different model layers, and other affects, the model-generated numbers are slightly different than the values indicated in the tables presented in this appendix. Differences are less than 1% and are within the margin of error of the table values. As an example, it is noted that while recharge from irrigation return flows in the CBWCB for WY 2001-02 (8,900 AF) was the basis for estimating the irrigation return flow percentage, application of the 3.6% return flow percentage to WY 2001-02 irrigation volumes for the Central Basin and West Coast Basin individually results in irrigation return flow volumes for each basin (approximately 6,000 AF in the Central Basin and 2,900 AFY in the West Coast Basin) that differ slightly from volumes in the numerical model (approximately 6,300 AF in the Central Basin and 2,600 AF in the West Coast Basin). These differences are considered to be insignificant as the differences result in a deviation of less than 1% over the baseline period in each of the two basins.

Figure 6 illustrates the baseline period annual water balances and cumulative change in groundwater storage. The Central Basin water balance is shown on the top of the figure and the West Coast Basin water balance is depicted on the bottom of the figure. As shown in Figure 6, the MFSG (with minor contributions from the DGSG) recharge is the largest inflow to the Central Basin followed by subsurface inflow, deep percolation of precipitation, mountain front recharge, irrigation return flows, and the AGB injection. Groundwater pumping is the major outflow along with a small amount of subsurface outflow to the West Coast Basin. Any other types of inflows or outflows from the basin were negligible and therefore, are not listed in Tables H-15 or H-16. Annual change in storage varies considerably from year to year, with an overall negative cumulative change (i.e., loss) in storage over the 10-year baseline period.

As depicted in Figure 6, in the West Coast Basin, the seawater intrusion barriers (WCBB and DGB) are the largest source of recharge; subsurface inflow from adjacent basins with a small amount from the ocean also provide significant recharge followed by deep percolation of precipitation. Smaller components of recharge include irrigation return flows, mountain front recharge, and the DGSG. As with the Central Basin, annual change in groundwater storage can vary from year to year. Groundwater pumping is the only outflow as there is no subsurface outflow. The cumulative change in storage in the West Coast Basin over the SNMP baseline period is positive, thus indicating an increase.

WRD also calculates the basins' change in storage annually with a method not based on the water balance. WRD uses groundwater levels to determine when additional replenishment water is required and to calculate groundwater annual and cumulative change in storage. These data are presented in WRD's annual *Engineering Survey and Report* (accessed at: http://www.wrd.org/engineering/groundwater-engineering-reports.php). This method is different than the water balance method presented in this appendix and as a result, the

Table H-15 Water Balance for Baseline Period – Central Basin

Water Year	VOLUME OF GROUNDWATER INFLOW, OUTFLOW, AND CHANGE IN STORAGE (acre-feet per year)										
	2000-01	**2001-02**	**2002-03**	**2003-04**	**2004-05**	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**Average**
Groundwater Inflow											
Spreading Grounds	109,982	121,142	123,551	103,088	203,749	135,695	96,748	95,795	74,959	117,415	118,212
Seawater Barrier [a]	5,542	6,023	4,593	5,895	4,440	2,539	2,463	6,487	7,474	5,477	5,093
Precipitation Infiltration	24,846	0	24,944	12,847	25,297	17,824	400	25,488	14,625	21,878	16,815
Mountain Front Recharge	9,225	0	9,226	5,760	9,212	6,992	1,797	9,234	5,895	8,047	6,539
Irrigation Return Flows	5,767	6,313	5,947	6,171	5,442	5,542	5,786	5,625	5,230	5,071	5,689
Subsurface Inflow	34,932	41,731	40,173	45,799	31,767	37,185	42,189	40,252	50,698	49,493	41,422
Total Inflow	190,294	175,208	208,434	179,559	279,906	205,776	149,383	182,882	158,882	207,382	193,771
Groundwater Outflow											
Groundwater Production	-193,837	-198,508	-188,752	-199,074	-187,520	-189,445	-196,695	-204,783	-195,337	-195,692	-194,964
Subsurface Outflow	-6,530	-6,456	-6,753	-5,444	-4,823	-4,732	-4,650	-3,463	-3,719	-2,884	-4,945
Total Outflow	-200,367	-204,964	-195,505	-204,518	-192,343	-194,177	-201,345	-208,246	-199,056	-198,576	-199,910
Change in Groundwater Storage											
Annual Change in Storage	-10,073	-29,756	12,929	-24,959	87,564	11,599	-51,962	-25,364	-40,174	8,806	-6,139
Cumulative Change in Storage	-10,073	-39,829	-26,900	-51,858	35,705	47,305	-4,658	-30,022	-70,196	-61,390	

Negative values indicate a loss or reduction

Water balances are extracted from USGS/GBMP groundwater model and due to rounding errors, model gridding, distribution of flows into and out of different model layers, and other affects, the model-generated numbers are slightly different than supporting tables; differences are less than 1% and are within the margin of error of the supporting number estimates.

a - Volume injected at Alamitos Gap Barrier includes injection into both Central Basin and Orange County Basin because they cannot be separated in USGS/GBMP groundwater model water balances used for SNMP mixing model

Table H-16 Water Balance for Baseline Period – West Coast Basin

Water Year	VOLUME OF GROUNDWATER INFLOW, OUTFLOW, AND CHANGE IN STORAGE (acre-feet per year)										
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	Average
Groundwater Inflow											
Spreading Grounds	463	671	187	177	276	68	0	1,273	2,085	562	576
Seawater Barriers	24,405	24,929	23,641	18,470	15,926	17,946	22,003	20,784	19,519	23,741	21,136
Precipitation Infiltration	12,407	0	12,825	6,673	12,847	9,106	252	12,085	5,862	10,762	8,282
Mountain Front Recharge	3,421	0	3,472	2,120	3,456	2,623	681	3,275	1,861	2,925	2,384
Irrigation Return Flows	3,006	2,598	2,815	2,877	2,724	2,713	2,818	2,671	2,522	2,417	2,716
Subsurface Inflow	14,902	14,268	14,877	14,529	12,954	11,602	11,791	10,106	11,952	9,427	12,641
Total Inflow	58,605	42,466	57,816	44,845	48,184	44,058	37,545	50,194	43,801	49,834	47,735
Groundwater Outflow											
Groundwater Production	-54,982	-51,138	-52,375	-48,640	-41,452	-37,463	-38,624	-39,233	-46,229	-44,618	-45,475
Subsurface Outflow	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-54,982	-51,138	-52,375	-48,640	-41,452	-37,463	-38,624	-39,233	-46,229	-44,618	-45,475
Change in Groundwater Storage											
Annual Change in Storage	3,623	-8,672	5,440	-3,795	6,733	6,595	-1,079	10,961	-2,428	5,217	2,260
Cumulative Change in Storage	3,623	-5,049	391	-3,403	3,329	9,925	8,845	19,807	17,378	22,595	

Negative values indicate a loss or reduction

Water balances are extracted from USGS/GBMP groundwater model and due to rounding errors, model gridding, distribution of flows into and out of different model layers, and other affects, the model-generated numbers are slightly different than supporting tables; differences are less than 1% and are within the margin of error of the supporting number estimates.

approximate changes in storage presented in Tables H-15 and H-6 may not exactly match numbers presented in the *Engineering Survey and Report.* Two future planning period water balance scenarios are presented as Figure 7 (No Future Projects Scenario) and Figure 8 (All Projects Scenario). The No Future Projects Scenario water balances assume that average baseline period inflows and outflows continue for every year of the future planning period with no changes (i.e. no new projects implemented, just continuation of existing projects). The All Projects Scenario water balances assume that all future projected changes in inflows and outflows described in this appendix are implemented, including increased recharge at the MFSG, DGSG, and seawater intrusion barriers, slightly decreased irrigation return flow in the Central Basin, slightly increased irrigation return flow in the West Coast Basin, and increased pumping for the desalters. Other inflows and outflows, including precipitation return flow, mountain front recharge, and subsurface flows are maintained at the average baseline period volumes for each year of the future planning period. The No Future Projects Scenario water balances are needed so that the S/N impacts from the various proposed projects can be compared with a scenario where S/N loading and unloading remains at average baseline conditions. Refer to Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality* for further discussion of S/N impacts from proposed projects. As with the baseline period water balances, it is noted that volumes for certain inflows and outflows extracted from the USGS/GBMP groundwater model vary slightly from those indicated in the tables presented in this appendix. This occurred as a result of numerical rounding during apportionment of certain flows into and out of the various model mixing volumes (basins/subareas/layers) and other affects. Differences are less than 1% and are within the margin of error of the numbers presented in the tables.

The No Future Projects Scenario water balances for the Central Basin and West Coast Basin for the future planning period are presented in **Tables H-17** and **H-18**, respectively, and Figure7. Average baseline period inflows and outflows were duplicated for each year from WY 2010-11 through 2024-25. By 2025 in the Central Basin, there is an annual loss of storage of about 6,100 acre-feet (AF) and a cumulative loss in storage (over the future planning period) of approximately 92,000 AF. By 2025 in the West Coast Basin, there is an annual gain in storage of about 2,300 AF and a cumulative gain in storage (over the future planning period) of approximately 34,000 AF.

The water balances for the All Projects Scenario, which include the combined future changes discussed above, are presented in **Tables H-19** and **H-20**, respectively, and Figure 8. Average baseline period inflows and outflows are duplicated for each year from WY 2010-11 through 2024-25 and projected future changes (due to implementation of proposed projects) are superimposed on this average baseline condition. In comparison with the No Future Projects Scenario, the All Projects Scenario recharges additional water to the basins. By 2025 in the Central Basin, there is an average annual gain in storage of about 1,500 AF and a cumulative increase in storage (over the future planning period) of approximately 22,400 AF. By 2025 in the West Coast Basin, there is an average annual gain in storage of about 2,600 AF and a cumulative increase in storage (over the future planning period) of approximately 38,500 AF.

Table H-17 No Future Projects Scenario Water Balances for Future Planning Period – Central Basin

Water Year	VOLUME OF GROUNDWATER INFLOW, OUTFLOW, AND CHANGE IN STORAGE (acre-feet per year)															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
Groundwater Inflow																
Spreading Grounds	118,212	118,212	118,212	118,212	118,212	118,212	118,212	118,212	118,212	118,212	118,212	118,212	118,212	118,212	118,212	118,212
Seawater Barrier [a]	5,093	5,093	5,093	5,093	5,093	5,093	5,093	5,093	5,093	5,093	5,093	5,093	5,093	5,093	5,093	5,093
Precipitation Infiltration	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815
Mountain Front Recharge	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539
Irrigation Return Flows	5,689	5,689	5,689	5,689	5,689	5,689	5,689	5,689	5,689	5,689	5,689	5,689	5,689	5,689	5,689	5,689
Subsurface Inflow	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422
Total Inflow	193,771	193,771	193,771	193,771	193,771	193,771	193,771	193,771	193,771	193,771	193,771	193,771	193,771	193,771	193,771	193,771
Groundwater Outflow																
Groundwater Production	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964
Subsurface Outflow	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945
Total Outflow	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910
Change in Groundwater Storage																
Annual Change in Storage	-6,139	-6,139	-6,139	-6,139	-6,139	-6,139	-6,139	-6,139	-6,139	-6,139	-6,139	-6,139	-6,139	-6,139	-6,139	-6,139
Cumulative Change in Storage	-6,139	-12,278	-18,417	-24,556	-30,695	-36,834	-42,973	-49,112	-55,251	-61,390	-67,529	-73,668	-79,807	-85,946	-92,085	

Negative values indicate a loss or reduction

Water balances are based on values extracted from the USGS/GBMP groundwater model for the baseline period (WY 2001 to WY 2010) and due to rounding errors, model gridding, distribution of flows into and out of different model layers, and other affects, the model-generated numbers are slightly different than supporting tables; differences are less than 1% and are within the margin of error of the supporting number estimates

a - Volume injected at Alamitos Gap Barrier includes injection into both Central Basin and Orange County Basin because they cannot be separated in USGS/GBMP groundwater model water balances used for SNMP mixing model

Table H-18 No Future Projects Scenario Water Balances for Future Planning Period – West Coast Basin

Water Year	VOLUME OF GROUNDWATER INFLOW, OUTFLOW, AND CHANGE IN STORAGE (acre-feet per year)															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
Groundwater Inflow																
Spreading Grounds	576	576	576	576	576	576	576	576	576	576	576	576	576	576	576	576
Seawater Barriers	21,136	21,136	21,136	21,136	21,136	21,136	21,136	21,136	21,136	21,136	21,136	21,136	21,136	21,136	21,136	21,136
Precipitation Infiltration	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282
Mountain Front Recharge	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384
Irrigation Return Flows	2,716	2,716	2,716	2,716	2,716	2,716	2,716	2,716	2,716	2,716	2,716	2,716	2,716	2,716	2,716	2,716
Subsurface Inflow	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641
Total Inflow	47,735	47,735	47,735	47,735	47,735	47,735	47,735	47,735	47,735	47,735	47,735	47,735	47,735	47,735	47,735	47,735
Groundwater Outflow																
Groundwater Production	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475
Subsurface Outflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475	-45,475
Change in Groundwater Storage																
Annual Change in Storage	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260
Cumulative Change in Storage	2,260	4,519	6,779	9,038	11,298	13,557	15,817	18,076	20,336	22,595	24,855	27,114	29,374	31,633	33,893	

Negative values indicate a loss or reduction

Water balances are based on values extracted from the USGS/GBMP groundwater model for the baseline period (WY 2001 to WY 2010) and due to rounding errors, model gridding, distribution of flows into and out of different model layers, and other affects, the model-generated numbers are slightly different than supporting tables; differences are less than 1% and are within the margin of error of the supporting number estimates

Table H-19 All Projects Scenario Water Balances for Future Planning Period – Central Basin

Water Year	VOLUME OF GROUNDWATER INFLOW, OUTFLOW, AND CHANGE IN STORAGE (acre-feet per year)															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
Groundwater Inflow																
Spreading Grounds	120,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	124,667
Seawater Barrier [a]	6,200	6,200	6,200	6,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	6,933
Precipitation Infiltration	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815	16,815
Mountain Front Recharge	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539	6,539
Irrigation Return Flows	5,041	5,038	5,036	5,034	5,031	5,029	5,027	5,025	5,023	5,020	5,018	5,016	5,014	5,012	5,008	5,025
Subsurface Inflow	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422	41,422
Total Inflow	196,016	201,013	201,011	201,009	202,007	202,005	202,003	202,000	201,998	201,996	201,994	201,992	201,990	201,987	201,984	201,400
Groundwater Outflow																
Groundwater Production	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964	-194,964
Subsurface Outflow	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945	-4,945
Total Outflow	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910	-199,910
Change in Groundwater Storage																
Annual Change in Storage	-3,893	1,104	1,102	1,100	2,097	2,095	2,093	2,091	2,089	2,086	2,084	2,082	2,080	2,078	2,074	1,491
Cumulative Change in Storage	-3,893	-2,790	-1,688	-588	1,509	3,604	5,697	7,788	9,877	11,963	14,048	16,130	18,210	20,287	22,362	

Negative values indicate a loss or reduction

a - Volume injected at Alamitos Gap Barrier includes injection into both Central Basin and Orange County Basin because they cannot be separated in groundwater model water balances used for mixing model

Table H-20 All Projects Scenario Water Balances for Future Planning Period – West Coast Basin

Water Year	VOLUME OF GROUNDWATER INFLOW, OUTFLOW, AND CHANGE IN STORAGE (acre-feet per year)															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
Groundwater Inflow																
Spreading Grounds	760	760	760	760	760	760	760	1,760	1,760	1,760	1,760	1,760	1,760	1,760	1,760	1,293
Seawater Barriers	21,292	22,249	21,600	24,500	24,500	24,500	24,500	24,500	24,500	24,500	24,500	24,500	24,500	24,500	24,500	23,943
Precipitation Infiltration	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282	8,282
Mountain Front Recharge	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384
Irrigation Return Flows	2,507	2,510	2,537	2,565	2,592	2,620	2,647	2,675	2,702	2,729	2,757	2,784	2,812	2,839	2,866	2,676
Subsurface Inflow	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641
Total Inflow	47,865	48,825	48,204	51,131	51,159	51,186	51,213	52,241	52,268	52,296	52,323	52,351	52,378	52,405	52,433	51,219
Groundwater Outflow																
Groundwater Production[a]	-46,230	-46,338	-46,226	-46,226	-49,526	-49,526	-49,526	-49,526	-49,526	-49,526	-49,526	-49,526	-49,526	-49,526	-49,526	-48,653
Subsurface Outflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-46,230	-46,338	-46,226	-46,226	-49,526	-49,526	-49,526	-49,526	-49,526	-49,526	-49,526	-49,526	-49,526	-49,526	-49,526	-48,653
Change in Groundwater Storage																
Annual Change in Storage	1,636	2,488	1,978	4,906	1,633	1,660	1,688	2,715	2,743	2,770	2,797	2,825	2,852	2,880	2,907	2,565
Cumulative Change in Storage	1,636	4,124	6,102	11,007	12,640	14,301	15,989	18,704	21,447	24,217	27,014	29,839	32,691	35,571	38,478	

Negative values indicate a loss or reduction

a - Includes average annual groundwater production over baseline period plus net additional annual groundwater pumping from desalter wells

3 Future Groundwater Levels

Given the projected increase in storage over the future planning period for the All Projects Scenario, groundwater levels are expected to rise in the future. In order to estimate the change in groundwater levels, CH2MHILL incorporated into the existing USGS/GBMP groundwater flow model the estimated annual water budget projections developed for the No Future Projects Scenario and All Projects Scenario and simulated the groundwater level response for both scenarios from WY 2010-11 through 2024-25. Figure 37 shows the simulated groundwater level change (from WY 2010-11 to 2024-25) within the four model layers for the All Projects Scenario. The map was generated by subtracting the WY 2010-11 simulated groundwater elevation from the WY 2024-25 simulated groundwater elevation for the All Projects Scenario for each model grid cell within each model layer. Figure 37 shows that simulated groundwater elevations in all model layers increase over the 15-year future planning period across much of the CBWCB with the exception of the Los Angeles Forebay, in which varying degrees of groundwater level decline are predicted in Model Layers 2 through 4 due to groundwater production in these layers. In order to quantify the groundwater level impact of planned projects included in the All Projects Scenario, a separate map (Figure 38) was prepared showing the difference between WY 2024-25 groundwater levels for the All Projects Scenario versus WY 2024-25 groundwater levels for the No Future Projects Scenario. Figure 38 shows that the increase in groundwater recharge from the planned projects have a significant positive impact (i.e., increase) on groundwater levels across the CBWCB compared to the No Future Projects Scenario over the 15-year future planning period.

Appendix I
Simulated Baseline and Future
Salt and Nutrient Groundwater Quality

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1 Introduction

This Appendix I describes the simulated baseline and future salt and nutrient (S/N) groundwater quality for the Central Basin and West Coast Basin (CBWCB or Study Area). Key components of this appendix include:

- Description of major projects to be implemented during the future planning period (Water Year [WY] 2010-11 to 2024-25) that affect S/N loading,
- Estimation of baseline period (WY 2000-01 to 2009-10) and future planning period S/N mass balances (basin inflows and outflows),
- Description of the mixing model that was developed to estimate future groundwater quality,
- Simulation of baseline and future planning period S/N groundwater quality using the mixing model,
- Calculation of impacts on groundwater quality due to proposed major recycled water projects and use of available assimilative capacity, and
- An anti-degradation analysis of the CBWCB.

Section 2 describes the mixing model that was developed to estimate future water quality and the scenarios that were simulated by the mixing model. Section 3 presents an analysis of historical S/N groundwater quality trends. Section 4 describes the baseline and future S/N balances. Section 5 describes the baseline and future groundwater quality and use of the available assimilative capacity by existing and planned major recycled water projects. Section 6 presents the anti-degradation analysis.

Attachment I-A provides a description of the Mann-Kendall statistical trend test used to assess historical groundwater quality trends. Attachment I-B presents total dissolved solids (TDS), chloride, and nitrate time-concentration plots for Water Replenishment District of Southern California (WRD) nested groundwater monitoring wells. Attachment I-C presents baseline and future S/N balance tables. Attachment I-D provides figures showing projections for future groundwater quality through WY 2049-50 for TDS, chloride, and nitrate.

References cited in this appendix and other appendices are provided at the end of the Salt and Nutrient Management Plan (SNMP).

2 SNMP Mixing Model and Simulation of Groundwater Quality

An SNMP mixing model was developed to simulate future planning period groundwater quality and evaluate the effects of planned future projects on overall groundwater quality in the CBWCB through WY 2024-25. This mixing model was developed in Microsoft Excel™ and is effectively a set of linked spreadsheets used to represent “continuously-stirred” mixing volumes. At the request of Los Angeles Regional Water Quality Control Board (LARWQCB), these spreadsheets were provided to the LARWQCB in October 2013. The mixing model was designed to: 1) account for the current groundwater volume and S/N mass in storage within the CBWCB, and 2) track the loading/unloading of S/Ns through major groundwater sources and sinks under current (baseline period) and future land use/water use conditions (various scenarios for the future planning period).

The estimated current groundwater volume (provided by the MODFLOW regional groundwater flow model that was developed by the United States Geological Survey [USGS] in 2003 and was recently updated for the Groundwater Basins Master Plan [GBMP]) and associated S/N mass in storage (concentrations provided by estimated existing average S/N groundwater quality) within the CBWCB served as initial inputs into the mixing model. Consideration of the groundwater volume and S/N mass in storage is necessary for predicting future groundwater quality concentrations in order to compare simulated concentrations with Basin Plan Objectives (BPOs) and anti-degradation thresholds (assimilative capacity) defined by the Recycled Water Policy. In recognition of the variable hydrogeologic and groundwater quality conditions and different BPOs established for the Central Basin and West Coast Basin, the CBWCB was divided into discrete mixing volumes (subareas/layers) in the SNMP mixing model.

The effect of S/N loading on groundwater quality is predicated on the following understanding that groundwater quality: 1) improves if the flow-weighted concentration of all inflows (or mass) is less than the flow-weighted concentration (or mass) of all outflows, 2) degrades if the flow-weighted concentration of all inflows (or mass) is greater than the flow-weighted concentration (or mass) of all outflows, or 3) remains unchanged if flow-weighted concentration (or mass) of all inflows equals the flow-weighted concentration (or mass) of all outflows.

The S/N inflows and outflows were mixed with the existing groundwater volume and quality using the mixing model and groundwater concentrations were estimated for each year of the baseline and future planning periods. The simulated baseline concentrations were compared with the dominant actual observed groundwater quality trends. Based on the comparison, inflow and outflow concentrations were adjusted to achieve a better match to observed concentrations. For the future planning period, several different scenarios were simulated as described in Section 2.3 *Scenarios Simulated to Estimate Future Groundwater Quality*.

2.1 Mixing Model Calibration

To address the uncertainty in estimating S/N loading for each individual S/N source, the baseline period (WY 2000-01 through 2009-10) was used to compare simulated concentration trends against observed concentration trends on a basin/subarea-scale, identify S/N loading factors with the highest level of significance, and of those factors, modify the ones with the highest level of uncertainty to provide a reasonable match between observed and simulated concentrations.

Regional observed concentration trends were measured by performing the Mann-Kendall statistical trend test as described in Section 3 *Groundwater Quality Trend Analysis*. On a basin/subarea-scale, initial simulation results (groundwater concentrations and annual concentration trends within a given subarea/basin) were compared to observed background concentrations and concentrations trends over the baseline period to determine the sensitivity of the model to individual S/N loads. Loading factors with higher levels of uncertainty were refined until simulated results best matched observed concentrations and concentration trends on a basin/subarea-wide basis. With the exception of refinement of nitrate loading associated with operations at the Montebello Forebay Spreading Grounds (see adjustment No. 3 below), all refinements to key loading assumptions in the mixing model were applied across the entire CBWCB and not selectively applied to individual subareas or layers. Following several iterations, the following adjustments to key S/N loading estimates were incorporated into the final calibrated mixing model:

Initial simulation results indicated that TDS and chloride loading were underestimated across the CBWCB (resulting in declining TDS/chloride concentration trends over the baseline period not in agreement with observed groundwater quality trends). One key TDS loading factor with relatively high uncertainty is the evaporation/concentration effect of applied irrigation water. An initial evaporation/concentration factor of three was applied to TDS and chloride in irrigation return flow (i.e. 300% of applied irrigated water concentration was assumed for return flows). However, preliminary simulation results indicated the use of a higher evaporation/concentration factor was warranted. To better reflect the TDS and chloride trends observed in the CBWCB, an evaporation/concentration factor of nine (i.e. 900%) was applied to TDS and chloride concentrations in applied irrigation water. This resulted in an average irrigation return flow of 4,100 mg/L of TDS and 381 mg/L of chloride in the Central Basin and 3,363 mg/L of TDS and 827 mg/L of chloride in the West Coast Basin (for imported water and groundwater).

Comparison of initial simulated groundwater nitrate concentrations across the CBWCB to actual observed groundwater nitrate concentrations indicated that either: 1) nitrate concentrations in irrigation return flow (with fertilizer added) were overestimated or 2) additional nitrate attenuation in the vadose zone was not captured in the mixing model. To account for the attenuation of nitrate and to match actual observed groundwater quality concentrations and trends, nitrate-N concentrations in irrigation return flow were reduced by a factor of 10% (i.e. 90% attenuation).

Comparison of initial simulated and background nitrate-N or NO_3-N concentrations in groundwater and trends within the Montebello Forebay indicated that measurable nitrate attenuation occurs beneath the Montebello Forebay Spreading Grounds (MFSG). To match the observed groundwater quality in this critical area, the following nitrate attenuation factors were applied to MFSG blended recharge water quality and respective vertical and horizontal subsurface groundwater flows beneath the Montebello Forebay:

- MFSG water quality to Model Layer 1 = 84% of NO_3-N (16% attenuation)
- From Model Layer 1 to Layer 2 in Montebello Forebay = 100% of NO_3-N (no attenuation)
- From Model Layer 2 to Layer 3 in Montebello Forebay = 62% of NO_3-N (38% attenuation)
- From Model Layer 3 to Layer 4 in Montebello Forebay = 0% of NO_3-N (100% attenuation)
- From Model Layer 1 in Montebello Forebay to Model Layer 1 in Central Basin Pressure Area = 6% of NO_3-N (94% attenuation).

To account for mineral dissolution along rainfall recharge flowpaths, a constant concentration of 150 mg/L for TDS and 20 mg/L for chloride was applied to recharge related to deep percolation of precipitation. This level of increase allowed for a better match between simulated and actual observed concentrations. The annual nitrate-N concentration in raw precipitation was applied directly to deep percolation of precipitation.

2.2 Mixing Model Assumptions

The primary assumption of the SNMP mixing model is that S/N mixing within a given mixing volume is complete during each annual time step. While the CBWCB is divided into 20 mixing volumes (i.e., subareas/layers) to account for variable loading and non-uniform concentrations across the basins, it is recognized that the assumption of complete mixing can result in two potential errors: 1) overestimation or underestimation of the S/N concentration assigned to subsurface flows between discreet neighboring volumes, and 2) overestimation of the effect of S/N loading changes associated with a point-source projects in one mixing volume on neighboring mixing volumes. The effect of the two potential errors on vertical S/N transport between mixing volumes (e.g., Layer 1 to Layer 2 in a given subarea) is limited for two reasons: 1) vertical flows are generally fairly consistent across each basin/subarea; therefore, the volume-weighted average concentration for each model layer is a representative concentration for vertical S/N fluxes, and 2) insofar as S/Ns migrate vertically but are maintained in a respective basin/subarea, they do not affect the volume-weighted average concentration for that basin/subarea.

Examination of concentration contour maps and future simulation results indicate that the two potential errors associated with the assumption of complete S/N mixing within mixing volumes likely contributed to the slight overestimation of the TDS and chloride concentrations assigned to horizontal subsurface flowpaths (e.g., Layer 1 to adjacent subarea Layer 1; Layer 2 to adjacent subarea Layer 2, etc.) from the Los Angeles Forebay, Montebello Forebay, and Whittier Area to the Central Basin Pressure Area. These errors resulted in a conservative overestimation of groundwater quality for the Central Basin Pressure Area and help to explain partly why this subarea is projected to experience the highest concentration increase and the greatest use of current available assimilative capacity with respect to TDS and chloride.

Simulation results also indicate that some of the projected TDS and chloride concentration increases in the Central Basin Pressure Area were caused by two local factors: 1) loading from irrigation return flows within the Central Basin Pressure Area, and 2) limited unloading from pumping; most of the pumping in the Central Basin Pressure Area is by wells screened in Model Layer 3, which has lower TDS and chloride concentrations compared to the subarea volume-weighted average concentration for all layers. In addition to these two factors, some of the TDS and chloride concentration increases in the Central Basin Pressure Area are also a result of S/N loading associated with subsurface inflows from the Los Angeles Forebay, Montebello Forebay, and Whittier Area. Volume-weighted average TDS and chloride concentrations are higher in these upgradient areas than in the Central Basin Pressure Area. However, concentration contour maps indicate that the volume-weighted average TDS and chloride concentrations in Model Layers 2 and 3 in the Los Angeles Forebay and Whittier Area are higher than respective concentrations along the boundary shared with the Central Pressure Area. Thus, S/N fluxes along these boundaries are slightly overestimated.

2.3 Scenarios Simulated to Estimate Future Groundwater Quality

For the SNMP future planning period, several changes in the future water and S/N balances are anticipated due to the implementation of proposed projects in the CBWCB. Appendix H *Baseline and Future Water Balances* identifies baseline period (WY 2000-01 through 2009-10) and future planning period (WY 2010-11 through 2024-25) water balances for groundwater, imported water, and recycled water use; stormwater capture; and all other basin inflows and outflows. **Table I-1** summarizes the major proposed projects or "scenarios" that were simulated by the SNMP mixing model to determine future water quality and assess assimilative capacity impacts.

As shown in Table I-1, a total of 11 scenarios were simulated by the SNMP mixing model and results from the simulations were compared to Scenario 1 (i.e. continued baseline period average conditions in the future). Scenarios 1 through 7 were assessed to determine water quality impacts of individual projects in isolation. In reality, some combination of these projects will be implemented in the future planning period, so Scenarios 8 through 11 were simulated to assess the impacts of various combinations of projects. As described in Table I-1, Scenarios 8 through 11 also include the following minor future changes:

- Decreased imported water use for supply in the Central Basin (from a baseline period average of 129,300 acre-feet per year (AFY) to about 121,000 AFY by WY 2024-25) and slightly increased imported water for supply in the West Coast Basin (from a baseline period average of about 143,000 AFY to about 155,600 AFY by WY 2024-25). This results in a net decrease in imported water supply in the CBWCB and a reduction in S/N loading from irrigation return flows.
- Increased stormwater capture at the Dominguez Gap Spreading Grounds (DGSG) from a baseline period average of about 760 AFY to about 1,760 AFY by WY 2017-18.

During the future planning period, a recycled water project under WRD's Groundwater Reliability Improvement Program (GRIP) is expected to be implemented to supply increased tertiary-treated recycled water and/or advanced treated recycled water for recharge at the MFSG to completely replace imported water (up to 21,000 AFY). Two alternatives, GRIP Recycled Water Project A (GRIP A) and GRIP Recycled Water Project B (GRIP B) (Scenarios 6 and 7, respectively) described in Table I-1 are the end result of many studies conducted over a number of years to assess multiple potential projects to improve water supply reliability in the face of imported water supply uncertainties and increasing costs. These studies evaluated a wide spectrum of projects, including consideration of different levels of recycled water treatment and blending, modifications to existing wastewater treatment facilities, continued imported water deliveries, alternative imported water supplies, desalination, and increased stormwater capture (MWH, 2009a through 2009l; RMC, 2011b; SDLAC, 2012; and CH2MHILL, 2012c). GRIP A and GRIP B were determined to be the best alternatives for implementation and thus, potential water quality impacts for both scenarios were simulated by the SNMP mixing model.

Table I-1 Description of Scenarios Simulated by the SNMP Mixing Model

Scenario No.	Description
1	**No Future Projects** – Average of baseline period conditions (i.e. continuation of only existing projects and no implementation of proposed projects) reproduced for each year of the future planning period (Water Year [WY] 2010-11 through 2024-25).
2	**Increased Recycled Water for Irrigation (Baseline Period Average Water Quality)** – This is a proposed project in the Central Basin and West Coast Basin (CBWCB) that would increase the use of recycled water for irrigation (replacing imported water and groundwater). Recycled water used for irrigation is anticipated to increase from the 10-year baseline period (WY 2000-01 through 20009-10) average of about 10,600 acre-feet per year (AFY) to about 23,100 AFY by WY 2024-25. For this scenario, recycled water quality for salt and nutrients (S/Ns) is equivalent to the baseline period average (see Table I-9). For the CBWCB Salt and Nutrient Management Plan (SNMP), S/Ns specifically refers to nitrate as nitrogen (nitrate-N), total dissolved solids (TDS), and chloride.
3	**Increased Recycled Water for Irrigation (Water Quality Equivalent to MCL/SMCLs)** – This is a proposed project in the CBWCB that would increase the use of recycled water for irrigation (replacing imported water and groundwater). Recycled water used for irrigation is anticipated to increase from a baseline period average of about 10,600 AFY to about 23,100 AFY by WY 2024-25. For this scenario, recycled water quality is equivalent to: • Nitrate-N – Primary Maximum Contaminant Level (MCL) of 10 milligrams per liter (mg/L), • TDS – Secondary Maximum Contaminant Level (SMCL) of 1,000 mg/L, and • Chloride – SMCL of 500 mg/L. These recycled water concentrations are higher than the baseline period averages (Scenario 2). Currently, permitted recycled water quality limits established for non-potable reuse (irrigation, industrial and recreational activities) are generally more conservative than the SMCLs established for TDS and chloride.
4	**Seawater Intrusion Barriers** – This scenario consists of planned projects that would increase injection volumes and increase the use of recycled water that has undergone advanced water treatment (AWT) to completely replace imported water at the West Coast Basin Seawater Intrusion Barrier (WCBB), Alamitos Gap Seawater Intrusion Barrier (AGB), and Dominguez Gap Seawater Intrusion Barrier (DGB). Total AWT recycled water used for injection at the barriers is anticipated to increase from a baseline period average of about 9,500 AFY to about 31,700 AFY by WY 2018-19. The switch to AWT recycled water from imported water significantly reduces TDS and chloride in the recharge water (changes in nitrate concentrations are not significant). As a result, these planned seawater barrier projects were designated as an implementation measure, as further discussed in Appendix J in the SNMP.

Scenario No.	Description
5	**Increased Groundwater Pump and Treat by the Desalters in the West Coast Basin** – This scenario consists of planned projects that would increase the amount of groundwater pumped and treated by the two existing desalter facilities in the West Coast Basin. The Robert W. Goldsworthy Desalter will be expanded and the associated groundwater pumping will increase from a baseline period average of about 1,900 AFY to about 5,500 AFY by WY 2014-15. Groundwater pumping for treatment by the C. Marvin Brewer Desalter is also expected to increase from a baseline period average of about 500 AFY to an average of about 900 AFY in the future planning period. Since these planned desalter projects are expected to improve groundwater quality, they were designated as an implementation measure, as further discussed in Appendix J in the SNMP.
6	**Groundwater Reliability Improvement Program, Recycled Water Project A (GRIP A)** – This is a planned project in the Central Basin that would increase the use of recycled water, specifically a blend of AWT recycled water (10,000 AFY) and tertiary-treated recycled water (11,000 AFY) to completely replace imported water for recharge at the Montebello Forebay Spreading Grounds (MFSG) beginning WY 2017-18.
7	**GRIP Recycled Water Project B (GRIP B)** – This is a proposed project in the Central Basin that would increase the use of tertiary-treated recycled water (21,000 AFY) to completely replace imported water for recharge at the MFSG beginning WY 2014-15.
8	**Combined Projects/Scenarios** – A combination of Scenarios 2 (increased recycled water for irrigation at baseline period average S/N concentrations), 4, 5, 6 (GRIP A), and minor future changes (includes increased and decreased imported water for supply in the West Coast Basin and Central Basin, respectively, and increased stormwater capture).
9	**Combined Projects/Scenarios** – A combination of Scenarios 2 (increased recycled water for irrigation at baseline period average S/N concentrations), 4, 5, 7 (GRIP B), and minor future changes (includes increased and decreased imported water for supply in the West Coast Basin and Central Basin, respectively, and increased stormwater capture).
10	**Combined Projects/Scenarios** – A combination of Scenarios 3 (increased recycled water for irrigation at SMCLs/MCL), 4, 5, 6 (GRIP A), and minor future changes (includes increased and decreased imported water for supply in the West Coast Basin and Central Basin, respectively, and increased stormwater capture).
11	**Combined Projects/Scenarios** – A combination of Scenarios 3 (increased recycled water for irrigation at SMCLs/MCL), 4, 5, 7 (GRIP B), and minor future changes (includes increased and decreased imported water for supply in the West Coast Basin and Central Basin, respectively, and increased stormwater capture).

SNMP – Salt and Nutrient Management Plan
S/N – salt and nutrient
MCL – Maximum Contaminant Level
SMCL – Secondary Maximum Contaminant Level
Nitrate-N – nitrate as nitrogen
TDS – total dissolved solids
mg/L – milligrams per liter
CBWCB – Central Basin and West Coast Basin
AFY – acre-feet per year
WY – Water Year
GRIP – Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A
GRIP B – GRIP Recycled Water Project B
MFSG – Montebello Forebay Spreading Grounds

At this time, GRIP A and GRIP B alternatives are being further evaluated by WRD in terms of feasibility and cost and a Draft Environmental Impact Report (EIR) was issued for public review in March 2014 (accessed at: http://www.wrd.org/business/water-replenishment-grip.php). In the Draft EIR, GRIP A was identified as the "proposed project," while GRIP B was identified as an "alternative" to the "proposed project" (AECOM, 2014). As a result, it is anticipated that GRIP A likely would be the project to be implemented by WRD. However, this is subject to change until the Final EIR is prepared and certified by WRD.

Unchanged factors over the future planning period include subsurface basin inflows and outflows, groundwater pumping (except for the increase associated with the desalters), precipitation infiltration, mountain front recharge, and source water quality. These unchanged factors are represented as the average of the 10-year baseline period for each year of the future planning period.

The simulated conditions for the SNMP mixing model scenarios are summarized in **Table I-2**.

3 Groundwater Quality Trend Analysis

The Mann-Kendall statistical trend test is a nonparametric test that is commonly used to detect trends in a concentration time-series that compares the relative magnitudes of sample data. The Mann-Kendall test is particularly applicable to groundwater quality evaluations because the test is statistically robust and can be effectively applied to data sets with censored values (i.e., non-detects). **Attachment I-A** contains a more detailed description of the test. The Mann-Kendall test was used to assess whether TDS, chloride, and nitrate-N concentrations in WRD nested groundwater monitoring wells and production wells are increasing, decreasing, or showing no significant change. The trend analysis results, along with visual assessment of time-concentration plots for TDS, chloride, and nitrate-N in WRD nested monitoring wells (**Attachment I-B**), were used to help assess the dominant regional water quality trends in the basins and subareas to support the model calibration process discussed in Section 5.1.1.

The trend analysis was conducted using the entire period of record available for each well. Only those wells with 10 or more data points were evaluated to ensure that the requirements of the Mann-Kendall test were satisfied. The results of the trend analysis for each S/N are described below.

3.1 TDS Concentration Trends

Table I-3 presents the results of the Mann-Kendall test for TDS, chloride, and nitrate-N trends for each model layer, the combined layers within each subarea, the Central Basin, West Coast Basin, and entire CBWCB. Numbers in the table represent the number of wells within each trend category. Wells with unknown well completions are also shown in the table designated as "UNKNOWN." Figure 39 is a map illustrating the distribution of the trend results for TDS, chloride, and nitrate-N. TDS trend maps are shown along the left column of the figure, with Model Layer 1 on top and Model Layer 4 on the bottom. The TDS trend data are mixed with some wells increasing, some decreasing, and some showing no trend; however, the majority of wells in both basins are stable (i.e. no trend).

Table I-2 Summary of Simulated Conditions for the SNMP Mixing Model Scenarios

Scenario [a]	SIMULATED CONDITIONS										
	Average Baseline Precipitation and Mountain Front Infiltration, Pumping, Subsurface Flows	Irrigation with Recycled Water			WCBB/DGB/AGB		Desalters		MFSG		
		Average Baseline	Increased Volume and Baseline Average WQ	Increased Volume and MCL/SMCL WQ	Average Baseline	Increased Injection Volume with AWT	Average Baseline	Increased Pumping	Average Baseline	Tertiary and AWT Recycled Water	Tertiary Recycled Water
1. No Future Projects	✓	✓			✓		✓				
2. Increased Recycled Water for Irrigation (baseline period average WQ)	✓		✓		✓		✓		✓		
3. Increased Recycled Water for Irrigation (WQ at MCL/SMCLs)	✓			✓	✓		✓		✓		
4. Seawater Intrusion Barriers (increased injection volume and AWT RW)	✓	✓				✓	✓		✓		
5. Desalters – Increased Groundwater Pump & Treat (WCB only)	✓	✓			✓			✓	✓		
6. GRIP A (10K AFY AWT & 11K AFY tertiary-treated RW)	✓	✓			✓		✓			✓	
7. GRIP B (21K AFY tertiary-treated RW)	✓	✓			✓		✓				✓
8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)	✓		✓			✓		✓		✓	
9. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)	✓		✓			✓		✓			✓
10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)	✓			✓		✓		✓		✓	
11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)	✓			✓		✓		✓			✓

a – Minor Future Changes, as referenced for all combined scenarios (Scenarios 8, 9, 10, and 11), include decreased imported water use for supply in the Central Basin, slightly increased imported water for supply in the West Coast Basin, and increased stormwater capture at the DGSG and other facilities

WQ – water quality for salt and nutrients
MCL – Primary Maximum Contaminant Level
SMCL – Secondary Maximum Contaminant Level
AWT – advanced water treatment
RW – recycled water
K – thousand
DGB – Dominguez Gap Seawater Intrusion Barrier
AGB – Alamitos Gap Seawater Intrusion Barrier
WCBB – West Coast Basin Seawater Intrusion Barrier
MFSG – Montebello Forebay Spreading Grounds
DGSG – Dominguez Gap Spreading Grounds
AFY – acre-feet per year
WCB – West Coast Basin
GRIP – Groundwater Reliability Improvement Program
GRIP A – Groundwater Reliability Improvement Program, Recycled Water Project A
GRIP B – Groundwater Reliability Improvement Program, Recycled Water Project B

(green box) baseline conditions
(peach box) future change

Table I-3 Water Quality Trend Analysis of Subareas/Model Layers of the CBWCB

Model Layer	Los Angeles Forebay			Montebello Forebay			Whittier Area			Central Presssure Area			Central Basin [a]			West Coast Basin			Total [b]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
LAYER 1																					
Increasing Trend	NA	NA	NA	0	5	0	NA	NA	NA	1	1	0	1	6	0	0	0	0	1	6	0
No Trend	NA	NA	NA	7	7	10	NA	NA	NA	1	1	3	8	8	13	0	0	0	8	8	13
Decreasing Trend	NA	NA	NA	6	4	4	NA	NA	NA	1	1	0	7	5	4	0	0	0	7	5	4
LAYER 2																					
Increasing Trend	2	2	0	5	16	2	0	0	0	12	13	1	19	31	3	6	6	1	25	37	4
No Trend	0	0	1	23	12	10	1	1	1	11	10	13	35	23	25	3	4	10	38	27	35
Decreasing Trend	0	0	0	6	3	10	0	0	0	1	0	1	7	3	11	5	4	1	12	7	12
LAYER 3																					
Increasing Trend	5	4	2	6	18	3	1	1	0	15	30	5	27	53	10	16	21	0	43	74	10
No Trend	3	3	4	26	16	17	2	2	2	45	36	30	76	57	53	33	25	45	109	82	98
Decreasing Trend	1	2	1	6	3	10	0	0	1	17	11	2	24	16	14	10	11	1	34	27	15
LAYER 4																					
Increasing Trend	1	1	0	2	1	1	0	0	0	3	8	0	6	10	1	4	6	0	10	16	1
No Trend	0	0	0	3	4	5	1	1	1	14	22	14	18	27	20	11	11	12	29	38	32
Decreasing Trend	0	1	0	1	1	0	0	0	0	2	7	2	3	9	2	0	2	1	3	11	3
UNKNOWN																			0	0	0
Increasing Trend	0	0	0	1	2	1	0	0	0	7	10	0	8	12	1	4	2	0	12	14	1
No Trend	1	1	0	1	3	0	0	0	0	10	2	1	12	6	1	1	2	0	13	8	1
Decreasing Trend	0	0	0	2	0	1	0	0	0	0	2	0	2	2	1	1	0	0	3	2	1
TOTAL																					
Increasing Trend	8	7	2	14	42	7	1	1	0	38	62	6	61	112	15	30	35	1	91	147	16
No Trend	4	4	5	60	42	42	4	4	4	81	71	61	149	121	112	48	42	67	197	163	179
Decreasing Trend	1	3	1	21	11	25	0	0	1	21	21	5	43	35	32	16	17	3	59	52	35

Mann-Kendall Trend analysis was conducted only for wells with 10 or greater sampling events; 95 percent confidence interval was applied

TDS - total dissolved solids   Cl - chloride NO_3-N - nitrate as nitrogen

Unknown indicates wells with no completion information; therefore, model layer is unknown

NA - not applicable; no Model Layer 1 in these areas

- Increasing Trend
- Decreasing Trend
- No Trend

a - Sum of Los Angeles Forebay, Montebello Forebay, Whittier Area, and Central Pressure Area

b - Sum of Central Basin and West Coast Basin

In the Central Basin, the Los Angeles Forebay has more wells with increasing TDS concentration trends (8) than decreasing trends (1), and four wells show no trends. While it is difficult to determine the reason for this trend pattern in the Los Angeles Forebay, examination of the trend data for two WRD multiple-completion monitoring wells shows higher TDS concentrations and more steeply increasing trends in the shallower wells compared with the deeper wells. These observations suggest loading from the surface as the reason for the increasing trends. It should be noted that TDS concentrations in the Montebello Forebay and the MFSG blended recharge water are well below concentrations in the Los Angeles Forebay. The Montebello Forebay provides subsurface recharge to the Los Angeles Forebay and managed aquifer recharge (MAR) in the Montebello Forebay are improving TDS groundwater quality overall in the Los Angeles Forebay.

In the Montebello Forebay, there are more wells with decreasing TDS concentration trends (21) than increasing trends (14), while the majority of wells (60) exhibit no trends. In the Whittier Area, most wells show no TDS concentration trends (4), with one well showing an increasing trend and no wells with decreasing trends. In the Central Basin Pressure Area, most wells (81) show no TDS concentration trends, while 35 wells show increasing trends and 21 wells show decreasing trends; so slightly more wells show increasing rather than deceasing trends. By summing the well numbers for all the subareas, the Central Basin as a whole has stable TDS concentrations, with most wells (149) showing no trends; in comparison, 61 wells show increasing trends and 43 wells show decreasing trends.

In the West Coast Basin, a greater number of wells (48) show no TDS concentration trends, while 30 wells show increasing trends and 16 wells show decreasing trends. While more wells have increasing rather than decreasing TDS concentrations, a closer examination of the location of the wells with increasing trends in Figure 39 indicates that many of the wells with increasing trends are likely influenced by the migration of saline plumes associated with historical seawater intrusion across the basin and not by current TDS loading. Given that the ambient background TDS concentrations are impacted by historical seawater intrusion, and ongoing mitigating measures such as the operation of the desalters and injection of high quality water at the seawater barriers for more than 40 years, ambient background TDS concentrations are declining overall in the West Coast Basin.

Overall for the CBWCB, TDS concentrations are predominantly stable, with most wells showing no TDS concentration trend (197), 91 wells showing increasing trends, and 59 wells showing decreasing trends (Table I-3).

3.2 Chloride Concentration Trends

Table I-3 and Figure 39 present the results of the Mann-Kendall test for water quality trends for chloride. Chloride trends are shown in the middle column of Figure 39, with Model Layer 1 on top and Model Layer 4 on the bottom. The trend data shows that chloride concentrations in most wells across each subarea are either stable or increasing, with fewer wells showing a decreasing trend.

In the Central Basin, the Los Angeles Forebay has more wells with increasing chloride concentration trends (7) than decreasing trends (3), and four wells show no trends. In the

Montebello Forebay, there are an equal number of wells (42) showing increasing and stable chloride concentration trends, with a smaller number of wells (11) showing decreasing trends. In the Whittier Area, most wells show no chloride concentration trends (4), with one well showing an increasing trend and no wells with decreasing trends. In the Central Basin Pressure Area, most wells (71) show no chloride concentration trends, while 62 wells show increasing trends, and 21 wells show decreasing trends. In the Central Basin as a whole, most wells show no chloride trends (121), while 112 wells show increasing trends, and 35 wells show decreasing trends. Increasing chloride trends are more prevalent at shallower depths (Model Layers 1, 2, and 3) compared with deeper depths (Model Layer 4). The reason for the significant number of wells with increasing chloride concentrations in the Central Basin is uncertain. It could be related to surface loading, but could also be related to dissolution of formation minerals in a system not at equilibrium.

In the West Coast Basin, a greater number of wells (42) show no chloride concentration trends, while 35 wells show increasing trends and 17 wells show decreasing trends. While there are more wells with increasing rather than decreasing chloride concentrations, a closer examination of the location of the wells with increasing trends on Figure 39 indicates that many of the wells with increasing trends are likely influenced by the migration of saline plumes associated with historical seawater intrusion across the basin and not by current chloride loading. Given that the saline plumes have been and continue to be actively remediated for more than 40 years through the injection of significant volumes of high quality water at the seawater barriers and the operation of the desalters, it is likely that ambient background chloride concentrations are declining overall in the West Coast Basin.

For the entire CBWCB, chloride concentrations are generally stable, with a greater number of wells (163) showing no trends; in comparison, 147 wells show increasing trends, and 52 wells show decreasing trends.

3.3 Nitrate Concentration Trends

Table I-3 and Figure 39 present the results of the Mann-Kendall test for water quality trends for nitrate. Nitrate trends are shown along the right column of the figure, with Model Layer 1 on top and Model Layer 4 on the bottom. The trend data generally show that nitrate concentrations are stable (i.e. no trend) in most wells in each subarea and basin, with a relatively small number of wells with decreasing nitrate trends outnumbering those with increasing trends.

In the Central Basin, most wells (5) in the Los Angeles Forebay show stable nitrate concentration trends, with 2 wells showing increasing trends and one well showing a decreasing trend. In the Montebello Forebay, most wells (42) show stable nitrate concentration trends, with a larger number of wells (25) showing decreasing trends compared with increasing trends (7). In the Whittier Area, most wells show no nitrate concentration trends (4), with one well showing a decreasing trend and no wells with increasing trends. In the Central Basin Pressure Area, most wells (61) show no nitrate concentration trends, while 6 wells show increasing trends and 5 wells show decreasing trends. In the Central Basin as a whole, nitrate concentrations are mainly stable, with most wells (112) showing no trends, 32 wells showing decreasing trends, and 15 wells showing increasing trends.

In the West Coast Basin, nitrate concentrations are also stable, with most wells (67) showing no trends, one well showing an increasing trend, and 3 wells showing decreasing trends.

Overall for the CBWCB, nitrate concentrations are primarily stable, with most wells (179) showing no trends, 16 wells showing increasing trends, and 35 wells showing decreasing trends.

4 Baseline and Future Planning Period Salt and Nutrient Balances

The S/N balances in the CBWCB consider the source water volumes of inflow and outflow and their associated TDS, chloride, and nitrate concentrations. The balances also consider any added TDS, chloride, and nitrate from use as well as other fate and transport processes, which can either increase or decrease S/N concentrations in groundwater. This section describes the methodology and data used to estimate key S/N loading and unloading factors and identify their individual and cumulative effects on groundwater quality in the CBWCB over the SNMP baseline period (WY 2000-01 to 2009-10) and future planning period (WY 2010-11 to 2024-25). The same loading factors developed and calibrated to baseline groundwater quality conditions were applied to the future planning period predictions.

Section 4.1 describes the general methodology used to develop the S/N balances. Sections 4.2 through 4.9 presents the S/N concentrations for individual source waters and key S/N inflows and outflows in the CBWCB. The overall S/N balances for the baseline period and future planning period are presented in Section 4.10.

4.1 Methodology to Develop Salt and Nutrient Balances

As discussed earlier, the SNMP mixing model was developed to simulate the effect of current S/N loading on groundwater quality in the CBWCB. The mixing model was designed to incorporate the existing volume of groundwater and mass of TDS, chloride, and nitrate in storage and track the annual change in groundwater storage and S/N mass for each model subarea and layer. S/N loading estimates for key inflows (including recharge at spreading grounds, seawater intrusion barrier injection, irrigation return flow, mountain front and precipitation recharge, and subsurface inflow) and outflows (including groundwater pumping and subsurface outflows) were estimated based on volumetric water budgets presented in Appendix H *Baseline and Future Water Balances*. The sensitivity of groundwater quality within each model subarea/layer to individual S/N loading factors was identified through numerous simulations, and selected S/N loading estimates and assumptions were refined to ensure a reasonable agreement between simulated and dominant patterns in observed groundwater quality conditions over the SNMP baseline period (WY 2000-01 through 2009-10). Loading assumptions developed based on the baseline period assessment were then applied to the future planning period S/N balances.

4.2 Surface Water/Stormwater Quality

Surface water quality (dry and wet weather) data are collected by the Los Angeles County Department of Public Works (LACDPW) at mass emissions (river) and tributary stations. In the CBWCB, river water quality data are also collected by the Council for Watershed Health (CWH) and the Sanitation Districts of Los Angeles County (SDLAC). The CWH collects annual river water quality data as part of its mission to monitor the health of the Los Angeles and San Gabriel River Watersheds. SDLAC collects samples in the rivers upstream and downstream of their recycled water discharge points. The WRD and SDLAC also collect samples from the MFSG intakes, specifically to the Rio Hondo Spreading Grounds and the San Gabriel River Spreading Grounds.

For S/N loading calculations, TDS, chloride, and nitrate data from several stations in the Study Area were assessed to determine the best water quality station to represent the surface water recharged at the MFSG and DGSG and mountain front recharge. LACDPW mass emission stations near and upgradient of the MFSG and DGSG include Station S10 (located just downstream of the DGSG) and Station S14 (located upstream of the San Gabriel River Spreading Grounds). The station locations are shown in Figure 64. SDLAC stations upstream of the Montebello Forebay include two along the San Gabriel River (R-10 and R-18) and one within the Rio Hondo (RD-1). Station R-18 is not a permitted receiving water station and was only used for a short period of time for a special study (Montebello Forebay Attenuation and Dilution Study [Kennedy/Jenks/Todd, 2008]). Average annual wet weather TDS, chloride, and nitrate data collected from these stations and the results of spreading grounds intake samples are summarized in **Table I-4**.

LACDPW Station S10 is the nearest station to the DGSG and is used to represent surface water quality recharged in these spreading grounds. For local surface water recharged at the MFSG, data from Stations S14, R-10, R-18, RD-1, and sampling results of the spreading grounds intake were assessed. Stations S14 and R-10 contain a portion of effluent from upgradient water reclamation plants (WRPs) even during wet weather and thus are not representative of only surface water/stormwater quality. The MFSG intake sampling results during storm events when recycled and imported water are not recharged provide the most representative water quality for local stormwater recharging the MFSG.

The other component of surface water recharged in the CBWCB is mountain front recharge. There are very little available data for surface water runoff in mountain front areas. The CWH has two Random Monitoring Stations (SGLR00190 and SGLR030) with one sampling event each for electrical conductivity and nitrate-N, but no data for chloride (see Figure 64). In its sampling design, CWH integrates various types of surface water monitoring sites including both probabilistic randomized sites (Random Monitoring Stations) and targeted sampling at fixed sites (Fixed Monitoring Stations). Random Monitoring Stations are monitored less frequently than Fixed Monitoring Stations. TDS concentrations can be estimated from electrical conductivity values. The samples showed very different water quality. Because surface water quality can vary considerably based on the type of event sampled (i.e. first flush, dry flow, or wet season flow), the two sampling points are not adequate to estimate annual

Table I-4 Annual Average TDS, Chloride, and Nitrate-N Concentrations at Selected Surface Water Monitoring Stations

WATER YEAR	WATER QUALITY AT LOCAL SURFACE WATER MONITORING STATIONS (all concentrations in mg/L)																	
	S14[a]			S10[b]			R18[c]			R-10[c]			RD-1[c]			MFSG Intakes[d]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO3-N
2000-01	468	84	4.72	198	31	0.93	NDA	NDA	NDA	252	74	0.83	NDA	NDA	NDA	259	40	1.58 [e]
2001-02	369	62	0.74	181	20	0.57	NDA	NDA	NDA	425	105	0.67	NDA	NDA	NDA	259	40	1.58 [e]
2002-03	253	36	0.95	406	62	1.67	NDA	NDA	NDA	291	70	0.73	410	68	2.44	259	40	1.58 [e]
2003-04	630	133	6.10	315	55	2.38	NDA	NDA	NDA	270	52	0.86	436	77	2.59	170	17	1.09
2004-05	255	87	2.09	257	36	1.37	NDA	NDA	NDA	209	30	0.86	377	50	0.92	215	14	1.11
2005-06	518	91	1.72	329	50	1.64	303	78	0.12	215	50	0.46	453	95	0.91	490	81	3.80
2006-07	467	79	0.06	424	70	1.05	207	49	0.59	305	78	1.19	468	79	1.15	384	89	1.70
2007-08	517	93	0.00	337	56	0.00	NDA	NDA	NDA	256	18	1.48	476	87	1.16	209	34	1.20
2008-09	308	51	2.60	410	67	1.30	NDA	NDA	NDA	NDA	NDA	NDA	507	103	0.55	205	33	1.50
2009-10	271	43	2.20	117	13	0.71	NDA	NDA	NDA	NDA	NDA	NDA	507	95	0.75	140	14	0.65
Average	406	76	2.12	297	46	1.16	255	63	0.35	278	60	0.88	454	82	1.31	259	40	1.58

TDS - total dissolved solids
Cl - chloride
NO_3-N - nitrate as nitrogen
NDA - no data available

LACDPW - Los Angeles County Department of Public Works
WRD - Water Replenishment District of Southern California
SDLAC - Sanitation Districts of Los Angeles County
MFSG - Montebello Forebay Spreading Grounds

a - Average of wet weather surface water samples collected from LACDPW Mass Emission Monitoring Station S14; data from 2000 - 2011 Annual Stormwater Monitoring Final Reports, LACDPW
b - Average of wet weather surface water samples collected from LACDPW Mass Emission Monitoring Station S10; data from 2000 - 2011 Annual Stormwater Monitoring Final Reports, LACDPW
c - Data provided by SDLAC
d - Data from MFSG intakes during storm events when no imported or recycled water was recharging the spreading basins; data from WRD database
e - For missing data points, 10 year average value was used

mountain front recharge over the 10-year baseline period. As a result, MFSG intake sample results were used to represent mountain front recharge water quality.

4.3 Imported Water Quality

Imported water is used for potable supply and replenishment in the CBWCB. Imported water is provided by the Metropolitan Water District of Southern California (MWD), City of Los Angeles Department of Water and Power (LADWP), City of Whittier, Suburban Water Company, California Domestic Water Company, and San Gabriel Valley Water Company. Locations of MWD and LADWP imported water storage and treatment facilities are shown in Figure 65.

MWD imports water from the Colorado River (CR) and State Water Project (SWP) and supplies untreated water to the MFSG and treated water for potable supply and for injection at the seawater intrusion barriers. The S/N water quality for these two sources is different and thus, it was necessary to estimate the relative percentages of each water source delivered to the recharge projects and used for drinking water supply and irrigation in order to characterize the recharge water quality. Untreated water is delivered to the MFSG from MWD Meters CB-28 and CB-48 located in the Santa Ana Valley Basin and San Gabriel Basin, respectively. The water is transported via surface water to the MFSG and San Gabriel River instream recharge facilities. Water from Meter CB-28 originates from the Lake Silverwood and Lake Mathews reservoirs. Lake Silverwood is part of the SWP and is owned by the State of California and operated by the DWR. Lake Mathews is an MWD-owned and operated reservoir. Lake Silverwood contains 100% SWP water, while Lake Mathews contains 100% CR water. The mix of these two source waters delivered to Meter CB-28 is highly variable. Water from Meter CB-48 originates entirely from Lake Silverwood and is thus, 100% SWP water. MWD has estimated the relative percentage of CR and SWP water delivered to the MFSG each year during the SNMP baseline period. **Table I-5** shows the TDS, chloride, and nitrate water quality during the SNMP baseline period for untreated CR and SWP water and the estimated blended water quality delivered to the MFSG. Note that recharge water in the Montebello Forebay includes recycled water and local water in addition to untreated imported water.

Treated water from MWD's Jensen and Diemer Water Treatment Plants (WTPs) is delivered to the Dominguez Gap Seawater Intrusion Barrier (DGB) and Alamitos Gap Seawater Intrusion Barrier (AGB) for injection. The Jensen WTP treats and delivers 100% SWP water. The Diemer WTP treats and delivers a highly variable blend of SWP and CR water. Water from MWD's Jensen, Diemer, and Weymouth WTPs is delivered to the CBWCB for potable supply. The Weymouth WTP also treats and delivers a highly variable blend of SWP and CR water. **Table I-6** shows the annual average TDS, chloride, and nitrate-N concentrations in the effluent from MWD's Jensen, Diemer, and Weymouth WTPs.

The LADWP imports and treats water from the Owens River/Mono Basin. The LADWP also treats some raw SWP water delivered by MWD to LADWP's Los Angeles Aqueduct Treatment Plant. This water is delivered to both the Central Basin and West Coast Basin for potable supply. **Table I-7** provides the annual average TDS, chloride, and nitrate-N concentrations in LADWP-imported water during the baseline period.

Table I-5 Annual Average TDS, Chloride, and Nitrate-N Concentrations in Untreated Imported Water Supplied by MWD

WATER YEAR	IMPORTED WATER						MFSG RECHARGE BLEND	
	Untreated CR [ac]			Untreated SWP [bc]			Untreated	
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	CR	SWP
2000-01	561	70	0.14	270	75	0.67	68%	32%
2001-02	579	74	0.14	286	81	0.74	60%	40%
2002-03	597	81	0.23	266	75	0.70	72%	28%
2003-04	599	84	0.12	243	66	0.60	94%	6%
2004-05	626	91	0.21	235	58	0.85	72%	28%
2005-06	670	96	0.21	188	48	0.51	73%	27%
2006-07	680	100	0.23	233	61	0.63	82%	18%
2007-08	655	97	0.25	276	77	0.80	81%	19%
2008-09	651	95	0.30	280	76	0.55	0%	0%
2009-10	623	90	0.27	238	64	0.60	30%	70%
Average	624	88	0.21	251	68	0.67	63%	27%

All values in milligrams per liter (mg/L)
TDS - total dissolved solids
Cl - chloride
NO_3-N - nitrate as nitrogen
CR - Water from Colorado River
SWP - Water from State Water Project
MWD - Metropolitan Water District of Southern California

a - Used at the Montebello Forebay Spreading Grounds (Lake Mathews)
b - Used at the Montebello Forebay Spreading Grounds (Lake Silverwood)
c - Data from 2000 - 2011 Water Quality Reports issued by MWD

Table I-6 Annual Average TDS, Chloride, and Nitrate-N Concentrations in Treated Imported Water Supplied by MWD

WATER YEAR	WATER QUALITY OF MWD TREATMENT PLANT EFFLUENT (all concentrations in mg/L)								
	Jensen WTP [a]			Diemer WTP [a]			Weymouth WTP [b]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
2000-01	277	65	0.49	471	76	0.34	475	77	0.34
2001-02	318	81	0.60	496	81	0.32	500	81	0.32
2002-03	313	88	0.63	419	85	0.58	419	85	0.57
2003-04	275	71	0.61	414	86	0.45	431	86	0.43
2004-05	299	57	0.57	464	79	0.54	450	77	0.57
2005-06	283	51	0.49	401	70	0.43	372	66	0.42
2006-07	259	55	0.56	430	80	0.51	392	75	0.55
2007-08	294	72	0.69	536	95	0.44	522	95	0.46
2008-09	332	79	0.79	608	96	0.31	611	97	0.32
2009-10	316	77	0.65	574	91	0.30	559	90	0.30
Average	297	70	0.61	481	84	0.42	473	83	0.43

TDS - total dissolved solids
Cl - chloride
NO_3-N - nitrate as nitrogen

MWD - Metropolitan Water District of Southern California
WTP - Water Treatment Plant
mg/L - milligrams per liter

a - Used at the seawater intrusion barriers and for water supply
b - Used for water supply

Table I-7 Annual Average TDS, Chloride, and Nitrate-N Concentrations in LADWP Treated Imported Water from Owens River/Mono Basin

WATER YEAR	WATER QUALITY OF LADWP TREATED IMPORTED WATER FROM OWENS RIVER-MONO BASIN [ab] (all concentrations in mg/L)		
	TDS	Cl	NO_3-N
2000-01	175	22	0.04
2001-02	249	23	0.04
2002-03	214	26	0.31
2003-04	231	29	0.08
2004-05	200	25	0.20
2005-06	181	19	0.00
2006-07	209	21	0.00
2007-08	237	30	0.00
2008-09	266	29	0.18
2009-10	222	27	0.09
Average	218	25	0.09

TDS - total dissolved solids mg/L - milligrams per liter
Cl - chloride
NO_3-N - nitrate as nitrogen
CBWCB - Central Basin and West Coast Basin
LADWP - City of Los Angeles Department of Water and Power

a - Water used for water supply in CBWCB
b - Data provided by LADWP

The City of Whittier, Suburban Water Company, California Domestic Water Company, and San Gabriel Valley Water Company import groundwater extracted from the San Gabriel Basin for water supply in the Study Area. In addition, in WYs 2000-01 and 2002-03, a small amount of groundwater extracted from the Whittier Narrows area in the San Gabriel Basin was also delivered to the Montebello Forebay for replenishment. **Table I-8** presents the annual average TDS, chloride, and nitrate-N concentrations in these water sources during the baseline period.

4.4 Recycled Water Quality

In the CBWCB, recycled water has many uses, including groundwater recharge, urban landscape irrigation, agricultural irrigation, industrial and commercial process water, recreational facilities, and wildlife habitat maintenance. Treatment plants in the CBWCB that produce this recycled

Table I-8 Annual Average TDS, Chloride, and Nitrate-N Concentrations in Groundwater Imported to the CBWCB

WATER YEAR	WATER QUALITY OF GROUNDWATER IMPORTED TO THE CBWCB (all concentrations in mg/L)					
	San Gabriel Basin [a]			USEPA Groundwater Whittier Narrows in the San Gabriel Basin [b]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
2000-01	342	49	3.92	NDA	NDA	NDA
2001-02	342	49	3.92	603	60	0.96
2002-03	342	49	3.92	625	64	4.07
2003-04	342	49	3.92	NDA	NDA	NDA
2004-05	342	49	3.92	NDA	NDA	NDA
2005-06	337	49	3.83	NDA	NDA	NDA
2006-07	364	42	3.51	NDA	NDA	NDA
2007-08	346	35	3.16	NDA	NDA	NDA
2008-09	347	34	2.81	NDA	NDA	NDA
2009-10	354	37	3.09	NDA	NDA	NDA
Average	346	44	3.60	614	62	2.52

TDS - total dissolved solids
mg/L - milligrams per liter
Cl - chloride
CBWCB - Central Basin and West Coast Basin
NO_3-N - nitrate as nitrogen
NDA - no data available
USEPA - United States Environmental Protection Agency

a - Used for water supply; data from consumer confidence reports for San Gabriel Valley Water Company, City of Whittier, California Domestic Water Company, and Suburban Water Systems; weighted average based on volume delivered

b - Used at Montebello Forebay Spreading Grounds; from USEPA Whittier Narrows Operable Unit data base; quality for USEPA intermediate extraction wells EW-4-5, EW-4-6, and EW-4-7

water are owned and operated by the SDLAC, West Basin Municipal Water District (WBMWD), City of Los Angeles, and WRD. Locations of wastewater treatment plants are shown in Figure 66.

Relevant to the S/N balances is recycled water used for replenishment operations and irrigation in the Study Area, as other recycled water uses do not recharge the groundwater basins. Recycled water from the Pomona, San Jose Creek, and Whittier Narrows WRPs operated by the SDLAC is recharged in the Montebello Forebay. Recycled water from SDLAC's Long Beach, Los Coyotes, and San Jose Creek WRPs is used for irrigation and commercial/industrial applications in the Central Basin. The WRPs provide primary treatment, nitrification/denitrification (NdN) activated sludge biological treatment, granular media filtration, disinfection, and dechlorination.

Advanced treated recycled water produced by the Leo J. Vander Lans Advanced Water Treatment Facility (Vander Lans AWTF), owned by WRD, is injected at the AGB into the Central Basin and adjacent Orange County Basin. Advanced water treatment processes at the Vander Lans AWTF historically consisted of microfiltration (MF), reverse osmosis (RO), and ultraviolet irradiation (UV). During WY 2014-15, when the Vander Lans AWTF was expanded to produce from 3,360 AFY to 8,960 AFY of AWT recycled water, the treatment train was modified to also receive advanced oxidation process (AOP) through the addition of peroxide.

Advanced treated recycled water produced by the Edward C. Little Water Reclamation Facility (WRF), owned by the WBMWD, is injected at the West Coast Basin Seawater Intrusion Barrier (WCBB). Tertiary-treated recycled water produced by the Edward C. Little WRF is used for irrigation in the West Coast Basin. Treatment processes at the Edward C. Little WRF consists of MF, RO, AOP, and chemical stabilization. In 2013, the Edward C. Little WRF was expanded to produce from 14,000 AFY to 19,600 AFY of recycled water and the treatment train now includes ozonation (O_3).

Advanced treated recycled water from the Terminal Island Water Reclamation Plant/Advanced Water Purification Facility (TIWRP), owned by the City of Los Angeles, is injected at the DGB. A small amount of tertiary-treated recycled water produced by the TIWRP is used for local irrigation at the treatment facility. The TIWRP provides tertiary treatment, MF, RO, and chlorination and the facility capacity is 5,600 AFY. The TIWRP is currently undergoing expansion activities and by WY 2018-19, the TIWRP is expected to produce 11,200 AFY of AWT recycled water and treatment will also include AOP and chemical stabilization.

Annual average TDS, chloride, and nitrate-N concentrations for each recycled water source used for irrigation and/or replenishment in the Study Area are provided in **Table I-9**. TDS, chloride, and nitrate-N were not required monitoring parameters for the AWT recycled water produced by the TIWRP during the baseline period. In order to estimate the future planning period blend water quality for the DGB, S/N concentrations in the AWT recycled water is needed. In order to establish S/N concentrations for the AWT recycled water used for the DGB, a special sampling event was conducted at the TIWRP in July and August 2013 for TDS and chloride. The average of 2011 nitrate-N data for the TIWRP and the average of the special sampling conducted for TDS and chloride are provided at the bottom of Table I-9 and was used to calculate the future planning period S/N concentrations for blended water injected at the DGB.

Water conservation has the potential to impact the quality of recycled water by increasing salt concentrations due to reduced influent flows. SDLAC evaluated its WRPs in the CBWCB in terms of flow reductions and changes in TDS and chloride.[1] While wastewater flows have declined since 1998, TDS concentrations have remained steady and do not appear to be impacted by water conservation. However, chloride trends are a bit different. For the six

[1] Personal communication from Ann Heil, SDLAC, July 27, 2012.

Table I-9 Annual Average TDS, Chloride, and Nitrate-N Concentrations in Recycled Water Used for Irrigation and/or Groundwater Replenishment

WATER YEAR	WATER QUALITY OF EFFLUENT FROM WATER RECLAMATION PLANTS (all concentrations in mg/L)																													
	Pomona WRP [a]			San Jose Creek East WRP [a]			San Jose Creek West WRP [ab]			Whittier Narrows WRP [a]			Edward C. Little WRF [c] AWT			Edward C. Little WRF [d] Tertiary			Terminal Island Water Reclamation Plant/ Advanced Water Treatment Facility [e]			Leo J. Vander Lans WRP [f]			Los Coyotes WRP [b]			Long Beach WRP [b]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
2000-01	545	134	1.40	593	133	3.75	552	113	3.09	545	96	7.11	117	31	0.71	670	185	1.00							846	235	3.28	636	129	4.34
2001-02	553	143	1.40	626	143	3.46	556	116	3.30	554	96	5.71	95	18	0.51	672	190	1.00							851	227	4.03	628	129	2.88
2002-03	538	135	2.15	632	159	3.45	527	105	3.92	523	98	5.37	46	4	0.16	630	178	0.70	Prior to Plant Operations			Prior to Plant Operations			839	231	5.02	619	137	4.35
2003-04	543	128	6.01	612	148	4.10	532	108	5.48	537	97	6.21	60	8	0.03	642	182	0.20							873	241	5.58	578	119	5.97
2004-05	525	115	5.88	629	136	2.92	510	101	6.45	510	103	6.16	52	5	0.02	631	165	0.30							815	184	5.73	715	126	6.39
2005-06	518	101	4.63	609	147	2.83	514	105	6.10	574	113	6.57	42	5	0.20	630	198	0.90	NA	NA	NA	20	4	0.72	762	183	6.03	608	117	6.35
2006-07	536	113	4.55	633	160	2.94	515	106	6.36	541	103	6.92	42	4	0.18	711	220	1.10	NA	NA	NA	66	14	1.03	777	188	5.69	576	117	4.61
2007-08	570	132	5.44	649	158	3.13	536	117	6.61	561	112	6.33	62	5	0.24	791	248	1.90	NA	NA	NA	91	17	1.03	849	199	6.80	609	119	4.78
2008-09	584	130	5.97	661	155	4.00	562	111	7.22	576	114	5.93	50	4	0.20	793	235	1.20	NA	NA	NA	80	16	1.29	820	190	6.80	587	114	5.51
2009-10	536	126	6.69	618	150	3.54	527	108	7.77	579	116	6.76	80	9	0.34	878	311	1.83	NA	NA	NA	73	18	1.60	822	188	7.17	599	117	6.24
Average	545	126	4.41	626	149	3.41	533	109	5.63	550	105	6.31	65	9	0.26	705	211	1.01				66	14	1.13	825	207	5.61	616	122	5.14
2011 and 2013																			98	37	0.79									

TDS - total dissolved solids
Cl - chloride
NO_3-N - nitrate as nitrogen
NA - not available
WRD - Water Replenishment District of Southern California
WBMWD - West Basin Municipal Water District
SDLAC - Sanitation Districts of Los Angeles County
TIWRP - Terminal Island Water Reclamation Plant/Advanced Water Purification Facility
LVL AWTF - Leo J. Vander Lans Advanced Water Treatment Facility
ELWRF - Edward C. Little Water Recycling Facility
WRP - Water Reclamation Plant
mg/L - milligrams per liter

a - Used at the Montebello Forebay Spreading Grounds; data from 2000 - 2011 Annual Monitoring Reports, Montebello Forebay Groundwater Recharge Project (SDLAC)
b - Used for irrigation in the Central Basin; data from 2000 - 2011 Annual Monitoring Reports, Montebello Forebay Groundwater Recharge (SDLAC) and provided by SDLAC
c - Used at the West Coast Basin Barrier; data from 2000 - 2011 Annual Reports, West Coast Basin Barrier Project, Edward C. Little Water Recycling Facility (WBMWD)
d - Used for irrigation in West Coast Basin, data from 2000 - 2011 Annual Reports, West Coast Basin Barrier Project, Edward C. Little Water Recycling Facility (WBMWD); annual year averages
e - Used at the Dominguez Gap Barrier; City of Los Angeles' TIWRP came online in 2006; TDS, Cl, and NO_3-N not monitored in baseline period; for the future planning period, the average of TDS and chloride sampling conducted in July/August 2013 (provided by Seung Tag Oh, LADWP) and average of nitrate data from LADWP 2011 Harbor Water Recycling/DGB Project 2011 Annual Report (February 2012) used to estimate blend water quality
f - Used at the Alamitos Gap Barrier; data provided by WRD; the LVL AWTF came online in 2006

facilities that make up SDLAC's Joint Outfall System (including the WRPs that provide recycled water in Central Basin), chloride has increased at the Joint Water Pollution Control Plant, La Cañada WRP, and Whittier Narrows WRP. SDLAC has observed a slight increase at the Pomona WRP and San Jose Creek East WRP, but since chloride concentrations appear to be cyclical at these plants, this trend is not definitive. Chloride levels are staying steady or dropping at the Long Beach, Los Coyotes, and San Jose Creek West WRPs, although this trend may be influenced by chloride industrial dischargers shutting down or being rerouted to other plants. Assessment of the WBMWD's Edward C. Little WRF tertiary-treated recycled water quality presented in Table I-9 shows a significant increase in both TDS and chloride beginning in 2005-06. Based on these findings, tertiary-treated recycled water used for irrigation was simulated at both the average of baseline period concentrations and at higher concentrations in the future planning period as described Section 2.3 *Scenarios Simulated to Estimate Future Groundwater Quality.*

4.5 Groundwater Quality

Groundwater in the CBWCB is used for water supply. Groundwater recharges the basins through deep percolation of groundwater used for irrigation. The CBWCB also receives subsurface inflows from adjacent groundwater basins and the ocean. A small amount of groundwater leaves the CBWCB as subsurface outflow. Groundwater primarily leaves the basins through well pumping.

Irrigation water return flow is a mix of groundwater, imported water, and recycled water and is discussed in the Section 4.8 *Irrigation Return Flow Water Quality*. In addition to irrigation return flows, groundwater from adjacent basins and the ocean flows into the Study Area as subsurface inflow. **Table I-10** provides the TDS, chloride, and nitrate-N concentrations in the groundwater entering the Study Area as subsurface inflow. Groundwater can leave the CBWCB as subsurface outflow. Calculation of the average TDS, chloride, and nitrate-N concentrations in CBWCB groundwater is discussed in Appendix G *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality.* **Table I-11** presents the TDS, chloride, and nitrate-N groundwater quality of each subarea/layer in the Study Area. For each basin and for the Central Basin Pressure Area, two average concentrations were calculated: one average includes the coastal areas (i.e. seaward side of the seawater intrusion barriers) and the other average excludes these coastal areas (see Figure 2). Due to the significant influence of the WCBB-inland saline plume (shown in Figure 2) on the average groundwater quality in West Coast Basin, the average groundwater quality in the West Coast Basin also was calculated without the saline plume area and coastal areas.

As shown in Table I-11 and Figure 40 and discussed in Appendix G *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality,* average TDS, chloride, and nitrate concentrations in the Central Basin are below BPOs, and assimilative capacity is available. Due to historical seawater intrusion in the West Coast Basin, average TDS and chloride concentrations exceed Basin-Specific Basin Plan Objectives (BSBPOs) when the WCBB-inland saline plume area is included and, as a result, there is no assimilative capacity. Average nitrate concentrations in the West Coast Basin are well below the BPO and assimilative capacity is available for nitrate. As shown in Table I-11 and Figure 40, when the saline plume and coastal

Table I-10 Annual Average TDS, Chloride, and Nitrate-N Concentrations for Adjacent Groundwater Basins and Ocean

WATER YEAR	WATER QUALITY OF OTHER GROUNDWATER BASINS AND OCEAN (all concentrations in mg/L)																	
	Santa Monica [af]			Hollywood [ag]			San Fernando [bh]			Whittier Narrows [ch]			Orange County [d]			Ocean [e]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
2000-01	889	109	3.42	533	66	0.00	514	75	2.21	450	63	1.37	237	13	0.00	2,464	1,343	0.01
2001-02	889	109	3.42	533	66	0.00	553	76	2.19	465	61	1.75	237	13	0.00	2,464	1,343	0.01
2002-03	889	109	3.42	533	66	0.00	553	76	2.19	430	57	1.70	237	13	0.00	2,464	1,343	0.01
2003-04	889	109	3.42	533	66	0.00	591	77	2.17	420	59	1.70	237	13	0.00	2,464	1,343	0.01
2004-05	889	109	3.42	533	66	0.00	622	79	2.03	410	57	1.65	237	13	0.00	2,464	1,343	0.01
2005-06	889	109	3.42	533	66	0.00	622	79	2.03	445	68	1.85	237	13	0.00	2,464	1,343	0.01
2006-07	889	109	3.42	533	66	0.00	622	79	2.03	467	67	1.70	237	13	0.00	2,464	1,343	0.01
2007-08	889	109	3.42	533	66	0.00	622	79	2.03	480	85	1.70	237	13	0.00	2,464	1,343	0.01
2008-09	889	109	3.42	533	66	0.00	653	82	1.90	470	73	1.60	237	13	0.00	2,464	1,343	0.01
2009-10	889	109	3.42	533	66	0.00	628	81	1.89	510	91	2.25	237	13	0.00	2,464	1,343	0.01
Average	889	109	3.42	533	66	0.00	598	79	2.07	455	68	1.73	237	13	0.00	2,464	1,343	0.01

TDS - total dissolved solids
Cl - chloride
NO_3-N - nitrate as nitrogen
OCWD - Orange County Water District
CDPH - California Department of Public Health
mg/L - milligrams per liter

a - Data from CDPH (http://www.cdph.ca.gov/certlic/drinkingwater/Documents/Monitoringschedule/DistrictReports-Monitoring%20Page/CentralL.A.District16.pdf)
b - Data from Upper Los Angeles River Area Watermaster Annual Reports 2001 to 2011, Well Pollock No. 6
c - From LACDPW Well 2947LM; well used by San Gabriel River Watermaster to represent Whittier Narrows water quality
d - Data provided by OCWD; values in table represent overall average concentrations applied; different concentrations were applied for each model layer based on available nested well data; concentrations in each layer were kept constant for the 10 year baseline period due to limited geographic coverage across the County boundary and complications of variable inflow and outflow across the boundary over the 10 year baseline period
e - Average concentration in areas seaward of barriers
f - Because limited data were available, the average of 10 wells and 10 samples taken between 1994 and 2012 is used to represent water quality in all years
g - Because limited data were available, the average of 4 wells and 4 samples taken between 2011 and 2012 is used to represent water quality in all years
h - Data interpolated for missing years

Table I-11 Average TDS, Chloride, and Nitrate-N Concentrations in Subareas/Layers and in the Central Basin and West Coast Basin

Model Layer	GROUNDWATER QUALITY IN SUBAREAS/MODEL LAYERS AND IN THE CBWCB (all concentrations in mg/L)																																
	Los Angeles Forebay			Montebello Forebay			Whittier Area			Central Pressure Area (including coastal area)			Central Pressure Area (no coastal area)			Central Basin (including coastal area)			Central Basin (no coastal area)			West Coast Basin (including coastal area)			West Coast Basin (no coastal area)			West Coast Basin (no coastal area & no saline plume)			Coastal Area [a] (seaward of seawater barriers)		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS [b]	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
1	NA	NA	NA	486	79	1.94	NA	NA	NA	658	130	0.17	619	107	0.18	555	100	1.23	538	90	1.25	2,150	851	0.04	1,223	293	0.01	1,223	293	0.01	2,427	1,028	0.05
2	788	105	0.08	482	80	1.95	636	73	1.81	621	108	0.08	602	96	0.08	623	102	0.43	610	93	0.44	2,067	884	0.15	1,072	365	0.20	1,052	371	0.20	4,029	1,904	0.03
3	672	83	0.22	551	86	1.18	966	111	0.42	470	59	0.15	459	50	0.15	540	69	0.31	533	63	0.32	1,247	646	0.04	781	276	0.05	676	179	0.05	2,170	1,379	0.00
4	479	63	0.02	555	102	0.13	1,410	184	0.00	435	51	0.02	417	42	0.02	493	64	0.03	480	57	0.03	1,396	585	0.00	972	327	0.00	729	233	0.00	2,252	1,099	0.00
Average of all layers	640	81	0.15	534	88	1.13	1,007	121	0.57	485	65	0.10	470	55	0.10	538	73	0.28	529	67	0.28	1,424	660	0.04	890	306	0.05	747	224	0.05	2,464	1,343	0.01
BPO/BSBPO	700	150	10.00	700	150	10.00	700	150	10.00	700	150	10.00	700	150	10.00	700	150	10.00	700	150	10.00	800	250	10.00	800	250	10.00	800	250	10.00	700/ 800	150/ 250	10.00
Assimilative Capacity	60	69	9.85	166	62	8.87	-307	29	9.43	215	85	9.90	230	95	9.90	162	77	9.72	171	83	9.72	-624	-410	9.96	-90	-56	9.95	53	26	9.95	-1,764/ -1,664	-1,193/ -1,093	9.99

TDS - total dissolved solids
Cl - chloride
NO_3-N - nitrate as nitrogen
NA - not applicable; no Model Layer 1 in these areas
Averages based on groundwater concentration contour maps; average of all layers is a weighted average based on area and aquifer thickness
Negative numbers indicate there is no available assimilative capacity
BPO/BSBPO - Basin Plan Objective or Basin Specific Basin Plan Objective
(shaded orange) - Average concentration indicated exceeds BPO
(shaded gray) - Model Layer 1 not included; typically unsaturated within the Los Angeles Forebay and of very limited extent Whittier Area (see explanation in Section 2.5.3 in Appendix G *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality*)
a - Includes both Central Basin and West Coast Basin
b - Elevated TDS and chloride concentrations in the Whittier Area are likely naturally occurring as discussed in Section 3.5.3.2 in Appendix G *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality*

areas are removed from the West Coast Basin average calculations, the West Coast Basin does have available assimilative capacity for TDS, chloride, and nitrate. If seawater-impacted areas in the vicinity of the DGB were also removed from these average concentrations, there would be more available assimilative capacity. This calculation was performed only for existing conditions, i.e. baseline period, because it is too technically complex to simulate the West Coast Basin without the saline plume in the groundwater model, which is necessary for the mixing model analysis.

The Central Basin (excluding the coastal area) average groundwater quality provided in Table I-11 was used to represent the quality of groundwater removed through pumping in the Central Basin in WY 2000-01 in the mixing model. This is reasonable because production wells are generally evenly distributed across the basin. The mixing model used these initial values for the groundwater pumped from the basin and adjusted them for subsequent years based on other S/N inflows and outflows. A slightly different approach was required for estimating TDS and chloride removed through pumping in the West Coast Basin due to the high basin-wide average TDS and chloride concentrations as a result of the saline plume located inland of the WCBB. If the same approach used in the Central Basin were applied to the West Coast Basin, the high basin-wide average TDS and chloride concentrations would result in an overestimation of the TDS and chloride removed through pumping. Because pumping wells in the West Coast Basin are clustered and not well distributed and very few wells are located near or within the saline plume, average S/N concentrations in pumped groundwater in the West Coast Basin were calculated using individual active well pumping volumes and quality (volume-weighted average of pumping wells), not the basin-wide averages developed from concentration contour maps (discussed in Appendix G *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality* and presented in Table I-11).

Since nitrate concentrations do not vary across the West Coast Basin, the same method used in the Central Basin was used to calculate nitrate concentrations in groundwater pumped from the West Coast Basin. Accordingly, the average nitrate-N concentrations presented in Table I-11 were used to represent WY 2000-01 pumped groundwater quality and the SNMP mixing model was used to adjust the concentrations for subsequent years based on nitrate inflows and outflows. The estimated groundwater quality of S/Ns removed from the West Coast Basin by extraction is presented in **Table I-12**.

The C. Marvin Brewer (Brewer) Desalter and Robert W. Goldsworthy (Goldsworthy) Desalter treat brackish groundwater pumped from the WCBB-inland saline plume. The desalters help to remediate the trapped inland saline plume and the treated water is used for potable supply. Groundwater extraction for the desalters is projected to increase in the future planning period as described in Appendix H *Baseline and Future Water Balances.* The median concentrations of TDS and chloride in the raw groundwater pumped for the desalters from 2007 to 2012 is presented in **Table I-13**. Since nitrate concentrations do not vary across the West Coast Basin, the average nitrate-N concentrations presented in Table I-11 were used to represent WY 2000-01 desalter groundwater quality and the SNMP mixing model was used to adjust the concentrations for subsequent years based on nitrate inflows and outflows.

Table I-12 Average TDS, Chloride, and Nitrate-N Concentrations in Groundwater Pumped from the West Coast Basin

WATER YEAR	EXTRACTED GROUNDWATER QUALITY IN WEST COAST BASIN [a] (volume-weighted average in mg/L)		
	TDS	Cl	NO_3-N
2000-01	937	469	0.05 [b]
2001-02	937	469	
2002-03	937	469	
2003-04	937	469	
2004-05	937	469	
2005-06	937	469	
2006-07	937	469	
2007-08	937	469	
2008-09	937	469	
2009-10	937	469	
Average	937	469	

TDS - total dissolved solids
mg/L - milligrams per liter
Cl - chloride
NO_3-N - nitrate as nitrogen

a - Pumping volume-weighted average; data from WRD water quality database; quality representing groundwater extraction was calculated as the average concentration of active production wells weighted based on their respective average annual production from WY 2000-01 through 2009-10; the median concentration from 2007-2012 was applied directly for wells with TDS and chloride data; for wells lacking TDS and chloride data, interpolated values from the median (2007-2012) TDS and chloride concentration contour maps were applied; for wells screened across multiple layers, the average concentration from each pertinent layer was applied; one calculated value was used for all 10 years of the baseline period because the well water quality data are insufficient to support calculation of different annual averages

b - Nitrate value based on West Coast Basin (no coast) average from Table I-11; subsequent year nitrate concentrations estimated with mixing model

Table I-13 Average TDS, Chloride, and Nitrate-N Concentrations in Groundwater Pumped and Treated by Desalters

WATER YEAR	EXTRACTED GROUNDWATER QUALITY FOR BREWER DESALTER [a] (concentrations in mg/L)			EXTRACTED GROUNDWATER QUALITY FOR GOLDSWORTHY DESALTER [a] (concentrations in mg/L)		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
2000-01	4,700	2,200	0.05 [b]	1,900	670	0.05 [b]
2001-02	4,700	2,200		1,900	670	
2002-03	4,700	2,200		1,900	670	
2003-04	4,700	2,200		1,900	670	
2004-05	4,700	2,200		1,900	670	
2005-06	4,700	2,200		1,900	670	
2006-07	4,700	2,200		1,900	670	
2007-08	4,700	2,200		1,900	670	
2008-09	4,700	2,200		1,900	670	
2009-10	4,700	2,200		1,900	670	
Average	4,700	2,200		1,900	670	

TDS - total dissolved solids mg/L - milligrams per liter

Cl - chloride

NO_3-N - nitrate as nitrogen

a - Data from WRD water quality database; the median concentration from 2007-2012 was applied directly for wells with TDS and chloride data; one calculated value was used for all 10 years of the baseline period because the well water quality data are insufficient to support calculation of different annual averages

b - Nitrate value based on West Coast Basin (no coastal areas) average from Table 5; subsequent year nitrate concentrations estimated with mixing model

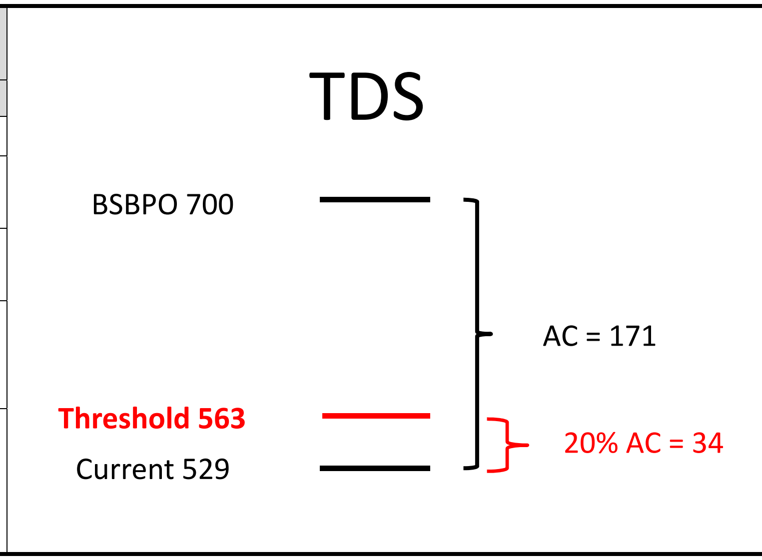
4.6 Assimilative Capacity Threshold

There are multiple recycled water projects in operation throughout the CBWCB. Ongoing major recycled water projects in the Central Basin include the MFSG, AGB, and irrigation with recycled water. In the West Coast Basin, existing major recycled water projects include the WCBB, DGB, and irrigation with recycled water. In accordance with the State Water Resources Control Board's (SWRCB) Recycled Water Policy, single recycled water projects utilizing less than 10% and multiple projects utilizing less than 20% of the available assimilative capacity in a basin/sub-basin need only conduct an anti-degradation analysis verifying the use of the assimilative capacity. Accordingly, single and multiple recycled water projects proposed in the CBWCB were assessed in terms of 10% and 20% of the existing available assimilative capacity, respectively. The 20% assimilative capacity threshold is provided in Table I-11.

Table I-14 provides an example of how the 20% assimilative capacity threshold was calculated for TDS groundwater quality in the Central Basin. The existing average TDS concentration in the basin was subtracted from the BSBPO to calculate the available assimilative capacity. 20% of the calculated available assimilative capacity was then added to the average TDS concentration to determine the assimilative capacity threshold. Similar steps were used to calculate the 20% and 10% assimilative capacity threshold for each S/N for each basin.

Table I-14 Calculation of Assimilative Capacity Threshold

	Central Basin (no coastal area)		
	TDS	**Cl**	**NO_3-N**
BPO/BSBPO	700	150	10.0
Average Concentration	529	67	0.28
Assimilative Capacity	171	83	9.72
20% Assimilative Capacity	**34**	17	1.94
20% Assimilative Capacity Threshold	**563**	84	2.22



All values in milligrams per liter
TDS – total dissolved solids
Cl – chloride
NO_3-N – nitrate as nitrogen
BPO/BSBPO – Basin Plan Objective/Basin-Specific Basin Plan Objective
AC – assimilative capacity
Coastal area – Seaward side of the seawater intrusion barrier

4.7 Montebello Forebay Spreading Water Quality

Water recharged in the Montebello Forebay includes untreated imported water (from CR and SWP), recycled water, and local water/stormwater. These source waters and their volumes recharged at the MFSG between WY 2000-01 through 2009-10 are described in Appendix H *Baseline and Future Water Balances*. The relative percentages of each source water and its quality (volume-weighted average) were used to estimate the S/N inflow from the managed aquifer recharge in the Montebello Forebay. **Table I-15** shows the estimated baseline and future planning period annual average S/N concentrations in water recharged at the MFSG.

Table I-15 Annual Average TDS, Chloride, and Nitrate-N Concentrations in Water Recharged at the MFSG

Water Year	PROJECTED QUALITY OF BLENDED RECHARGE WATER AT MFSG [a] (volume-weighted average in mg/L)					
	SCENARIO 6 - GRIP A 11,000 AFY tertiary & 10,000 AFY AWT Recycled Water [b]			SCENARIO 7 - GRIP B 21,000 AFY Tertiary Recycled Water		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
2010-11	418	86	2.42	418	86	2.42
2011-12	425	89	2.48	425	89	2.48
2012-13	425	89	2.48	425	89	2.48
2013-14	425	89	2.48	425	89	2.48
2014-15	438	92	2.62	460	98	2.85
2015-16	438	92	2.62	460	98	2.85
2016-17	438	92	2.62	460	98	2.85
2017-18	415	87	2.67	460	98	2.85
2018-19	415	87	2.67	460	98	2.85
2019-20	415	87	2.67	460	98	2.85
2020-21	415	87	2.67	460	98	2.85
2021-22	415	87	2.67	460	98	2.85
2022-23	415	87	2.67	460	98	2.85
2023-24	415	87	2.67	460	98	2.85
2024-25	415	87	2.67	460	98	2.85
Average 2011 to 2025	422	89	2.60	450	95	2.75

TDS - total dissolved solids
Cl - chloride
NO_3-N - nitrate as nitrogen
MFSG - Montebello Forebay Spreading Grounds
GRIP - Groundwater Reliability Improvement Program
GRIP A - GRIP Recycled Water Project A
AWT - advanced water treatment
AFY - acre-feet per year
AWTF - advanced water treatment facility
mg/L - milligrams per liter
GRIP B - GRIP Recycled Water Project B

a - Concentrations calculated based on spreading grounds source volumes and source water concentrations (volume-weighted average)

b - AWT recycled water quality represented by average baseline concentrations from WRDs Leo J. Vander Lans AWTF

Table I-15 shows the projected quality of the recharge water for both GRIP A and GRIP B (Scenarios 6 and 7, respectively, simulated by the SNMP mixing model, as discussed in Section 2.3). The projected water quality is a volume-weighted average of the source waters. The baseline period average water quality is used to represent future source water quality for imported water, stormwater, and tertiary-treated recycled water. For the AWT recycled water, the average baseline period water quality from WRD's Vander Lans AWTF was used for the volume-weighted averages for GRIP A. The projected TDS, chloride, and nitrate concentrations in the MFSG recharge water are higher for the 100% tertiary-treated recycled water scenario (GRIP B) compared with baseline conditions. The AWT/tertiary-treated recycled water blend (GRIP A) has similar average TDS, chloride, and nitrate concentrations to baseline conditions. The projected recharge water quality is well below BPOs for TDS, chloride, and nitrate for both GRIP A and GRIP B.

4.8 Seawater Barrier Injection Water Quality

The seawater intrusion barriers currently receive treated MWD imported water and AWT recycled water. These source waters and relative volumes are described in Appendix H *Baseline and Future Water Balances*. The delivered water quality (annual S/N concentrations) is reported in **Table I-16** for each seawater intrusion barrier for the baseline period. During the future planning period, AWT recycled water will replace imported water at all three barriers and overall injection volumes are projected to increase. AWT recycled water is projected to fully replace imported water at the AGB in WY 2014-15, at the WCBB in WY 2013-14, and at the DGB in WY 2018-19. Table I-16 shows the projected S/N concentrations in the recharge water for each barrier. The projected water quality is a volume-weighted average of the source waters. The baseline period average water quality is used to represent future source water quality for imported water and AWT recycled water at the WCBB and AGB.

For the DGB, AWT recycled water from City of Los Angeles' TIWRP is not normally tested for TDS and chloride. To provide a basis for the future blending calculations, samples of the AWT recycled water were analyzed in July and August 2013 and the average of these samples was used to represent average TDS and chloride concentrations in the AWT recycled water in the future planning period. For nitrate, 2011 AWT recycled water sampling results were used to represent the average for blending.

4.9 Irrigation Return Flow Water Quality

Water used for irrigation in the CBWCB includes imported water, groundwater, and recycled water. In order to determine the average S/N concentrations in irrigation return flows that percolate to groundwater, the relative volumes of each source water (described in Appendix H *Baseline and Future Water Balances*) were multiplied by their S/N concentrations to determine the irrigation water quality.

In addition to the S/Ns in the source water, S/Ns can become concentrated or attenuate due to evapotranspiration, removal by plant uptake, attenuation processes, or through fertilizer use. Nutrient plant uptake is the process by which plants absorb nutrients from applied water and surrounding soil.

Table I-16 Annual Average TDS, Chloride, and Nitrate-N Concentrations for Water Injected at Seawater Intrusion Barriers

Water Year	AVERAGE BASELINE QUALITY OF WATER DELIVERED TO BARRIERS FOR INJECTION (volume-weighted average in mg/L)								
	Alamitos Gap Barrier [a]			West Coast Basin Barrier [b]			Dominguez Gap Barrier [c]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
2000-01	277	65	0.49	309	62	0.51	277	65	0.49
2001-02	407	81	0.46	344	73	0.52	407	81	0.46
2002-03	313	88	0.63	261	68	0.41	313	88	0.63
2003-04	275	71	0.61	197	105	0.49	275	71	0.61
2004-05	299	57	0.57	229	41	0.38	299	57	0.57
2005-06	164	30	0.69	227	42	0.34	182	57	0.79
2006-07	197	38	0.86	245	48	0.47	155	53	0.79
2007-08	358	64	0.76	390	66	0.41	211	77	1.15
2008-09	403	65	0.75	581	86	0.37	168	59	0.80
2009-10	323	54	1.11	413	66	0.47	357	131	0.89
Baseline Average 2001 to 2010	302	61	0.69	320	66	0.44	264	74	0.72
Water Year	**PROJECTED QUALITY OF WATER DELIVERED TO BARRIERS FOR INJECTION (volume-weighted average in mg/L)**								
2010-11	257	54	0.74	206	41	0.41	262	60	0.64
2011-12	257	54	0.74	234	48	0.44	261	60	0.64
2012-13	257	54	0.74	135	25	0.33	278	63	0.62
2013-14	257	54	0.74	65	9	0.26	171	47	0.72
2014-15	66	14	1.13	65	9	0.26	171	47	0.72
2015-16	66	14	1.13	65	9	0.26	171	47	0.72
2016-17	66	14	1.13	65	9	0.26	171	47	0.72
2017-18	66	14	1.13	65	9	0.26	171	47	0.72
2018-19	66	14	1.13	65	9	0.26	98	37	0.79
2019-20	66	14	1.13	65	9	0.26	98	37	0.79
2020-21	66	14	1.13	65	9	0.26	98	37	0.79
2021-22	66	14	1.13	65	9	0.26	98	37	0.79
2022-23	66	14	1.13	65	9	0.26	98	37	0.79
2023-24	66	14	1.13	65	9	0.26	98	37	0.79
2024-25	66	14	1.13	65	9	0.26	98	37	0.79
Average 2011 to 2025	117	25	1.03	90	15	0.29	156	45	0.74

TDS - total dissolved solids
Cl - chloride
NO_3-N - nitrate as nitrogen
DGB - Dominguez Gap Barrier
mg/L - milligrams per liter
WRD - Water Replenishment District of Southern California
WBMWD - West Basin Municipal Water District
LADWP - Los Angeles Department of Water and Power
AWT - advanced water treatment

a - Data for baseline period provided by WRD; future planning period water quality calculated as a volume weighted average of source water volumes and average baseline period water quality

b - Data for baseline period provided by WBMWD; future planning period water quality calculated as a volume weighted average of source water volumes and average baseline period water quality

c - Water quality data for baseline period delivered water provided by Michael Hanson, LADWP; no data available for NO_3 for DGB for 2005-2006 so 2006-07 data used; future planning period water quality calculated as a volume weighted average of source water volumes and TDS and chloride sampling from July/August 2013 provided by Seung Tag Oh, LADWP, and nitrate data from LADWP 2011 Harbor Water Recycling/DGB Project 2011 Annual Report (February 2012)

There are limited available data to derive the nitrate load from urban fertilizer use. A recent UC Davis study of nitrate loading in five California counties provides a method for estimating this load. The upper limit of leaching from fertilizer applications on golf courses and other urban turf was estimated at 8.9 pounds of nitrogen per acre (UC Davis, 2012). This assumes an application rate of 45 pounds of nitrogen per acre per year, of which 36 pounds is lost before reaching groundwater. Nitrogen losses are due to plant uptake and volatilization and denitrification processes, which account for the loss of 90% of the applied nitrogen. This correlates to 5.5 mg/L of added nitrate-N to the volume-weighted source water concentrations.

Nitrate concentrations percolating to groundwater were adjusted based on the mixing model calibration process as discussed in Section 5.1.1 *Mixing Model Baseline Period Calibration.* To match the dominant trends in actual observed groundwater quality, an attenuation factor of 0.1 was applied. Evapotranspiration (ET) of the irrigation water results in salts and nitrate becoming more concentrated when it reaches groundwater. It is assumed that only 3.6% of the applied irrigation percolates to groundwater, as described in Appendix H *Baseline and Future Water Balances*. This represents a potential 36-fold increase in the concentration of salt. A 9-fold increase in TDS and chloride concentration (nitrate was accounted for in leaching values calculated in the 2012 UC Davis study) was assumed to account for ET concentration. The potential 36-fold increase was reduced to a 9-fold increase during the calibration process, as discussed in Section 5.1.1 *Mixing Model Baseline Period Calibration*, in order for the simulated salt concentration to more closely match the dominant actual observed groundwater quality trends. It is assumed that 12% of the Study Area is irrigated. This is based on the UC Davis study (2012), which estimated between 12% and 23% of irrigated turf in urban areas. The lower end of the range was selected based on existing conservation efforts and water rationing implemented in the Study Area during severe droughts, resulting in the replacement of lawns with lower water-use landscaping. **Table I-17** presents the TDS, chloride, and nitrate-N concentrations in raw irrigation water (i.e. consisting of treated imported water, groundwater, and recycled water) and irrigation return flows, assuming the effects on water quality due to fertilizer use, ET, and nitrogen attenuation.

4.10 Precipitation Percolation Water Quality

Precipitation recharges the groundwater basins through deep percolation. Generally, precipitation is low in S/Ns. Precipitation can pick up or leach salts and nutrients in the surface soils, vadose zone, and aquifer (mineral dissolution). Because precipitation water quality is so low with respect to TDS and chloride, it was assumed that precipitation will react with surface soils and subsurface media to leach these salts. Thus, TDS and chloride loading was adjusted through the SNMP mixing model calibration process, as discussed in Section 2.1 *Mixing Model Calibration*.

The process by which airborne pollutants are deposited to the earth is known as dry deposition. Nitrogen is one of the pollutants commonly associated with dry deposition. For the SNMP analysis, nitrogen leaching from dry deposition is assumed to be negligible. This is consistent with the UC Davis Study (2012), which assumed nitrogen in urbanized areas runs off with stormwater flows or is removed by nitrogen-fixing processes in turf areas. **Table I-18** provides the water quality for raw precipitation and the adjusted percolation water quality for the

Table I-17 Annual Average TDS, Chloride, and Nitrate-N Concentrations in Raw Irrigation Water and Return Flows

WATER YEAR	RECYCLED WATER, IMPORTED WATER, GROUNDWATER BLEND FOR IRRIGATION RAW WATER AND IRRIGATION RETURN FLOW CONCENTRATIONS USED FOR FUTURE PLANNING PERIOD (volume-weighted average in milligrams per liter)																							
	APPLIED RECYCLED WATER [c], IMPORTED WATER [d], AND GROUNDWATER [e] BLEND QUALITY												RETURN FLOW RECYCLED WATER [c], IMPORTED WATER [d], AND GROUNDWATER [e] QUALITY											
	Scenario 2 Recycled Water Quality at Average of Baseline Period						Scenario 3 Recycled Water Quality at MCL/SMCL						Scenario 2 Recycled Water Wuality at Average of Baseline Period						Scenario 3 Recycled Water Qualit/SMCL					
	Central Basin			West Coast Basin			Central Basin			West Coast Basin			Central Basin			West Coast Basin			Central Basin			West Coast Basin		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS [a]	Cl [a]	NO_3-N [b]	TDS [a]	Cl [a]	NO_3-N [b]	TDS [a]	Cl [a]	NO_3-N [b]	TDS [a]	Cl [a]	NO_3-N [b]
2000-01	425	31	0.56	316	91	0.33							3,823	279	0.61	2,843	818	0.58						
2001-02	470	35	0.56	409	101	0.30							4,227	318	0.61	3,680	910	0.58						
2002-03	431	41	0.73	347	107	0.45							3,877	365	0.62	3,122	963	0.59						
2003-04	430	38	0.71	317	92	0.40							3,872	340	0.62	2,856	827	0.59						
2004-05	442	31	0.74	321	78	0.41							3,974	276	0.62	2,889	706	0.59						
2005-06	426	28	0.71	311	75	0.34							3,834	253	0.62	2,796	674	0.58						
2006-07	429	30	0.69	303	78	0.38							3,865	266	0.62	2,729	706	0.59						
2007-08	494	36	0.60	484	107	0.32							4,445	320	0.61	4,355	962	0.58						
2008-09	509	33	0.57	534	113	0.25							4,585	295	0.61	4,803	1,013	0.58						
2009-10	500	31	0.59	513	112	0.24							4,503	279	0.61	4,617	1,012	0.57						
Baseline Average 2001 to 2010 or MCL/SMCL	456	66	0.79	387	96	0.34	1,000	500	10.00	1,000	500	10.00	4,101	299	0.61	3,469	859	0.58	9,000	4,500	3.55	9,000	4,500	3.55
2010-11	465	67	0.74	392	110	0.36	471	74	0.84	400	117	0.60	4,182	603	0.62	3,532	987	0.59	4,235	669	0.63	3,602	1,056	0.61
2011-12	466	67	0.75	392	109	0.36	472	75	0.86	400	117	0.61	4,190	605	0.62	3,529	984	0.59	4,248	677	0.64	3,600	1,054	0.61
2012-13	467	67	0.76	390	108	0.37	474	76	0.88	398	116	0.61	4,199	607	0.63	3,506	974	0.59	4,262	685	0.64	3,578	1,044	0.61
2013-14	467	68	0.76	389	108	0.37	475	77	0.90	397	116	0.61	4,207	609	0.63	3,502	970	0.59	4,275	693	0.64	3,574	1,041	0.61
2014-15	468	68	0.77	389	107	0.37	476	78	0.91	397	115	0.61	4,215	611	0.63	3,498	967	0.59	4,288	701	0.64	3,571	1,038	0.61
2015-16	469	68	0.78	388	107	0.37	478	79	0.93	396	115	0.62	4,223	613	0.63	3,494	963	0.59	4,301	709	0.64	3,567	1,035	0.61
2016-17	470	68	0.79	388	107	0.37	479	80	0.95	396	115	0.62	4,232	615	0.63	3,490	960	0.59	4,315	718	0.64	3,563	1,032	0.61
2017-18	471	69	0.80	387	106	0.37	481	81	0.97	396	114	0.62	4,240	617	0.63	3,486	957	0.59	4,328	726	0.65	3,560	1,029	0.61
2018-19	472	69	0.81	387	106	0.37	482	82	0.98	395	114	0.62	4,249	619	0.63	3,482	954	0.59	4,342	734	0.65	3,556	1,027	0.61
2019-20	473	69	0.81	386	106	0.37	484	83	1.00	395	114	0.63	4,257	621	0.63	3,478	951	0.59	4,355	743	0.65	3,553	1,024	0.61
2020-21	474	69	0.82	386	105	0.37	485	83	1.02	394	113	0.63	4,265	623	0.63	3,474	948	0.59	4,368	751	0.65	3,550	1,021	0.61
2021-22	475	70	0.83	386	105	0.37	487	84	1.04	394	113	0.63	4,274	626	0.63	3,471	945	0.59	4,382	759	0.65	3,546	1,019	0.61
2022-23	476	70	0.84	385	105	0.38	488	85	1.06	394	113	0.63	4,282	628	0.63	3,467	942	0.59	4,396	768	0.66	3,543	1,016	0.61
2023-24	477	70	0.85	385	104	0.38	490	86	1.07	393	113	0.63	4,291	630	0.63	3,463	939	0.59	4,409	776	0.66	3,540	1,014	0.61
2024-25	478	70	0.85	388	107	0.37	491	87	1.09	396	115	0.62	4,299	632	0.64	3,495	962	0.59	4,422	784	0.66	3,568	1,034	0.61
Average 2011 to 2025	471	69	0.80	388	107	0.37	481	81	0.97	396	115	0.62	4,240	617	0.63	3,491	960	0.59	4,328	726	0.65	3,565	1,032	0.61

TDS - total dissolved solids
Cl - chloride
NO_3-N - nitrate as nitrogen
MCL - primary maximum contaminant level
ET - evapotranspiration
WRPs - water reclamation plants
WRF - water reclamation facility
SMCL - secondary maximum contaminant level
SDLAC - Sanitation Districts of Los Angeles County
WBMWD - West Basin Municipal Water District
mg/L - milligrams per liter

See Section 4.8 of Appendix I *Baseline and Future Salt and Nutrient Groundwater Quality* for additional discussion of irrigation return flow loading assumptions

a - TDS and chloride concentrations increased 9 fold due to ET based on initial potential 30 fold increase adjusted downward based on mixing model calibration

b - Fertilizer application rate - net loading to groundwater is 8.9 pounds of nitrogen per acre based on UC Davis (2012 study) application rate of 45 pounds/acre, 36 pounds lost prior to leaching. 5.5 mg/L added; nitrate attenuated 90% based on mixing model calibration

c - Baseline recycled water quality is a volume-weighted blend of effluent from SDLAC's San Jose Creek, Los Coyotes, and Long Beach WRPs in Central Basin and effluent from WBMWD's Edward C. Little WRF in the West Coast Basin; for future planning period average of baseline period used for volume-weighted averages

d - Baseline imported water quality is a volume-weighted mix of treated imported water sources; for future planning period, baseline average used for volume-weighted average

e - Baseline groundwater quality used in volume-weighted averages is basin average for Central Basin and basin average excluding refinery industrial wells for the West Coast Basin; for future planning period, baseline average used for volume-weighted average

Table I-18 Annual Average TDS, Chloride, and Nitrate-N Concentrations in Raw and Return Flow Precipitation

WATER YEAR	BASELINE PERIOD RAW AND RETURN FLOW PRECIPITATION QUALITY (in milligrams per liter)					
	RAW PRECIPITATION [a]			ADJUSTED PRECIPITATION RETURN FLOW		
	TDS	Cl [b]	NO_3-N	TDS [c]	Cl [c]	NO_3-N
2000-01	2	0	0.18	150	20	0.18
2001-02	2	0	0.16	150	20	0.16
2002-03	2	0	0.20	150	20	0.20
2003-04	2	0	0.16	150	20	0.16
2004-05	2	0	0.16	150	20	0.16
2005-06	2	0	0.12	150	20	0.12
2006-07	2	0	0.19	150	20	0.19
2007-08	2	0	0.24	150	20	0.24
2008-09	2	0	0.12	150	20	0.12
2009-10	2	0	0.13	150	20	0.13
Baseline Average 2001-2010	2	0	0.16	150	20	0.16
WATER YEAR	**PROJECTED RAW AND RETURN FLOW PRECIPITATION QUALITY (in milligrams per liter)**					
2010-11	2	0	0.16	150	20	0.16
2011-12	2	0	0.16	150	20	0.16
2012-13	2	0	0.16	150	20	0.16
2013-14	2	0	0.16	150	20	0.16
2014-15	2	0	0.16	150	20	0.16
2015-16	2	0	0.16	150	20	0.16
2016-17	2	0	0.16	150	20	0.16
2017-18	2	0	0.16	150	20	0.16
2018-19	2	0	0.16	150	20	0.16
2019-20	2	0	0.16	150	20	0.16
2020-21	2	0	0.16	150	20	0.16
2021-22	2	0	0.16	150	20	0.16
2022-23	2	0	0.16	150	20	0.16
2023-24	2	0	0.16	150	20	0.16
2024-25	2	0	0.16	150	20	0.16
Δ 2025 [d]	0	0	0.00	0	0	0.00

TDS - total dissolved solids
Cl - chloride
EC - electrical conductivity
NO_3-N - nitrate as nitrogen

a - Data from USEPA CASTNET; Station Converse (CON186); San Bernardino County; TDS calculated from EC

b - zero values indicate non detects; no detection limits provided

c - TDS and chloride concentrations increased through mineral

d - This is the change in precipitation recharge between the baseline period average and WY 2025 baseline period. The average of the baseline period was used for the precipitation return flows for the future planning period.

4.11 Overall Salt and Nutrient Balances

TDS, chloride, and nitrate balances were developed for the 10-year baseline period (WY 2000-01 to 2009-10) and the future planning period (WY 2010-11 to 2024-25) based on the water quality described above. Salt and nutrient balances for various scenarios, as described in Section 2.3 *Scenarios Simulated to Estimate Future Groundwater Quality,* were estimated for the future planning period from WY 2010-11 to 2024-25. TDS, chloride, and nitrate balances are the basis for the mixing model water quality predictions.

Tables illustrating the TDS, chloride, and nitrate-N balance values for the Central Basin and West Coast Basin for the baseline period and for Scenarios 1, 8, 9, 10, and 11 of the future planning period are presented in **Attachment I-C**. Figures 41 through 58 present the S/N balances graphically. The Central Basin S/N balance is shown on the top of each figure, and the West Coast Basin S/N balance is shown on the bottom of each figure. A discussion of key findings is presented below.

4.11.1 TDS

4.11.1.1 Baseline Period

Figure 41 shows the TDS mass balances for the baseline period (WY 2000-01 to 2009-10) for the Central Basin and West Coast Basin. As shown in Figure 41, recharge at the MFSG is the largest TDS load to the Central Basin, followed by irrigation return flows and subsurface inflow. Deep percolation of precipitation, AGB injection, and mountain front recharge are minor TDS loading sources. Minor TDS loading associated with recharge at the DGSG in the Central Basin is included with the MFSG loading shown in Figure 41. In the Central Basin, groundwater pumping is the major TDS outflow, along with a small amount of subsurface outflow to the West Coast Basin. Annual changes in TDS mass vary considerably from year to year with an overall increase in cumulative TDS mass of about 11,900 tons in groundwater in the Central Basin over the baseline period. This mass change equates to an increase of 2.6 mg/L of TDS in groundwater over 10 years.

In the West Coast Basin, subsurface inflow from the ocean and adjacent basins is the largest TDS source, followed by irrigation return flows and injection at the seawater intrusion barriers. Smaller components of TDS loading include deep percolation of precipitation, mountain front recharge, and recharge at the DGSG. Groundwater pumping is the only TDS outflow as there is no subsurface outflow. Annual changes in TDS mass vary from year to year but are consistently negative, thereby indicating a net decrease in TDS mass in groundwater. The cumulative change in TDS mass in the West Coast Basin over the baseline period is a decrease of about 78,500 tons, equivalent to a decrease of 15.2 mg/L of TDS in groundwater over the 10 years.

4.11.1.2 Future Planning Period

Figures 42 through 46 illustrate the TDS mass balances for the future planning period (WY 2010-11 to 2024-25) for Scenario 1 (the No Future Projects Scenario) and Scenarios 8 through 11 (various combinations of proposed projects), respectively. For Scenarios 1 and 8 through 11, the MFSG recharge is the largest TDS loading source in the Central Basin followed by subsurface inflow and irrigation return flows. Precipitation infiltration, mountain front recharge, and AGB injection are minor TDS loading sources. Groundwater pumping is the major TDS outflow along with a small amount of subsurface outflow to the West Coast Basin. TDS loading is highest under scenarios that include GRIP B (Scenarios 9 and 11), with Scenario 11 having a higher TDS load than Scenario 9 due to the difference in simulated recycled water TDS concentrations. Under the No Future Projects Scenario (Scenario 1), the cumulative (WY 2010-11 to 2024-25) TDS mass increase in groundwater is about 19,200 tons, while the TDS mass increase for Scenarios 8 through 11 ranges from 28,300 to 103,800 tons. Increases in TDS mass do not necessarily correlate to increases in average groundwater TDS concentrations, as the volume change associated with TDS mass change must also be considered. For example, while cumulative TDS mass increases under Scenarios 8 through 10 are larger than for the No Future Projects Scenario, projected average TDS concentrations in the Central Basin are lower for Scenarios 8 through 10. This occurs because the water budget indicates a net positive storage change under Scenarios 8 through 10 and a net negative storage change under the No Future Projects Scenario. Only under Scenario 11 does the effect of combined projects result in a larger positive TDS mass increase and higher average groundwater TDS concentrations in the Central Basin compared to the No Future Projects Scenario.

For the No Future Projects Scenario and Scenarios 8 through 11 in the West Coast Basin (Figures 42 through 46), subsurface inflow followed by irrigation return flows and injection at the seawater barriers are the largest TDS sources. Precipitation infiltration, mountain front recharge, and recharge at the DGSG are minor TDS loading sources. Groundwater pumping is the only TDS outflow. TDS loading is less under Scenarios 8 through 11 compared with the No Future Projects Scenario as a result of two factors: 1) reduced TDS loading from increased AWT recycled water used at the seawater barriers under Scenarios 8 through 11, and 2) increased removal of TDS mass from groundwater due to increased desalter well pumping under Scenarios 8 through 11. Under the No Future Projects Scenario, the cumulative (WY 2010-11 to 2024-25) TDS mass decrease in groundwater is about -22,200 tons, equating to a decrease of -23.0 mg/L of TDS over the 15 years. In comparison, under Scenarios 8 through 11, the cumulative (WY 2010-11 to 2024-25) TDS mass decrease in groundwater ranges from 348,400 to 352,900 tons, equating to a groundwater TDS concentration decrease of 56.7 to 57.4 mg/L over the 15 years.

4.11.2 Chloride

4.11.2.1 Baseline Period

Figure 47 shows the chloride mass balances for the baseline period (WY 2000-01 to 2009-10) for the Central Basin and West Coast Basin. As shown in Figure 47, recharge at the MFSG is the largest chloride load to the Central Basin, followed by irrigation return flows and subsurface inflow from neighboring basins. Deep percolation of precipitation, AGB injection, and mountain front recharge are minor chloride loading sources. Minor chloride loading associated with recharge at the DGSG in the Central Basin is included with the MFSG loading shown in Figure

47. In the Central Basin, groundwater pumping is the major chloride outflow, along with a small amount of subsurface outflow to the West Coast Basin. Annual changes in chloride mass vary from year to year but are consistently positive. There is an overall increase in cumulative chloride mass of 56,300 tons in groundwater in the Central Basin over the baseline period, equivalent to an increase of 3.3 mg/L of chloride in groundwater over the 10 years.

In the West Coast Basin, subsurface inflow from the ocean and adjacent basins is the largest chloride source, followed by irrigation return flows and injection at the seawater intrusion barriers. Smaller components of chloride loading include deep percolation of precipitation, mountain front recharge, and recharge at the DGSG. Groundwater pumping is the only chloride outflow as there is no subsurface outflow. Annual changes in chloride mass vary slightly from year to year but are consistently negative, thereby indicating a net decrease in chloride mass in groundwater. This is in contrast to the trends analysis (Table I-4), which shows more wells (35) with increasing chloride concentrations than decreasing chloride concentrations (17) and 42 wells showing no trends. The difference in results can be explained by the seawater barriers acting to prevent new seawater intrusion and lower chloride concentrations (reduced mass loading) on a basin-wide basis. This contrasted with continuing migration of the existing inland saline plumes, results in increasing concentration trends in wells downgradient of the saline plumes. The cumulative change in chloride mass in the West Coast Basin over the baseline period is a decrease of about 99,000 tons, equivalent to a decrease of 15.6 mg/L of chloride in groundwater over the 10 years.

4.11.2.2 Future Planning Period

Figures 48 through 52 illustrate the chloride mass balances for the future planning period (WY 2010-11 to 2024-25) for Scenario 1 (the No Future Projects Scenario) and Scenarios 8 through 11 (various combinations of proposed projects), respectively. Similar to TDS, for Scenarios 1 and 8 through 11, the MFSG recharge is the largest chloride loading source in the Central Basin followed by irrigation return flows and subsurface inflow. Precipitation infiltration, mountain front recharge, and AGB injection, are minor chloride loading sources. Groundwater pumping is the major chloride outflow along with a small amount of subsurface outflow to the West Coast Basin. Chloride loading is highest under scenarios that include GRIP B (Scenarios 9 and 11), with Scenario 11 having a higher chloride load than Scenario 9 due to the difference in simulated recycled water chloride concentrations. Under the No Future Projects Scenario, the cumulative (WY 2010-11 to 2024-25) chloride mass increase in groundwater is about 86,000 tons, while the chloride mass increase for Scenarios 8 through 11 ranges from 94,900 to 122,200 tons. Increases in chloride mass generally correlate to increases in average groundwater chloride concentrations, but the volume change associated with chloride mass change must also be considered. For example, while cumulative chloride mass increases under Scenario 8 are larger than under the No Future Projects Scenario (94,900 tons versus 86,000 tons), projected average chloride concentrations in groundwater in the Central Basin are slightly lower under Scenario 8 (5.0 mg/L versus 5.1 mg/L for the No Future Projects Scenario). This occurs because the water budget indicates a net positive storage change under Scenario 8 and a net negative storage change under the No Future Projects Scenario. Under Scenarios 9 through 11, the effects of combined projects result in a larger positive chloride mass increase and higher average groundwater TDS concentrations in the Central Basin compared to the No Future Projects Scenario. By the end of the 15-year planning period in WY 2024-25, the projected increase in chloride concentration in groundwater in the Central Basin under Scenarios 9 through 11 ranges from 5.6 to 6.5 mg/L; under the No Future Projects Scenario, chloride levels in groundwater are projected to increase by 5.0 mg/L over the same period.

For Scenarios 1 and 8 through 11 in the West Coast Basin (Figures 48 through 52), subsurface inflow followed by irrigation return flows and injection at the seawater barriers are the largest chloride sources. Precipitation infiltration, mountain front recharge, and recharge at the DGSG are minor chloride loading sources. Groundwater pumping is the only chloride outflow. Chloride loading is less under Scenarios 8 through 11 compared with the No Future Projects Scenario as a result of two factors: 1) reduced chloride loading from increased AWT recycled water used at the seawater barriers under Scenarios 8 through 11, and 2) increased removal of chloride mass from groundwater due to increased desalter well pumping under Scenarios 8 through 11. Under the No Future Projects Scenario, the cumulative (WY 2010-11 to 2024-25) chloride mass decrease in groundwater is about 150,200 tons, equating to a groundwater chloride concentration decrease of 23.6 mg/L over the 15-year period. In comparison, under Scenarios 8 through 11, the cumulative (WY 2010-11 to 2024-25) chloride mass decrease in groundwater ranges from 220,800 to 225,100 tons, equating to a groundwater chloride concentration decrease of 34.1 to 34.7 mg/L over the same period.

4.11.3 Nitrate

4.11.3.1 Baseline Period

Figure 53 shows the nitrate mass balances for the baseline period (WY 2000-01 to 2009-10) for the Central Basin and West Coast Basin. As shown in Figure 53, recharge at the MFSG is the largest nitrate load to the Central Basin, followed by subsurface inflow from neighboring basins. Mountain front recharge, irrigation return flows, AGB injection, and deep percolation of precipitation are minor nitrate loading sources. Minor nitrate loading associated with recharge at the DGSG in the Central Basin is included with the MFSG loading shown in Figure 53. Groundwater pumping is the major nitrate outflow, along with a small amount of subsurface outflow to the West Coast Basin. Annual changes in nitrate mass vary from year to year, but a net increase in nitrate mass in groundwater is estimated for each of the 10 years in the baseline period. Thus, there is an overall increase in nitrate mass of about 3,100 tons in the Central Basin over the 10-year baseline period, equivalent to an increase of 0.07 mg/L of nitrate-N in groundwater.

In the West Coast Basin, injection at the seawater intrusion barriers is typically the largest nitrate source followed by subsurface inflows from neighboring basins and mountain front recharge. Smaller components of nitrate loading include irrigation return flows, deep percolation of precipitation, and recharge at the DGSG. Groundwater pumping is the only nitrate outflow as there is no subsurface outflow. Annual changes in nitrate mass vary from year to year but are consistently positive. The cumulative change in nitrate-N mass in groundwater in the West Coast Basin over the 10-year baseline period is an increase of about 320 tons, equivalent to an increase of 0.04 mg/L of nitrate-N in groundwater.

4.11.3.2 Future Planning Period

Figures 54 through 58 illustrate the nitrate mass balances for the future planning period (WY 2010-11 to 2024-25) for Scenario 1 (the No Future Projects Scenario) and Scenarios 8 through 11 (various combinations of proposed projects), respectively. For Scenarios 1 and 8 through 11, recharge at the MFSG is the largest nitrate loading source to the Central Basin (due primarily to its large inflow volume relative to other inflows) followed by subsurface inflow from neighboring basins. Mountain front recharge, irrigation return flows, AGB injection, and precipitation infiltration are minor nitrate loading sources. Groundwater pumping is the major nitrate outflow along with a small amount of subsurface outflow to the West Coast Basin. Nitrate loading is highest under scenarios that include GRIP B (Scenarios 9 and 11), with Scenario 11 having a slightly higher nitrate load than Scenario 9 due to the difference in simulated recycled water nitrate concentrations. Increased nitrate loading also occurs under scenarios that include GRIP A (Scenarios 8 and 10). Under the No Future Projects Scenario, the cumulative (WY 2010-11 to 2024-25) nitrate mass increase in groundwater is about 4,700 tons, equating to a small groundwater nitrate concentration increase of 0.07 mg/L over the 15-year period. Under Scenarios 8 through 11, the nitrate mass increase in groundwater under Scenarios 8 through 11 ranges from 5,500 to 5,800 tons, equating to a groundwater nitrate concentration increase of 0.14 to 0.15 mg/L for the same period.

For Scenarios 1 and 8 through 11 in the West Coast Basin (Figures 54 through 58), injection at the seawater intrusion barriers is the largest nitrate inflow, followed by subsurface inflow from adjacent basins and mountain front recharge. Smaller components of nitrate loading include irrigation return flows, precipitation infiltration, and recharge at the DGSG. Groundwater pumping is the only nitrate outflow. Nitrate loading is similar for all five scenarios, with cumulative (WY 2010-11 to 2024-25) nitrate mass increases in groundwater ranging from 457 to 466 tons, equating to a groundwater nitrate concentration increase of 0.06 to 0.07 mg/L over the 15-year period.

5 Simulated Baseline and Future Groundwater Quality

5.1 Baseline Period Groundwater Quality Results

Figure 59 shows the simulated results of the calibrated mixing model for the baseline period of WY 2000-01 through 2009-10 for (from top to bottom) the Los Angeles Forebay, Montebello Forebay, Whittier Area, and Central Basin Pressure Area, as well as for the entire Central Basin and West Coast Basin. Each chart in Figure 59 shows the simulated average concentration for each model layer and for all model layers within the given subarea or basin. In general, the charts illustrate that the average groundwater concentrations within a given subarea and in the lower model layers (Layers 3 and 4) have not changed significantly as a result of recent historical S/N loading. These trends are consistent with the dominant actual observed well concentration trends (see Table I-4) and generally reflect the large buffering capacity of the existing groundwater in storage and the muted impact of S/N loading on the surface at lower aquifer depths. Some larger changes in S/N concentrations over time are observed in Layer 1 due to the smaller volumes of groundwater and S/N mass in these layers. Additional discussion of the baseline mixing model results are presented below by subarea.

5.1.1 Los Angeles Forebay

As depicted in the top row of Figure 59, overall average simulated concentrations within the Los Angeles Forebay (black line) for TDS, chloride, and nitrate are relatively flat, with slight overall increases in Layer 4 and an increase in nitrate in Layer 1. These trends are generally consistent with trends observed in the few Los Angeles Forebay wells for which trends could be analyzed (see Table I-3).

5.1.2 Montebello Forebay

As depicted in the second row of Figure 59, within the Montebello Forebay, simulated overall TDS concentrations (black line) decrease moderately (from 534 to 482 mg/L), while overall chloride and nitrate concentrations are generally flat. These TDS, chloride, and nitrate trends are generally consistent with trends observed in Montebello Forebay wells (see Table I-4).

5.1.3 Whittier Area

As depicted in the third row of Figure 59, overall average simulated concentrations within the Whittier Area (black line) for TDS, chloride, and nitrate are relatively flat, consistent with observed trends in the few Whittier Area wells for which trends could be analyzed (see Table I-4).

5.1.4 Central Basin Pressure Area

As depicted in the fourth row of Figure 59, overall average simulated concentrations within the Central Basin Pressure Area (black line) for TDS, nitrate, and chloride are relatively flat. These trends are consistent with observed trends in Central Basin Pressure Area wells (see Table I-4).

5.1.5 Central Basin (all subareas, not including coastal area)

Simulated concentrations in the Central Basin (including all forebay areas and the pressure area landward of the AGB) are shown in the second to bottom row on Figure 59. The simulated average concentrations for TDS, chloride, and nitrate show relatively flat to minor increasing trends over the baseline period, indicating that historical S/N loading has not significantly impacted ambient groundwater concentrations within the Central Basin as a whole. Over the 10-year baseline period, the average TDS and chloride concentrations in the Central Basin increased by about 3 and 2 mg/L, respectively, while simulated nitrate concentrations increased by 0.06 mg/L.

5.1.6 West Coast Basin (not including coastal areas)

Simulated concentrations in the West Coast Basin are shown in the bottom row on Figure 59. The overall simulated concentrations (black line) show that TDS and chloride concentrations decreased moderately over the baseline period. While there is a slight increase in nitrate-N from 0.05 to 0.10 mg/L, the magnitude of the increase is small and the overall average simulated nitrate concentration is relatively flat. TDS concentrations decreased from 890 to

875 mg/L, while chloride decreased from 306 to 290 mg/L. In contrast, TDS and chloride concentration trends in West Coast Basin wells indicate that TDS and chloride concentrations are flat to slightly increasing regionally within the West Coast Basin (Table I-4). However, a closer examination of the location of the wells with increasing trends on Figure 39 indicates that many of the wells with increasing trends are likely influenced by the migration of saline plumes associated with historical seawater intrusion across the basin and not by current TDS and chloride loading. Given that the ambient groundwater is impacted by historical seawater intrusion, and ongoing mitigation measures, including the operation of the desalters and injection of high quality water at the seawater barriers for more than 40 years, it is likely that current TDS and chloride loading is helping to lower the ambient background TDS and chloride concentrations in the West Coast Basin.

5.2 Future Planning Period Groundwater Quality Results by Subarea

Table I-19 shows the water quality changes simulated by the SNMP mixing model and percentage use of assimilative capacity between 2010 and 2025 for each scenario for each subarea and for the basins as a whole. S/N concentrations and the assimilative capacity in 2010 are represented as the existing average groundwater quality and available assimilative capacity calculated based on the last five years of water quality data (2007 to 2012), as described in Appendix G *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality.* Impacts to water quality and assimilative capacity were quantified and summarized in Table I-19 for the following conditions: 1) No Future Projects Scenario – average baseline conditions continued through the future planning period, 2) Overall Scenario – the indicated future project/scenario in combination with average baseline conditions continued through the future planning period, and 3) Scenario minus Baseline Conditions – the indicated future project/scenario excluding or subtracting average baseline conditions.

Figure 60 shows the simulated results for TDS in groundwater for Scenarios 1 through 11 (each including baseline conditions) from WY 2010-11 through 2024-25 for (from top to bottom) the Los Angeles Forebay, Montebello Forebay, Whittier Area, and Central Basin Pressure Area, as well as for the entire Central Basin and West Coast Basin. Each chart in Figure 60 shows the simulated TDS concentration trends for each scenario (including baseline conditions) within the indicated subarea or basin and the 10% and 20% assimilative capacity thresholds. Figures 61and 62 show the simulated concentration trends for chloride and nitrate, respectively. In the West Coast Basin, where there is no available assimilative capacity for TDS and chloride due to historical seawater intrusion, the BPO/BSBPOs are shown rather than the 10% or 20% assimilative capacity threshold. Because the projected scenario concentrations plot very close together, there is an index on the side of each chart, which shows the relative position of each scenario concentration in WY 2024-25. The results for each subarea and basin as a whole are discussed below.

Table I-19 Future Projects – Groundwater Quality Impacts and Use of Available Assimilative Capacity

FUTURE PROJECTS - CHANGE IN GROUNDWATER QUALITY AND USE OF AVAILABLE ASSIMILATIVE CAPACITY

Scenario	1. No Future Projects			2. Increased Recycled Water Irrigation (Baseline period average RW quality)						3. Increased Recycled Water Irrigation (RW quality at MCL/SMCLs)						4. Seawater Barriers						5. Desalters						6. GRIP A (Tertiary and AWT RW)					
Subarea/Basin				Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
LOS ANGELES FOREBAY [e]																																	
Change (2010 to 2025) (mg/L)	2.4	1.3	0.15	4.0	1.7	0.15	1.6	0.4	0.00	4.7	2.5	0.15	2.3	1.2	0.0	2.4	1.3	0.15	0.0	0.0	0.00	2.4	1.3	0.15	0.0	0.0	0.00	2.4	1.3	0.15	0.0	0.0	0.00
A.C. Used (2010 to 2025) (%)	4.0%	1.9%	1.5%	6.7%	2.4%	1.5%	2.7%	0.6%	0.0%	7.9%	3.7%	1.5%	3.9%	1.8%	0.0%	4.0%	1.9%	1.5%	0.0%	0.0%	0.0%	4.0%	1.9%	1.5%	0.0%	0.0%	0.0%	4.0%	1.9%	1.5%	0.0%	0.0%	0.0%
MONTEBELLO FOREBAY [e]																																	
Change (2010 to 2025) (mg/L)	-62.9	-2.1	0.02	-61.8	-1.9	0.02	1.1	0.2	0.00	-61.7	-1.4	0.02	1.2	0.6	0.0	-62.9	-2.1	0.02	0.0	0.0	0.00	-62.9	-2.1	0.02	0.0	0.0	0.00	-64.7	-0.8	0.16	-1.8	1.2	0.14
A.C. Used (2010 to 2025) (%)	-37.9%	-3.4%	0.3%	-37.3%	-3.0%	0.2%	0.7%	0.3%	0.0%	-37.2%	-2.3%	0.3%	0.7%	1.0%	0.0%	-37.9%	-3.4%	0.3%	0.0%	0.0%	0.0%	-37.9%	-3.4%	0.3%	0.0%	0.0%	0.0%	-39.0%	-1.4%	1.8%	-1.1%	2.0%	1.6%
WHITTIER AREA [e]																																	
Change (2010 to 2025) (mg/L)	-36.1	-2.9	0.05	-34.8	-2.5	0.05	1.3	0.3	0.00	-34.2	-1.8	0.05	1.9	1.1	0.0	-36.1	-2.9	0.05	0.0	0.0	0.00	-36.1	-2.9	0.05	0.0	0.0	0.00	-36.1	-2.9	0.05	0.0	0.0	0.00
A.C. Used (2010 to 2025) (%)	NC	-9.8%	0.5%	NC	-8.6%	0.5%	NC	1.2%	0.0%	NC	-6.0%	0.5%	NC	3.8%	0.0%	NC	-9.8%	0.5%	NC	0.0%	0.0%	NC	-9.8%	0.5%	NC	0.0%	0.0%	NC	-9.8%	0.5%	NC	0.0%	0.0%
CENTRAL BASIN PRESSURE AREA [e]																																	
Change (2010 to 2025) (mg/L)	21.5	7.9	0.13	22.5	8.2	0.13	1.0	0.3	0.00	22.9	8.7	0.13	1.5	0.8	0.0	19.0	7.5	0.13	-2.5	-0.4	0.00	21.5	7.9	0.13	0.0	0.0	0.00	21.7	8.1	0.13	0.3	0.2	0.00
A.C. Used (2010 to 2025) (%)	9.3%	8.4%	1.3%	9.8%	8.6%	1.3%	0.5%	0.3%	0.0%	10.0%	9.2%	1.3%	0.6%	0.8%	0.0%	8.2%	8.0%	1.3%	-1.1%	-0.4%	0.1%	9.3%	8.4%	1.3%	0.0%	0.0%	0.0%	9.4%	8.5%	1.3%	0.1%	0.2%	0.0%
CENTRAL BASIN [e]																																	
Change (2010 to 2025) (mg/L)	**4.6**	**5.1**	**0.11**	**5.8**	**5.4**	**0.11**	**1.2**	**0.3**	**0.00**	**6.2**	**5.9**	**0.11**	**1.6**	**0.8**	**0.00**	**2.8**	**4.8**	**0.11**	**-1.8**	**-0.3**	**0.00**	**4.6**	**5.1**	**0.11**	**0.0**	**0.0**	**0.00**	**4.1**	**5.5**	**0.14**	**-0.5**	**0.4**	**0.03**
A.C. Used (2010 to 2025) (%)	**2.7%**	**6.1%**	**1.1%**	**3.4%**	**6.4%**	**1.1%**	**0.7%**	**0.3%**	**0.0%**	**3.6%**	**7.1%**	**1.1%**	**0.9%**	**1.0%**	**0.0%**	**1.6%**	**5.8%**	**1.1%**	**-1.1%**	**-0.3%**	**0.0%**	**2.7%**	**6.1%**	**1.1%**	**0.0%**	**0.0%**	**0.0%**	**2.4%**	**6.6%**	**1.4%**	**-0.3%**	**0.5%**	**0.3%**
WEST COAST BASIN [e]																																	
Change (2010 to 2025) (mg/L)	**-23.0**	**-23.6**	**0.07**	**-21.3**	**-23.0**	**0.07**	**1.7**	**0.6**	**0.00**	**-20.6**	**-22.4**	**0.07**	**2.4**	**1.3**	**0.00**	**-41.0**	**-28.3**	**0.06**	**-18.0**	**-4.7**	**0.00**	**-36.6**	**-29.4**	**0.07**	**-13.6**	**-5.8**	**0.00**	**-23.0**	**-23.6**	**0.07**	**0.0**	**0.0**	**0.00**
A.C. Used (2010 to 2025) (%)	**NC**	**NC**	**0.7%**	**NC**	**NC**	**0.7%**	**NC**	**NC**	**0.0%**	**NC**	**NC**	**0.7%**	**NC**	**NC**	**0.0%**	**NC**	**NC**	**0.6%**	**NC**	**NC**	**0.0%**	**NC**	**NC**	**0.7%**	**NC**	**NC**	**0.0%**	**NC**	**NC**	**0.7%**	**NC**	**NC**	**0.0%**

Scenario	1. No Future Projects			7. GRIP B (Tertiary RW)						8. Combined Projects/Scenarios (2 + 4 + 5 + 6 + Minor Future Changes) [d]						9. Combined Project/Scenarios (2 + 4 + 5 + 7 + Minor Future Changes) [d]						10. Combined Projects/Scenarios (3 + 4 + 5 + 6 + Minor Future Changes) [d]						11. Combined Projects/Scenarios (3 + 4 + 5 + 7 + Minor Future Changes) [d]					
Subarea/Basin				Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a]			Scenario minus Baseline Conditions [b]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
LOS ANGELES FOREBAY [e]																																	
Change (2010 to 2025) (mg/L)	2.4	1.3	0.15	2.5	1.3	0.15	0.1	0.0	0.00	-1.3	0.8	0.15	-3.7	-0.5	0.00	-1.2	0.8	0.15	-3.6	-0.5	0.00	-0.6	1.6	0.15	-3.0	0.3	0.00	-0.5	1.6	0.15	-2.9	0.4	0.00
A.C. Used (2010 to 2025) (%)	4.0%	1.9%	1.5%	4.2%	1.9%	1.5%	0.2%	0.0%	0.0%	-2.2%	1.1%	1.5%	-6.2%	-0.8%	0.0%	-2.0%	1.1%	1.5%	-6.0%	-0.7%	0.0%	-1.0%	2.4%	1.5%	-5.0%	0.5%	0.0%	-0.9%	2.4%	1.5%	-4.9%	0.5%	0.0%
MONTEBELLO FOREBAY [e]																																	
Change (2010 to 2025) (mg/L)	-62.9	-2.1	0.02	-45.7	3.8	0.22	17.2	5.9	0.20	-66.4	-1.1	0.16	-3.5	1.0	0.14	-47.4	3.6	0.22	15.5	5.7	0.20	-66.1	-0.7	0.16	-3.2	1.4	0.14	-47.1	4.0	0.22	15.8	6.0	0.20
A.C. Used (2010 to 2025) (%)	-37.9%	-3.4%	0.3%	-27.5%	6.2%	2.5%	10.4%	9.5%	2.2%	-40.0%	-1.7%	1.8%	-2.1%	1.6%	1.6%	-28.6%	5.8%	2.5%	9.4%	9.1%	2.2%	-39.8%	-1.1%	1.8%	-1.9%	2.2%	1.6%	-28.4%	6.4%	2.5%	9.5%	9.8%	2.2%
WHITTIER AREA [e]																																	
Change (2010 to 2025) (mg/L)	-36.1	-2.9	0.05	-36.1	-2.9	0.05	0.0	0.0	0.00	-42.1	-3.8	0.05	-6.0	-0.9	0.00	-42.1	-3.8	0.05	-6.0	-0.9	0.00	-41.5	-3.1	0.05	-5.4	-0.2	0.00	-41.5	-3.1	0.05	-5.4	-0.2	0.00
A.C. Used (2010 to 2025) (%)	NC	-9.8%	0.5%	NC	-9.8%	0.5%	NC	0.0%	0.0%	NC	-12.8%	0.5%	NC	-3.1%	0.0%	NC	-12.8%	0.5%	NC	-3.1%	0.0%	NC	-10.5%	0.5%	NC	-0.7%	0.0%	NC	-10.5%	0.5%	NC	-0.7%	0.0%
CENTRAL BASIN PRESSURE AREA [e]																																	
Change (2010 to 2025) (mg/L)	21.5	7.9	0.13	22.9	8.4	0.13	1.4	0.4	0.01	18.4	7.6	0.13	-3.1	-0.4	0.01	19.5	7.9	0.14	-2.0	-0.1	0.01	18.8	8.2	0.13	-2.6	0.2	0.01	20.0	8.4	0.14	-1.5	0.5	0.01
A.C. Used (2010 to 2025) (%)	9.3%	8.4%	1.3%	9.9%	8.9%	1.3%	0.6%	0.5%	0.1%	8.0%	8.0%	1.4%	-1.3%	-0.4%	0.1%	8.5%	8.3%	1.4%	-0.8%	-0.1%	0.1%	8.2%	8.6%	1.4%	-1.1%	0.2%	0.1%	8.7%	8.9%	1.4%	-0.6%	0.5%	0.1%
CENTRAL BASIN [e]																																	
Change (2010 to 2025) (mg/L)	**4.6**	**5.1**	**0.11**	**7.7**	**6.4**	**0.15**	**3.1**	**1.3**	**0.04**	**0.7**	**5.0**	**0.14**	**-4.0**	**-0.1**	**0.03**	**4.2**	**5.9**	**0.15**	**-0.4**	**0.8**	**0.04**	**1.1**	**5.6**	**0.14**	**-3.5**	**0.5**	**0.03**	**4.7**	**6.5**	**0.15**	**0.1**	**1.3**	**0.04**
A.C. Used (2010 to 2025) (%)	**2.7%**	**6.1%**	**1.1%**	**4.5%**	**7.7%**	**1.5%**	**1.8%**	**1.5%**	**0.4%**	**0.4%**	**6.0%**	**1.4%**	**-2.3%**	**-0.1%**	**0.3%**	**2.5%**	**7.1%**	**1.5%**	**-0.2%**	**0.9%**	**0.4%**	**0.7%**	**6.7%**	**1.4%**	**-2.0%**	**0.6%**	**0.3%**	**2.8%**	**7.8%**	**1.5%**	**0.1%**	**1.6%**	**0.4%**
WEST COAST BASIN [e]																																	
Change (2010 to 2025) (mg/L)	**-23.0**	**-23.6**	**0.07**	**-23.0**	**-23.6**	**0.07**	**0.1**	**0.0**	**0.00**	**-57.4**	**-34.7**	**0.06**	**-34.4**	**-11.1**	**0.00**	**-57.3**	**-34.7**	**0.06**	**-34.3**	**-11.1**	**0.00**	**-56.8**	**-34.1**	**0.06**	**-33.8**	**-10.5**	**0.00**	**-56.7**	**-34.1**	**0.06**	**-33.7**	**-10.4**	**0.00**
A.C. Used (2010 to 2025) (%)	**NC**	**NC**	**0.7%**	**NC**	**NC**	**0.7%**	**NC**	**NC**	**0.0%**	**NC**	**NC**	**0.6%**	**NC**	**NC**	**0.0%**	**NC**	**NC**	**0.6%**	**NC**	**NC**	**0.0%**	**NC**	**NC**	**0.6%**	**NC**	**NC**	**0.0%**	**NC**	**NC**	**0.6%**	**NC**	**NC**	**0.0%**

TDS - total dissolved solids
AWT - advanced water treatment
MCL - maximum contaminant level
Cl - chloride
SMCL - secondary MCL
NO_3-N - nitrate as nitrogen
mg/L - milligrams per liter
NC - No assimilative capacity available
A.C. - assimilative capacity
GRIP - Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A
GRIP B - GRIP Recycled Water Project B
Baseline - The period of time from water year 2000-01 to 2009-10 used for assessment of salt and nutrient inflows and outflows

a - “Overall Scenario” quantifies the impacts of the indicated future project/scenario in combination with existing projects in the CBWCB, i.e. including average baseline conditions (No Future Projects Scenario) continued through the future planning period

b - “Scenario minus Baseline Conditions” quantifies the impacts of the indicated future project/scenario solely, without existing projects in the CBWCB, i.e. excluding average baseline conditions (No Future Projects Scenario) or background loading

c - Positive value indicates the scenario is increasing concentrations or using additional available assimilative capacity; negative value indicates the scenario is improving groundwater quality or increasing available assimilative capacity

d -Minor Future Changes, as referenced for all combined scenarios (8, 9, 10, and 11), include decreased imported water use for supply in the Central Basin, slightly increased imported water for supply in the West Coast Basin, and increased stormwater capture at the DGSG and other facilities

e - 2010 year values used to calculate changes in concentrations and use of assimilative capacity are the average existing groundwater quality and available assimilative capacity (See Table I-11)

5.2.1 Los Angeles Forebay

As shown in Figure 60 and Table I-19, average simulated TDS concentrations in groundwater both increase and decrease very slightly over the future planning period in the Los Angeles Forebay depending on the scenario. Under the No Future Projects Scenario, TDS increases by 2.4 mg/L, equivalent to using 4.0% of the available assimilative capacity. Evidenced by the close plotting relative to the No Future Projects Scenario, TDS concentrations in the Los Angeles Forebay are insensitive to loading changes involving the seawater intrusion barriers, West Coast Basin desalter wells, and the GRIP A and GRIP B alternatives. Compared to the No Future Projects Scenario, TDS concentration increases are slightly higher under Scenarios 2 and 3 as a result of projected increases in recycled water for irrigation. Decreases in TDS concentrations observed for combined future projects (Scenarios 8 through 11) illustrate the benefit of minor future changes (specifically reduced future water use as a result of conservation) on groundwater TDS concentrations. For all scenarios, TDS concentrations remain well below the BSBPO of 700 mg/L, and single and multiple recycled water projects use less than 10% and 20% of the available assimilative capacity, respectively.

As shown in Figure 61 and Table I-19, average simulated chloride concentrations in groundwater increase between 0.8 and 2.5 mg/L over the future planning period in the Los Angeles Forebay for all scenarios, equivalent to using 1.1% to 3.7% of the available assimilative capacity. Scenarios that include increased recycled water use for irrigation (Scenarios 2 and 3) result in slightly larger increases in chloride concentration. However, such impacts are reduced under combined future projects (Scenarios 8 through 11), which incorporate the effect of background changes, including reduced overall future water use due to conservation. For all scenarios, chloride concentrations remain below the BSBPO of 150 mg/L, and single and multiple recycled water projects use less than 10% and 20% of the available assimilative capacity, respectively.

As shown in Figure 62 and Table I-19, average simulated nitrate concentrations in groundwater increase very slightly (0.15 mg/L) over the future planning period in the Los Angeles Forebay for all scenarios, equivalent to using 1.5% to 2.4% of the available assimilative capacity. Nitrate concentrations remain well below the BPO of 10 mg/L, and single and multiple recycled water projects use less than 10% and 20% of the available assimilative capacity, respectively.

5.2.2 Montebello Forebay

As shown in Figure 60 and Table I-19, average simulated TDS concentrations in groundwater decrease (between 45.7 and 66.4 mg/L) over the future planning period in the Montebello Forebay for all scenarios. The decrease in TDS concentrations are smaller for scenarios that include GRIP B (Scenario 7, 9, and 11). Nonetheless, TDS concentrations remain below the BSBPO of 700 mg/L for all scenarios, and single and multiple recycled water projects use none of the available assimilative capacity.

As shown in Figure 61 and Table I-19, average simulated chloride concentrations in groundwater both decrease and increase over the future planning period in the Montebello Forebay, depending on the scenario. Slight increases in chloride concentrations (3.6 to 4.0 mg/L) are projected for scenarios that include GRIP B (Scenarios 7, 9, and 11). Such increases are equivalent to using 5.8% to 6.4% of the available assimilative capacity; chloride concentrations decrease in all other scenarios. For all scenarios, chloride concentrations remain below the BSBPO of 150 mg/L, and single and multiple recycled water projects use less than 10% and 20% of the available assimilative capacity, respectively.

As shown in Figure 62 and Table I-19, average simulated nitrate concentrations in groundwater increase very slightly (between 0.02 and 0.22 mg/L) over the future planning period in the Montebello Forebay for all scenarios, equivalent to using 2.5% or less of the available assimilative capacity. Nitrate concentrations remain below the BPO of 10 mg/L, and single and multiple recycled water projects use less than 10% and 20% of the available assimilative capacity, respectively.

5.2.3 Whittier Area

As shown in Figure 60 and Table I-19, average simulated TDS concentrations in groundwater decrease (between 34.2 and 42.1 mg/L) over the future planning period in the Whittier Area for all scenarios. There are very minor differences between scenarios. For all scenarios, TDS concentrations remain below the BSBPO of 700 mg/L, and while some projects slightly increase TDS concentrations relative to the No Future Projects Scenario, single and multiple recycled water projects use none of the available assimilative capacity.

As shown in Figure 61 and Table I-19, average simulated chloride concentrations in groundwater decrease over the future planning period in the Whittier Area for all scenarios (between 1.8 and 3.8 mg/L). Chloride concentrations remain below the BSBPO of 150 mg/L, and while some projects slightly increase chloride concentrations relative to the No Future Projects Scenario, single and multiple recycled water projects use none of the available assimilative capacity.

As shown in Figure 62 and Table I-19, average simulated nitrate concentrations in groundwater increase very slightly (0.05 mg/L) over the future planning period for all scenarios. However, nitrate concentrations remain well below the BPO of 10 mg/L, and single and multiple recycled water projects use less than 10% and 20% of the available assimilative capacity, respectively.

5.2.4 Central Basin Pressure Area

As shown in Figure 60 and Table I-19, average simulated TDS concentrations in groundwater increase (between 18.4 and 22.9 mg/L) over the future planning period in the Central Basin Pressure Area for all scenarios, equivalent to using between 8.0% and 10.0% of the available assimilative capacity. The concentrations are similar for all scenarios including the No Future Projects Scenario. For all scenarios, TDS concentrations remain below the BSBPO of 700 mg/L, and with the exception of Scenario 3 (which uses 10% of the assimilative capacity), scenarios including single and multiple recycled water projects use less than 10% and 20% of the available assimilative capacity, respectively. It is noted that most of the TDS concentration increases occur under No Future Projects conditions, reflecting TDS loading from subsurface inflows and irrigation return flows, not recycled water projects. For example, Scenario 3 results in an additional increase of 1.5 mg/L of TDS relative to the No Future Projects Scenario, equivalent to using an additional 0.6% of the available assimilative capacity.

As shown in Figure 61 and Table I-19, average simulated chloride concentrations in groundwater increase (between 7.5 and 8.7 mg/L) over the future planning period in the Central Basin Pressure Area for all scenarios, equivalent to using between 8.0% and 9.2% of the available assimilative capacity. The chloride concentrations are similar for all scenarios, including the No Future Projects Scenario. For all scenarios, chloride concentrations remain well below the BSBPO of 150 mg/L, and single and multiple recycled water projects use less than 10% and 20% of the available assimilative capacity, respectively. Similar to TDS, most of the chloride loading is associated with No Future Projects conditions, reflecting chloride loading from subsurface inflows and irrigation return flows, not recycled water projects. For example, Scenario 3 results in an additional increase of 0.8 mg/L of chloride relative to the No Future Projects Scenario, equivalent to using an additional 0.8% of the available assimilative capacity.

As shown in Figure 62 and Table I-19, average simulated nitrate concentrations in groundwater increase very slightly (0.13 and 0.14 mg/L) over the future planning period in the Central Basin Pressure Area for all scenarios, equivalent to using between 1.3% and 1.4% of the available assimilative capacity. The nitrate concentrations are similar for all scenarios, including the No Future Projects Scenario. Most of the loading is associated with No Future Projects conditions, reflecting nitrate loading from subsurface inflows and irrigation return flows, not recycled water projects. For all scenarios, concentrations remain well below the BPO of 10 mg/L, and single and multiple recycled water projects use less than 10% and 20% of the available assimilative capacity, respectively.

5.2.5 Central Basin (all subareas, not including coastal area)

Central Basin results are similar to the Central Basin Pressure Area results because the Pressure Area contains the largest volume of groundwater compared to the other subareas within the Central Basin. As shown in Figure 60 and Table I-19, average simulated TDS concentrations in groundwater in the Central Basin increase between 0.7 and 7.7 mg/L over the future planning period for all scenarios, equivalent to using between 0.4% and 4.5% of the available assimilative capacity. TDS concentrations remain well below the BSBPO of 700 mg/L, and single and multiple recycled water projects use less than 10% and 20% of the available assimilative capacity, respectively.

As shown in Figure 261 and Table I-19, average simulated chloride concentrations in groundwater increase (between 4.8 and 6.5 mg/L) over the future planning period in the Central Basin for all scenarios, equivalent to using 5.8% to 7.8% of the available assimilative capacity. Chloride concentrations remain well below the BSBPO of 150 mg/L, and single and multiple recycled water projects use less than 10% and 20% of the available assimilative capacity, respectively.

As shown in Figure 62 and Table I-19, average simulated nitrate concentrations in groundwater increase very slightly (between 0.11 and 0.15 mg/L) over the future planning period in the Central Basin for all scenarios, equivalent to using between 1.1% and 1.5% of the available assimilative capacity. Nitrate concentrations remain well below the BPO of 10 mg/L, and single and multiple recycled water projects use less than 10% and 20% of the available assimilative capacity, respectively.

5.2.6 West Coast Basin (not including coastal areas)

As shown in Figure 60 and Table I-19, average simulated TDS concentrations in groundwater decrease (between 20.6 and 57.4 mg/L) over the future planning period in the West Coast Basin for all scenarios. However, TDS concentrations are above the BSBPO of 800 mg/L due to historical seawater intrusion, and there is no available assimilative capacity for TDS when the saline plume is included in the calculation of the basin average. Nonetheless, TDS concentrations continue to decline as a result of existing implementation measures, including the basin adjudication to limit pumping and operation of the seawater barriers and desalter facilities. Proposed implementation measures, as further discussed in Appendix J *Implementation Plan* of the SNMP, including increased injection of AWT recycled water at the seawater barriers and increased groundwater pump and treat by the desalters, are expected to further improve groundwater quality in the future.

As shown in Figure 61 and Table I-19, average simulated chloride concentrations in groundwater decrease (between 22.4 and 34.7 mg/L) over the future planning period in the West Coast Basin for all scenarios. However, chloride concentrations are above the BSBPO of 250 mg/L due to historical seawater intrusion, and there is no available assimilative capacity for chloride when the saline plume is included in the calculation of the basin average. Chloride concentrations continue to decline due to existing implementation measures, including the basin adjudication to limit pumping and operation of the seawater barriers and desalter facilities. Proposed implementation measures, as further discussed in Appendix J *Implementation Plan* of the SNMP, including increased injection of AWT recycled water at the seawater barriers and increased groundwater pump and treat by the desalters, are expected to further improve groundwater quality in the future.

As shown in Figure 62 and Table I-19, average simulated nitrate concentrations in groundwater increase very slightly (between 0.06 and 0.07 mg/L) over the future planning period in the West Coast Basin for all scenarios, equivalent to using between 0.6% and 0.7% of the available assimilative capacity. Concentrations remain well below the BPO of 10 mg/L for all scenarios. Overall, single and multiple recycled water projects use less than 10% and 20% of the available assimilative capacity, respectively.

5.3 Future Project Impacts on Groundwater Quality

Figures 14, 15, and 16 illustrate the groundwater quality impacts and use of assimilative capacity (results from Table I-19) graphically for TDS, chloride, and nitrate-N, respectively, for (from top to bottom) the Los Angeles Forebay, Montebello Forebay, Whittier Area, and Central Basin Pressure Area, as well as for the entire Central Basin and West Coast Basin. In the figures, the "Overall Scenario" results (which include baseline conditions) are depicted along the first and third columns from the left and the "Scenario minus Baseline Conditions," which provides the impacts of the indicated project/scenario in isolation of baseline conditions or background loading associated with existing projects, are depicted along the second and fourth columns from the left. Impacts in terms of the S/N concentration (two far left columns) and use of assimilative capacity (two far right columns) are provided. As shown in Figures 14 and 15, there is no available assimilative capacity in the West Coast Basin for TDS and chloride due to historical seawater intrusion. In the Whittier Area, there is no available assimilative capacity for TDS due to naturally occurring conditions associated with marine source rocks in the underlying aquifers (see Section 5.3.1.2 in the SNMP and Appendix G *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality* for further details).

5.3.1 Scenarios 2 and 3 – Increased Recycled Water for Irrigation

As described in Section 2.3, Scenarios 2 and 3 were simulated by the SNMP mixing model to determine potential groundwater quality impacts associated with increased use of recycled water for irrigation. For Scenario 2, S/N concentrations in the recycled water are equivalent to baseline period average concentrations. For Scenario 3, S/N concentrations in the recycled water are equivalent to the SMCLs for TDS and chloride and the MCL for nitrate, which are greater than the baseline period average S/N concentrations.

Figures 14 and 15 and Table I-19 show that increased recycled water use for irrigation only slightly increases TDS and chloride concentrations in groundwater and uses a minimal amount of the available assimilative capacity, significantly less than 10%. Thus, recycled water with higher salt concentrations (TDS and chloride at SMCLs) results in slightly higher salt loading than recycled water with baseline period average salt concentrations. The increased recycled water use for irrigation has no impact on nitrate loading (Figure 16). Overall, Figures 14 through 16 illustrate that the use of recycled water impacts all subareas and the basins has a whole at similar levels, since irrigation occurs in all areas. However, recycled water use for irrigation has minimal impacts on groundwater quality in the CBWCB and these minor impacts are more than offset by other projects that reduce S/N loading.

Because the negative water quality impacts of increased recycled water use for irrigation have been demonstrated in the SNMP to be minor and more than offset by implementation measures and projects that improve groundwater quality, the SNMP may be used to modify currently permitted recycled water quality limits established for non-potable reuse (irrigation, industrial and recreational activities) and provide a basis for streamlining the permitting process for future recycled water projects, per the Recycled Water Policy and the Governor's recent drought proclamations (refer to Section 9.3 in the SNMP). In particular, irrigation with recycled water has very minor impacts on groundwater quality and thus, permits for individual irrigation sites does not appear warranted. As a result, TDS, chloride, and nitrate standards for recycled water used for irrigation and other non-potable reuse applications can be set equivalent to SMCLs/MCL, while still protecting groundwater quality and preserving beneficial uses.

5.3.2 Scenario 4 – Seawater Intrusion Barriers

As described in Section 2.3, Scenario 4 was simulated by the SNMP mixing model to determine potential groundwater quality impacts associated with proposed seawater intrusion barrier projects that would increase injection volumes and increase the use of AWT recycled water to completely replace imported water at all three seawater barriers (AGB, DGB, and WCBB). Figures 14 and 15 and Table I-19 show that Scenario 4 would decrease TDS and chloride concentrations in the Central Basin Pressure Area, the entire Central Basin, and the entire West Coast Basin, since these are the areas where the seawater barriers are located. Scenario 4 has no impact on nitrate loading (Figure 16) because nitrate concentrations in imported water and AWT recycled water are both very low. Overall, the proposed seawater barrier projects would significantly improve TDS and chloride groundwater quality in both basins, especially in the West Coast Basin and accordingly, these projects were designated as an implementation measure, as further discussed in Appendix J *Implementation Plan* of the SNMP. As a result, this SNMP may be used to provide a basis for streamlining the permitting process for future AWT recycled water projects, per the Recycled Water Policy.

5.3.3 Scenario 5 – Desalters

As described in Section 2.3, Scenario 5 was simulated by the SNMP mixing model to determine potential groundwater quality impacts associated with proposed desalter projects that would increase the pumping and treatment of seawater-impacted groundwater in the West Coast Basin. Figures 14 and 15 and Table I-19 show that Scenario 5 would decrease TDS and chloride concentrations in the West Coast Basin, where the desalters are located. The desalters have no impact on nitrate loading (Figure 16) because nitrate concentrations in the saline plume are the same as in ambient groundwater. Overall, the proposed desalter projects would significantly improve TDS and chloride groundwater quality in the West Coast Basin and accordingly, these projects were designated as an implementation measure, as further discussed in Appendix J *Implementation Plan* of the SNMP.

5.3.4 Scenarios 6 and 7 – GRIP A and GRIP B

As stated in Section 2.3, WRD established GRIP to completely replace imported water (up to 21,000 AFY) with reliable alternative water supplies (e.g. recycled water) for recharge at the MFSG. Two project alternatives, GRIP A (Scenario 6) and GRIP B (Scenario 7), are currently being evaluated for implementation, so their potential groundwater quality impacts were simulated separately by the SNMP mixing model. Both alternatives would result in the same total recharge volumes at the MFSG; however, the recycled water quality would be different under the different scenarios.

Figures 14, 15, and 16 and Table I-19 show that impacts from the GRIP scenarios are greatest in the Montebello Forebay, where the project will be implemented. GRIP A has negligible impacts on groundwater quality, decreasing TDS slightly and increasing chloride and nitrate very slightly in the Central Basin. This is because the AWT/tertiary-treated recycled water blend ratio for GRIP A mirrors the average imported water quality that it is replacing for recharge at the MFSG. GRIP B would increase TDS, chloride, and nitrate concentrations compared with the No Future Projects Scenario. However, GRIP B would not cause S/N concentrations to exceed BPO/BSBPOs or utilize more than 10% of the available assimilative capacity in the Central Basin. Minor negative groundwater quality impacts associated with GRIP B are more than offset by the positive impacts of other projects and implementation measures.

While groundwater quality impacts from GRIP B are greater than GRIP A, the costs of GRIP A are significantly higher than GRIP B. As presented in Appendix J *Implementation Plan* in the SNMP, estimated costs for GRIP A are $779M, while estimated costs for GRIP B are $182M (CH2MHILL, 2012a)[2]. Thus, water quality benefits must be weighed against costs and other evaluation criteria. Because of the negligible impacts of GRIP A and the minor negative water quality impacts of GRIP B overall in the Central Basin, this SNMP may be used to provide a basis for streamlining the permitting process for GRIP projects (and other recycled water projects) in the future, per the Recycled Water Policy and the Governor's recent drought proclamations (refer to Section 9.3 in the SNMP).

5.3.5 Scenarios 8, 9, 10, and 11 – Combined Projects/Scenarios

As described in Section 2.3, Scenarios 8 through 11 were simulated by the SNMP mixing model to determine potential groundwater quality impacts associated with combinations of proposed projects/scenarios, which also include minor future changes (i.e. increased and decreased imported water for supply in the West Coast Basin and Central Basin, respectively, and increased stormwater capture). Figures 14, 15, and 16 and Table I-19 show that Scenarios 8 through 11 would result in small increases in TDS, chloride, and nitrate concentrations in groundwater in the Central Basin. However, S/N concentrations do not exceed BPO/BSBPOs by 2025 and multiple recycled water projects do not utilize more than 20% (or even 10%) of the available assimilative capacity in the Central Basin. In the West Coast Basin, Scenarios 8 through 11 would result in decreasing TDS and chloride concentrations in groundwater. There is a very small increase in nitrate concentrations, which is insignificant given the very low nitrate concentration in ambient groundwater.

5.3.6 Summary of Impacts of Future Scenarios

Table I-20 summarizes overall changes in groundwater quality, impacts on BPO/BSBPOs, and use of assimilative capacity for each of the scenarios in terms of TDS, chloride, and nitrate in groundwater in the Central Basin. The table quantifies the impacts of average baseline conditions continued through the future planning period (No Future Projects Scenario) plus the indicated future project or project combinations. **Table I-21** quantifies the impacts of future project(s) solely, i.e. excluding the impact of average baseline conditions continued through the future planning period. Thus, Table I-20 illustrates total impacts, while Table I-21 illustrates the impacts of just the project or combined projects without the contributions of baseline conditions or background loading associated with existing projects. **Tables I-22** and **I-23** show similar predictions for the West Coast Basin for the overall scenarios and for the isolated project or project combinations, respectively. Increased Stormwater Capture is listed as a scenario in Tables I-20 through I-23 to summarize the expected general impacts. Because stormwater capture projects could not be quantified in terms of increased recharge volumes and S/N concentrations (with the exception of stormwater capture in the MFSG and DGSG), this scenario could not be simulated by the SNMP mixing model. Nonetheless, increased

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[2] Capital costs include construction of treatment and conveyance facilities; injection; flow equalization; sewer connection fees, and flow diversion costs; and O&M costs including facilities O&M, recycled water purchase, and sewer surcharge fee.

Table I-20 Summary of Groundwater Quality Impacts of Overall Future Scenarios [b] in the Central Basin in 2025

Scenario [a]	CENTRAL BASIN WATER QUALITY IMPACTS IN 2025								
	TDS			Chloride			Nitrate-N		
	Concentration	BSBPO 700 mg/L	Use of AC	Concentration	BSBPO 150 mg/L	Use of AC	Concentration	BPO 10 mg/L	Use of AC
1. No Future Projects (baseline conditions only)	Increase 4.6 mg/L	Not exceeded	2.7%	Increase 5.1 mg/L	Not exceeded	6.1%	Increase 0.11 mg/L	Not exceeded	1.1%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 533 mg/L and AC of 167 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 72 mg/L and AC of 78 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.39 mg/L and AC of 9.61 mg/L in 2025		
2. Increased Recycled Water for Irrigation (baseline period average WQ)	Increase 5.8 mg/L	Not exceeded	3.4%	Increase 5.4 mg/L	Not exceeded	6.4%	Increase 0.11 mg/L	Not exceeded	1.1%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 534 mg/L and AC of 166 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 72 mg/L and AC of 78 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.39 mg/L and AC of 9.61 mg/L in 2025		
3. Increased Recycled Water for Irrigation (WQ at SMCLs/MCL)	Increase 6.2 mg/L	Not Exceeded	3.6%	Increase 5.9 mg/L	Not exceeded	7.1%	Increase 0.11 mg/L	Not exceeded	1.1%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 535 mg/L and AC of 165 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 73 mg/L and AC of 77 mg/L in 2035			NOT A CONCERN (BELOW BPO) Projected concentration of 0.39 mg/L and AC of 9.61 mg/L in 2025		
4. Seawater Barriers (increased injection volume and AWT RW)	Increase 2.8 mg/L	Not exceeded	1.6%	Increase 4.8 mg/L	Not exceeded	5.8%	Increase 0.11 mg/L	Not exceeded	1.1%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 531 mg/L and AC of 169 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 71 mg/L and AC of 79 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.39 mg/L and AC of 9.61 mg/L in 2025		
5. Desalters (increased groundwater pump and treat)	Increase 4.6 mg/L	Not Exceeded	2.7%	Increase 5.1 mg/L	Not exceeded	6.1%	Increase 0.11 mg/L	Not exceeded	1.1%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 533 mg/L and AC of 167 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 72 mg/L and AC of 78 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.39 mg/L and AC of 9.61 mg/L in 2025		
6. GRIP A (10K AFY AWT & 11K tertiary-treated RW)	Increase 4.1 mg/L	Not Exceeded	2.4%	Increase 5.5 mg/L	Not exceeded	6.6%	Increase 0.14 mg/L	Not exceeded	1.4%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 533 mg/L and AC of 167 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 72 mg/L and AC of 78 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.42 mg/L and AC of 9.58 mg/L in 2025		
7. GRIP B (21K AFY tertiary-treated RW)	Increase 7.7 mg/L	Not exceeded	4.5%	Increase 6.4 mg/L	Not exceeded	7.7%	Increase 0.15 mg/L	Not exceeded	1.5%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 536 mg/L and AC of 164 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 73 mg/L and AC of 77 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.43 mg/L and AC of 9.57 mg/L in 2025		
8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)	Increase 0.7 mg/L	Not exceeded	0.4%	Increase 5.0 mg/L	Not exceeded	6.0%	Increase 0.14 mg/L	Not exceeded	1.4%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 529 mg/L and AC of 171 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 72 mg/L and AC of 78 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.42 mg/L and AC of 9.58 mg/L in 2025		
9. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)	Increase 4.2 mg/L	Not exceeded	2.5%	Increase 5.9 mg/L	Not exceeded	7.1%	Increase 0.15 mg/L	Not exceeded	1.5%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 533 mg/L and AC of 167 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 73 mg/L and AC of 77 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.43 mg/L and AC of 9.57 mg/L in 2025		
10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)	Increase 1.1 mg/L	Not exceeded	0.7%	Increase 5.6 mg/L	Not exceeded	6.7%	Increase 0.14 mg/L	Not exceeded	1.4%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 530 mg/L and AC of 170 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 72 mg/L and AC of 78 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.42 mg/L and AC of 9.58 mg/L in 2025		
11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)	Increase 4.7 mg/L	Not exceeded	2.8%	Increase 6.5 mg/L	Not exceeded	7.8%	Increase 0.15 mg/L	Not exceeded	1.5%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 533 mg/L and AC of 167 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 73 mg/L and AC of 77 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.43 mg/L and AC of 9.57 mg/L in 2025		
Increased Stormwater Capture	Decrease	Not exceeded	Not available	Decrease	Not exceeded	Not available	Decrease	Not exceeded	Not available

a – Minor Future Changes, as referenced for all combined scenarios (8, 9, 10, and 11), include decreased imported water use for supply in the Central Basin, slightly increased imported water for supply in the West Coast Basin, and increased stormwater capture at the DGSG and other facilities

b - Quantifies the impacts of average baseline conditions continued through the future planning horizon (No Future Projects Scenario) plus the indicated future project/scenario

WQ – water quality
MCL – primary maximum contaminant level
SMCL – secondary maximum contaminant level
mg/L – milligrams per liter
Nitrate-N – nitrate as nitrogen
TDS – total dissolved solids
BPO – Basin Plan Objective
BSBPO – Basin-Specific Basin Plan Objective
GRIP – Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A
GRIP B – GRIP Recycled Water Project B
DGSG – Dominguez Gap Spreading Grounds
AWT – advanced water treatment
RW – recycled water
AC – assimilative capacity
AFY – acre-feet per year
K – thousands

(green box) – groundwater quality improvement
(orange box) – groundwater quality decline

Table I-21 Summary of Groundwater Quality Impacts of Future Scenarios Minus Baseline Conditions [b] in the Central Basin in 2025

Scenario [a]	CENTRAL BASIN WATER QUALITY IMPACTS IN 2025								
	TDS			Chloride			Nitrate-N		
	Concentration	BSBPO 700 mg/L	Use of AC	Concentration	BSBPO 150 mg/L	Use of AC	Concentration	BPO 10 mg/L	Use of AC
1. No Future Projects (baseline conditions only)	Increase 4.6 mg/L	Not exceeded	2.7%	Increase 5.1 mg/L	Not exceeded	6.1%	Increase 0.11 mg/L	Not exceeded	1.1%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 533 mg/L and AC of 167 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 72 mg/L and AC of 78 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.39 mg/L and AC of 9.61 mg/L in 2025		
2. Increased Recycled Water for Irrigation (baseline average WQ)	Increase 1.2 mg/L	Not exceeded	0.7%	Increase 0.3 mg/L	Not exceeded	0.3%	No change 0.0 mg/L	Not exceeded	0%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 530 mg/L and AC of 170 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 67 mg/L and AC of 83 mg/L in 2025			NO EFFECT ON WQ Projected concentration of 0.28 mg/L and AC of 9.72 mg/L in 2025		
3. Increased Recycled Water for Irrigation (MCL or SMCL WQ)	Increase 1.6 mg/L	Not Exceeded	0.9%	Increase 50.8 mg/L	Not exceeded	1.0%	No Change 0.0 mg/L	Not exceeded	0%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 530 mg/L and AC of 170 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 67 mg/L and AC of 83 mg/L in 2035			NO EFFECT ON WQ Projected concentration of 0.28 mg/L and AC of 9.72 mg/L in 2025		
4. Seawater Barriers (increased injection volume and AWT RW)	Decrease -1.8 mg/L	Not exceeded	-1.1%	Decrease -0.3 mg/L	Not exceeded	-0.3%	No change 0.0 mg/L	Not exceeded	0%
	WQ IMPROVEMENT Projected concentration of 527 mg/L and AC of 173 mg/L in 2025			WQ IMPROVEMENT Projected concentration of 66 mg/L and AC of 84 mg/L in 2025			NO EFFECT ON WQ Projected concentration of 0.28 mg/L and AC of 9.72 mg/L in 2025		
5. Desalters (increased groundwater pump and treat)	No Change 0.0 mg/L	Not Exceeded	0%	No change 0.0 mg/L	Not exceeded	0%	No change 0.0 mg/L	Not exceeded	0%
	NO EFFECT ON WQ Projected concentration of 529 mg/L and AC of 171 mg/L in 2025			NO EFFECT ON WQ Projected concentration of 67 mg/L and AC of 83 mg/L in 2025			NO EFFECT ON WQ Projected concentration of 0.28 mg/L and AC of 9.72 mg/L in 2025		
6. GRIP A (10K AFY AWT & 11K tertiary-treated RW)	Decrease -0.5 mg/L	Not Exceeded	-0.3%	Increase 0.4 mg/L	Not exceeded	0.5%	Increase 0.03 mg/L	Not exceeded	0.3%
	WQ IMPROVEMENT Projected concentration of 528 mg/L and AC of 172 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 67 mg/L and AC of 83 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.31 mg/L and AC of 9.69 mg/L in 2025		
7. GRIP B (21K AFY tertiary-treated RW)	Increase 3.1 mg/L	Not exceeded	1.8%	Increase 1.3 mg/L	Not exceeded	1.5%	Increase 0.04 mg/L	Not exceeded	0.4%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 532 mg/L and AC of 168 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 68 mg/L and AC of 82 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.32 mg/L and AC of 9.68 mg/L in 2025		
8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)	Decrease -4.0 mg/L	Not Exceeded	-2.3%	Decrease -0.1 mg/L	Not exceeded	-0.1%	Increase 0.03 mg/L	Not exceeded	0.3%
	WQ IMPROVEMENT Projected concentration of 525 mg/L and AC of 175 mg/L in 2025			WQ IMPROVEMENT Projected concentration of 67 mg/L and AC of 83 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.31 mg/L and AC of 9.69 mg/L in 2025		
9. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)	Decrease -0.4 mg/L	Not exceeded	-0.2%	Increase 0.8 mg/L	Not exceeded	0.9%	Increase 0.04 mg/L	Not exceeded	0.4%
	WQ IMPROVEMENT Projected concentration of 528 mg/L and AC of 172 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 67 mg/L and AC of 83 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.32 mg/L and AC of 9.68 mg/L in 2025		
10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)	Decrease -3.5 mg/L	Not exceeded	-2.0%	Increase 0.5 mg/L	Not exceeded	0.6%	Increase 0.03 mg/L	Not exceeded	0.3%
	WQ IMPROVEMENT Projected concentration of 525 mg/L and AC of 175 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 67 mg/L and AC of 83 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.31 mg/L and AC of 9.69 mg/L in 2025		
11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)	Increase 0.1 mg/L	Not exceeded	0.1%	Increase 1.3 mg/L	Not exceeded	1.6%	Increase 0.04 mg/L	Not exceeded	0.4%
	NOT A CONCERN (BELOW BSBPO) Projected concentration of 529 mg/L and AC of 171 mg/L in 2025			NOT A CONCERN (BELOW BSBPO) Projected concentration of 68 mg/L and AC of 82 mg/L in 2025			NOT A CONCERN (BELOW BPO) Projected concentration of 0.32 mg/L and AC of 9.68 mg/L in 2025		
Increased Stormwater Capture	Decrease	Not exceeded	Not available	Decrease	Not exceeded	Not available	Decrease	Not exceeded	Not available

a – Minor Future Changes, as referenced for all combined scenarios (8, 9, 10, and 11), include decreased imported water use for supply in the Central Basin, slightly increased imported water for supply in the West Coast Basin, and increased stormwater capture at the DGSG and other facilities

b - Quantifies the impacts of average baseline conditions continued through the future planning horizon (No Future Projects Scenario) plus the indicated future project/scenario

WQ – water quality
MCL – primary maximum contaminant level
SMCL – secondary maximum contaminant level
mg/L – milligrams per liter
Nitrate-N – nitrate as nitrogen
TDS – total dissolved solids
BPO – Basin Plan Objective
BSBPO – Basin-Specific Basin Plan Objective
GRIP – Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A
GRIP B – GRIP Recycled Water Project B
AWT – advanced water treatment
RW – recycled water
AC – assimilative capacity
AFY – acre-feet per year
K – thousands

[green box] – groundwater quality improvement
[orange box] – groundwater quality decline

Table I-22 Summary of Groundwater Quality Impacts of Overall Future Scenarios [b] in the West Coast Basin in 2025

Scenario [a]	WEST COAST BASIN WATER QUALITY IMPACTS IN 2025								
	TDS			Chloride			Nitrate-N		
	Concentration	BSBPO 800 mg/L	Use of AC	Concentration	BSBPO 250 mg/L	Use of AC	Concentration	BPO 10 mg/L	Use of AC
1. No Future Projects (baseline conditions only)	Decrease -23.0 mg/L	Currently exceeded	None available	Decrease -23.6 mg/L	Currently exceeded	None available	Increase 0.07 mg/L	Not exceeded	0.7%
	WQ IMPROVEMENT Projected concentration of 867 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 282 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.12 mg/L and AC of 9.88 mg/L in 2025		
2. Increased Recycled Water for Irrigation (baseline average WQ)	Decrease -21.3 mg/L	Currently exceeded	None available	Decrease -23.0 mg/L	Currently exceeded	None available	Increase 0.07 mg/L	Not exceeded	0.7%
	WQ IMPROVEMENT Projected concentration of 869 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 283 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.12 mg/L and AC of 9.88 mg/L in 2025		
3. Increased Recycled Water for Irrigation (MCL or SMCL WQ)	Decrease -20.6 mg/L	Currently exceeded	None available	Decrease -22.4 mg/L	Currently exceeded	None available	Increase 0.07 mg/L	Not exceeded	0.7%
	WQ IMPROVEMENT Projected concentration of 869 mg/L and concentrations declining			WQ IMPROVEMENT Projected concentration of 284 mg/L and concentrations declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.12 mg/L and AC of 9.88 mg/L in 2025		
4. Seawater Barriers (increased injection volume and AWT RW)	Decrease -41.0 mg/L	Currently exceeded	None available	Decrease -28.3 mg/L	Currently exceeded	None available	Increase 0.06 mg/L	Not exceeded	0.6%
	WQ IMPROVEMENT Projected concentration of 849 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 278 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.11 mg/L and AC of 9.89 mg/L in 2025		
5. Desalters (increased groundwater pump and treat)	Decrease -36.6 mg/L	Currently exceeded	None available	Decrease -29.4 mg/L	Currently exceeded	None available	Increase 0.07 mg/L	Not exceeded	0.7%
	WQ IMPROVEMENT Projected concentration of 853 mg/L and concentrations declining			WQ IMPROVEMENT Projected concentration of 276 mg/L and concentrations declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.12 mg/L and AC of 9.88 mg/L in 2025		
6. GRIP A (10K AFY AWT & 11K tertiary-treated RW)	Decrease -23.0 mg/L	Currently exceeded	None available	Decrease -23.6 mg/L	Currently exceeded	None available	Increase 0.07 mg/L	Not exceeded	0.7%
	WQ IMPROVEMENT Projected concentration of 867 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 282 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.12 mg/L and AC of 9.88 mg/L in 2025		
7. GRIP B (21K AFY tertiary-treated RW)	Decrease -23.0 mg/L	Currently exceeded	None available	Decrease -23.6 mg/L	Currently exceeded	None available	Increase 0.07 mg/L	Not exceeded	0.7%
	WQ IMPROVEMENT Projected concentration of 867 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 282 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.12 mg/L and AC of 9.88 mg/L in 2025		
8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)	Decrease -57.4 mg/L	Currently exceeded	None available	Decrease -34.7 mg/L	Currently exceeded	None available	Increase 0.06 mg/L	Not exceeded	0.6%
	WQ IMPROVEMENT Projected concentration of 833 mg/L and concentrations declining			WQ IMPROVEMENT Projected concentration of 271 mg/L and concentrations declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.11 mg/L and AC of 9.89 mg/L in 2025		
9. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)	Decrease -57.3 mg/L	Currently exceeded	None available	Decrease -34.7 mg/L	Currently exceeded	None available	Increase 0.06 mg/L	Not exceeded	0.6%
	WQ IMPROVEMENT Projected concentration of 833 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 271 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.11 mg/L and AC of 9.89 mg/L in 2025		
10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)	Decrease -56.8 mg/L	Currently exceeded	None available	Decrease -34.1 mg/L	Currently exceeded	None available	Increase 0.06 mg/L	Not exceeded	0.6%
	WQ IMPROVEMENT Projected concentration of 833 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 272 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.11 mg/L and AC of 9.89 mg/L in 2025		
11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)	Decrease -56.7 mg/L	Currently exceeded	None available	Decrease -34.1 mg/L	Currently exceeded	None available	Increase 0.06 mg/L	Not exceeded	0.6%
	WQ IMPROVEMENT Projected concentration of 833 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 272 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.11 mg/L and AC of 9.89 mg/L in 2025		
Increased Stormwater Capture	Decrease	Currently exceeded	Not available	Decrease	Currently exceeded	Not available	Decrease	Not exceeded	Not available

a – Minor Future Changes, as referenced for all combined scenarios (8, 9, 10, and 11), include decreased imported water use for supply in the Central Basin, slightly increased imported water for supply in the West Coast Basin, and increased stormwater capture at the DGSG and other facilities

b - Quantifies the impacts of average baseline conditions continued through the future planning horizon (No Future Projects Scenario) plus the indicated future project/scenario

WQ – water quality
MCL – primary maximum contaminant level
SMCL – secondary maximum contaminant level
mg/L – milligrams per liter
Nitrate-N – nitrate as nitrogen
TDS – total dissolved solids
BPO – Basin Plan Objective
BSBPO – Basin-Specific Basin Plan Objective
GRIP – Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A
GRIP B – GRIP Recycled Water Project B
AWT – advanced water treatment
RW – recycled water
AC – assimilative capacity
AFY – acre-feet per year
K – thousands

(green box) – groundwater quality improvement
(peach box) – groundwater quality decline

Table I-23 Summary of Groundwater Quality Impacts of Future Scenarios Minus Baseline Conditions [b] in the West Coast Basin in 2025

Scenario [a]	WEST COAST BASIN WATER QUALITY IMPACTS IN 2025								
	TDS			Chloride			Nitrate-N		
	Concentration	BSBPO 800 mg/L	Use of AC	Concentration	BSBPO 250 mg/L	Use of AC	Concentration	BPO 10 mg/L	Use of AC
1. No Future Projects (baseline conditions only)	Decrease -23.0 mg/L	Currently exceeded	None available	Decrease -23.6 mg/L	Currently exceeded	None available	Increase 0.07 mg/L	Not exceeded	0.7%
	WQ IMPROVEMENT Projected concentration of 867 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 282 mg/L and concentrations are declining			NOT A CONCERN (BELOW BPO) Projected concentration of 0.12 mg/L and AC of 9.88 mg/L in 2025		
2. Increased Recycled Water for Irrigation (baseline average WQ)	Increase 1.7 mg/L	Currently exceeded	None available	Increase 0.6 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	NOT A CONCERN (MINIMAL IMPACT) Projected concentration of 892 mg/L and increase is minimal			NOT A CONCERN (MINIMAL IMPACT) Projected concentration of 307 mg/L and increase is minimal			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
3. Increased Recycled Water for Irrigation (MCL or SMCL WQ)	Increase 2.4 mg/L	Currently exceeded	None available	Increase 1.3 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	NOT A CONCERN (MINIMAL IMPACT) Projected concentration of 892 mg/L and increase is minimal			NOT A CONCERN (MINIMAL IMPACT) Projected concentration of 284 mg/L and increase is minimal			NOT A CONCERN Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
4. Seawater Barriers (increased injection volume and AWT RW)	Decrease -18.0 mg/L	Currently exceeded	None available	Decrease -4.7 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	WQ IMPROVEMENT Projected concentration of 872 mg/L and concentration are declining			WQ IMPROVEMENT Projected concentration of 301 mg/L and concentration are declining			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
5. Desalters (increased groundwater pump and treat)	Decrease -13.6 mg/L	Currently exceeded	None available	Decrease -5.8 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	WQ IMPROVEMENT Projected concentration of 876 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 300 mg/L and concentrations are declining			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
6. GRIP A (10K AFY AWT & 11K tertiary-treated RW)	No Change 0.0 mg/L	Currently exceeded	None available	No Change 0.0 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	NO EFFECT ON WQ Projected concentration of 890 mg/L and concentrations are declining			NO EFFECT ON WQ Projected concentration of 306 mg/L and concentrations are declining			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
7. GRIP B (21K AFY tertiary-treated RW)	Increase 0.1 mg/L	Currently exceeded	None available	No Change 0.0 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	NOT A CONCERN (MINIMAL IMPACT) Projected concentration of 890 mg/L and increase is minimal			NO EFFECT ON WQ Projected concentration of 306 mg/L and concentrations are declining			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)	Decrease -34.4 mg/L	Currently exceeded	None available	Decrease -11.1 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	WQ IMPROVEMENT Projected concentration of 856 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 295 mg/L and concentrations are declining			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
9. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)	Decrease -34.3 mg/L	Currently exceeded	None available	Decrease -11.1 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	WQ IMPROVEMENT Projected concentration of 856 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 295 mg/L and concentrations are declining			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)	Decrease -33.8 mg/L	Currently exceeded	None available	Decrease -10.5 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	WQ IMPROVEMENT Projected concentration of 856 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 295 mg/L and concentrations are declining			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)	Decrease -33.7 mg/L	Currently exceeded	None available	Decrease -10.4 mg/L	Currently exceeded	None available	No Change 0.00 mg/L	Not exceeded	0.0%
	WQ IMPROVEMENT Projected concentration of 856 mg/L and concentrations are declining			WQ IMPROVEMENT Projected concentration of 295 mg/L and concentrations are declining			NO EFFECT ON WQ Projected concentration of 0.05 mg/L and AC of 9.95 mg/L in 2025		
Increased Stormwater Capture	Decrease	Currently exceeded	Not available	Decrease	Currently exceeded	Not available	Decrease	Not exceeded	Not available

a – Minor Future Changes, as referenced for all combined scenarios (8, 9, 10, and 11), include decreased imported water use for supply in the Central Basin, slightly increased imported water for supply in the West Coast Basin, and increased stormwater capture at the DGSG and other facilities

b - Quantifies the impacts of average baseline conditions continued through the future planning horizon (No Future Projects Scenario) plus the indicated future project/scenario

WQ – water quality
MCL – primary maximum contaminant level
SMCL – secondary maximum contaminant level
mg/L – milligrams per liter
Nitrate-N – nitrate as nitrogen
TDS – total dissolved solids
BPO – Basin Plan Objective
BSBPO – Basin-Specific Basin Plan Objective
GRIP – Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A
GRIP B – GRIP Recycled Water Project B
AWT – advanced water treatment
RW – recycled water
AC – assimilative capacity
AFY – acre-feet per year
K – thousands

(green) – groundwater quality improvement
(peach) – groundwater quality decline

stormwater capture is expected to improve groundwater quality due to the relatively high quality water associated with surface water and stormwater. Various enhanced stormwater capture projects are in place and planned for the CBWCB and the new Waste Discharge Requirements for Municipal Separate Sewer System (MS4) discharges within the coastal watersheds of Los Angeles County are expected to result in increased stormwater recharge and improved surface water quality (LARWQCB, 2012b) and thus, were designated as implementation measures (see Appendix J of the SNMP).

While some scenarios increase S/N concentrations, the increases over the future planning period are small and S/N concentrations will not exceed BPO/BSBPOs in the Central Basin. Additionally, multiple recycled water projects do not use more than 20% (or even 10%) of the available assimilative capacity. Future projects generally will improve groundwater quality in the West Coast Basin. While increased recycled water for irrigation will increase S/Ns in groundwater during the future planning period, the increases are very small. Due to existing elevated TDS and chloride concentrations in the West Coast Basin associated with historical seawater intrusion, there is no available assimilative capacity for these constituents. Nonetheless, TDS and chloride concentrations are anticipated to achieve BPO/BSBPOs beyond the future planning period as discussed in Section 5.4 *Groundwater Quality Projections Beyond WY 2024-25*.

5.4 Groundwater Quality Projections Beyond Water Year 2024-25

When groundwater quality projections were presented at the December 2012 CBWCB SNMP Stakeholder Workshop, two questions were raised by the CBWCB stakeholders:

- When will TDS and chloride in the West Coast Basin reach BSBPOs?
- Will the 20% assimilative capacity threshold for TDS and chloride be reached in the Central Basin Pressure Area in the future?

In order to answer these questions, the SNMP mixing model was used to simulate future conditions through WY 2049-50. It is noted, that as projections are extended into the future, uncertainties increase with respect to underlying baseline condition assumptions and future projects and implementation measures. Therefore, the projected dates are considered estimates. Figures I-D-1, I-D-2, and I-D-3 in **Attachment I-D** show TDS, chloride, and nitrate concentrations in groundwater, respectively, projected out to WY 2049-50. Based on the analysis, the BSBPO for TDS (800 mg/L) and chloride (250 mg/L) are estimated to be reached by about 2034 and 2035, respectively, under Scenarios 8 through 11 (combined projects/scenarios) in the West Coast Basin.

The WY 2049-50 projections indicate that the 20% assimilative capacity threshold for TDS and chloride in the Central Basin Pressure Area (or any other subareas or basins) are not anticipated to be reached by WY 2049-50 under the combined scenarios. TDS and chloride concentrations show asymptotic trends or a leveling off of the increasing trends in the future.

The simulation of water quality conditions through WY 2049-50 was conducted solely for informational purposes. As part of the 10-year periodic review of the SNMP, basin conditions will be updated based on the most current available data and groundwater quality projections will be adjusted accordingly.

6 Anti-Degradation Assessment

Section 9 *Anti-Degradation* of the SWRCB Recycled Water Policy states:

a. *The State Water Board* [SWRCB] *adopted Resolution No. 68-16 as a policy statement to implement the Legislature's intent that waters of the state shall be regulated to achieve the highest water quality consistent with the maximum benefit to the people of the state.*

b. *Activities involving the disposal of waste that could impact high quality waters are required to implement best practicable treatment or control of the discharge necessary to ensure that pollution or nuisance will not occur, and the highest water quality consistent with the maximum benefit to the people of the state will be maintained.*

c. *Groundwater recharge with recycled water for later extraction and use in accordance with this Policy and state and federal water quality law is to the benefit of the people of the state of California. Nonetheless, the State Water Board finds that groundwater recharge projects using recycled water have the potential to lower water quality within a basin. The proponent of a groundwater recharge project must demonstrate compliance with Resolution No. 68-16. Until such time as a salt/nutrient management plan is in effect, such compliance may be demonstrated as follows:*

   (1) A project that utilizes less than 10 percent of the available assimilative capacity in a basin/sub-basin (or multiple projects utilizing less than 20 percent of the available assimilative capacity in a basin/sub-basin) need only conduct an antidegradation analysis verifying the use of the assimilative capacity. For those basins/sub-basins where the Regional Water Boards have not determined the baseline assimilative capacity, the baseline assimilative capacity shall be calculated by the initial project proponent, with review and approval by the Regional Water Board, until such time as the salt/nutrient plan is approved by the Regional Water Board and is in effect. For compliance with this subparagraph, the available assimilative capacity shall be calculated by comparing the mineral water quality objective with the average concentration of the basin/sub-basin, either over the most recent five years of data available or using a data set approved by the Regional Water Board Executive Officer. In determining whether the available assimilative capacity will be exceeded by the project or projects, the Regional Water Board shall calculate the impacts of the project or projects over at least a ten year time frame.

   (2) In the event a project or multiple projects utilize more than the fraction of the assimilative capacity designated in subparagraph (1), then a Regional Water

Board-deemed acceptable antidegradation analysis shall be performed to comply with Resolution No. 68-16. The project proponent shall provide sufficient information for the Regional Water Board to make this determination. An example of an approved method is the method used by the State Water Board in connection with Resolution No. 2004-0060 and the Regional Water Board in connection with Resolution No. R8-2004-0001. An integrated approach (using surface water, groundwater, recycled water, stormwater, pollution prevention, water conservation, etc.) to the implementation of Resolution No. 68-16 is encouraged.

d. *Landscape irrigation with recycled water in accordance with this Policy is to the benefit of the people of the State of California. Nonetheless, the State Water Board finds that the use of water for irrigation may, regardless of its source, collectively affect groundwater quality over time. The State Water Board intends to address these impacts in part through the development of salt/nutrient management plans described in paragraph 6.*

   (1) A project that meets the criteria for a streamlined irrigation permit and is within a basin where a salt/nutrient management plan satisfying the provisions of paragraph 6(b) is in place may be approved without further antidegradation analysis, provided that the project is consistent with that plan.

   (2) A project that meets the criteria for a streamlined irrigation permit and is within a basin where a salt/nutrient management plan satisfying the provisions of paragraph 6(b) is being prepared may be approved by the Regional Water Board by demonstrating through a salt/nutrient mass balance or similar analysis that the project uses less than 10 percent of the available assimilative capacity as estimated by the project proponent in a basin/sub-basin (or multiple projects using less than 20 percent of the available assimilative capacity as estimated by the project proponent in a basin/sub-basin).

Average TDS, chloride, and nitrate concentrations in the Central Basin and West Coast Basin and the available assimilative capacities were estimated and discussed in Appendix G *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality* and are summarized in Table I-11. Table I-19 presents the change in groundwater quality for TDS, chloride, and nitrate in the Central Basin due to the implementation of individual proposed projects (Scenarios 2 through 7) and the implementation of these projects in combination (Scenarios 8 through 11) during the future planning period through WY 2024-25. As shown in Table I-19, no individual project uses more than 10% of the available assimilative capacity and multiple projects (Scenarios 8 through 11) also use less than 10% of the assimilative capacity. The analysis of Scenarios 2 and 3 (increased recycled water for irrigation with S/N concentrations at baseline period averages and at SMCLs/MCL) shows that recycled water irrigation is a small component of S/N loading and that even at higher concentrations than those stipulated in current recycled water irrigation permits, these proposed projects do not use more than 10% of the available assimilative capacity. The analysis also shows that while Scenario 7 (GRIP B – 21,000 AFY of tertiary-treated recycled water to replace imported water) uses more of the available assimilative capacity compared with Scenario 1 (No Future Projects) and Scenario 6 (GRIP A – 21,000 AFY of a blend of AWT and tertiary-treated recycled water to replace imported water), Scenario 7 does not use more than 10% of the available assimilative capacity and Scenarios 9 and 11 (GRIP B combined with proposed recycled water and other projects) also use less than 10% of the available assimilative capacity.

Table I-19 presents the change in groundwater quality for TDS, chloride, and nitrate in the West Coast Basin due to the implementation of individual proposed projects (Scenarios 2 through 7) and the implementation of these projects in combination (Scenarios 8 through 11) during the future planning period through WY 2024-25. Due to historical seawater intrusion in the CBWCB, average TDS and chloride concentrations in groundwater in the West Coast Basin currently exceed BSBPOs, so there is no available assimilative capacity for TDS and chloride. Nonetheless, existing implementation measures, including the basin adjudication to limit pumping and ongoing operation of the seawater barriers and desalter facilities have resulted in declining TDS and chloride concentrations in the West Coast Basin. In addition, implementation of Scenario 4 (increased recharge of AWT recycled water at the seawater barriers to replace imported water) further reduces TDS and chloride loading and improves groundwater quality in the CBWCB. Existing and planned implementation measures will result in average groundwater quality in the West Coast Basin achieving BSBPOs for TDS and chloride in the future.

In addition to the minimal negative, and in some cases positive, water quality impacts associated with the proposed recycled water projects in the CBWCB, the Recycled Water Policy and the Governor's recent drought proclamations (see Section 9.3 in the SNMP) recognize the tremendous need for and benefits of increased recycled water use in California. As stated in the Recycled Water Policy, "*The collapse of the Bay-Delta ecosystem, climate change, and continuing population growth have combined with a severe drought on the Colorado River and failing levees in the Delta to create a new reality that challenges California's ability to provide the clean water needed for a healthy environment, a healthy population and a healthy economy, both now and in the future. . . . We strongly encourage local and regional water agencies to move toward clean, abundant, local water for California by emphasizing appropriate water recycling, water conservation, and maintenance of supply infrastructure and the use of stormwater (including dry-weather urban runoff) in these plans; these sources of supply are drought-proof, reliable, and minimize our carbon footprint and can be sustained over the long-term.*" (SWRCB, 2009)

Clearly, the benefits in terms of sustainability and reliability of recycled water use cannot be overstated. The SNMP analysis finds that AWT recycled water is one of the highest quality source waters available (higher quality than imported water in terms of TDS and chloride) and that use of AWT recycled water is a critical component in achieving WQOs/BPOs and preserving beneficial uses in the West Coast Basin where historical seawater intrusion has degraded groundwater quality in certain areas. Tertiary-treated recycled water is also a critical component of the water supply portfolio in the CBWCB and its use can be safely increased, including implementation of higher S/N loading projects including GRIP B (which has higher S/N loading compared with GRIP A) and the increased use of recycled water for irrigation with S/N concentrations equivalent to SMCLs/MCL (which results in higher S/N loading compared with recycled water at baseline period S/N averages), while still protecting groundwater quality and preserving beneficial uses. Increased use of recycled water reduces reliance on potable water supplies, in particular increasingly uncertain and costly imported water supplies. Thus, the increased use of recycled water ensures that the water supply in the CBWCB is sustainable through the future. **Table I-24** presents the results of the anti-degradation assessment of the proposed recycled projects in the CBWCB in accordance with SWRCB Resolution No. 68-16 (Anti-Degradation Policy).

Table I-24 Anti-Degradation Assessment

SWRCB Resolution No. 68-16 Component	Anti-Degradation Assessment Result
Water quality changes associated with proposed recycled water project(s) are consistent with the maximum benefit of the people of the State. The water quality changes associated with proposed recycled water project(s) will not unreasonably affect present and anticipated beneficial uses. The water quality changes will not result in water quality less than prescribed in the Basin Plan.	• Water quality changes associated with proposed recycled water projects in the Central Basin and West Coast Basin (CBWCB) are consistent with the maximum benefit of the people of the State. • The water quality changes associated with proposed recycled water projects in the CBWCB will not unreasonably affect present and anticipated beneficial uses. • The water quality changes associated with proposed recycled water projects in the CBWCB will not result in water quality less than prescribed in the Basin Plan. • GRIP A and GRIP B will not use more than 10% of the available AC in the Central Basin. • GRIP A and GRIP B will not cause groundwater quality to exceed BPO/BSBPOs in the Central Basin. • Use of recycled water for GRIP A and GRIP B to replace imported water is consistent with the SWRCB Recycled Water Policy, which encourages reliance on local, drought-proof water supplies. • Seawater intrusion barrier projects are utilizing AWT recycled water and imported water improve groundwater quality in both basins. • Use of recycled water at the seawater intrusion barriers to replace imported water is consistent with the SWRCB Recycled Water Policy, which encourages increased reliance on local, drought-proof water sources. • Recycled water used for irrigation will not use more than 10% of the available AC in either basin. • Recycled water used for irrigation will not cause groundwater quality to exceed BPO/BSBPOs. • Use of recycled water for irrigation to replace imported water and groundwater is consistent with the SWRCB Recycled Water Policy, which encourages increased reliance on local, drought-proof water sources.

SWRCB Resolution No. 68-16 Component	Anti-Degradation Assessment Result
The projects are consistent with the use of best practicable treatment or control to avoid pollution or nuisance and maintain the highest water quality consistent with the maximum benefit to the people of the State.	• The proposed recycled water projects in the CBWCB are consistent with the use of the best practicable treatment or control to avoid pollution or nuisance and maintain the highest water quality consistent with the maximum benefit to the people of the State. • The proposed GRIP recycled water project will use either tertiary-treated and/or AWT recycled water; higher loading associated with GRIP B will not use more than 10% of the available (AC) or cause groundwater to exceed BPO/BSBPOs. • The benefit to the people of the State for GRIP A versus GRIP B must consider the significantly higher costs associated with production and use of AWT recycled water. • The ongoing seawater intrusion barrier projects currently use AWT recycled water. • Recycled water used for irrigation is currently tertiary-treated and this is the appropriate level of treatment for this very minor component of S/N loading, as determined from the SNMP analysis.
The proposed project(s) is necessary to accommodate important economic or social development.	• The proposed recycled water projects in the CBWCB are necessary to accommodate important economic and social development. • Given the uncertainties and increasing costs of imported water, increasing use of recycled water ensures a diversified and more reliable water supply. • The proposed GRIP Recycled Water Project provides a sustainable and reliable water source to replenish the groundwater basins, maintains high-quality groundwater, complies with pertinent regulatory requirements by employing an institutionally feasible approach, minimizes costs to agencies using groundwater, and engages stakeholders in the decision-making process. • Ongoing operation of the seawater intrusion barriers are necessary to prevent seawater intrusion and replenish the groundwater basins.
Implementation measures are being or will be implemented to help achieve BPOs in the future.	• Implementation measures are being implemented and additional implementation measures have been proposed in the CBWCB to help achieve or remain below BPO/BSBPOs in the future. • BPO/BSBPOs are being achieved and will not be exceeded in the Central Basin. • The ongoing operation of the seawater intrusion barriers and desalters are improving groundwater quality in the West Coast Basin and TDS and chloride levels will eventually achieve BSBPOs.

CBWCB – Central Basin and West Coast Basin
GRIP – Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A; this project alternative utilizes a blend of tertiary-treated & AWT recycled water to replace imported water for recharge at the Montebello Forebay Spreading Grounds
GRIP B – GRIP Recycled Water Project B; this project alternative utilizes 100% tertiary-treated recycled water to replace imported water for recharge at the Montebello Forebay Spreading Grounds
BPO – Basin Plan Objective
SNMP – Salt and Nutrient Management Plan
SWRCB – State Water Resources Control Board
AC – assimilative capacity
BSBPOs – Basin-Specific Basin Plan Objectives
S/Ns – salts and nutrients
AWT – advanced water treatment

Attachment I-A

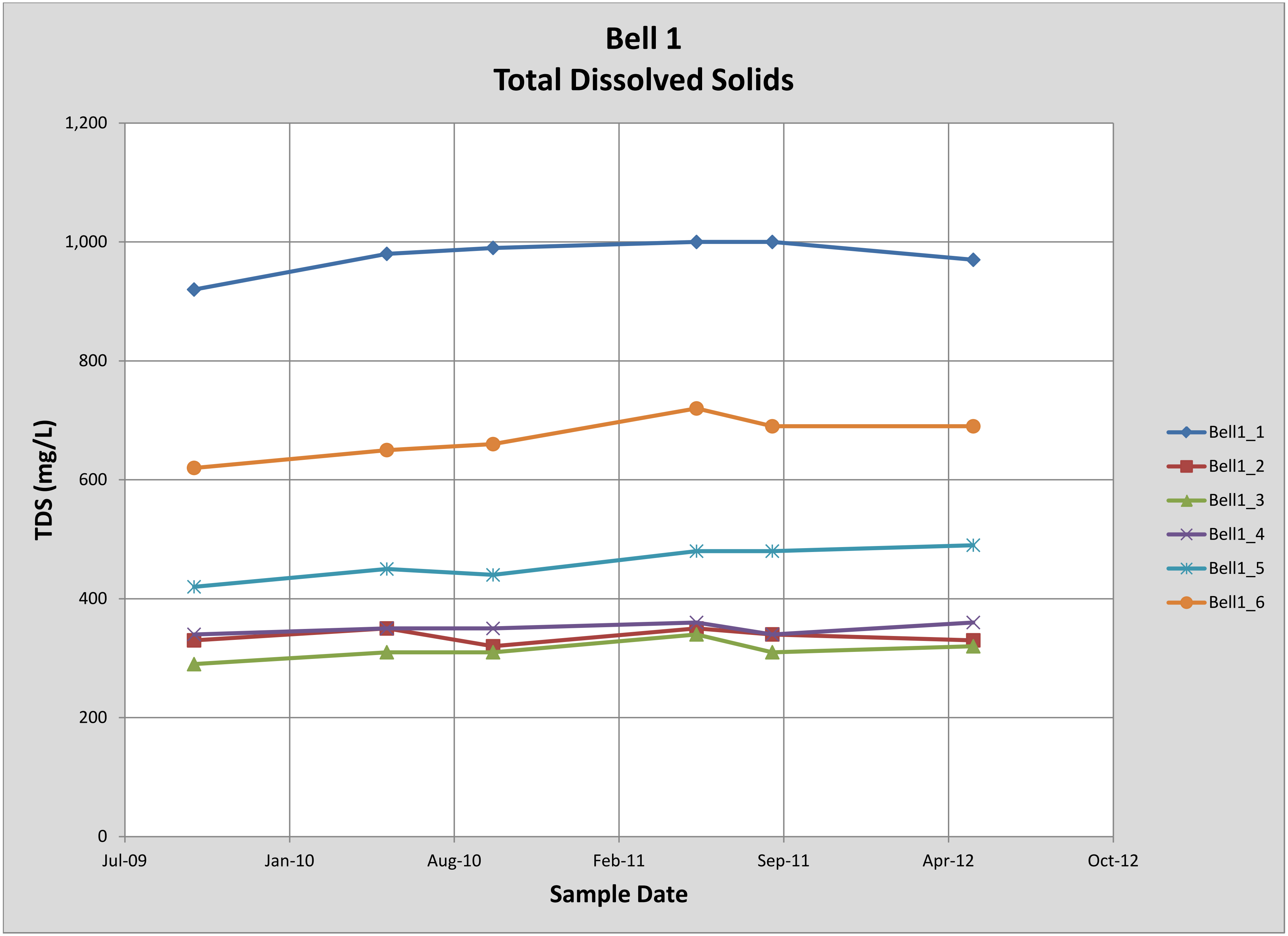
Description of Mann-Kendall Trend Test

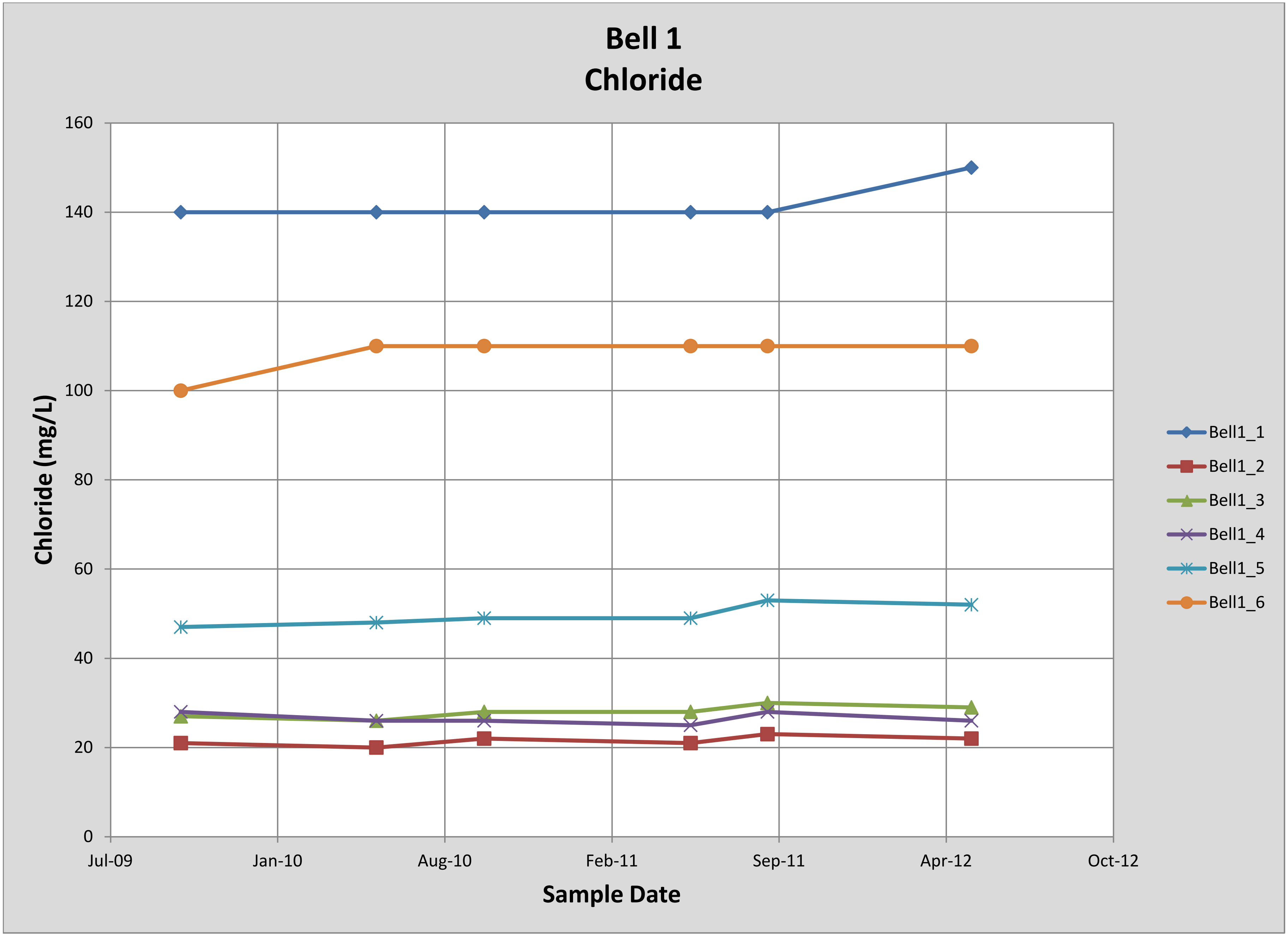
The Mann-Kendall statistical trend test is a nonparametric test that is commonly used to detect trends in a concentration time-series plot that contains the relative magnitudes of sample data. The Mann-Kendall test is particularly applicable to groundwater quality evaluations because the test is statistically robust and can be effectively applied to data sets with censored values (i.e., non-detects). For datasets with more than 10 values, the normal approximation to the Mann-Kendall test was performed using Minitab 15 and the Minitab macro MKTREND. For each dataset, the Sen's Slope, a nonparametric alternative for estimating a slope, was also calculated using Minitab 15 and the Minitab macro SENSLOPE. The Sen's Slope represents the median slope for all the pairs of time points in a dataset. For each Mann-Kendall test, an appropriate method was applied to censored data. Depending on the data distribution, any censored data with a reporting limit exceeding the lowest detected value in a given dataset was either removed or assigned a consistent concentration below the lowest detected value in the given dataset.

For the Mann-Kendall test, positive values of S, Z, and Sen's Slope suggest a possible increasing concentration trend, while negative values suggest a possible decreasing trend. A value of zero for S, Z, and Sen's Slope suggests no trend. A 95 percent confidence interval (p-value = 0.05) was used to define a level of significance; p-values less than 0.05 represent a very significant trend. P-values less than 0.10 may also suggest a trend, while trends for series with p-values greater than 0.10 are considered statistically insignificant.

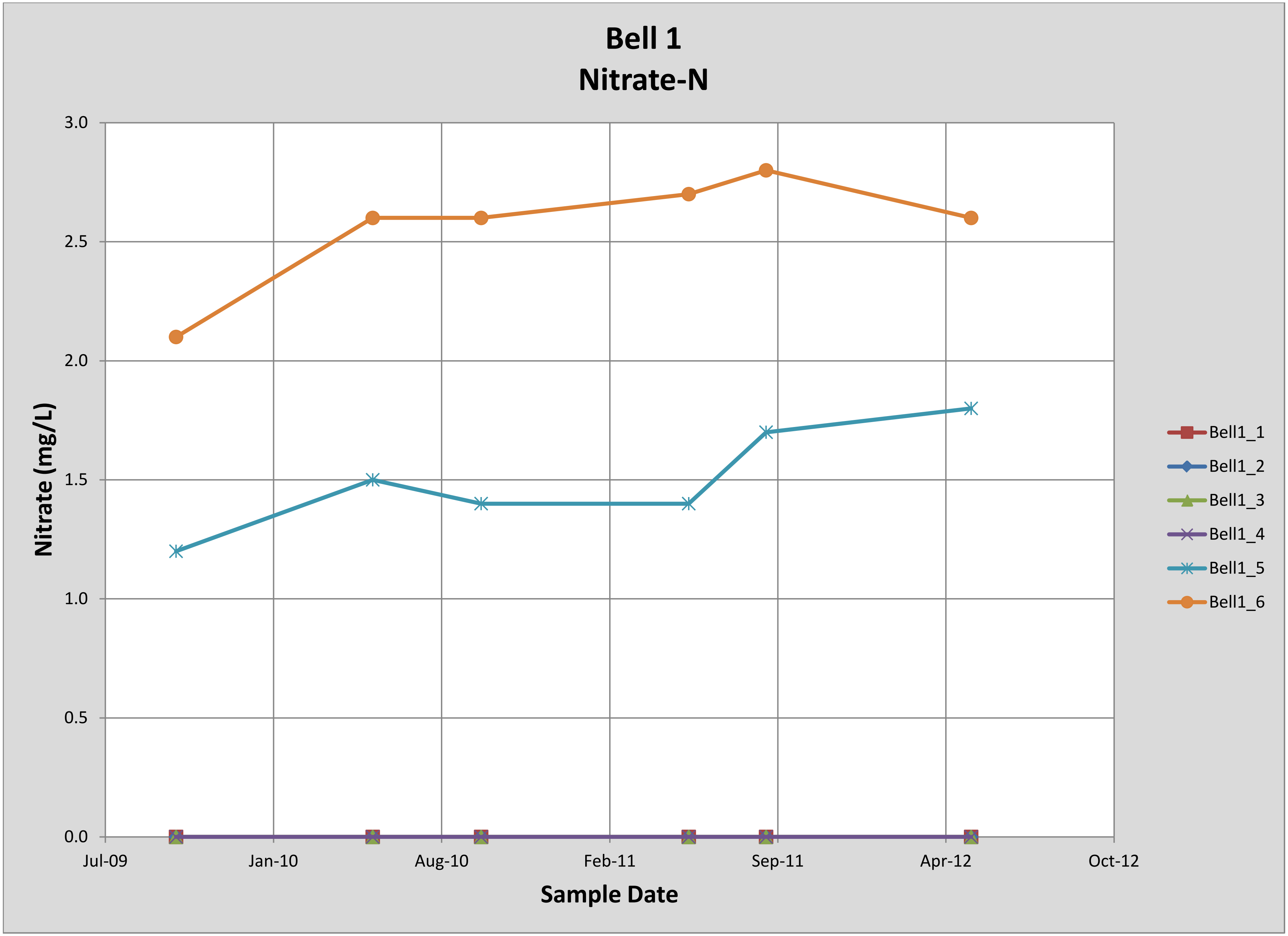
Attachment I-B

TDS, Chloride, and Nitrate Time-Concentration Plots for WRD Nested Groundwater Monitoring Wells

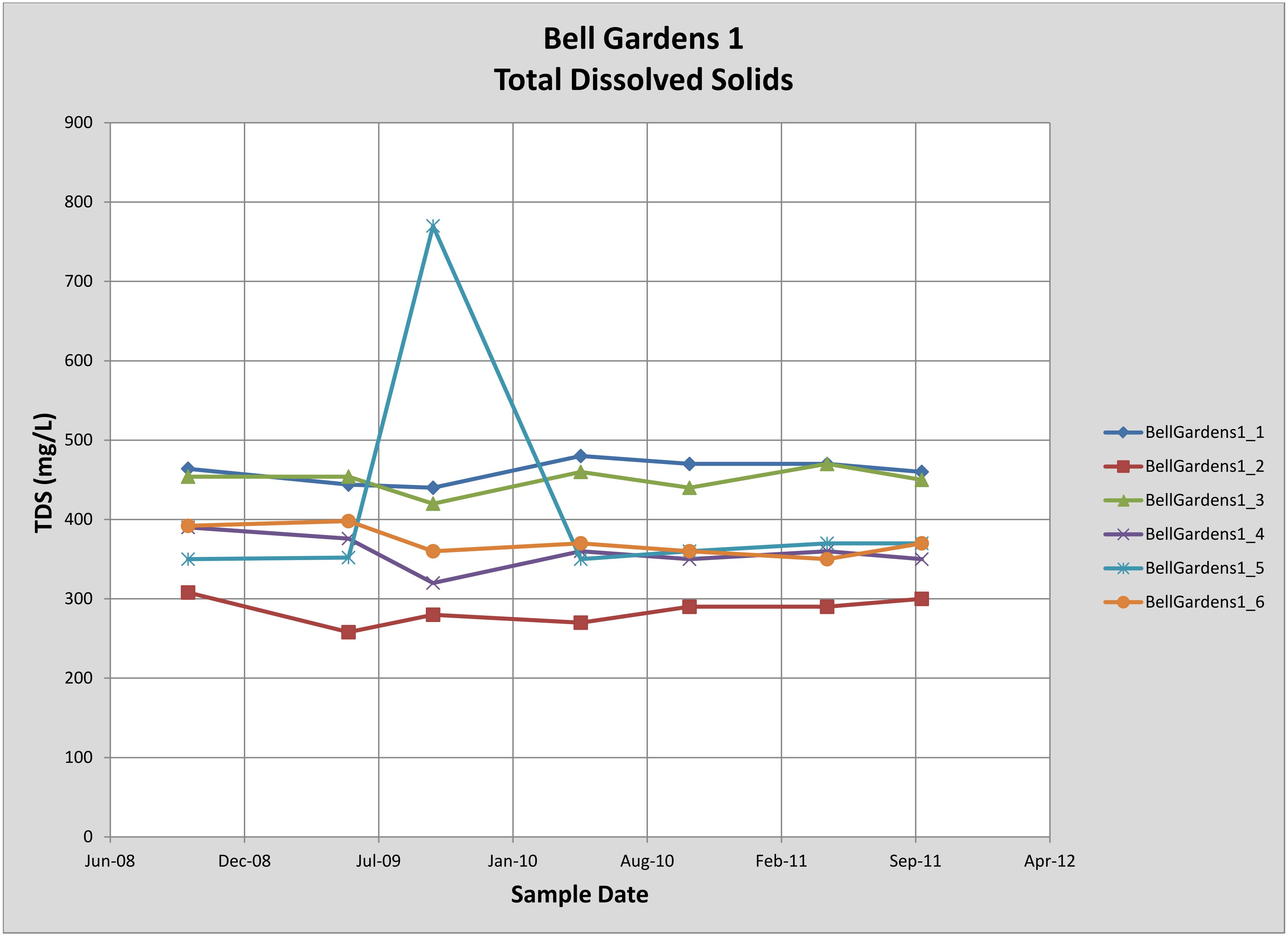

Bell 1
Total Dissolved Solids
1,200
1,000
800
600
400
200
0
TDS (mg/L)
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Oct-12
Sample Date
Bell1_1
Bell1_2
Bell1_3
Bell1_4
Bell1_5
Bell1_6

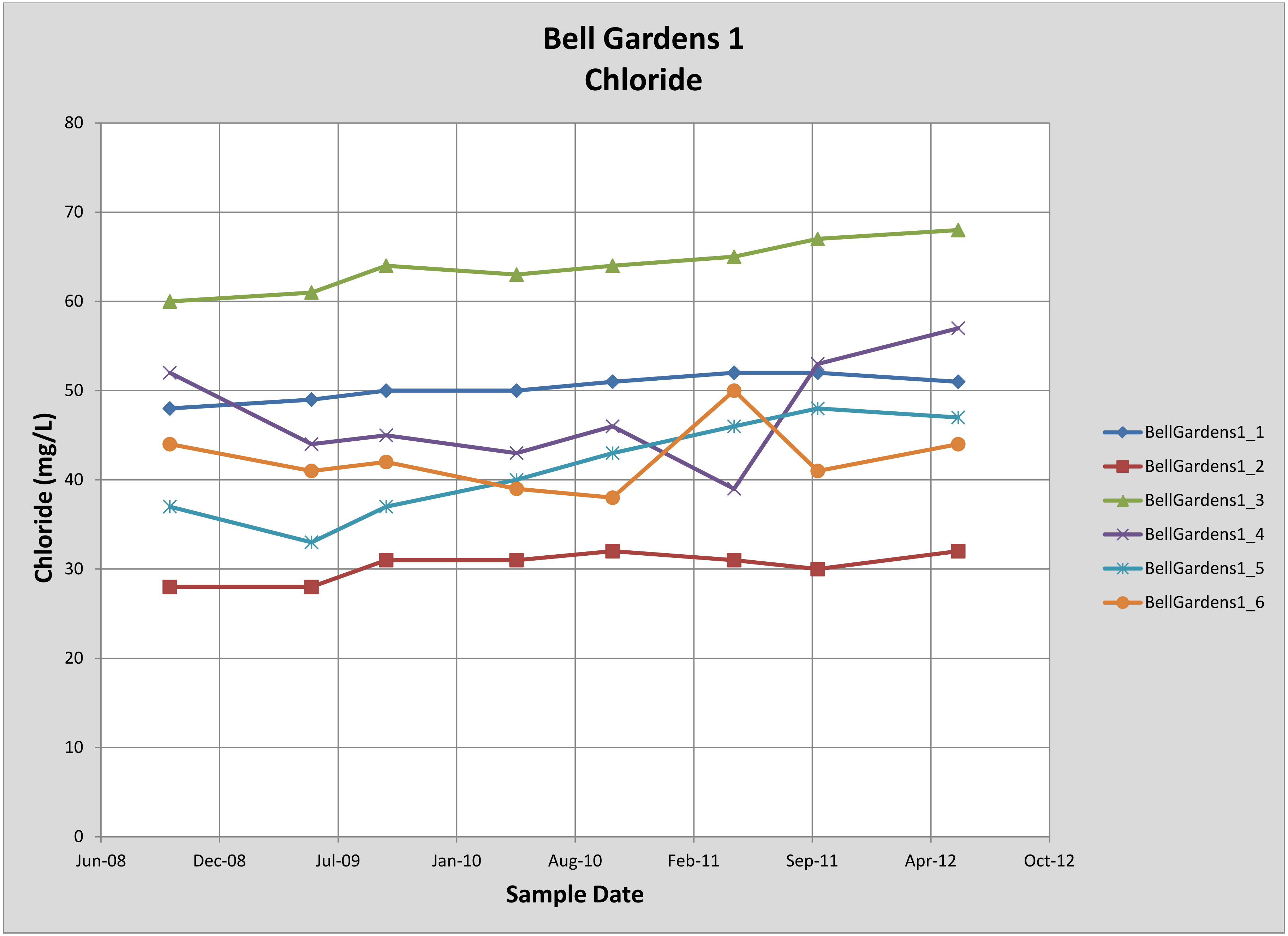


Bell 1
Chloride
Chloride (mg/L)
160
140
120
100
80
60
40
20
0
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Oct-12
Sample Date
Bell1_1
Bell1_2
Bell1_3
Bell1_4
Bell1_5
Bell1_6

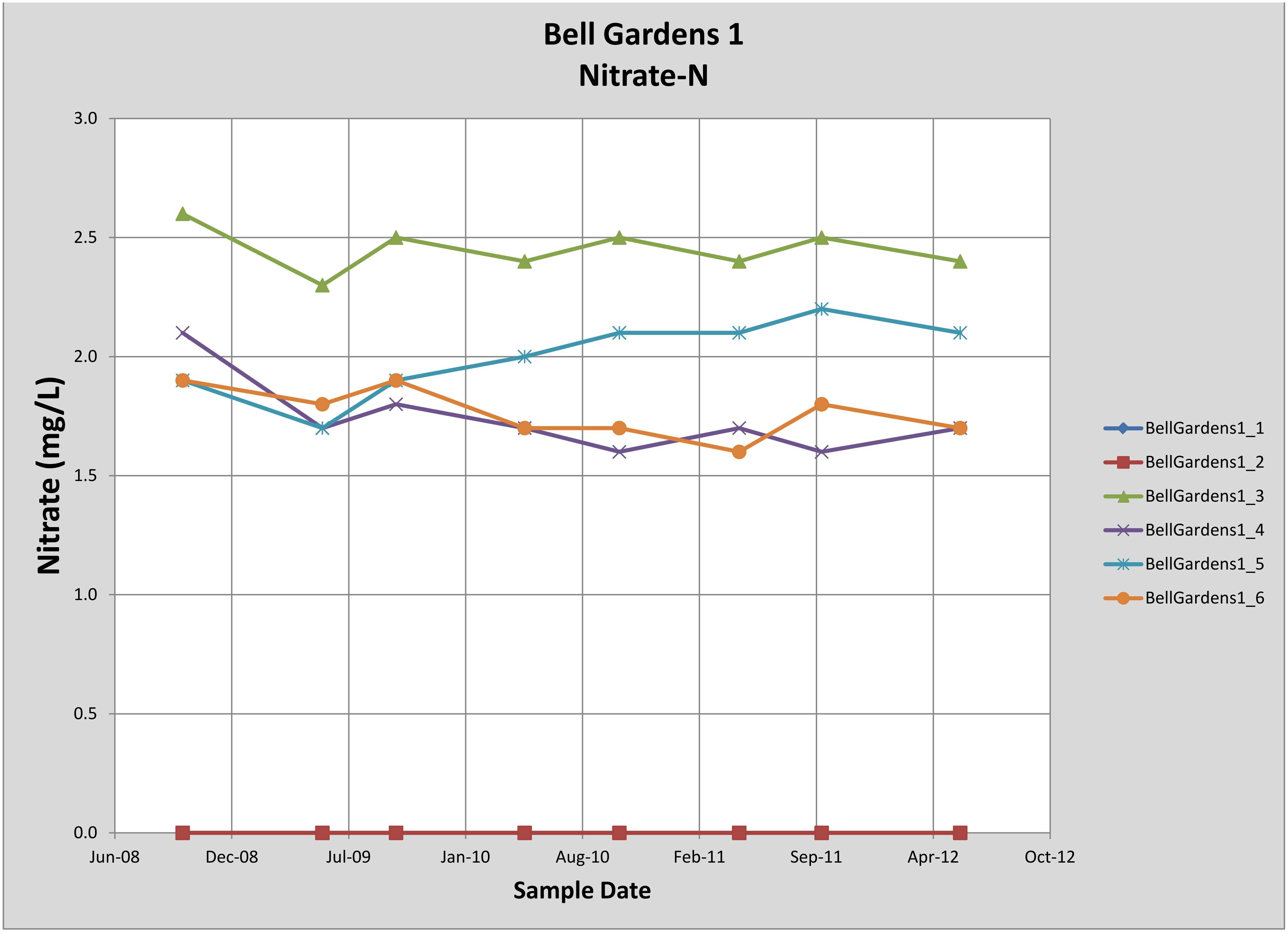


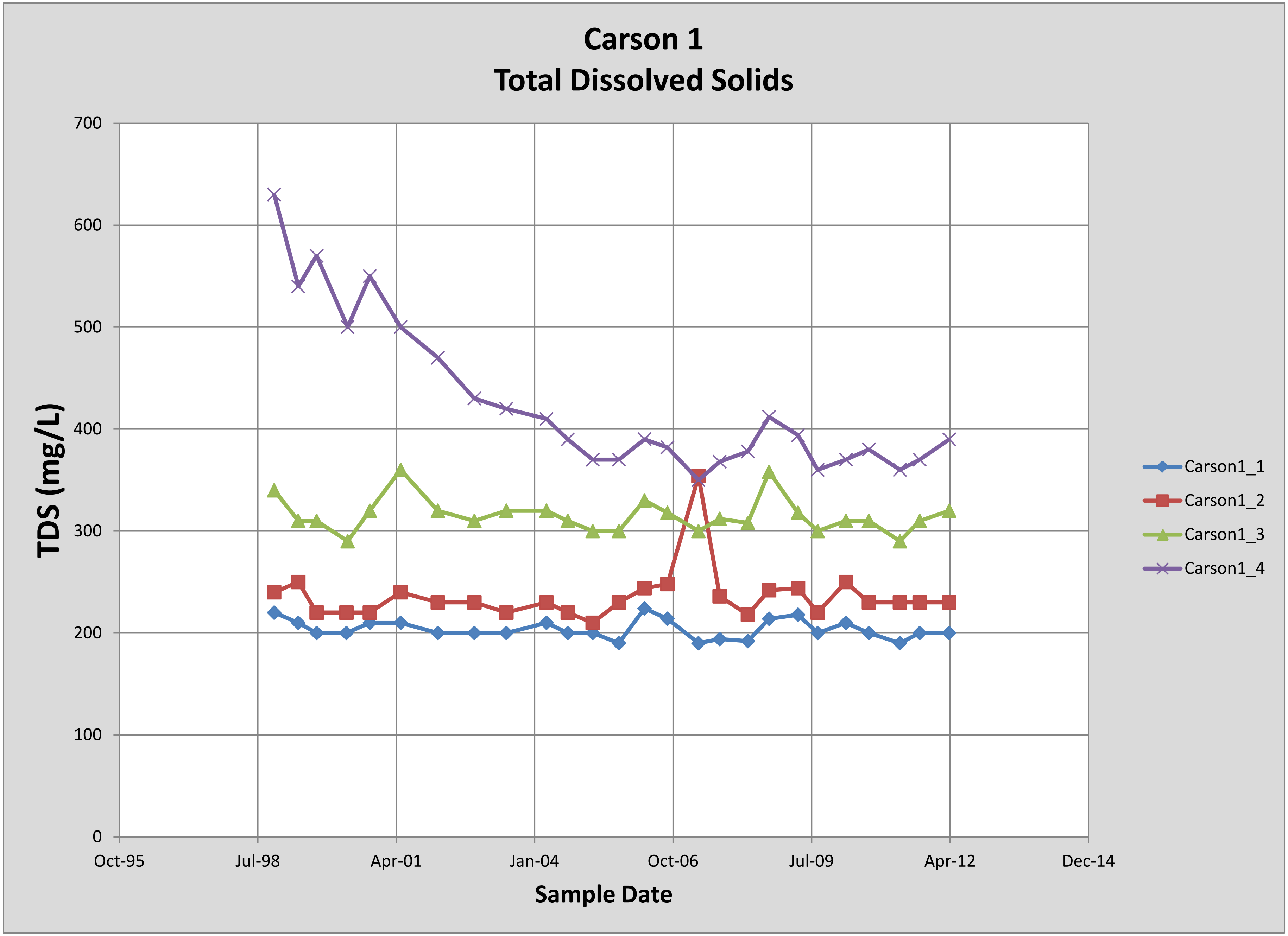
Bell 1
Nitrate-N
Nitrate (mg/L)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Oct-12
Sample Date
Bell1_1
Bell1_2
Bell1_3
Bell1_4
Bell1_5
Bell1_6


Bell Gardens 1
Total Dissolved Solids
TDS (mg/L)
0
100
200
300
400
500
600
700
800
900
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Sample Date
BellGardens1_1
BellGardens1_2
BellGardens1_3
BellGardens1_4
BellGardens1_5
BellGardens1_6

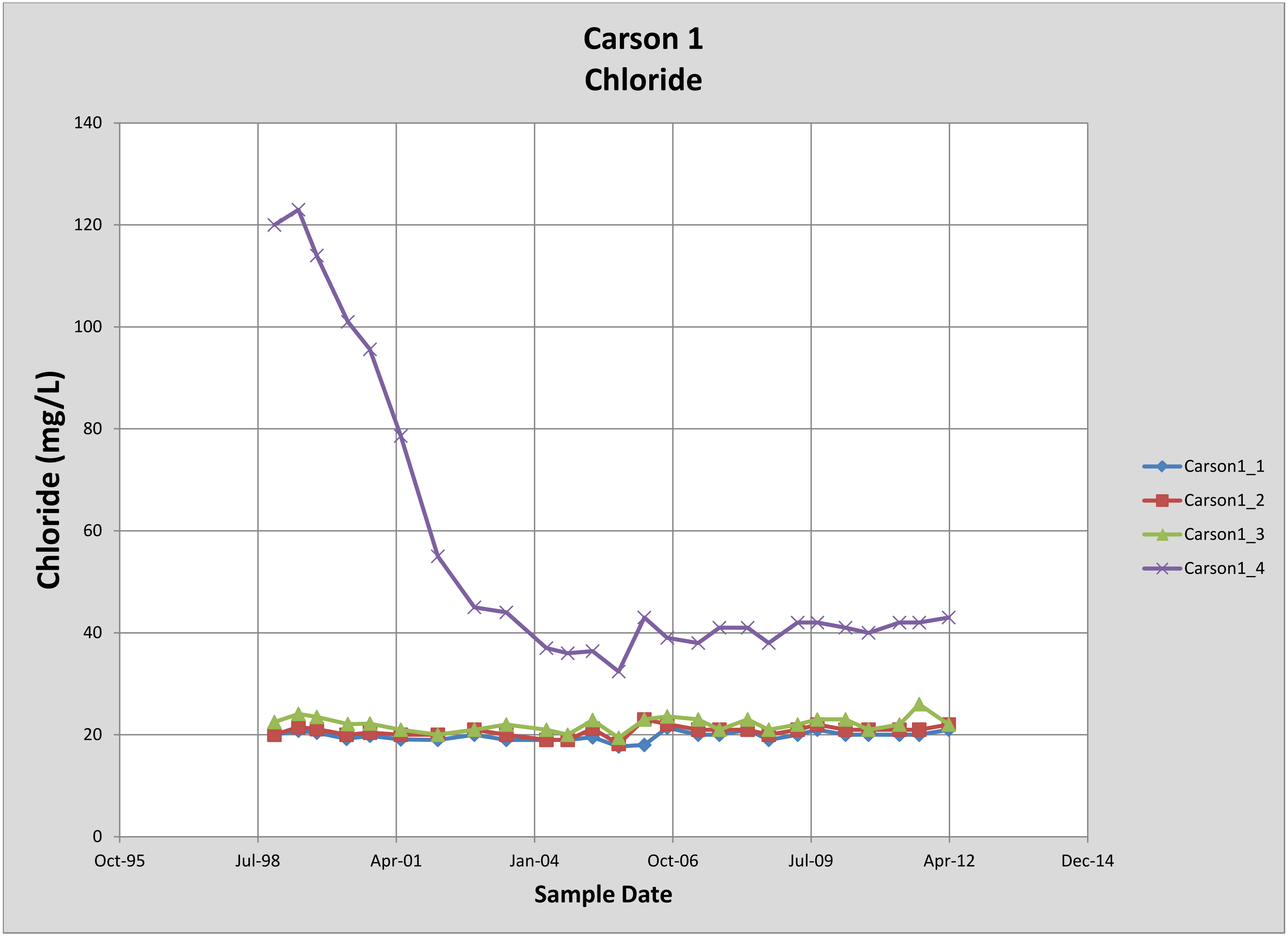


Bell Gardens 1
Chloride
Chloride (mg/L)
80
70
60
50
40
30
20
10
0
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Oct-12
Sample Date
BellGardens1_1
BellGardens1_2
BellGardens1_3
BellGardens1_4
BellGardens1_5
BellGardens1_6

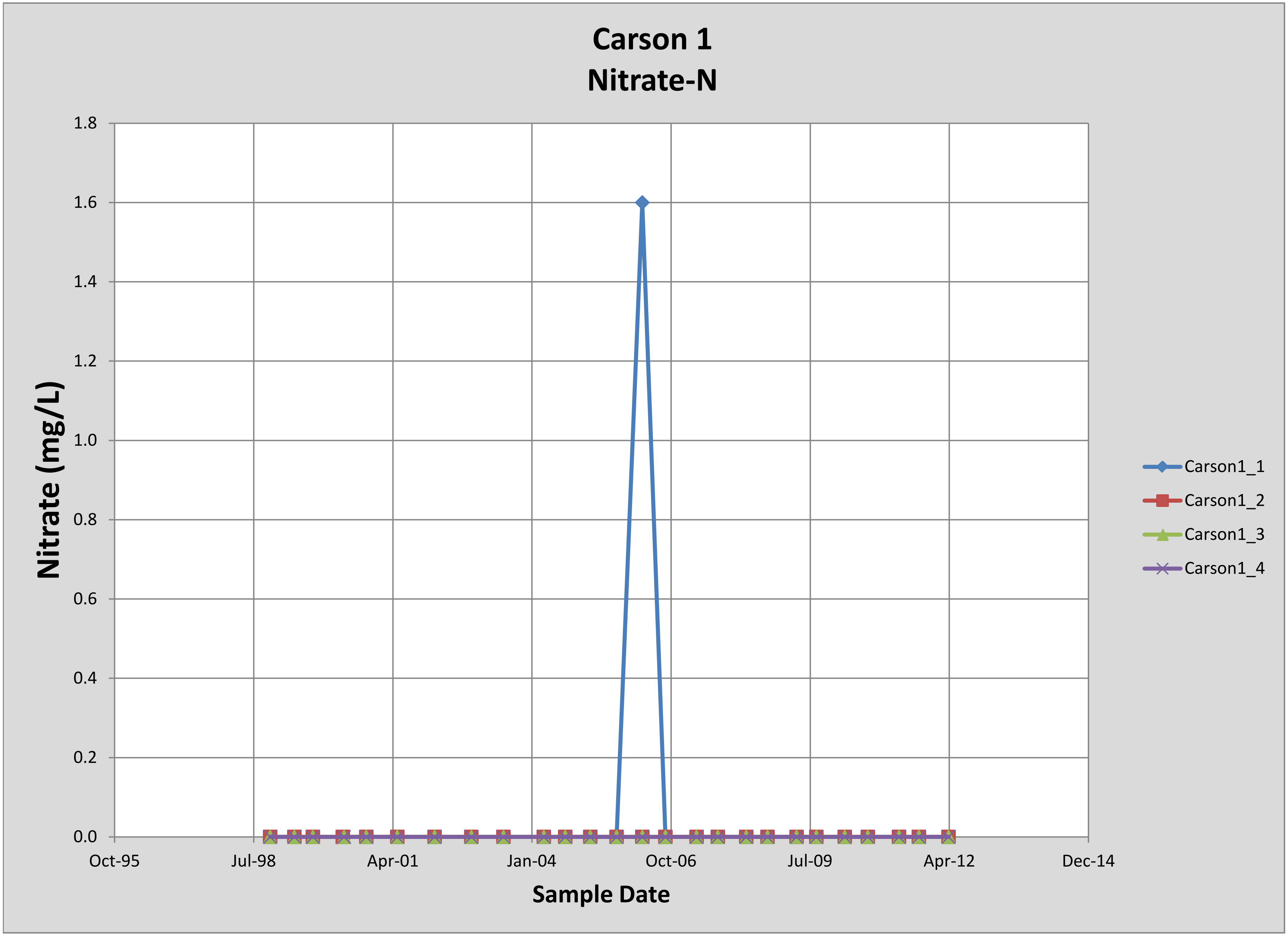

Bell Gardens 1
Nitrate-N
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Nitrate (mg/L)
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Oct-12
Sample Date
BellGardens1_1
BellGardens1_2
BellGardens1_3
BellGardens1_4
BellGardens1_5
BellGardens1_6

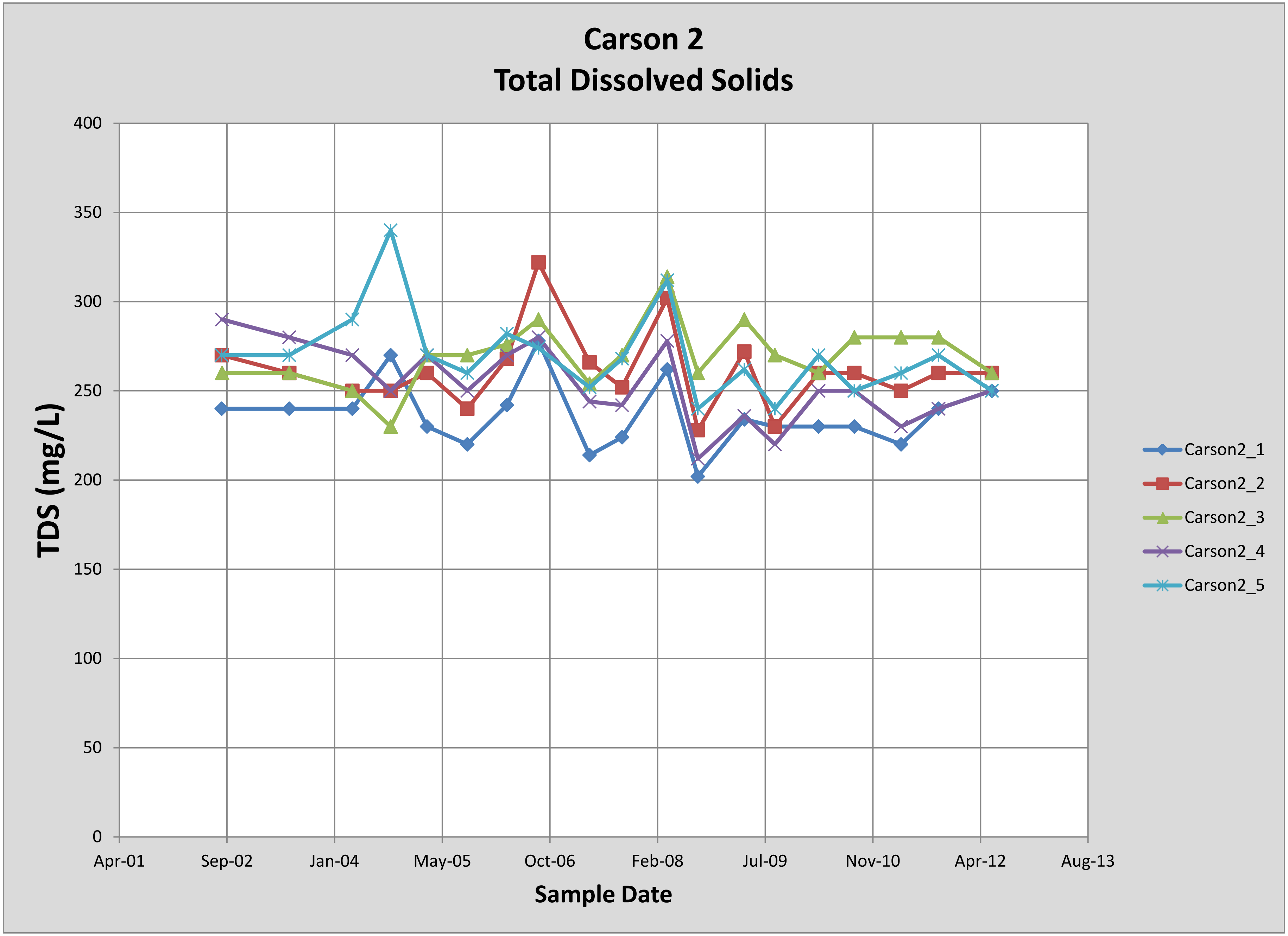


Carson 1
Total Dissolved Solids
TDS (mg/L)
700
600
500
400
300
200
100
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Carson1_1
Carson1_2
Carson1_3
Carson1_4

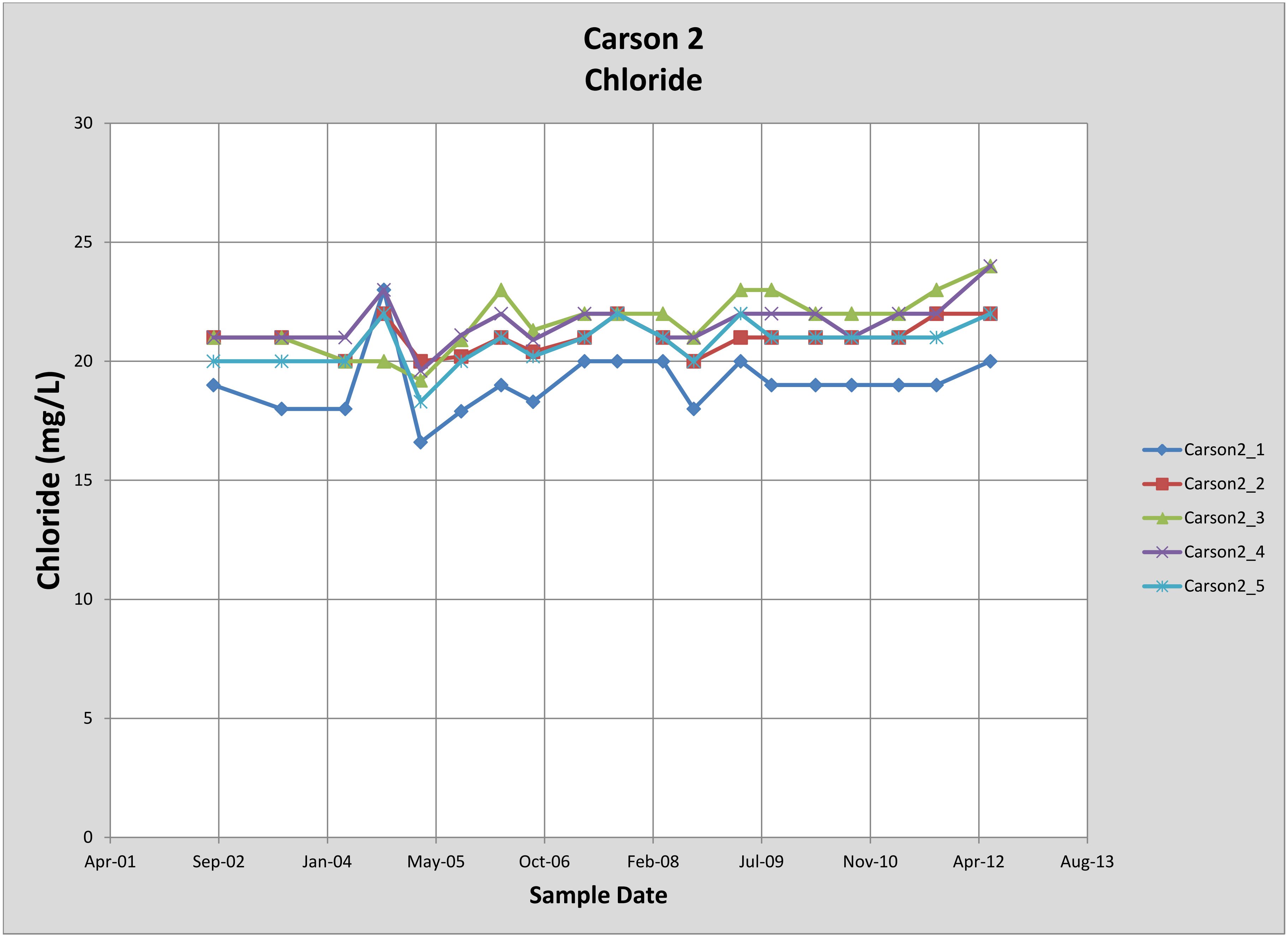


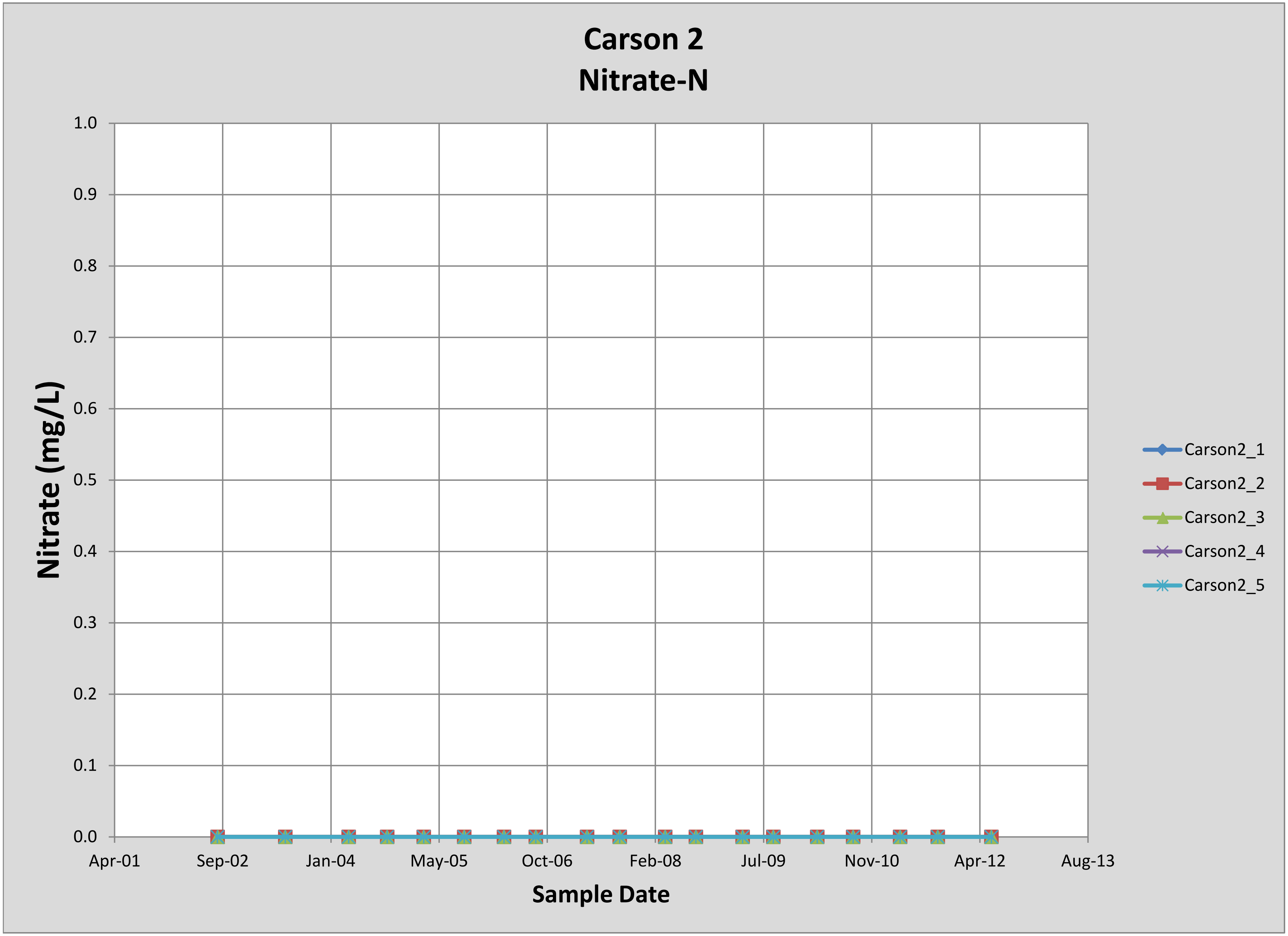
Carson 1
Chloride
Chloride (mg/L)
140
120
100
80
60
40
20
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Carson1_1
Carson1_2
Carson1_3
Carson1_4


Carson 1
Nitrate-N
Nitrate (mg/L)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Carson1_1
Carson1_2
Carson1_3
Carson1_4

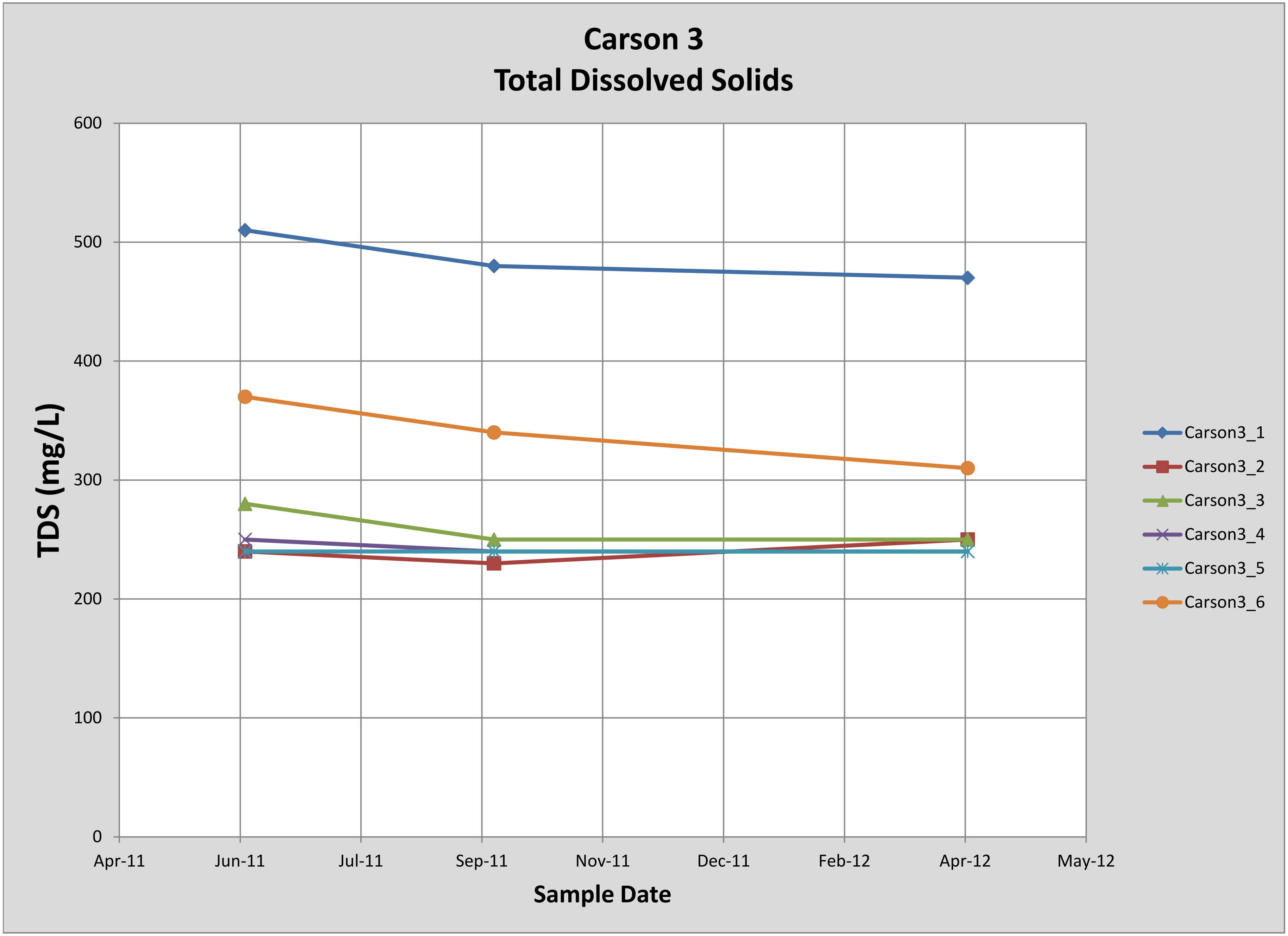


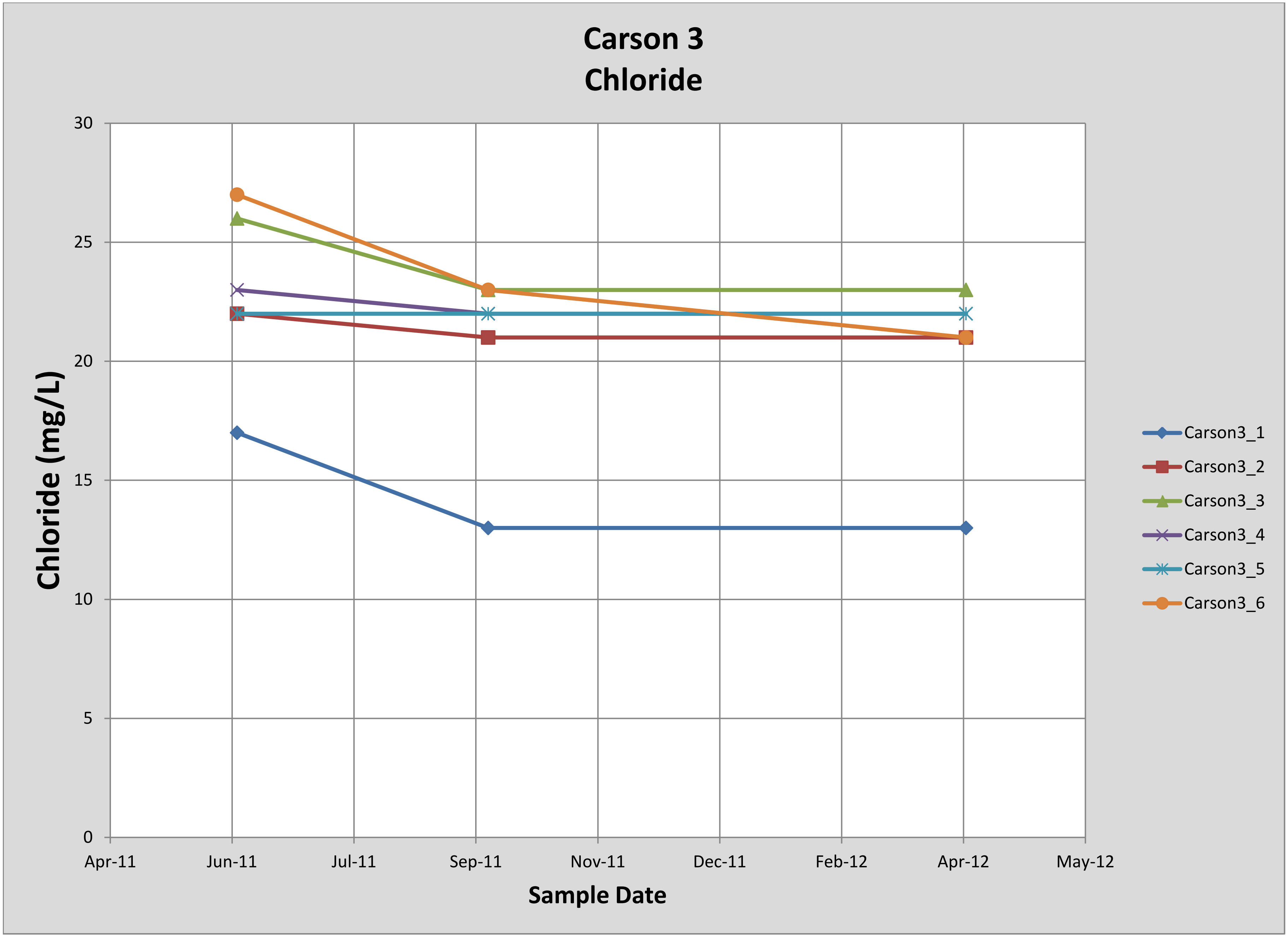
Carson 2
Total Dissolved Solids
TDS (mg/L)
400
350
300
250
200
150
100
50
0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Carson2_1
Carson2_2
Carson2_3
Carson2_4
Carson2_5


Carson 2
Chloride
Chloride (mg/L)
30
25
20
15
10
5
0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Carson2_1
Carson2_2
Carson2_3
Carson2_4
Carson2_5

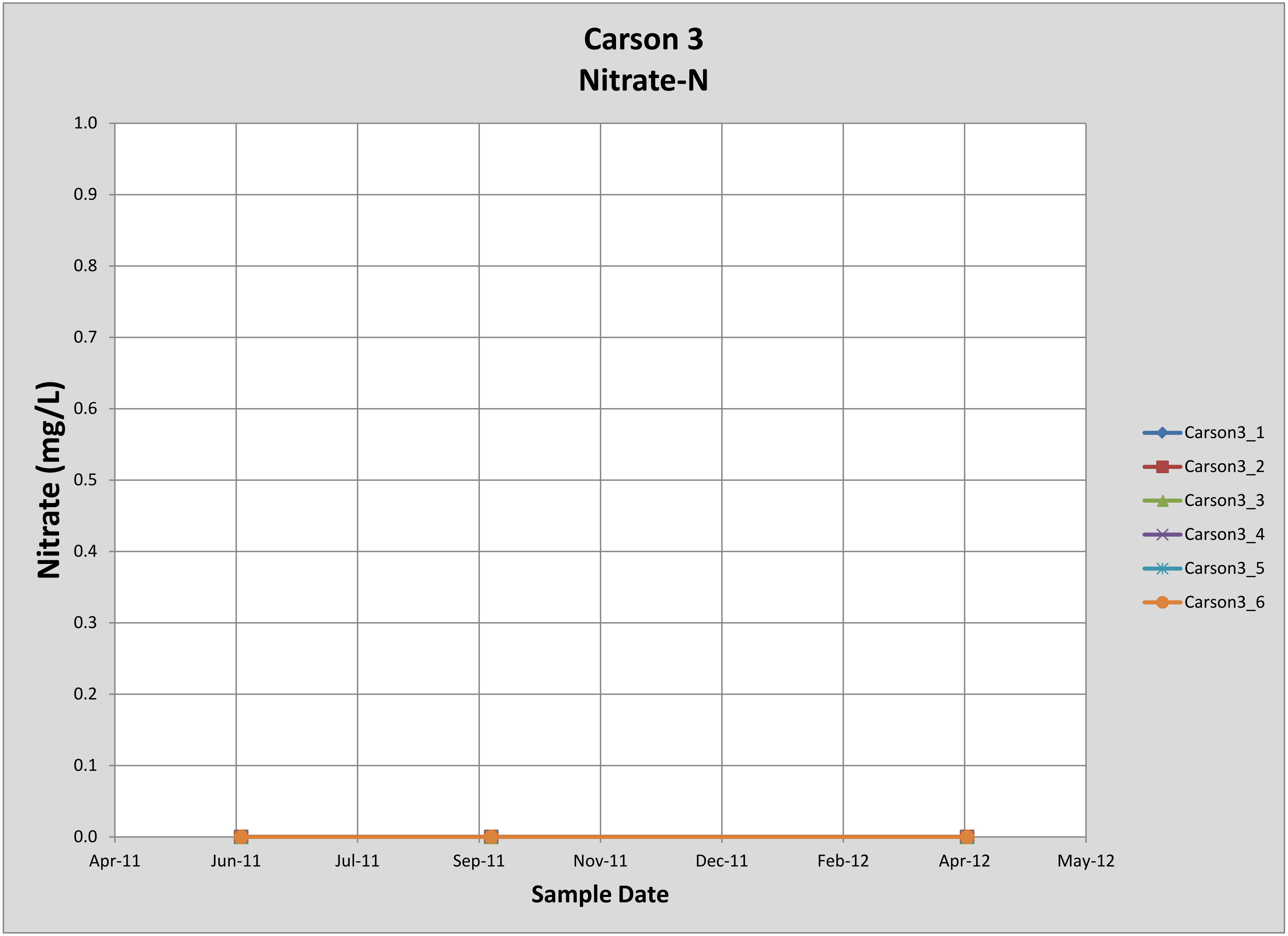


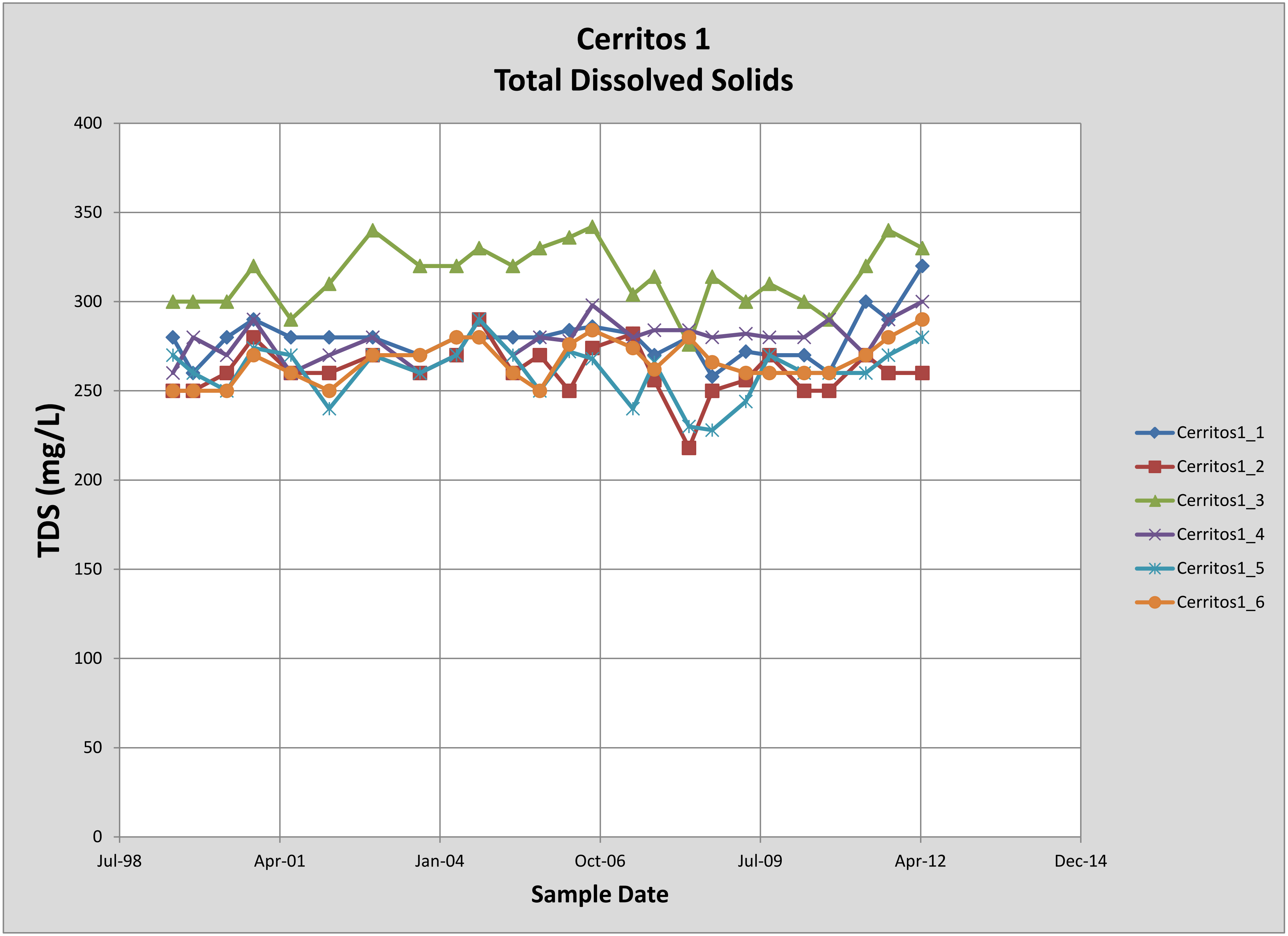
Carson 2
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Carson2_1
Carson2_2
Carson2_3
Carson2_4
Carson2_5

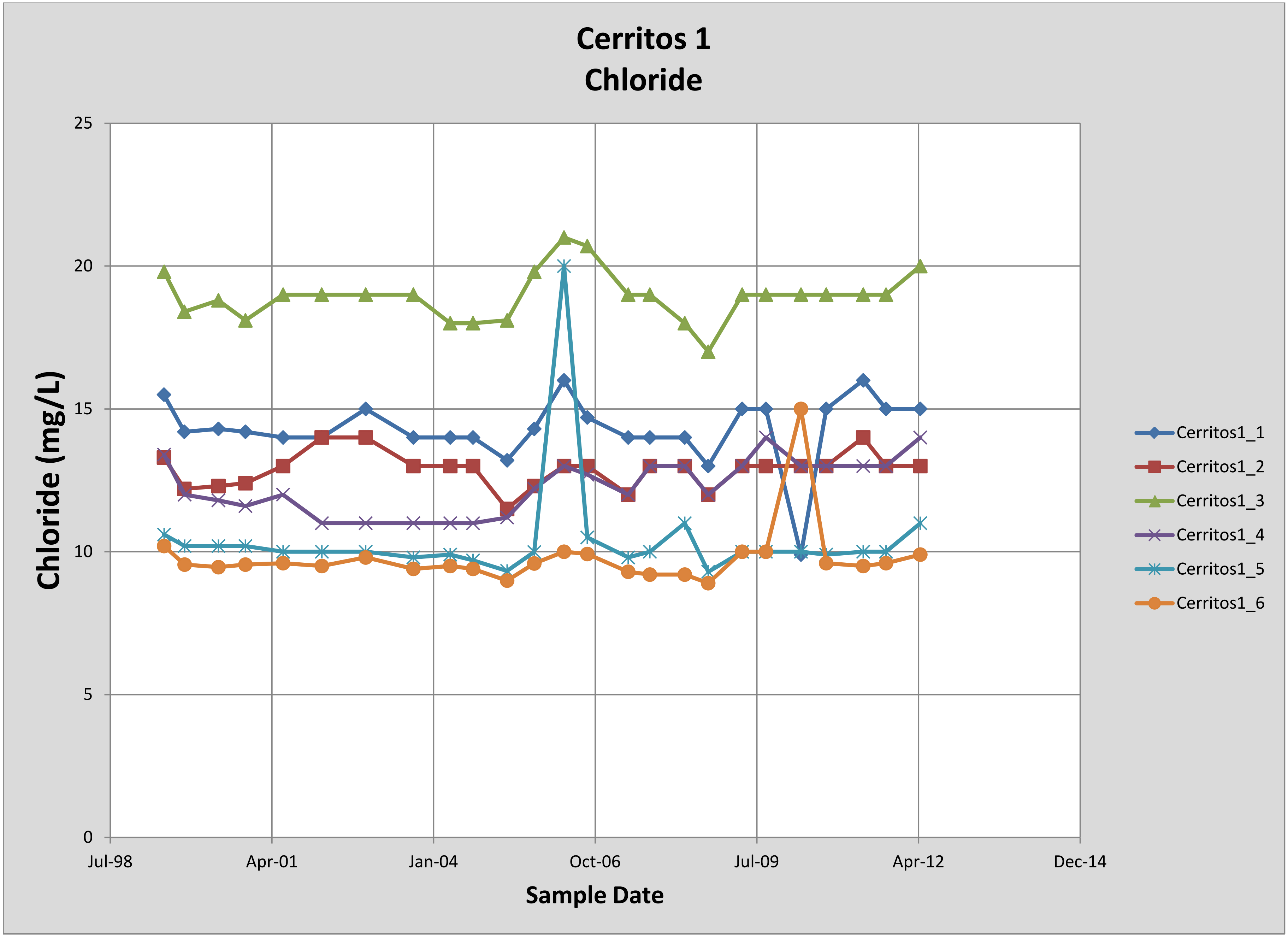

Carson 3
Total Dissolved Solids
TDS (mg/L)
600
500
400
300
200
100
0
Apr-11
Jun-11
Jul-11
Sep-11
Nov-11
Dec-11
Feb-12
Apr-12
May-12
Sample Date
Carson3_1
Carson3_2
Carson3_3
Carson3_4
Carson3_5
Carson3_6



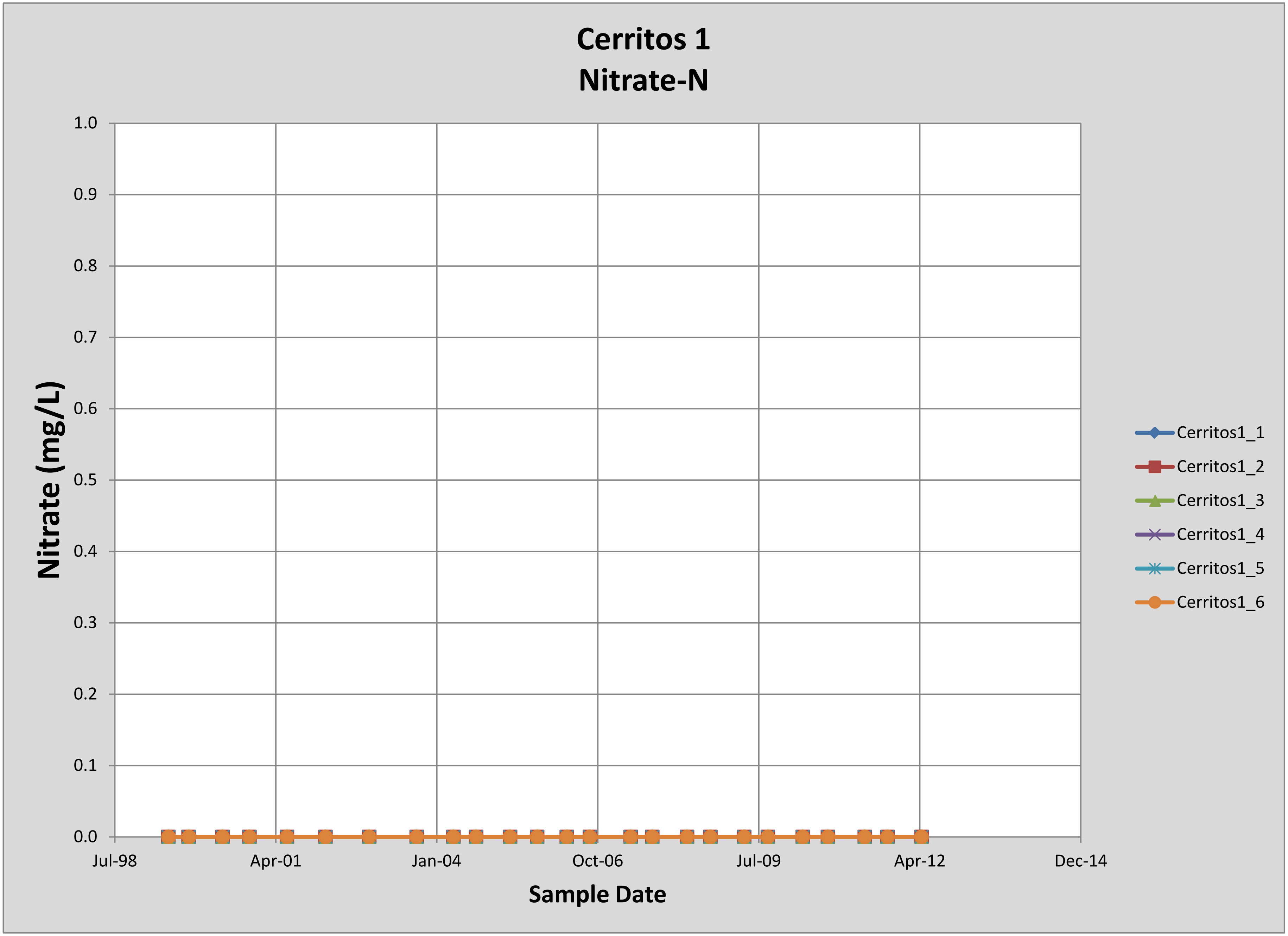
Carson 3
Chloride
Chloride (mg/L)
Sample Date
0
5
10
15
20
25
30
Apr-11
Jun-11
Jul-11
Sep-11
Nov-11
Dec-11
Feb-12
Apr-12
May-12
Carson3_1
Carson3_2
Carson3_3
Carson3_4
Carson3_5
Carson3_6

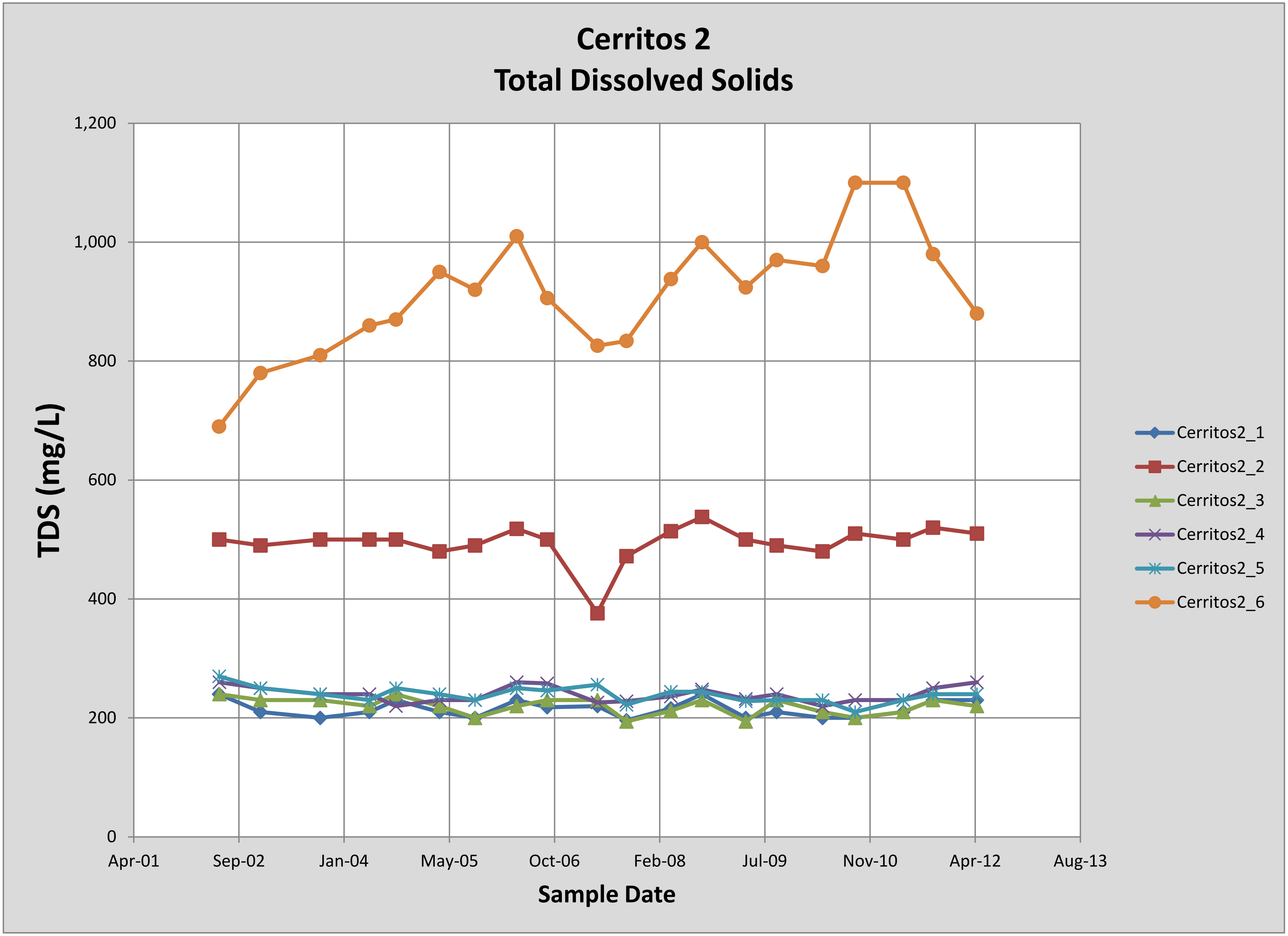

Carson 3
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Apr-11
Jun-11
Jul-11
Sep-11
Nov-11
Dec-11
Feb-12
Apr-12
May-12
Sample Date
Carson3_1
Carson3_2
Carson3_3
Carson3_4
Carson3_5
Carson3_6

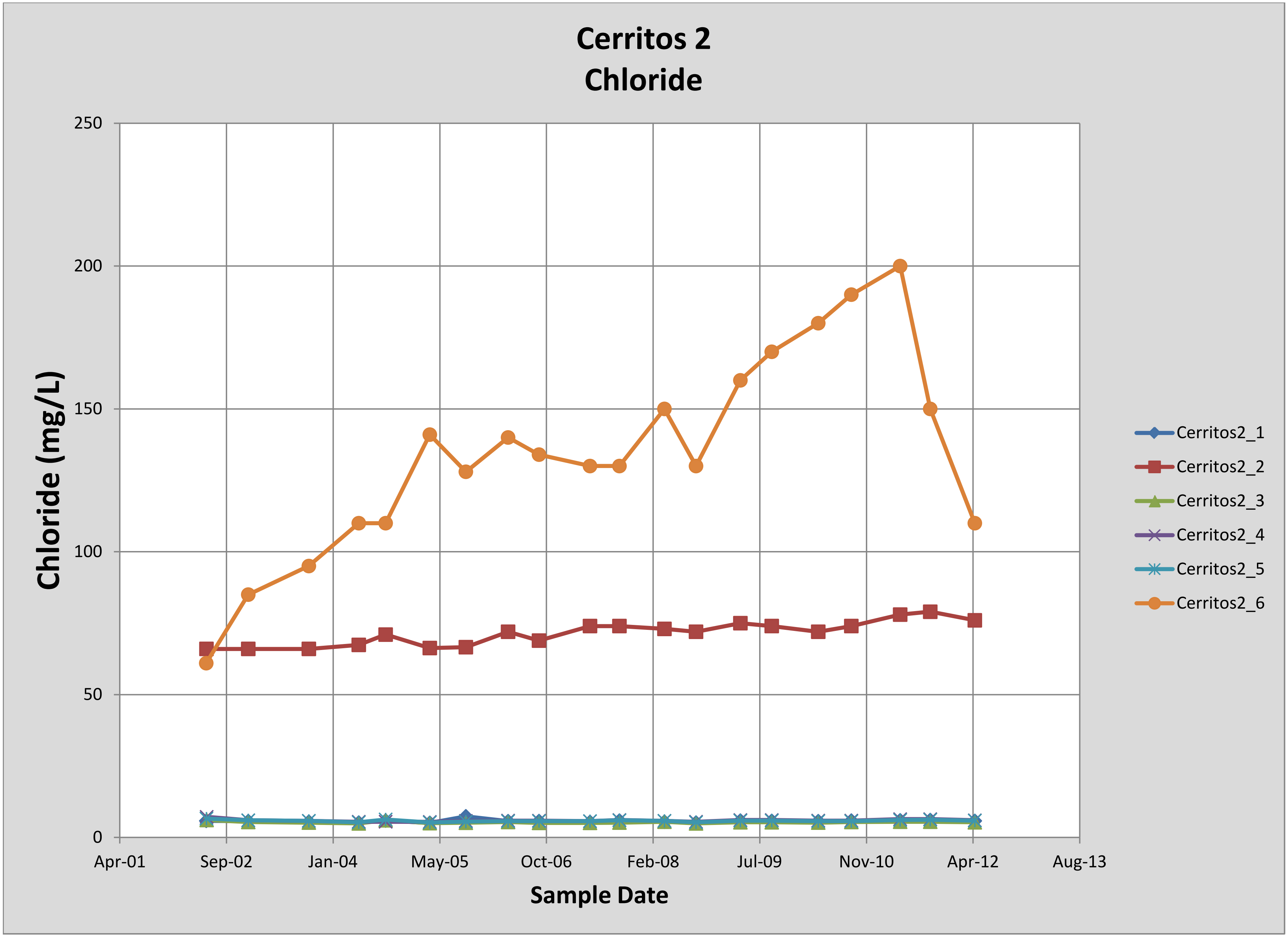

Cerritos 1
Total Dissolved Solids
TDS (mg/L)
400
350
300
250
200
150
100
50
0
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Cerritos1_1
Cerritos1_2
Cerritos1_3
Cerritos1_4
Cerritos1_5
Cerritos1_6

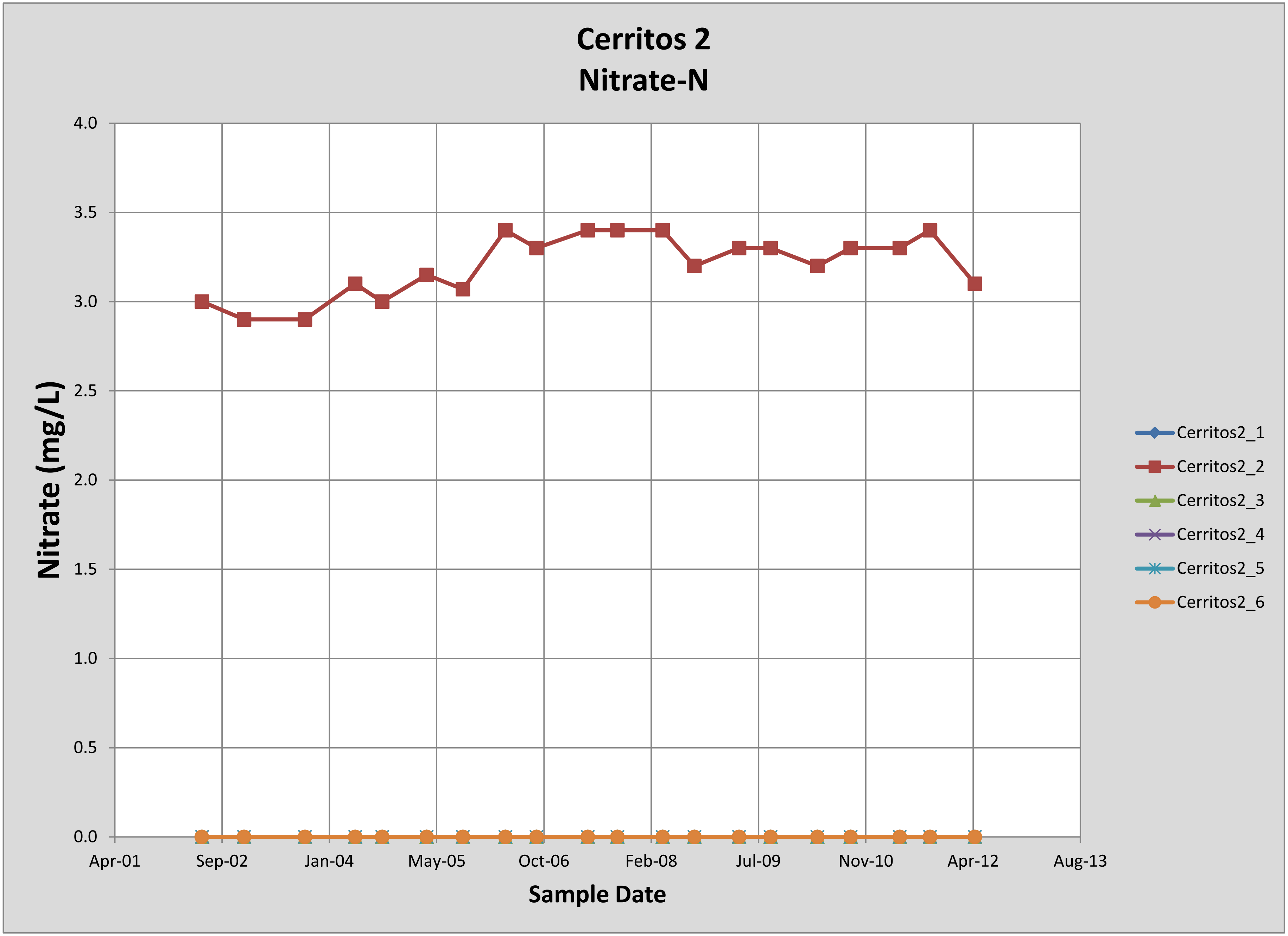


Cerritos 1
Chloride
Chloride (mg/L)
Sample Date
0
5
10
15
20
25
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Cerritos1_1
Cerritos1_2
Cerritos1_3
Cerritos1_4
Cerritos1_5
Cerritos1_6

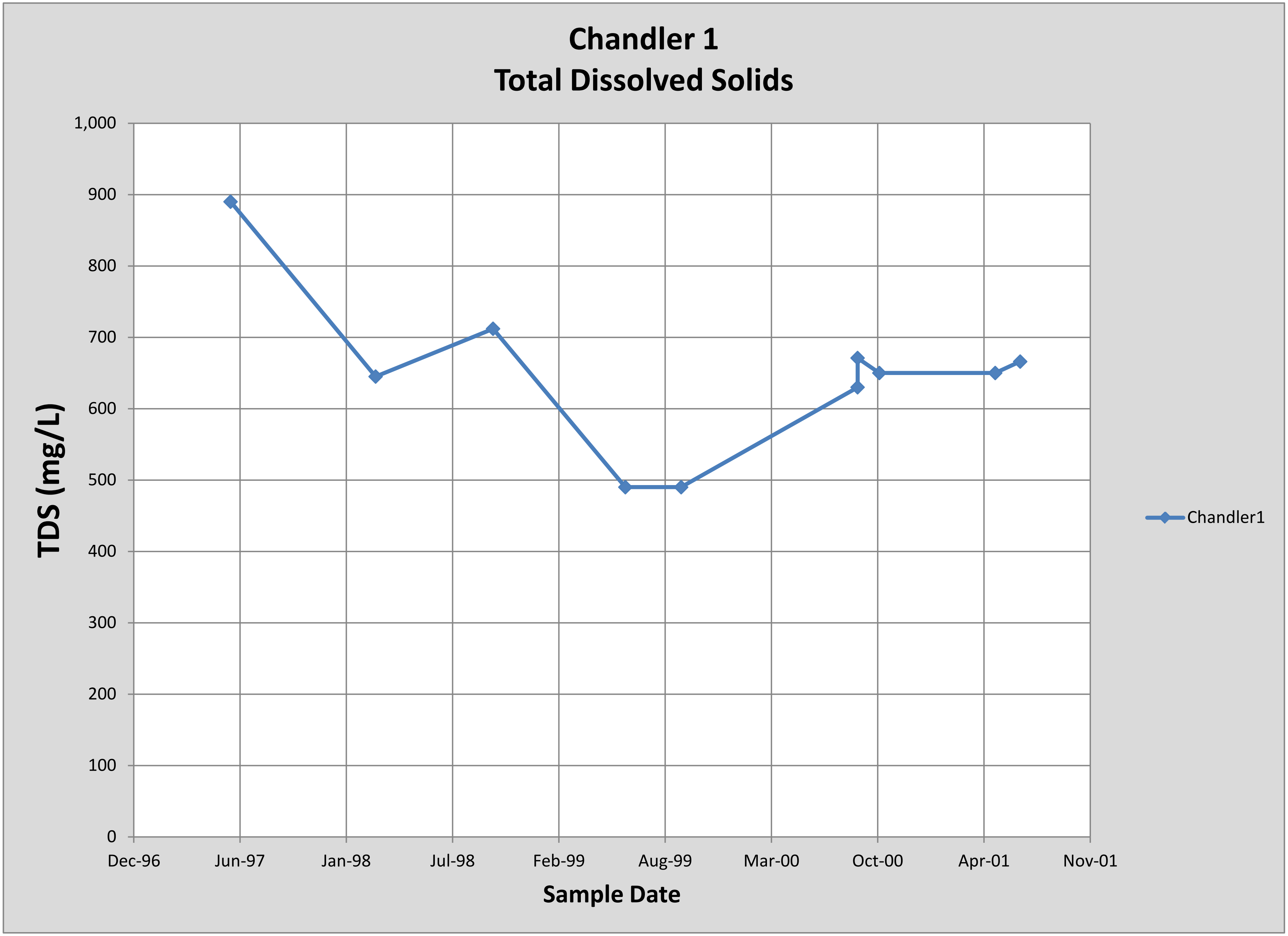

Cerritos 1
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Cerritos1_1
Cerritos1_2
Cerritos1_3
Cerritos1_4
Cerritos1_5
Cerritos1_6


Cerritos 2
Total Dissolved Solids
TDS (mg/L)
1,200
1,000
800
600
400
200
0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Cerritos2_1
Cerritos2_2
Cerritos2_3
Cerritos2_4
Cerritos2_5
Cerritos2_6

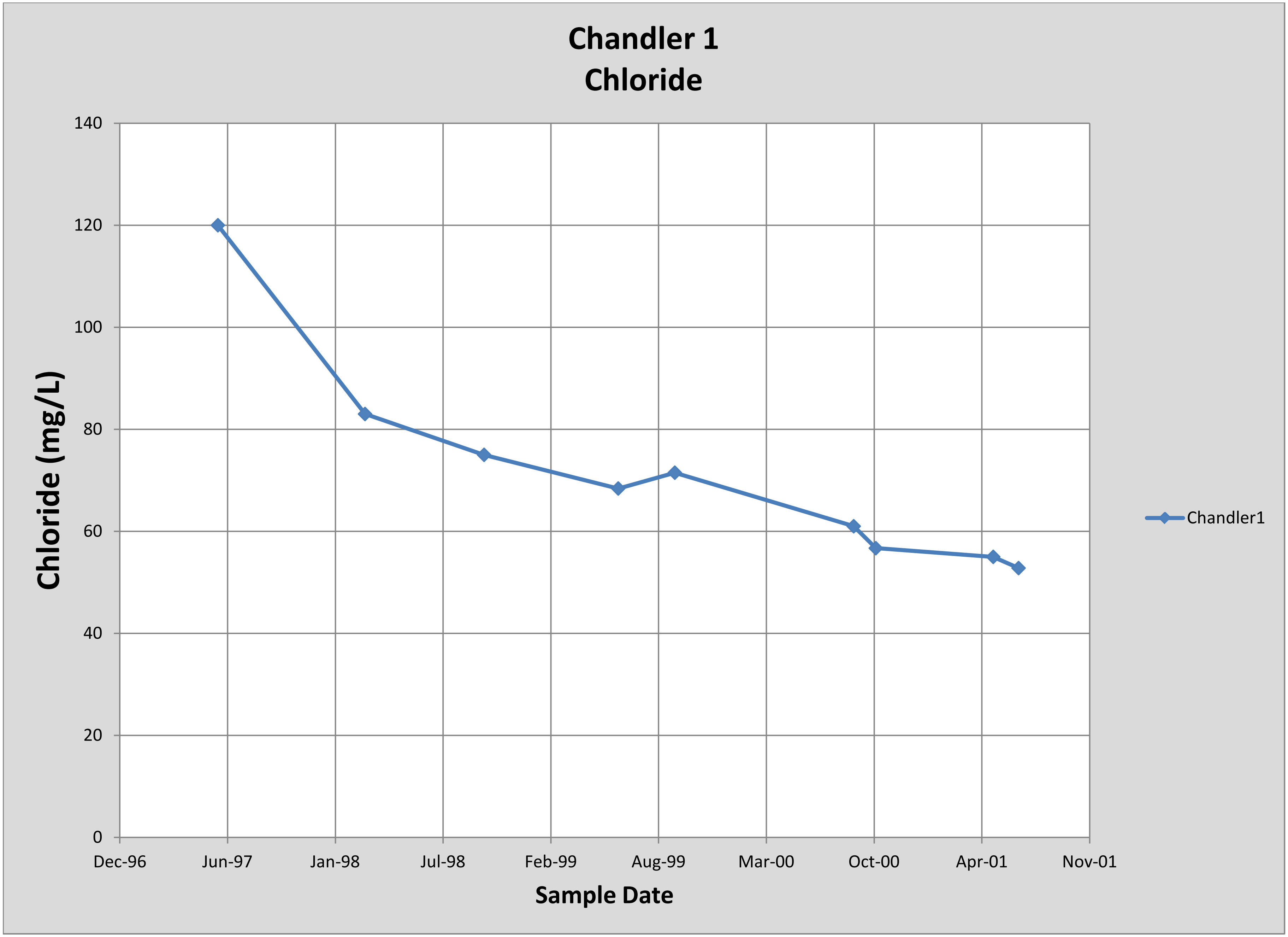

Cerritos 2
Chloride
Chloride (mg/L)
250
200
150
100
50
0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Cerritos2_1
Cerritos2_2
Cerritos2_3
Cerritos2_4
Cerritos2_5
Cerritos2_6



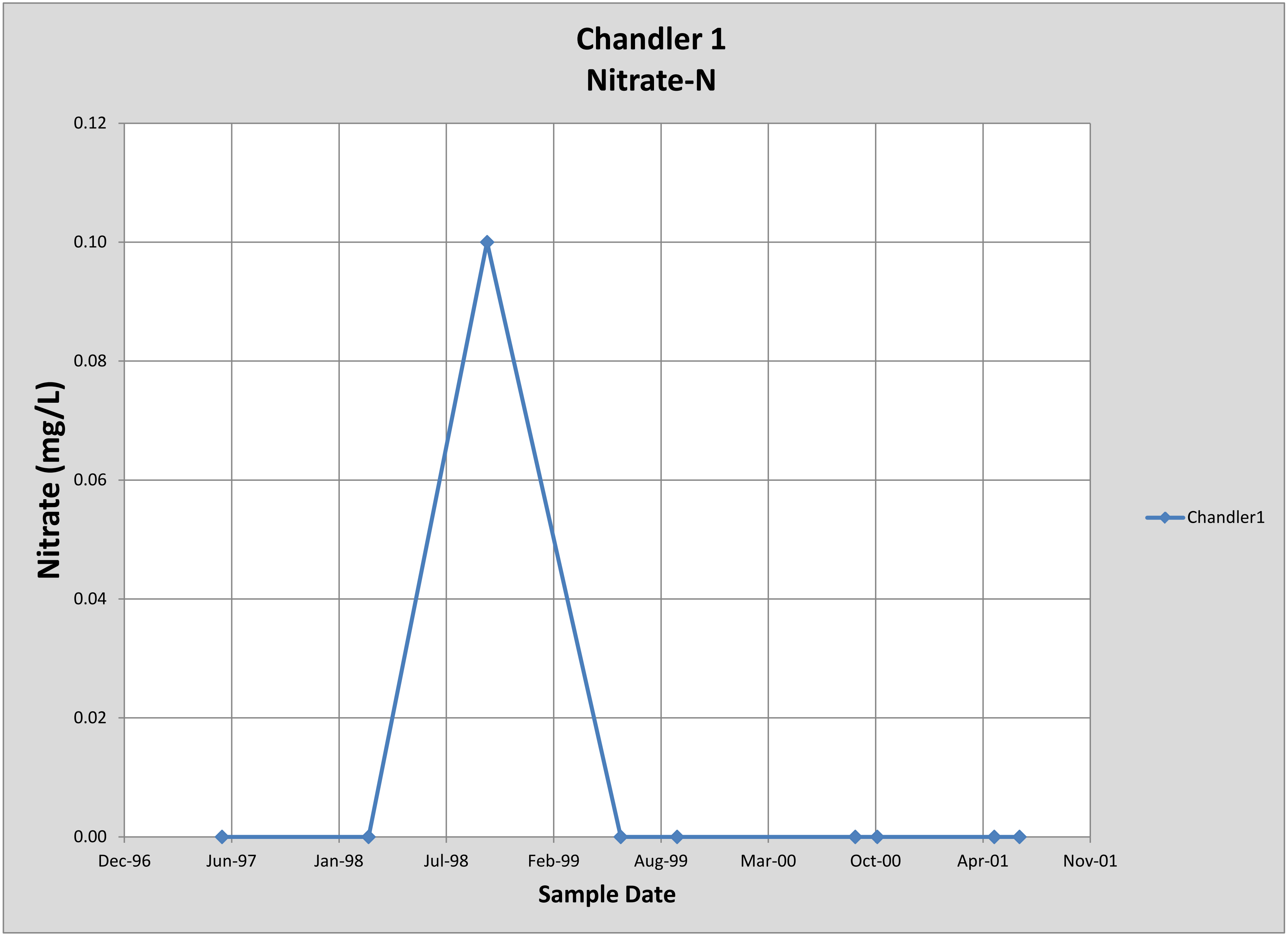
Cerritos 2
Nitrate-N
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Nitrate (mg/L)
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Cerritos2_1
Cerritos2_2
Cerritos2_3
Cerritos2_4
Cerritos2_5
Cerritos2_6

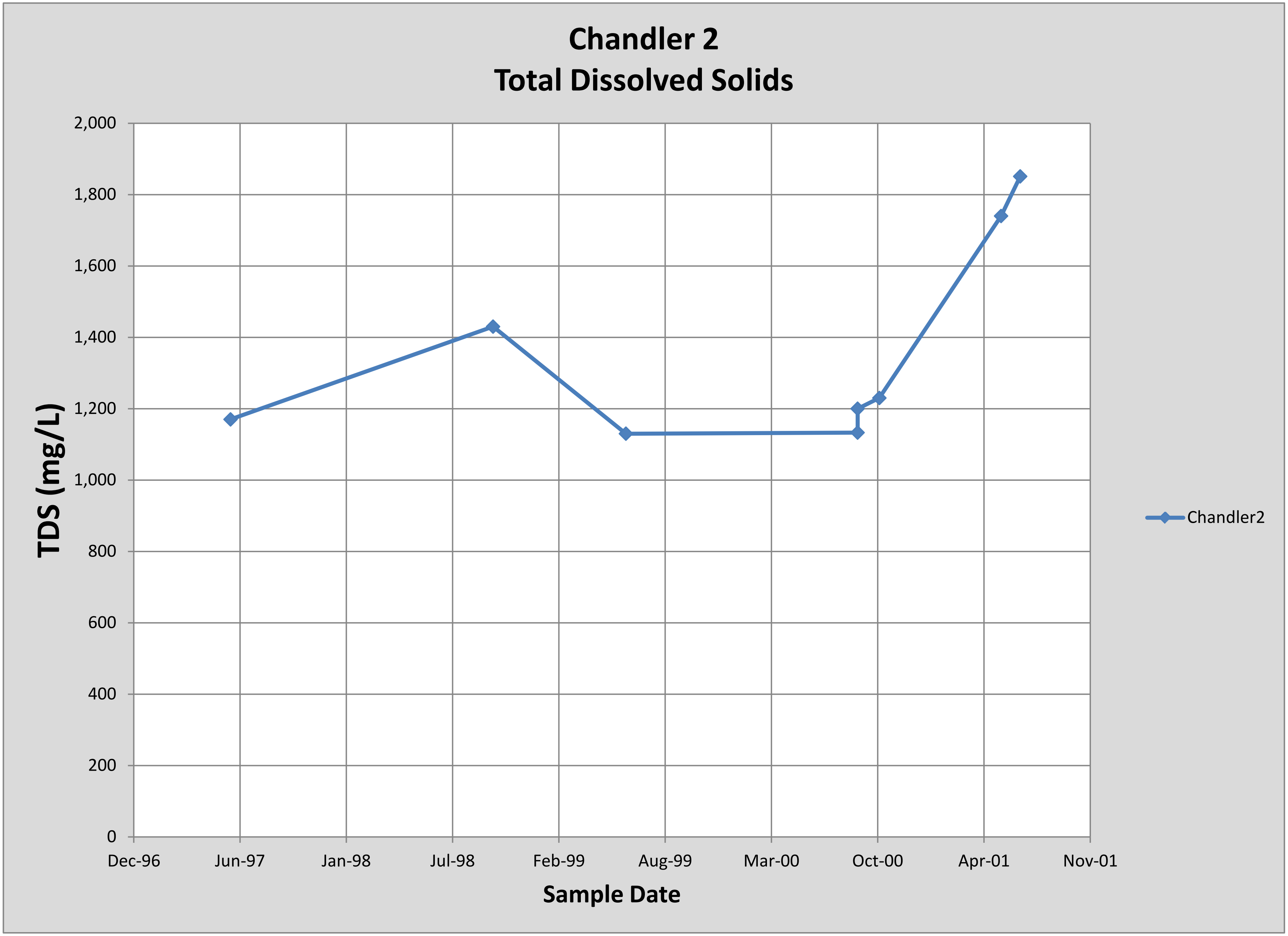


Chandler 1
Total Dissolved Solids
TDS (mg/L)
1,000
900
800
700
600
500
400
300
200
100
0
Dec-96
Jun-97
Jan-98
Jul-98
Feb-99
Aug-99
Mar-00
Oct-00
Apr-01
Nov-01
Sample Date
Chandler1

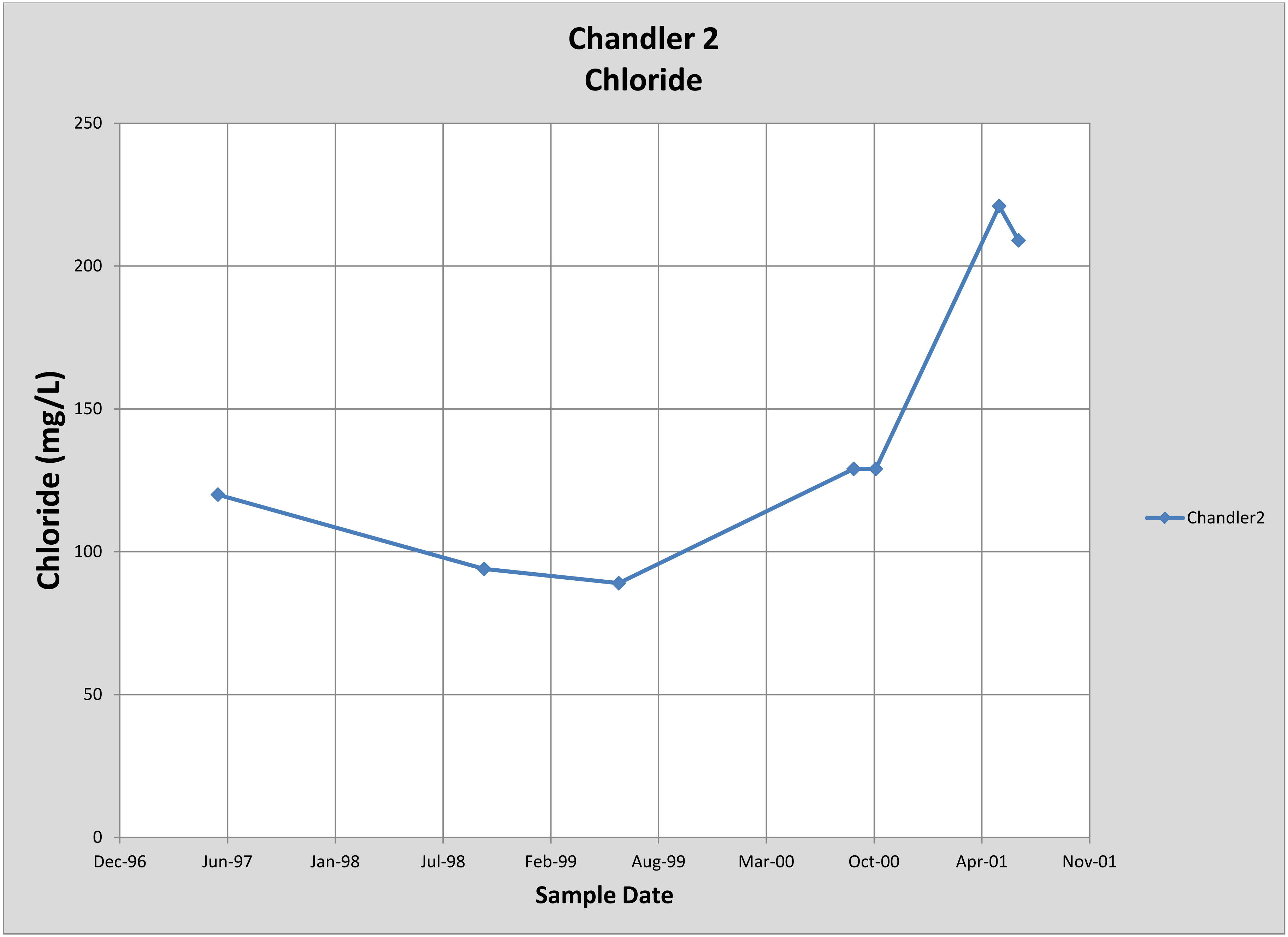


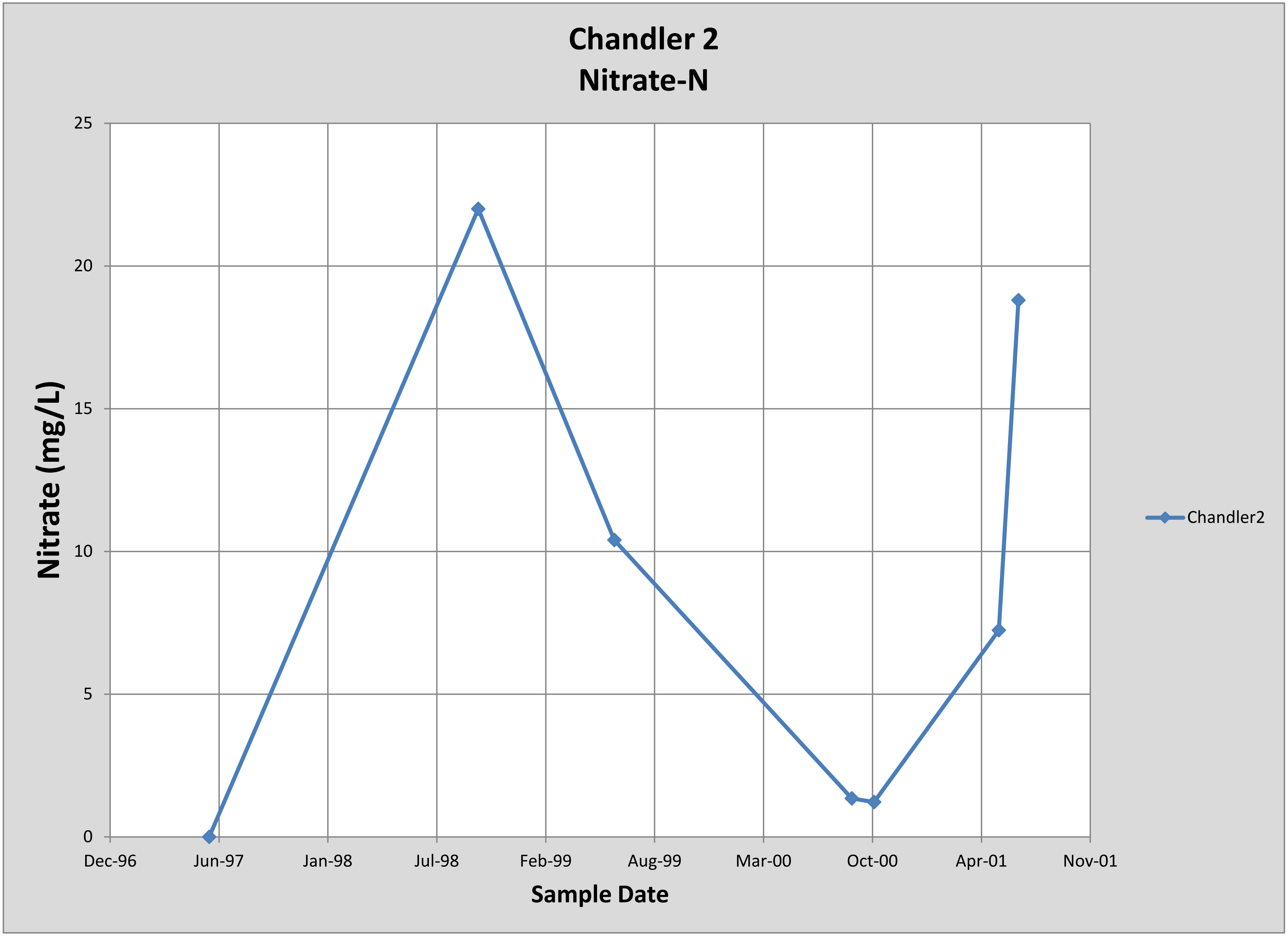
Chandler 1
Chloride
Chloride (mg/L)
140
120
100
80
60
40
20
0
Dec-96
Jun-97
Jan-98
Jul-98
Feb-99
Aug-99
Mar-00
Oct-00
Apr-01
Nov-01
Sample Date
Chandler1


Chandler 1
Nitrate-N
Nitrate (mg/L)
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Dec-96
Jun-97
Jan-98
Jul-98
Feb-99
Aug-99
Mar-00
Oct-00
Apr-01
Nov-01
Sample Date
Chandler1

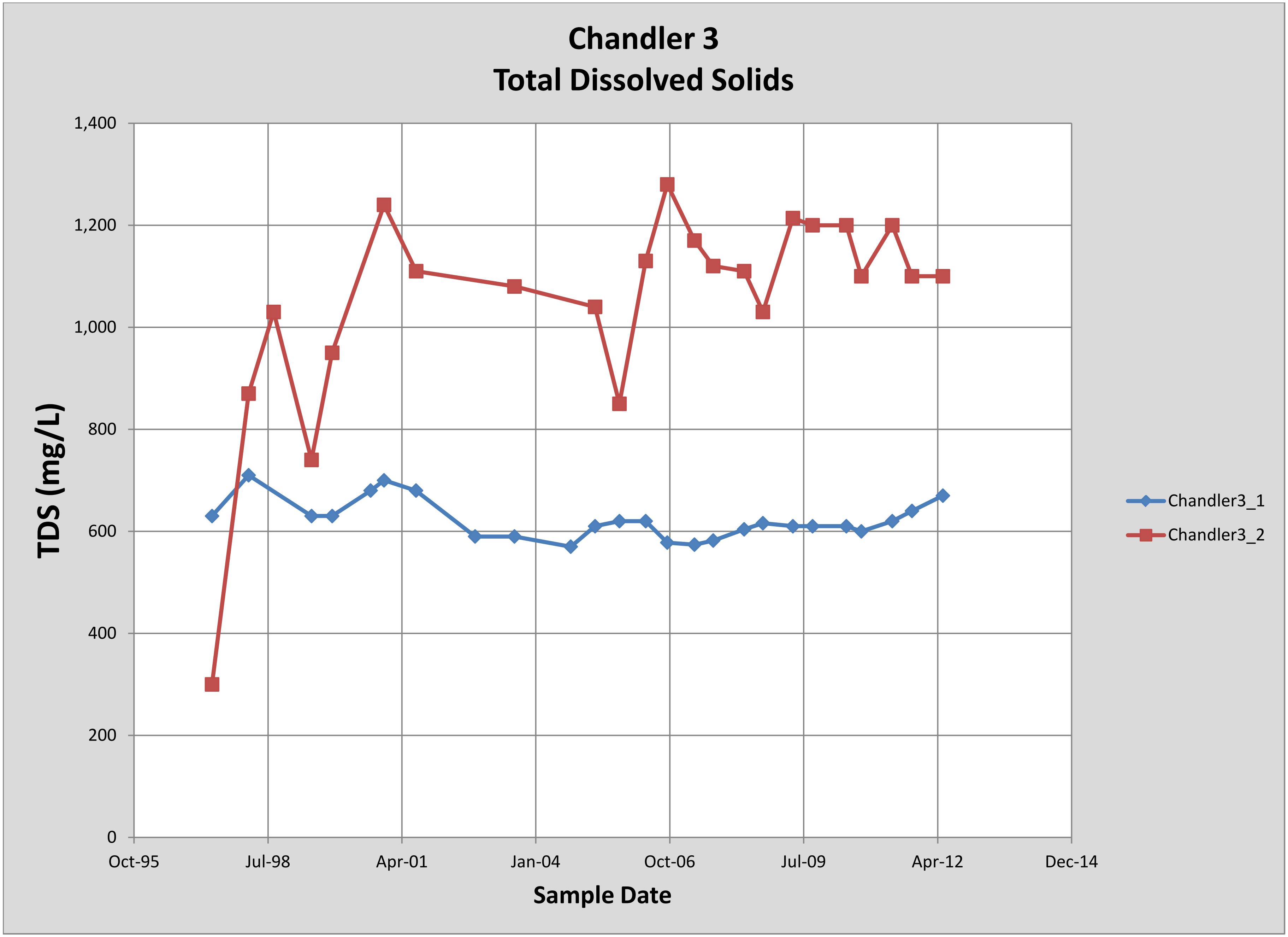


Chandler 2
Total Dissolved Solids
TDS (mg/L)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Dec-96
Jun-97
Jan-98
Jul-98
Feb-99
Aug-99
Mar-00
Oct-00
Apr-01
Nov-01
Sample Date
Chandler2

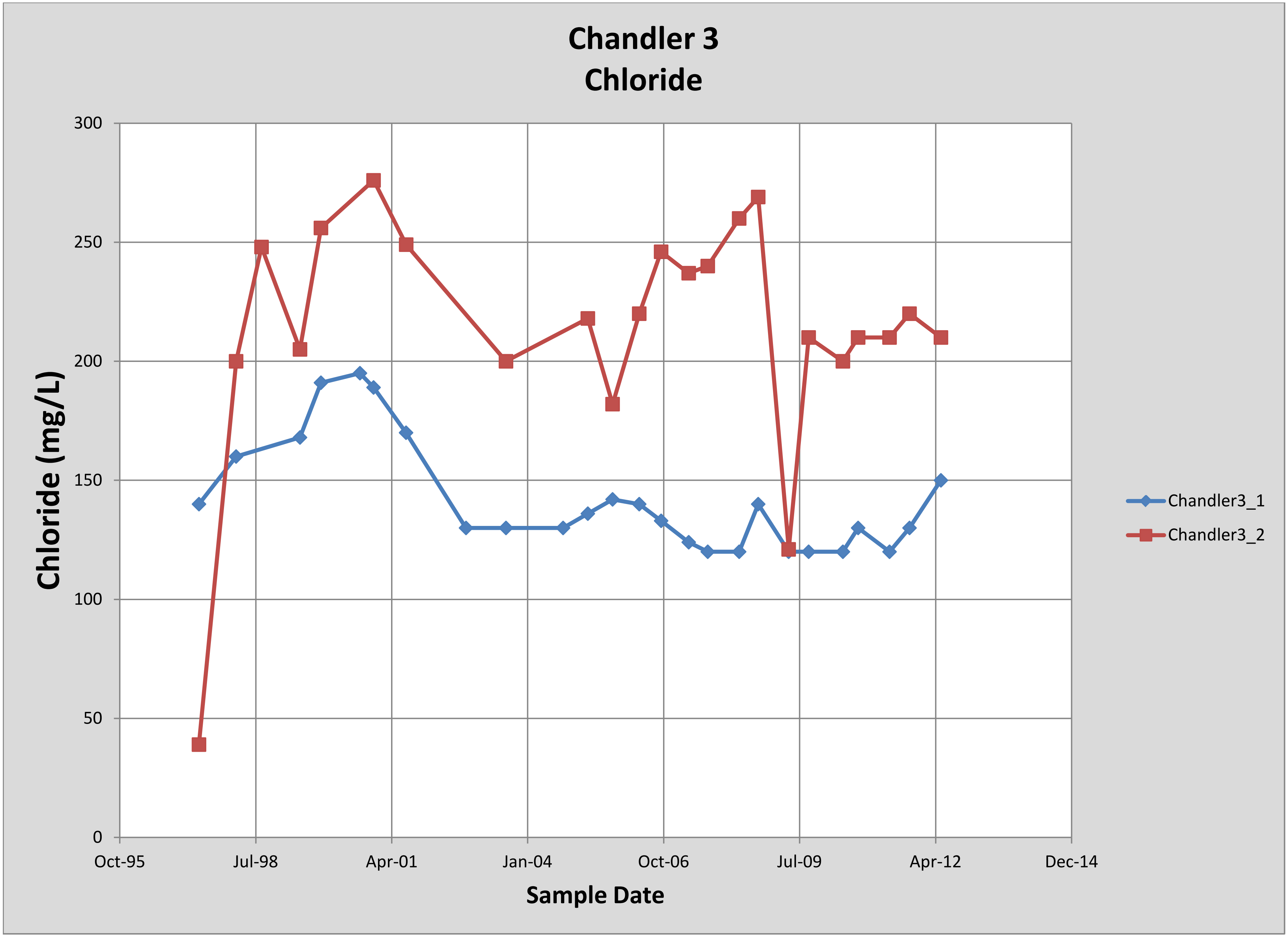

Chandler 2
Chloride
Chloride (mg/L)
250
200
150
100
50
0
Dec-96
Jun-97
Jan-98
Jul-98
Feb-99
Aug-99
Mar-00
Oct-00
Apr-01
Nov-01
Sample Date
Chandler2

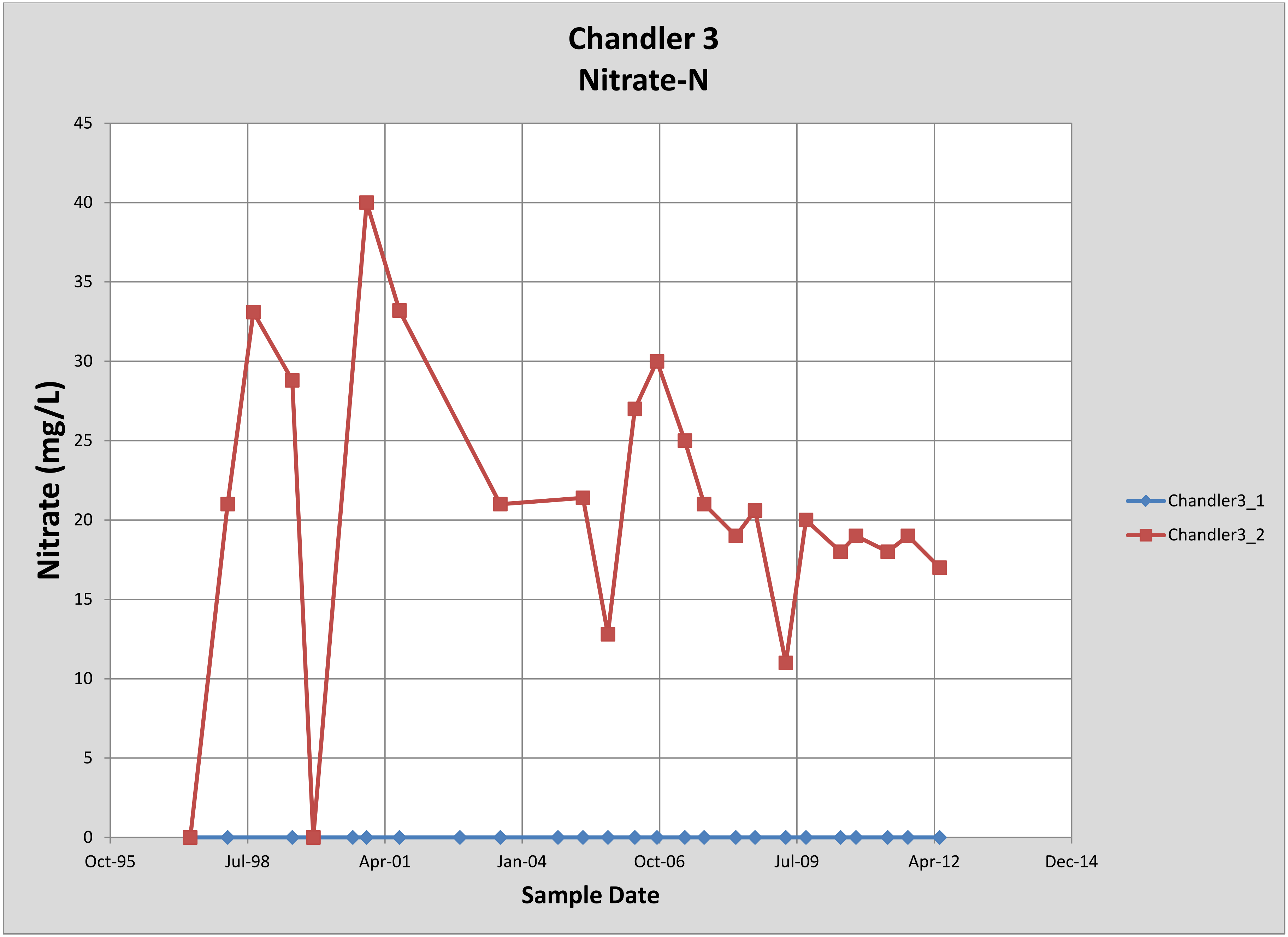


Chandler 2
Nitrate-N
Nitrate (mg/L)
0
5
10
15
20
25
Dec-96
Jun-97
Jan-98
Jul-98
Feb-99
Aug-99
Mar-00
Oct-00
Apr-01
Nov-01
Sample Date
Chandler2

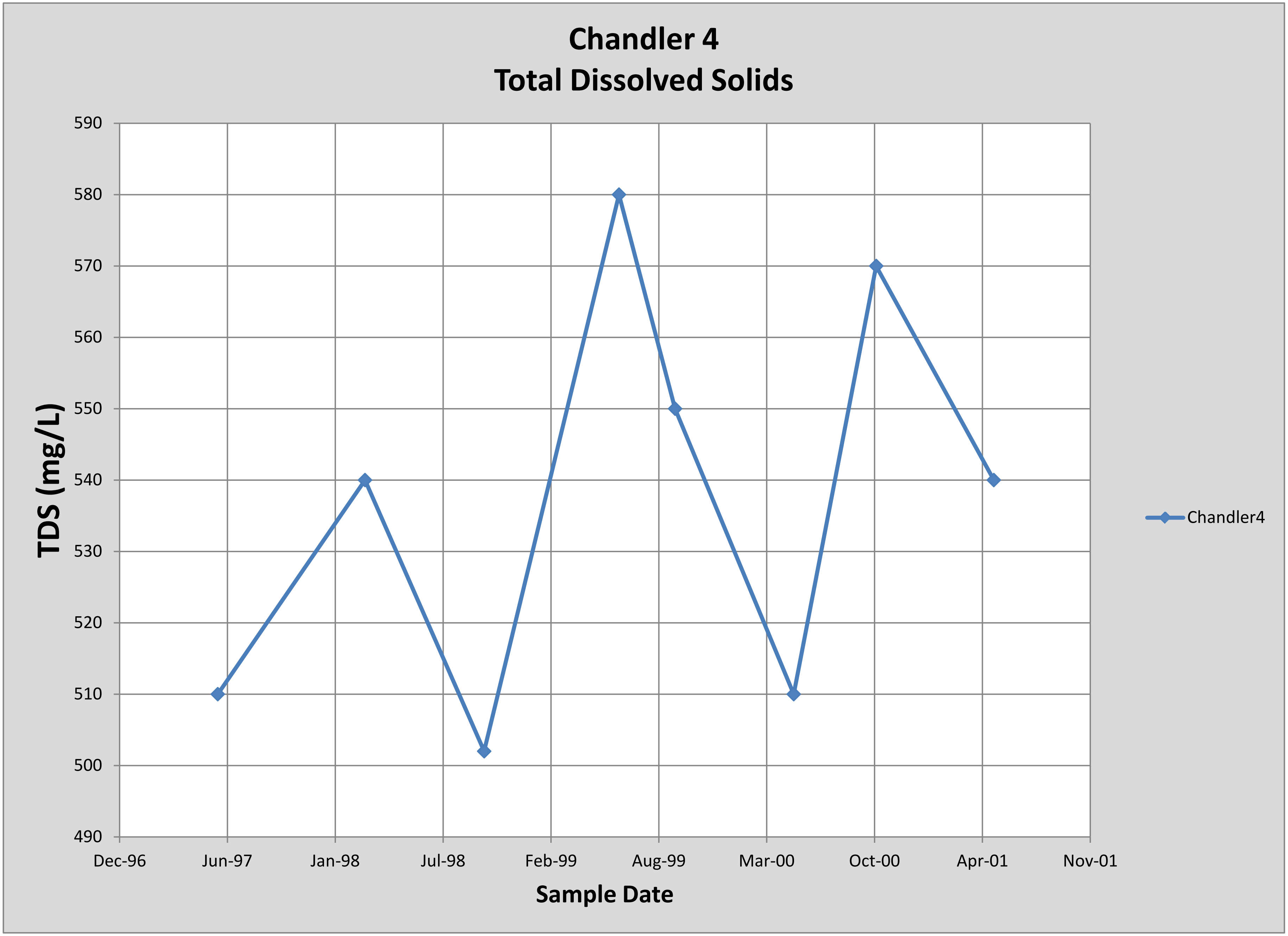


Chandler 3
Total Dissolved Solids
TDS (mg/L)
1,400
1,200
1,000
800
600
400
200
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Chandler3_1
Chandler3_2

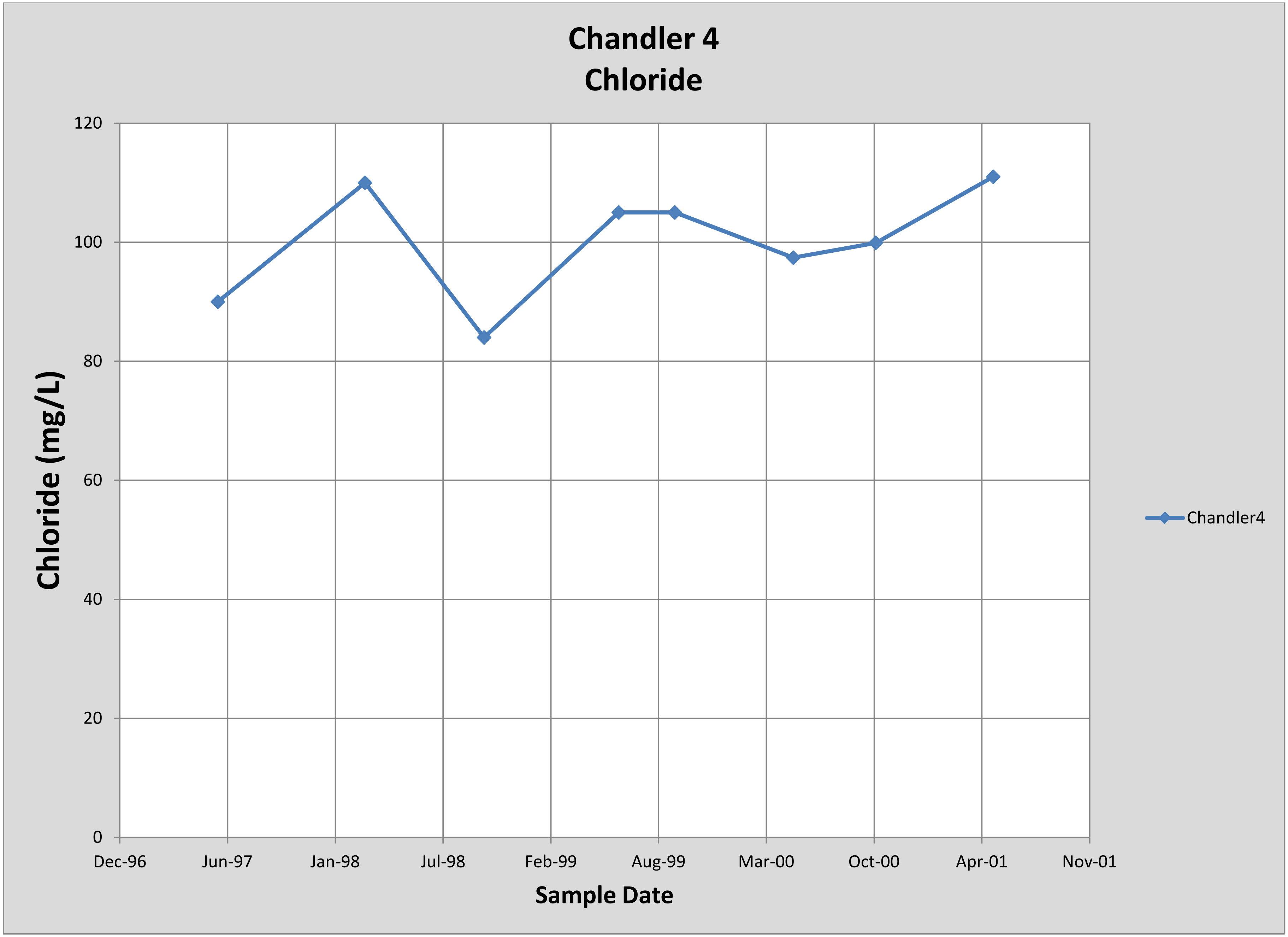

Chandler 3
Chloride
Chloride (mg/L)
300
250
200
150
100
50
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Chandler3_1
Chandler3_2

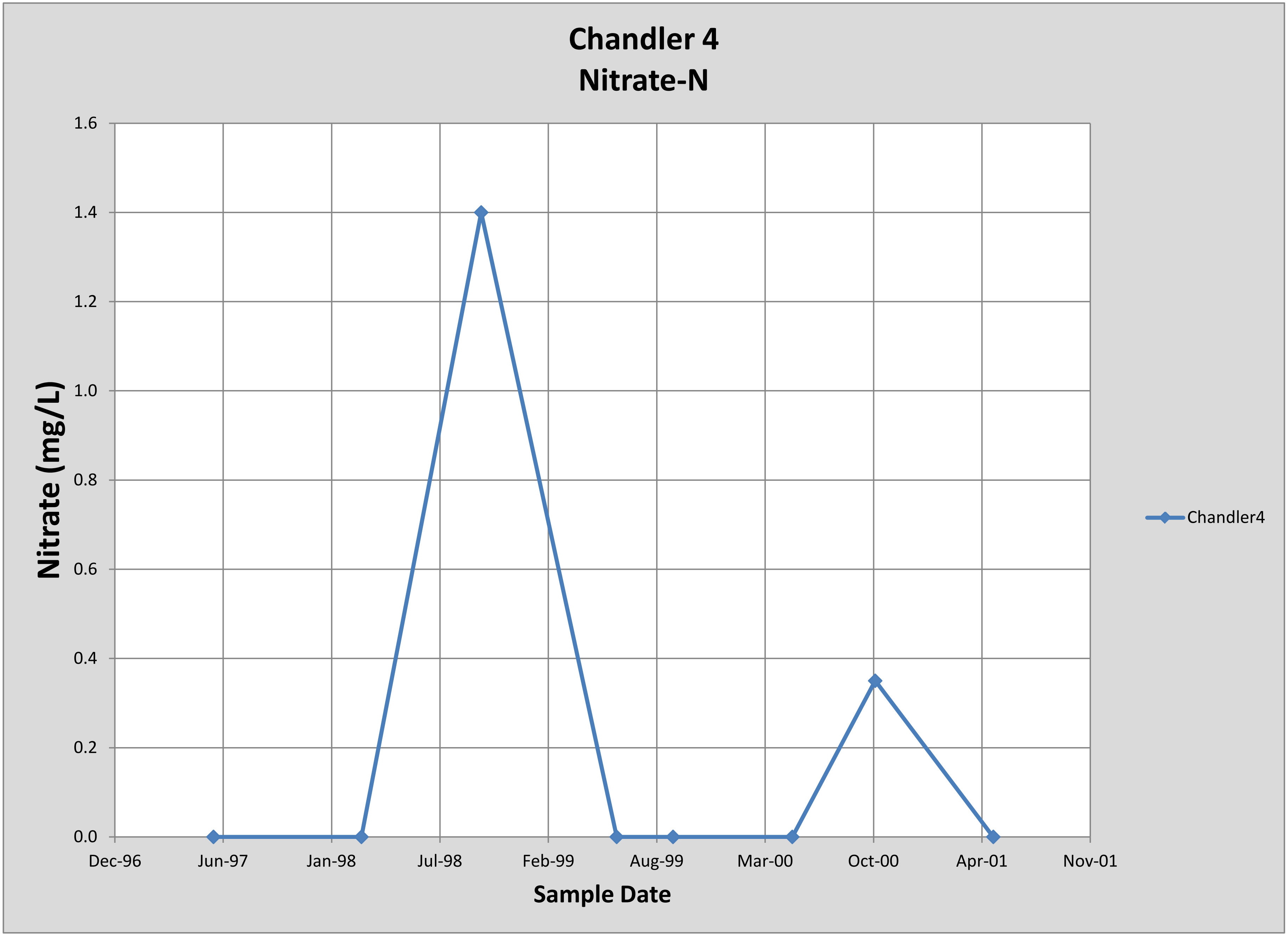


Chandler 3
Nitrate-N
Nitrate (mg/L)
45
40
35
30
25
20
15
10
5
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Chandler3_1
Chandler3_2

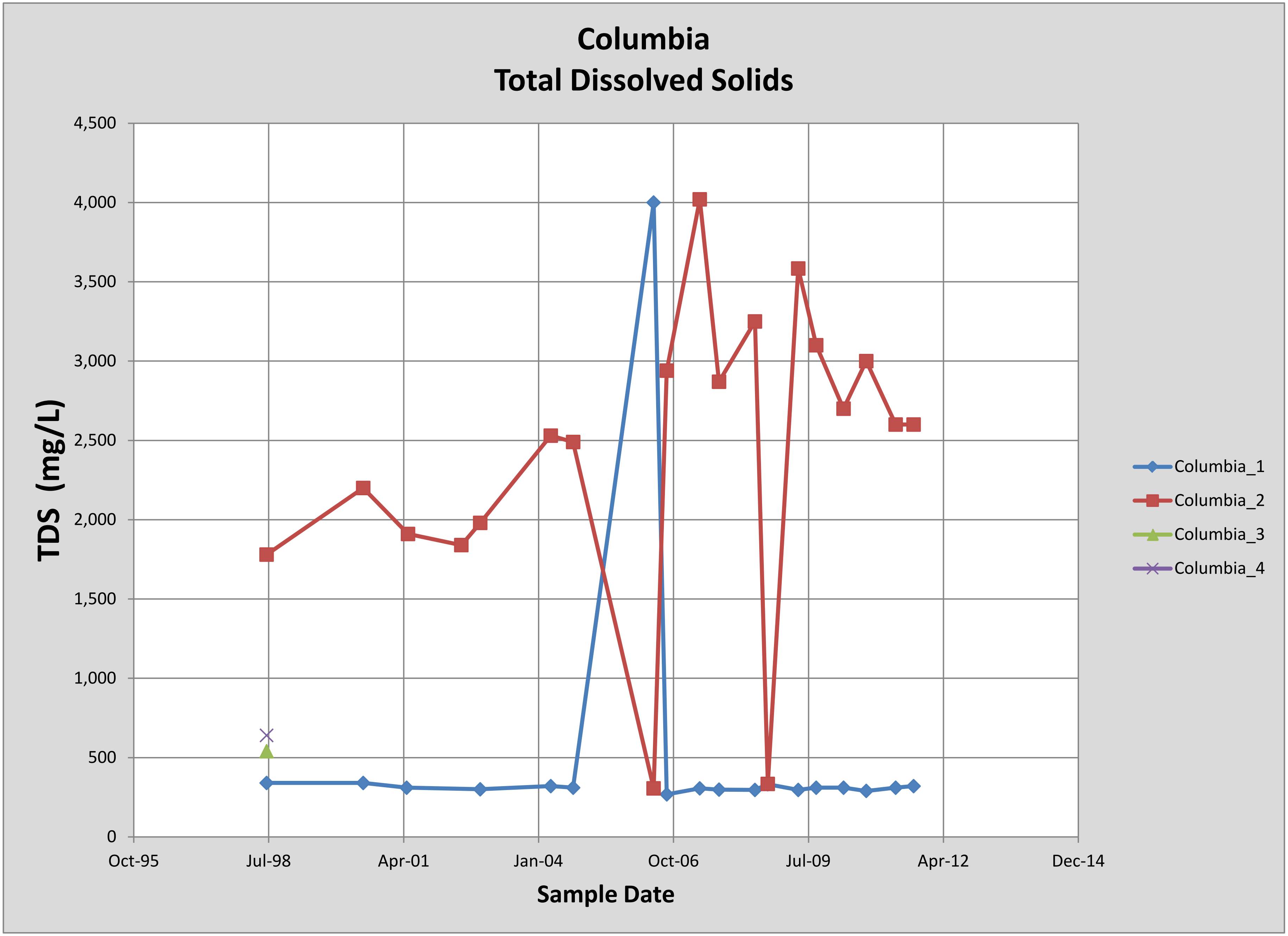


Chandler 4
Total Dissolved Solids
590
580
570
560
550
540
530
520
510
500
490
TDS (mg/L)
Dec-96
Jun-97
Jan-98
Jul-98
Feb-99
Aug-99
Mar-00
Oct-00
Apr-01
Nov-01
Sample Date
Chandler4

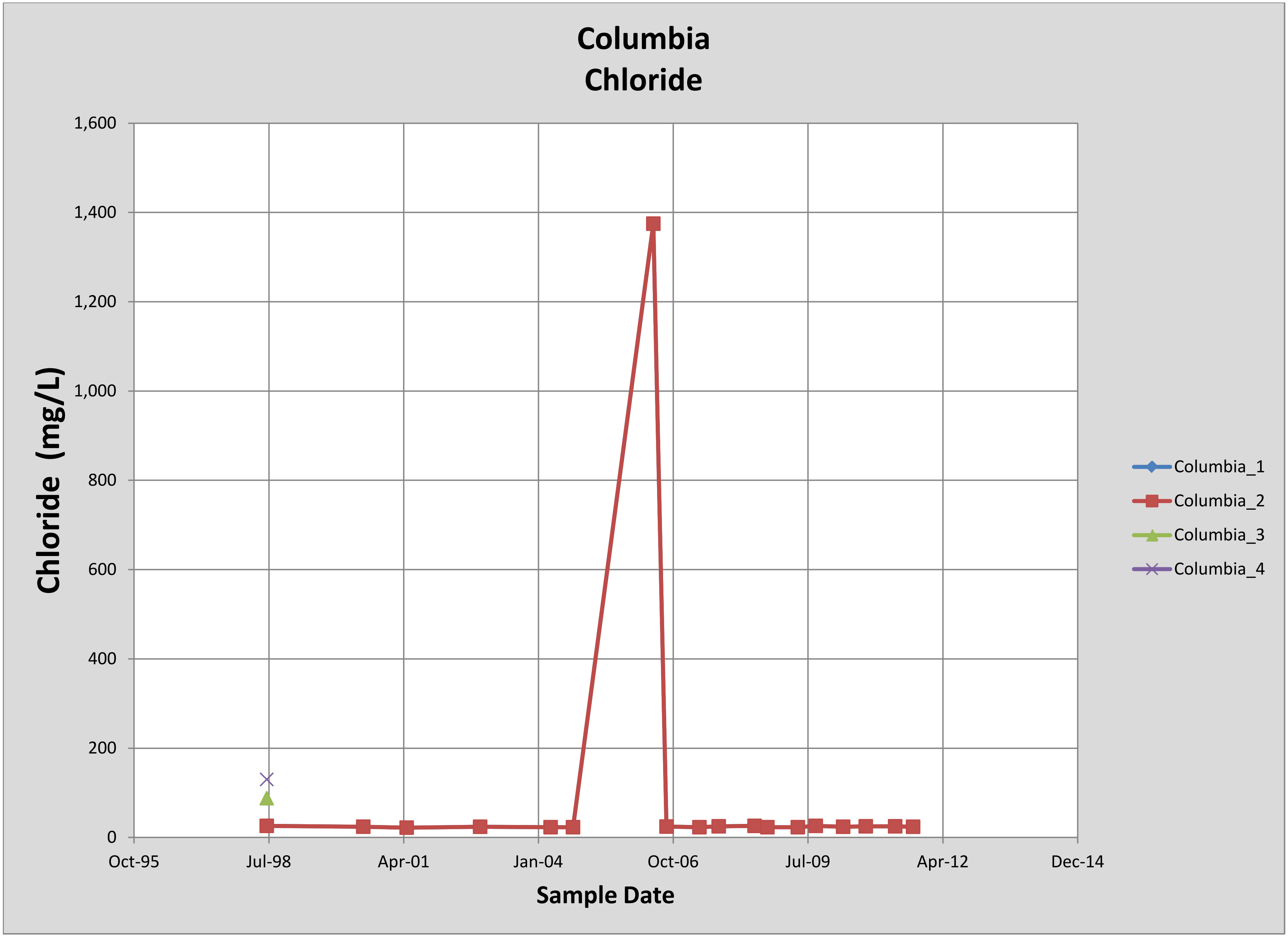

Chandler 4
Chloride
Chloride (mg/L)
0
20
40
60
80
100
120
Dec-96
Jun-97
Jan-98
Jul-98
Feb-99
Aug-99
Mar-00
Oct-00
Apr-01
Nov-01
Sample Date
Chandler4



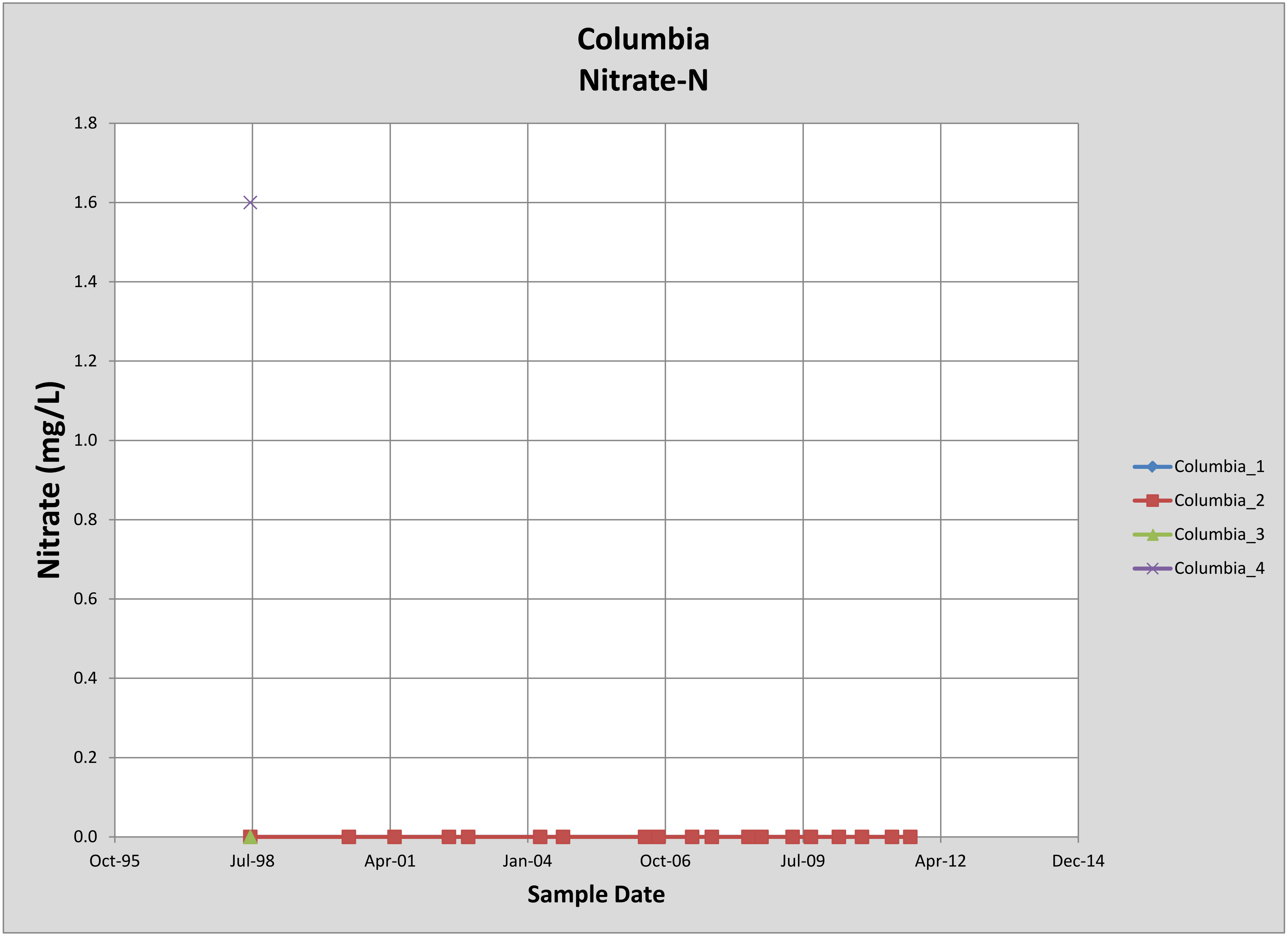
Chandler 4
Nitrate-N
Nitrate (mg/L)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Dec-96
Jun-97
Jan-98
Jul-98
Feb-99
Aug-99
Mar-00
Oct-00
Apr-01
Nov-01
Sample Date
Chandler4

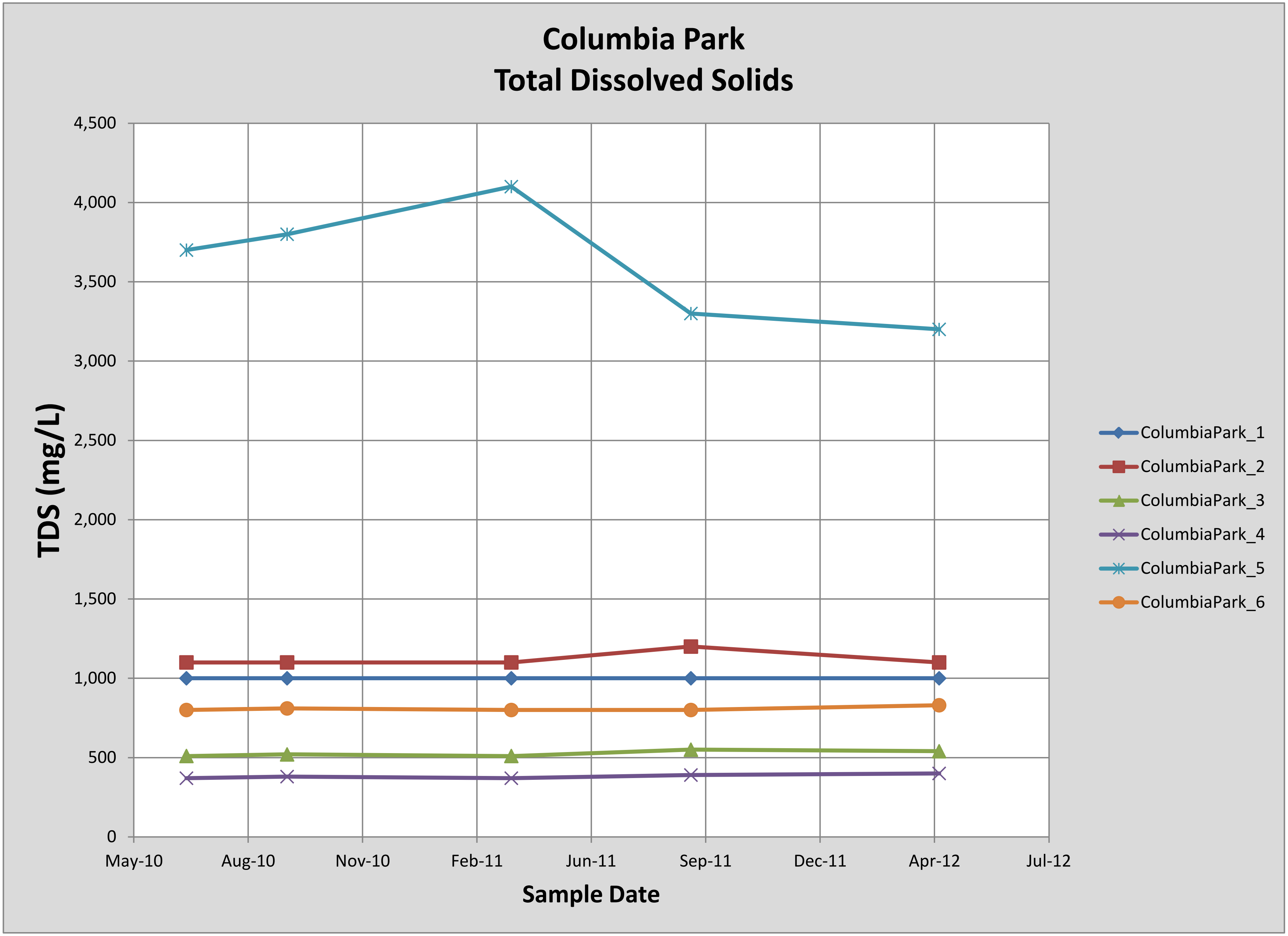


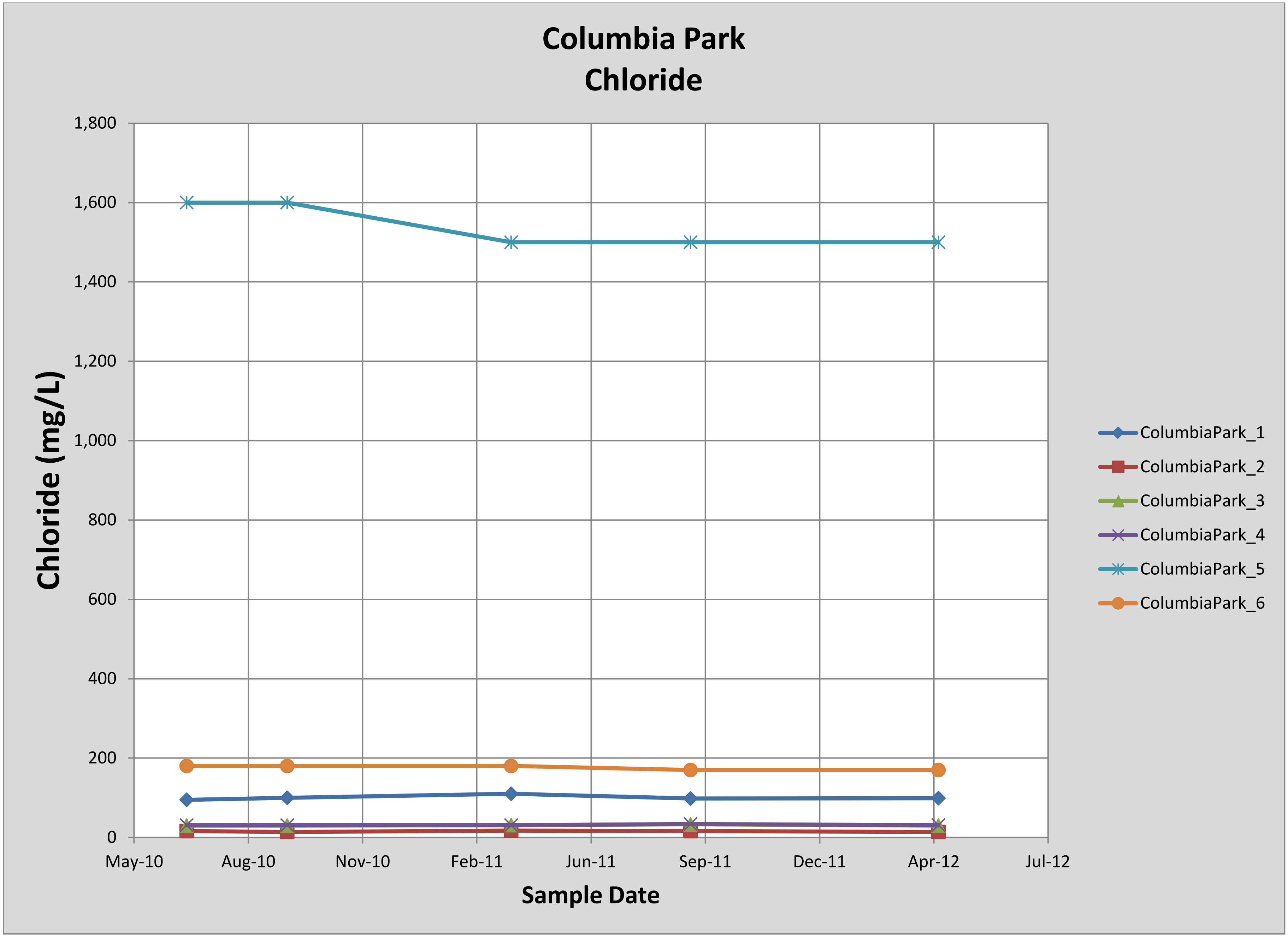
Columbia
Total Dissolved Solids
TDS (mg/L)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Columbia_1
Columbia_2
Columbia_3
Columbia_4

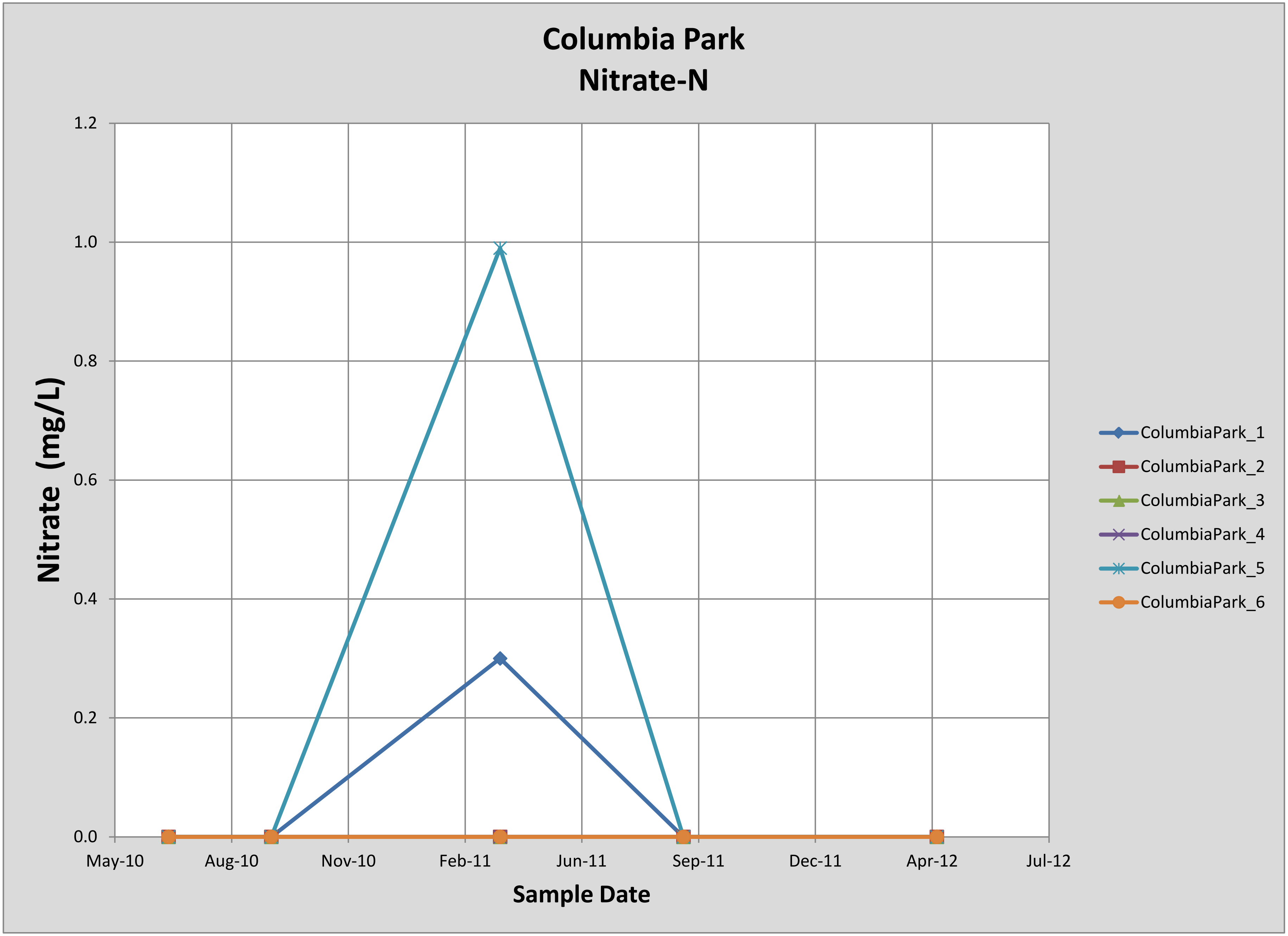


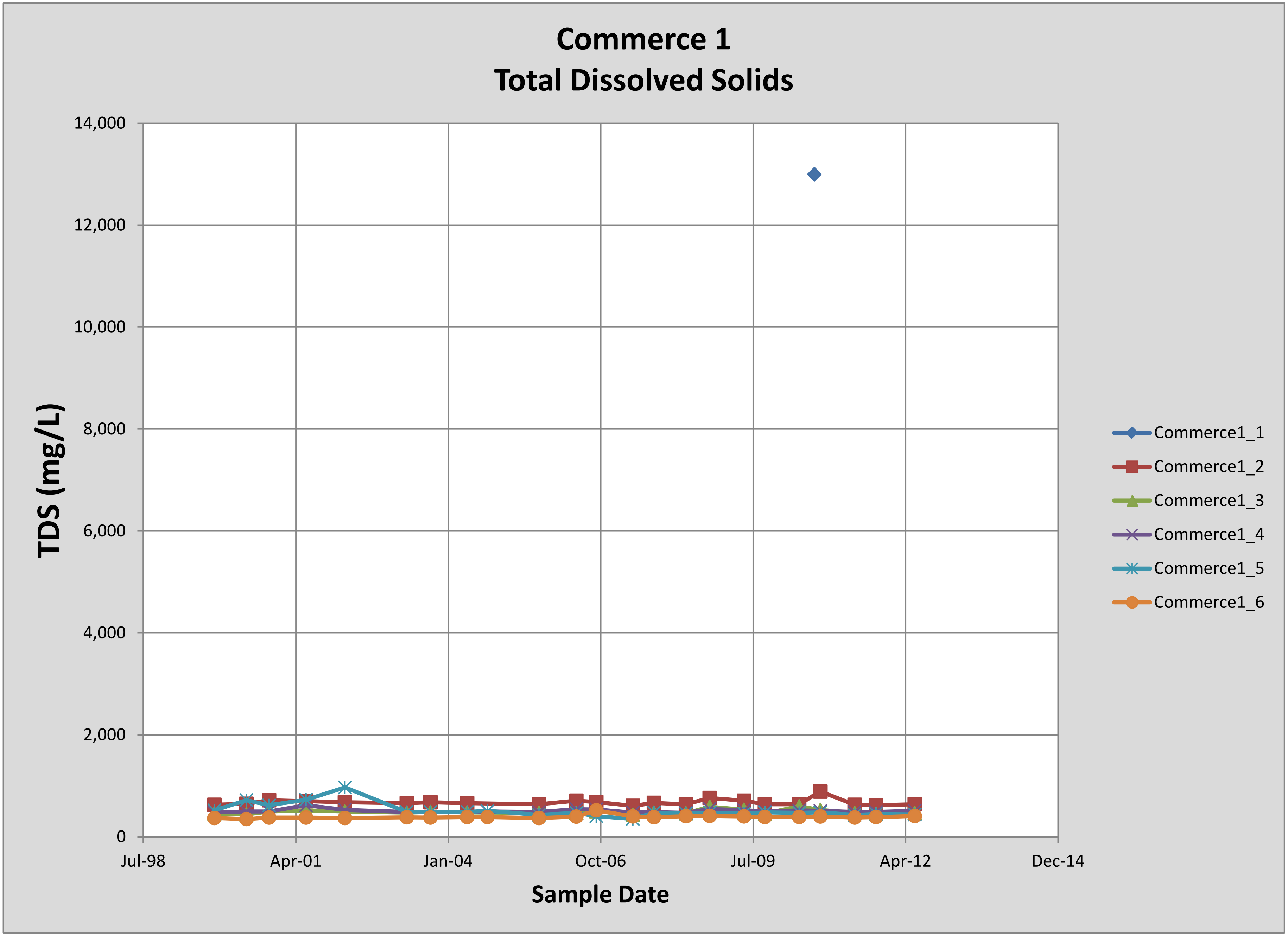
Columbia
Chloride
Chloride (mg/L)
1,600
1,400
1,200
1,000
800
600
400
200
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Columbia_1
Columbia_2
Columbia_3
Columbia_4

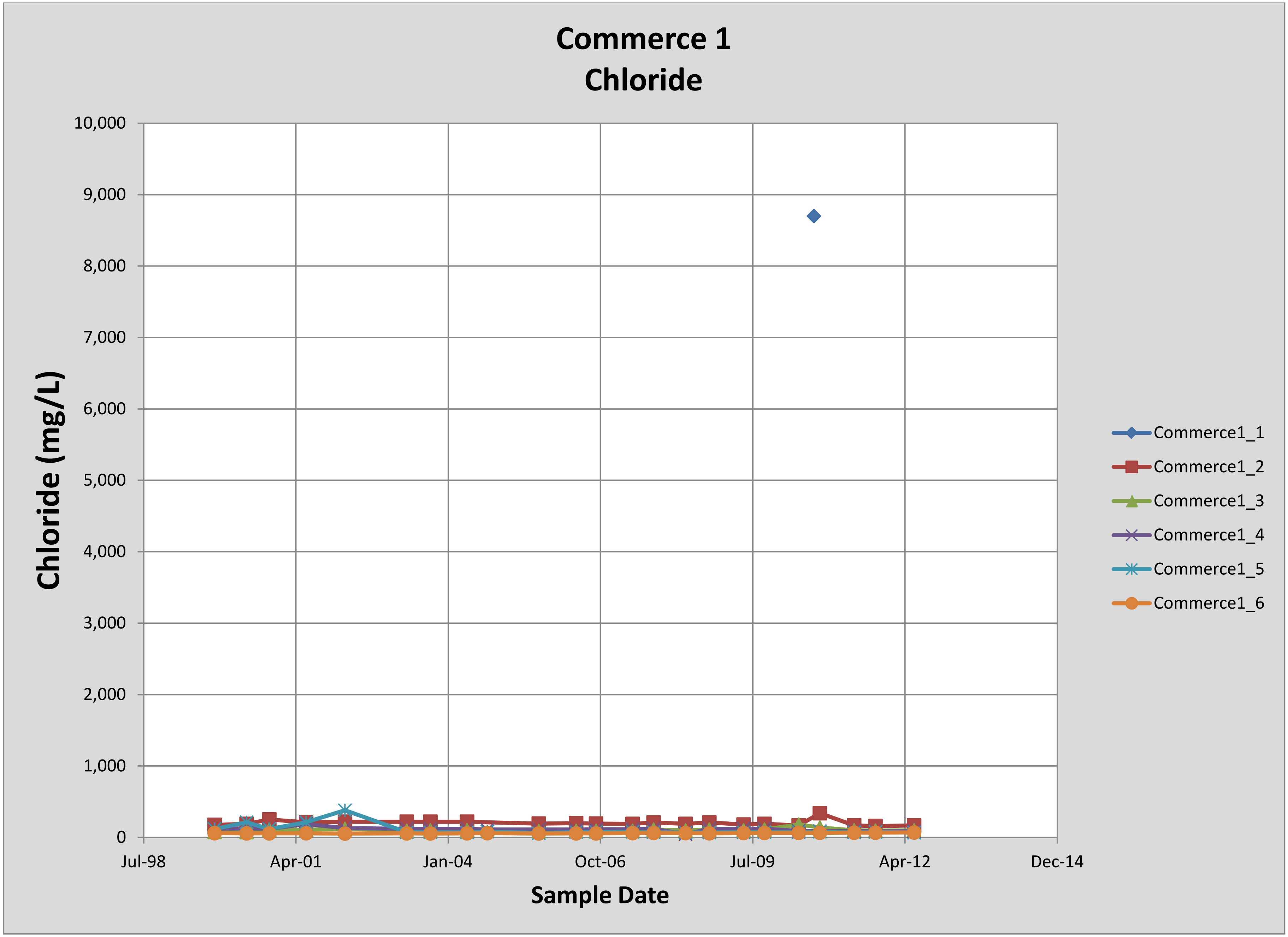

Columbia
Nitrate-N
Nitrate (mg/L)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Columbia_1
Columbia_2
Columbia_3
Columbia_4


Columbia Park
Total Dissolved Solids
TDS (mg/L)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
May-10
Aug-10
Nov-10
Feb-11
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Sample Date
ColumbiaPark_1
ColumbiaPark_2
ColumbiaPark_3
ColumbiaPark_4
ColumbiaPark_5
ColumbiaPark_6

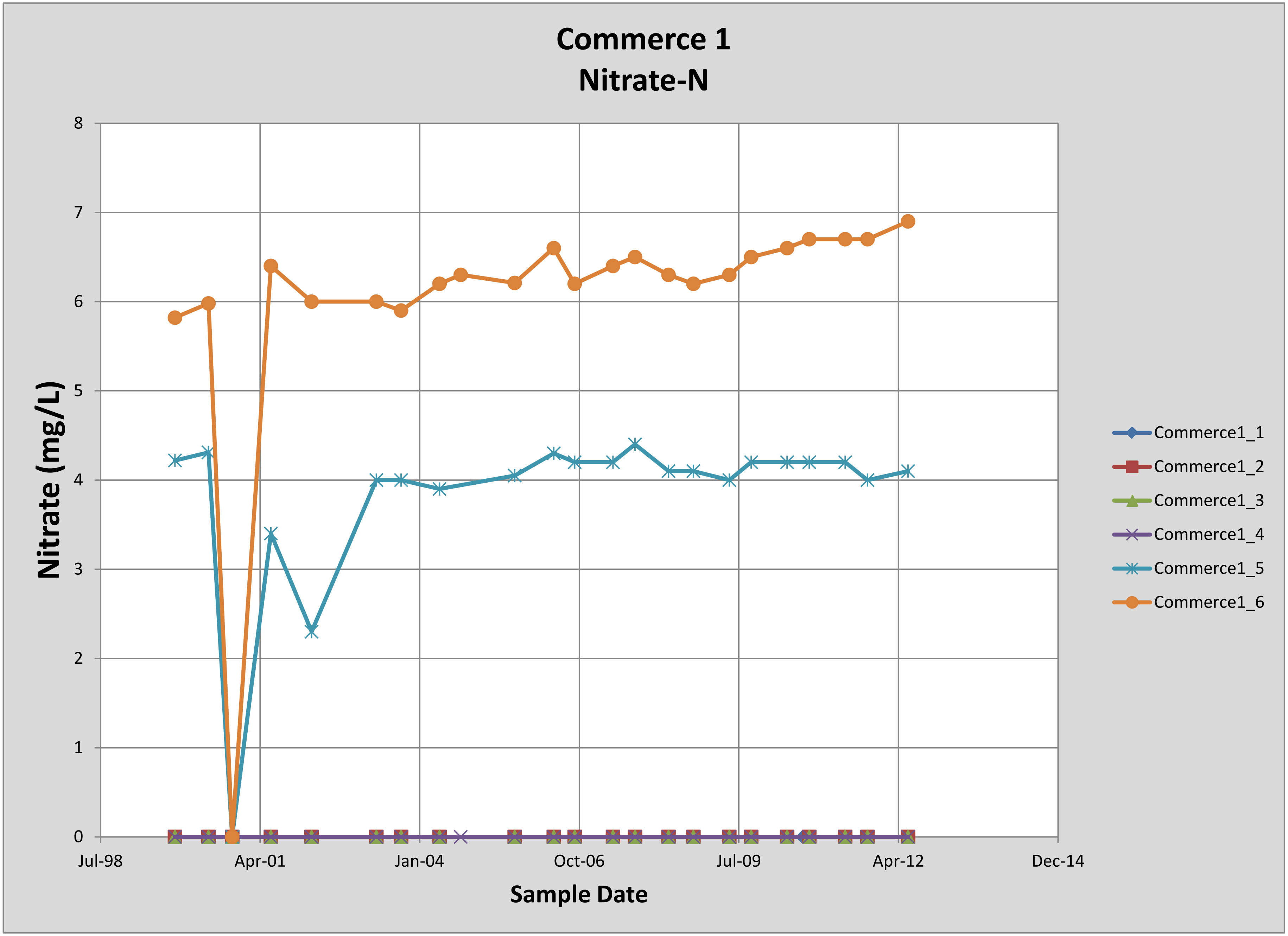

Columbia Park
Chloride
Chloride (mg/L)
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
May-10
Aug-10
Nov-10
Feb-11
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Sample Date
ColumbiaPark_1
ColumbiaPark_2
ColumbiaPark_3
ColumbiaPark_4
ColumbiaPark_5
ColumbiaPark_6

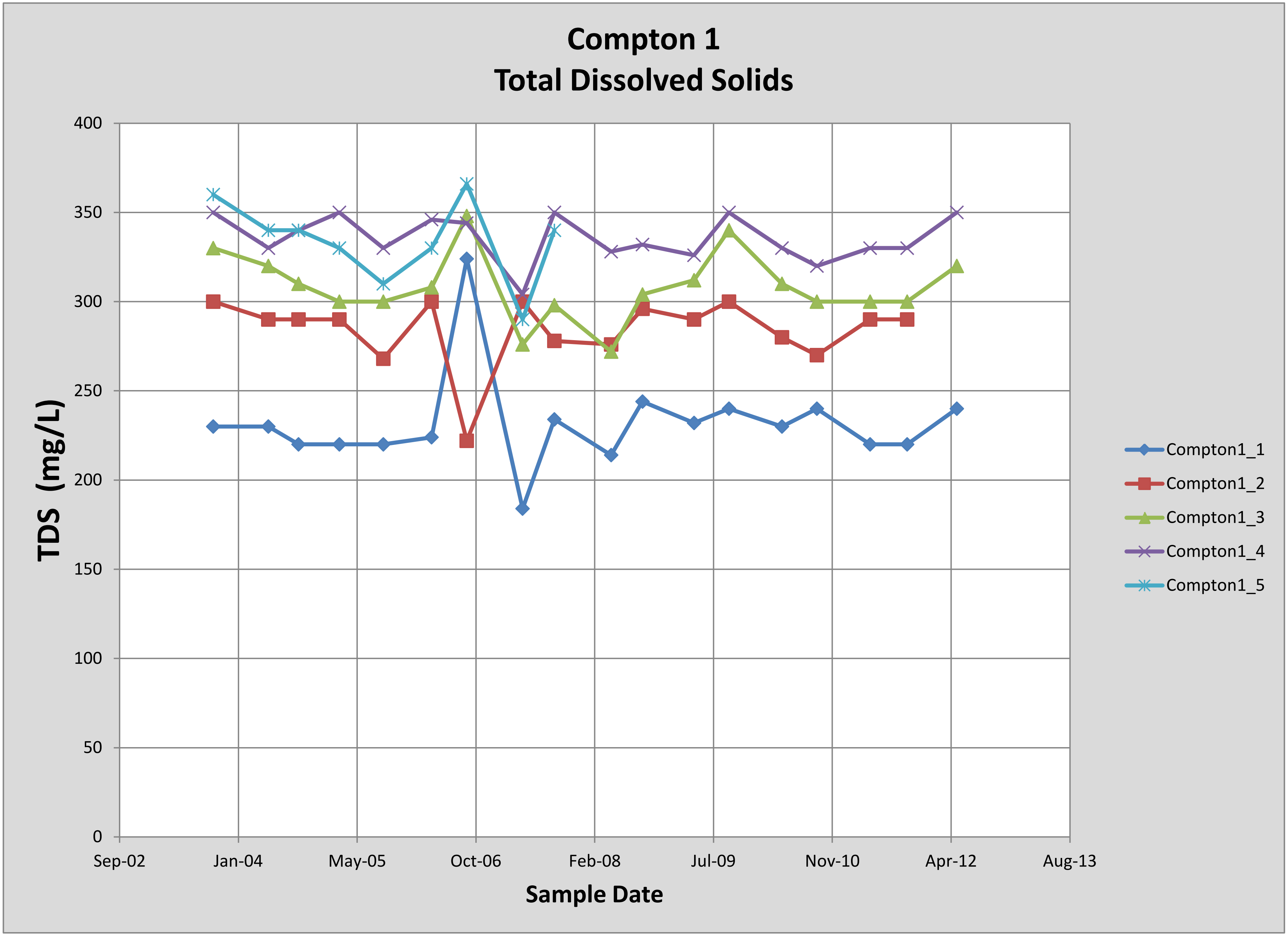

Columbia Park
Nitrate-N
Nitrate (mg/L)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
May-10
Aug-10
Nov-10
Feb-11
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Sample Date
ColumbiaPark_1
ColumbiaPark_2
ColumbiaPark_3
ColumbiaPark_4
ColumbiaPark_5
ColumbiaPark_6


Commerce 1
Total Dissolved Solids
TDS (mg/L)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Commerce1_1
Commerce1_2
Commerce1_3
Commerce1_4
Commerce1_5
Commerce1_6

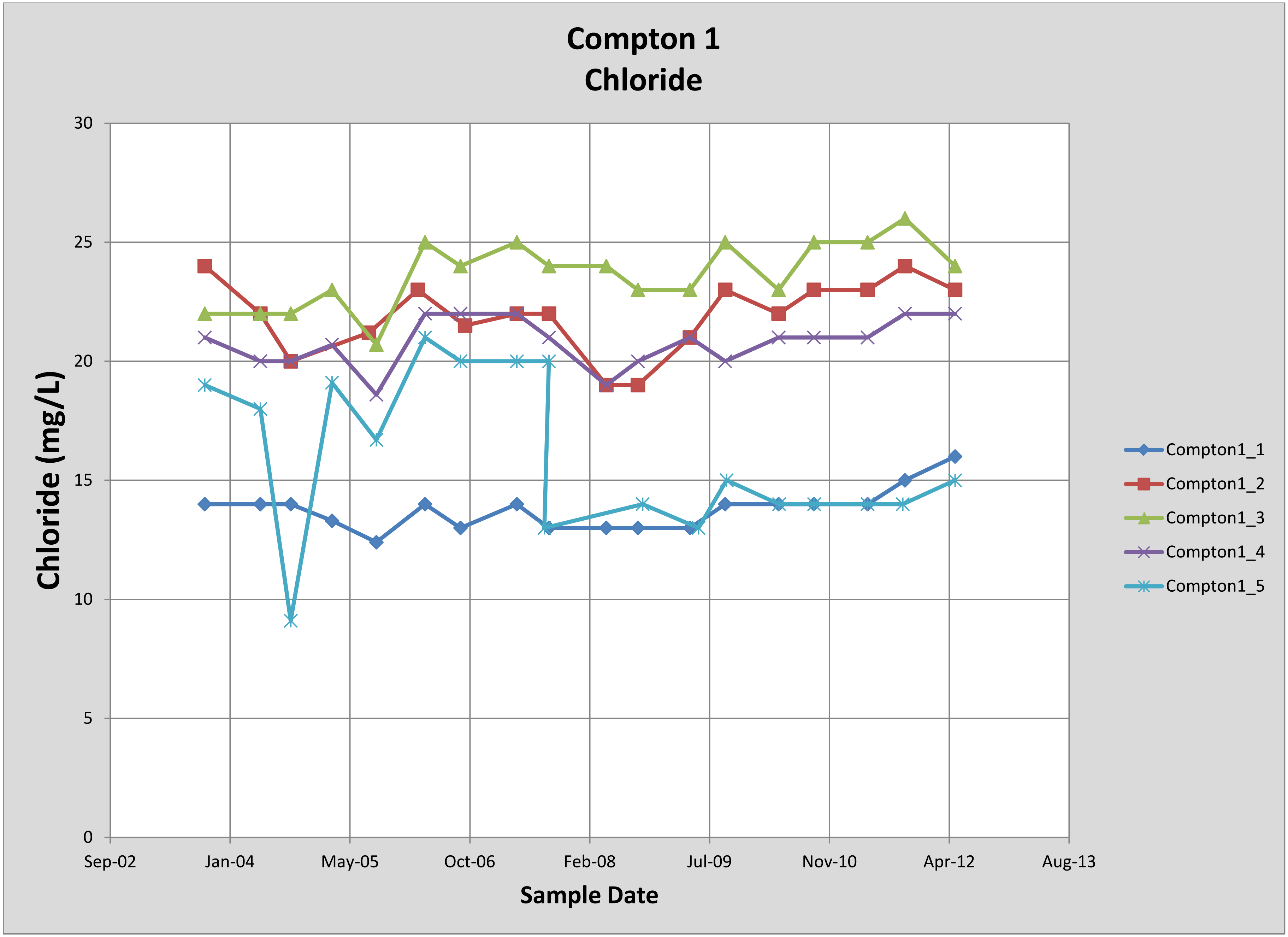


Commerce 1
Chloride
Chloride (mg/L)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Commerce1_1
Commerce1_2
Commerce1_3
Commerce1_4
Commerce1_5
Commerce1_6

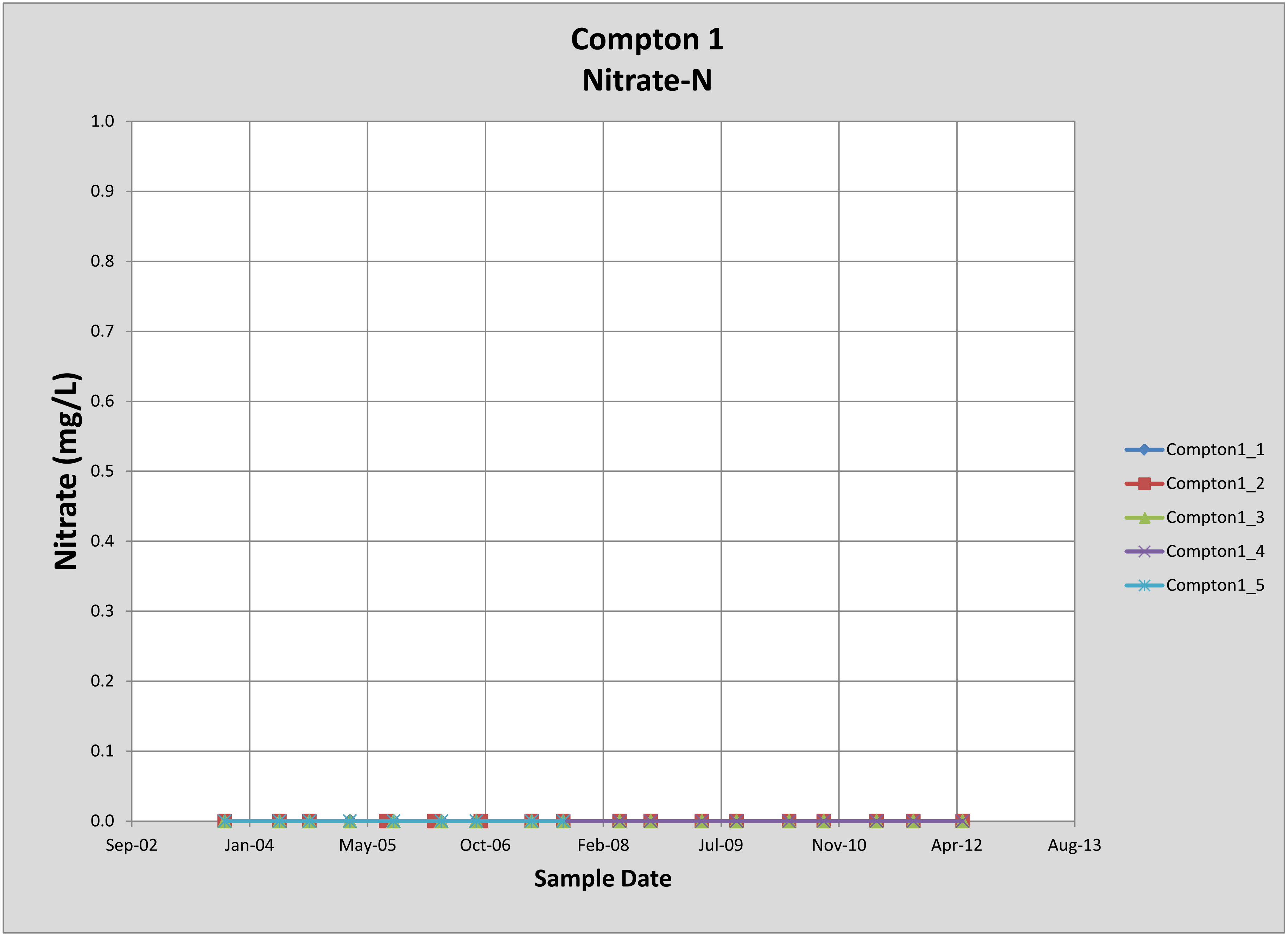

Commerce 1
Nitrate-N
Nitrate (mg/L)
8
7
6
5
4
3
2
1
0
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Commerce1_1
Commerce1_2
Commerce1_3
Commerce1_4
Commerce1_5
Commerce1_6

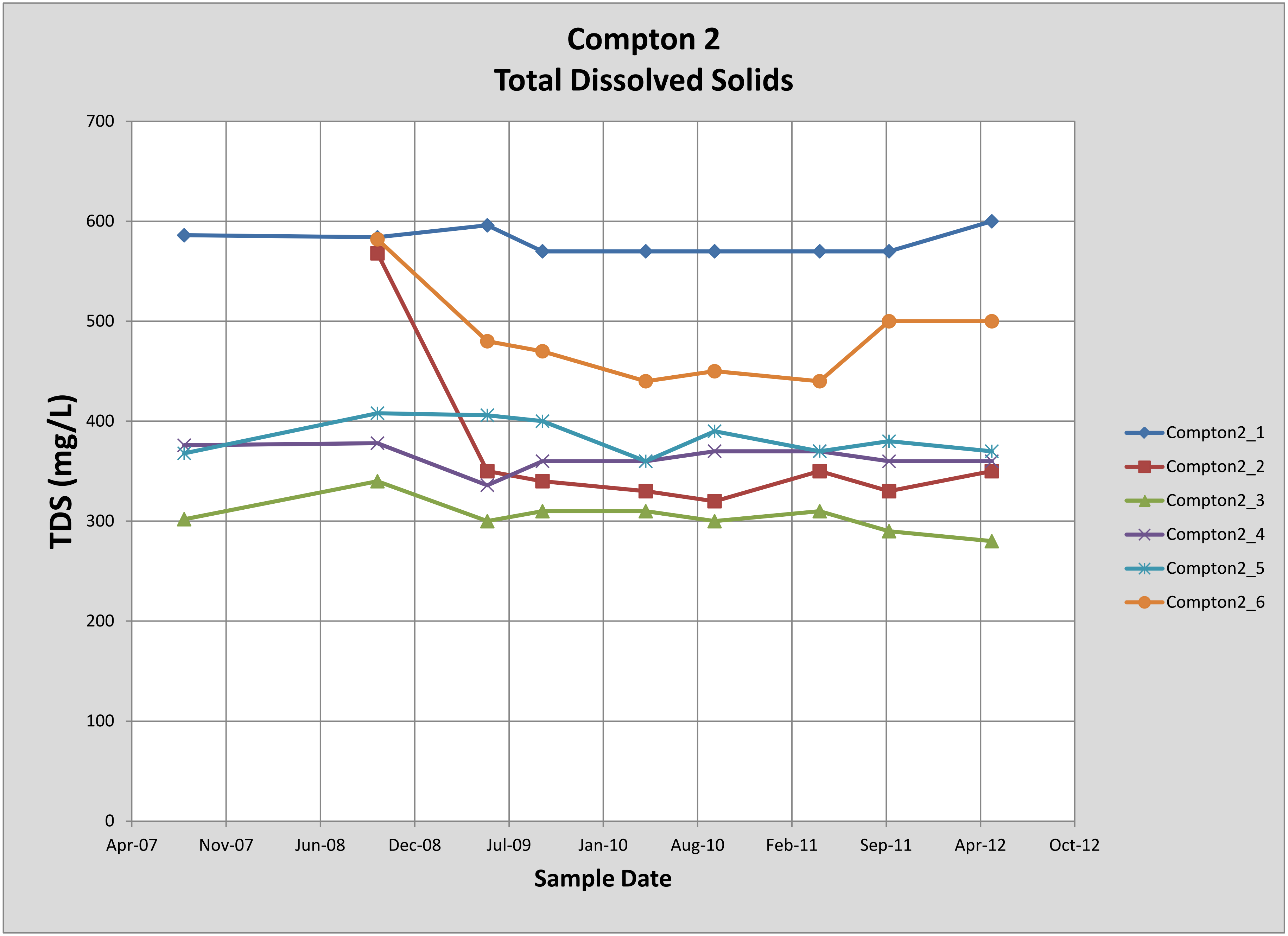


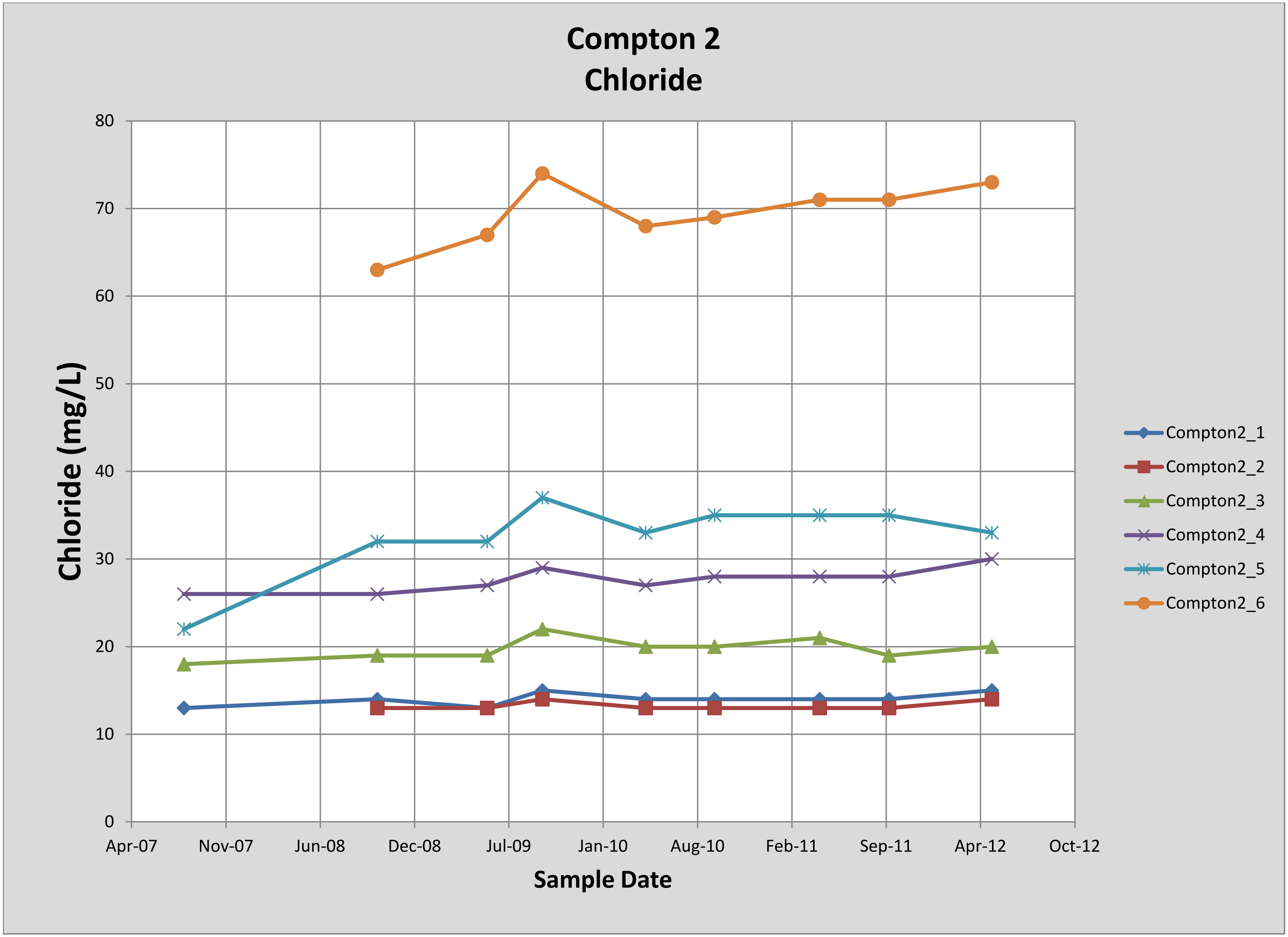
Compton 1
Total Dissolved Solids
TDS (mg/L)
400
350
300
250
200
150
100
50
0
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Compton1_1
Compton1_2
Compton1_3
Compton1_4
Compton1_5

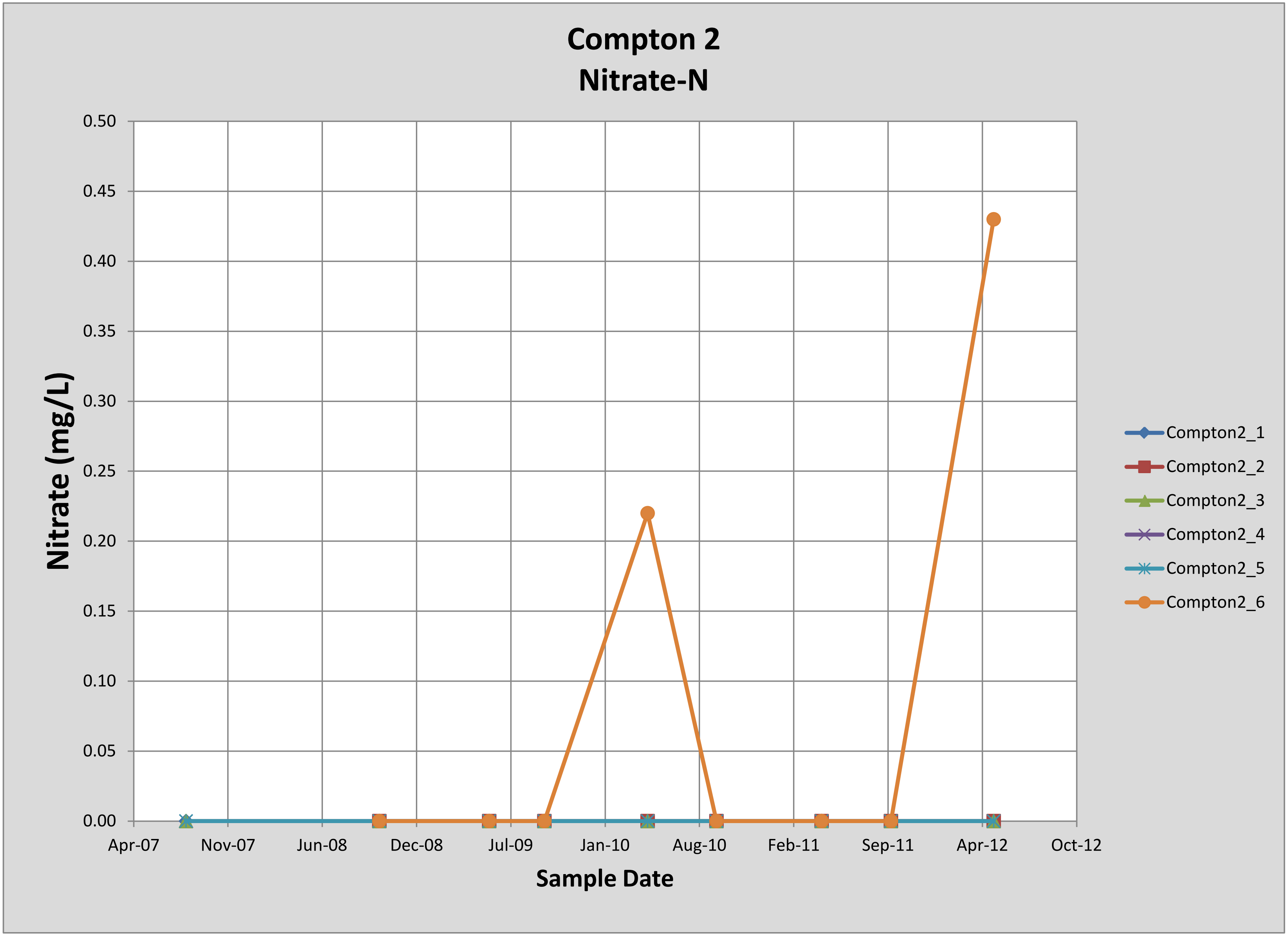


Compton 1
Chloride
Chloride (mg/L)
30
25
20
15
10
5
0
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Compton1_1
Compton1_2
Compton1_3
Compton1_4
Compton1_5

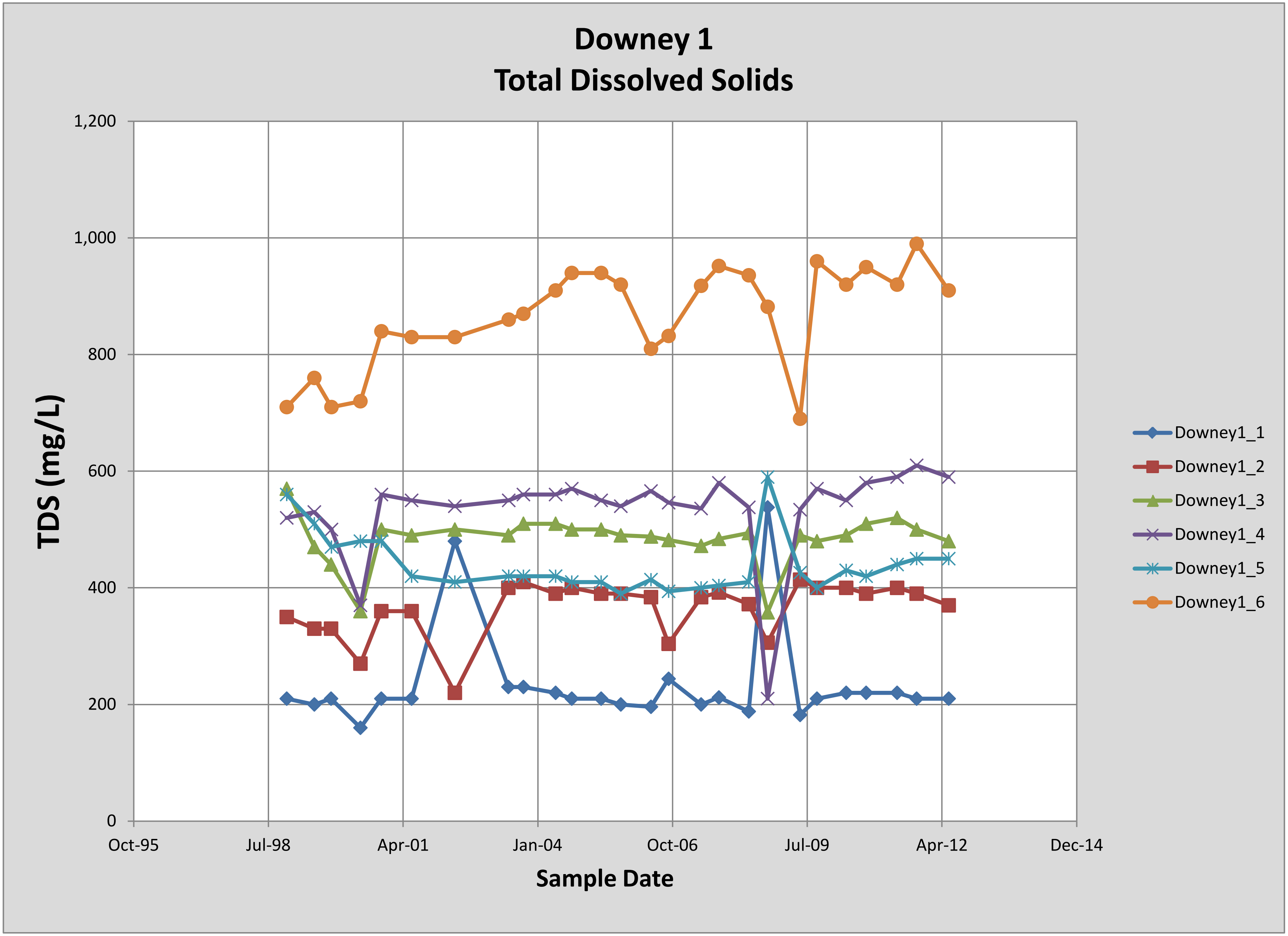

Compton 1
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Compton1_1
Compton1_2
Compton1_3
Compton1_4
Compton1_5


Compton 2
Total Dissolved Solids
TDS (mg/L)
700
600
500
400
300
200
100
0
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Oct-12
Sample Date
Compton2_1
Compton2_2
Compton2_3
Compton2_4
Compton2_5
Compton2_6

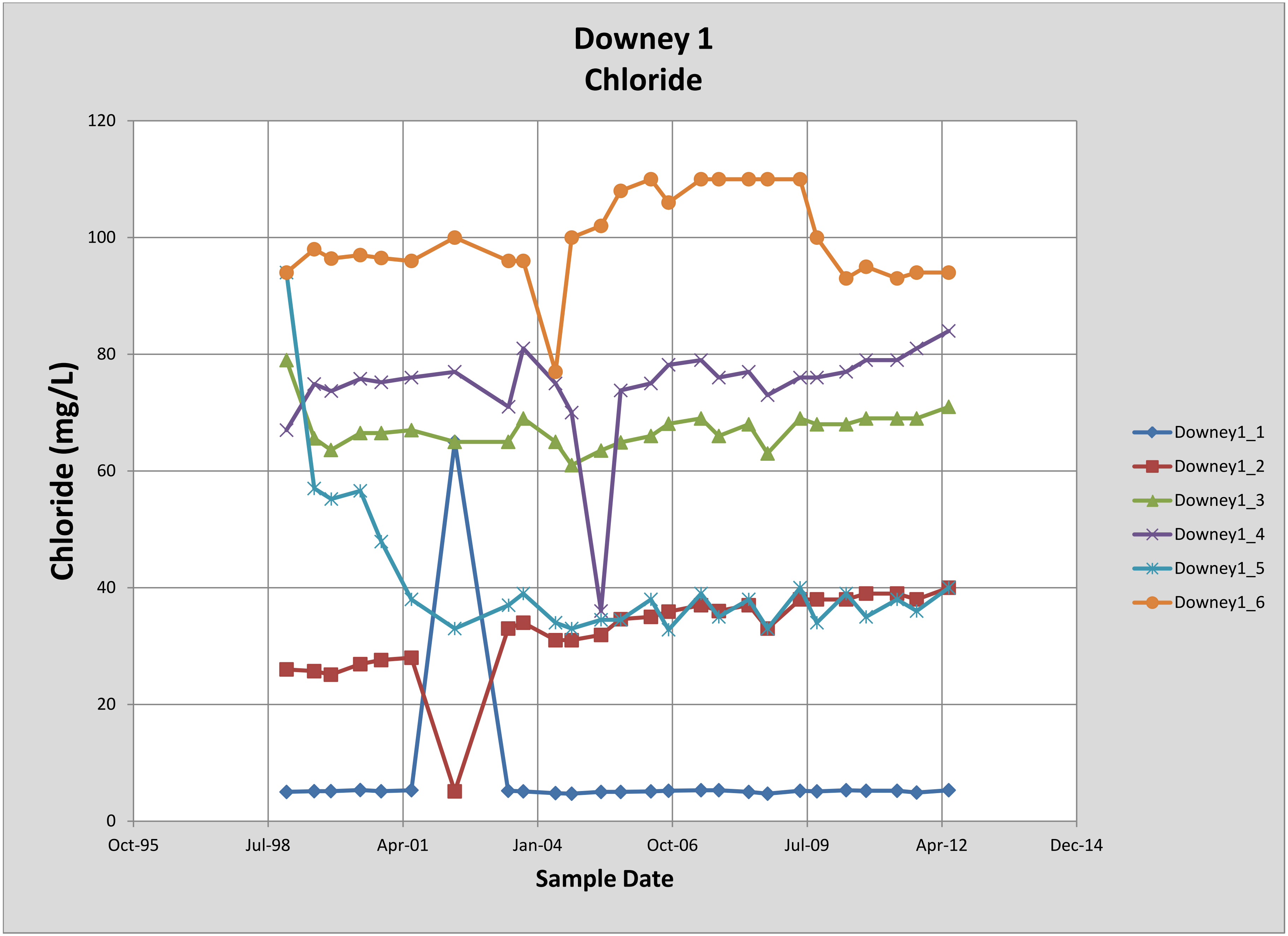

Compton 2
Chloride
Chloride (mg/L)
0
10
20
30
40
50
60
70
80
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Oct-12
Sample Date
Compton2_1
Compton2_2
Compton2_3
Compton2_4
Compton2_5
Compton2_6



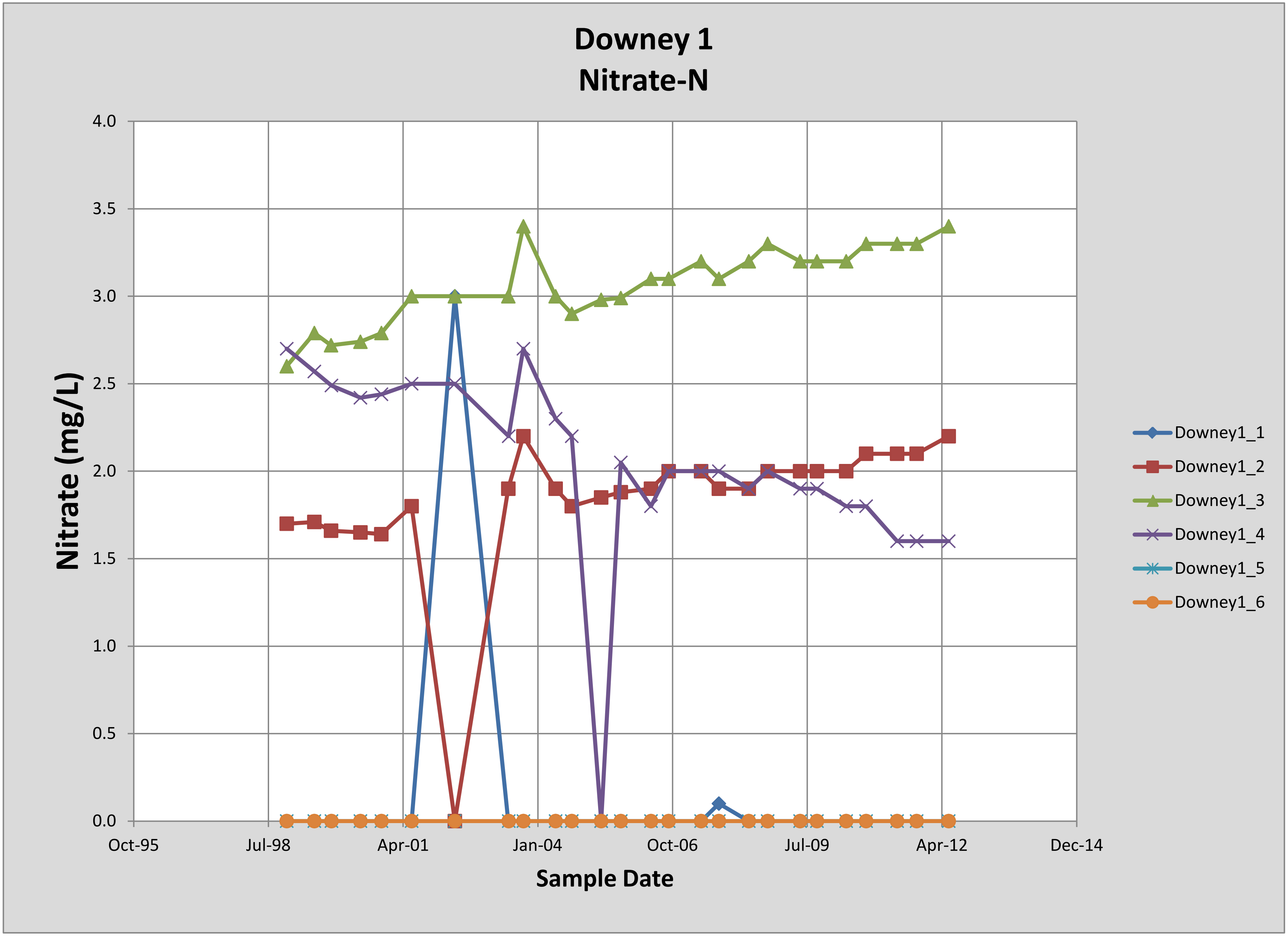
Compton 2
Nitrate-N
Nitrate (mg/L)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Oct-12
Sample Date
Compton2_1
Compton2_2
Compton2_3
Compton2_4
Compton2_5
Compton2_6



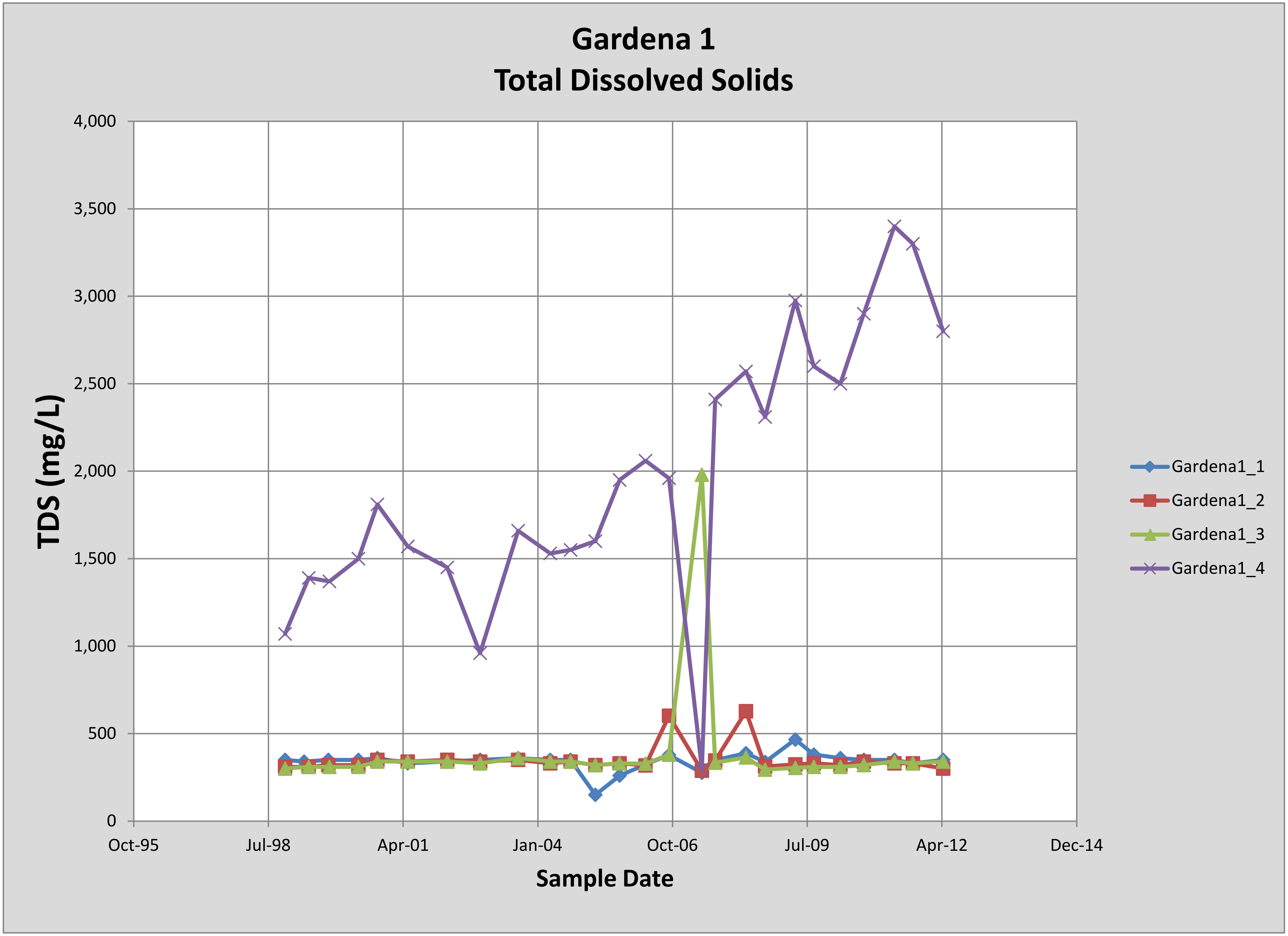
Downey 1
Total Dissolved Solids
TDS (mg/L)
0
200
400
600
800
1,000
1,200
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Downey1_1
Downey1_2
Downey1_3
Downey1_4
Downey1_5
Downey1_6



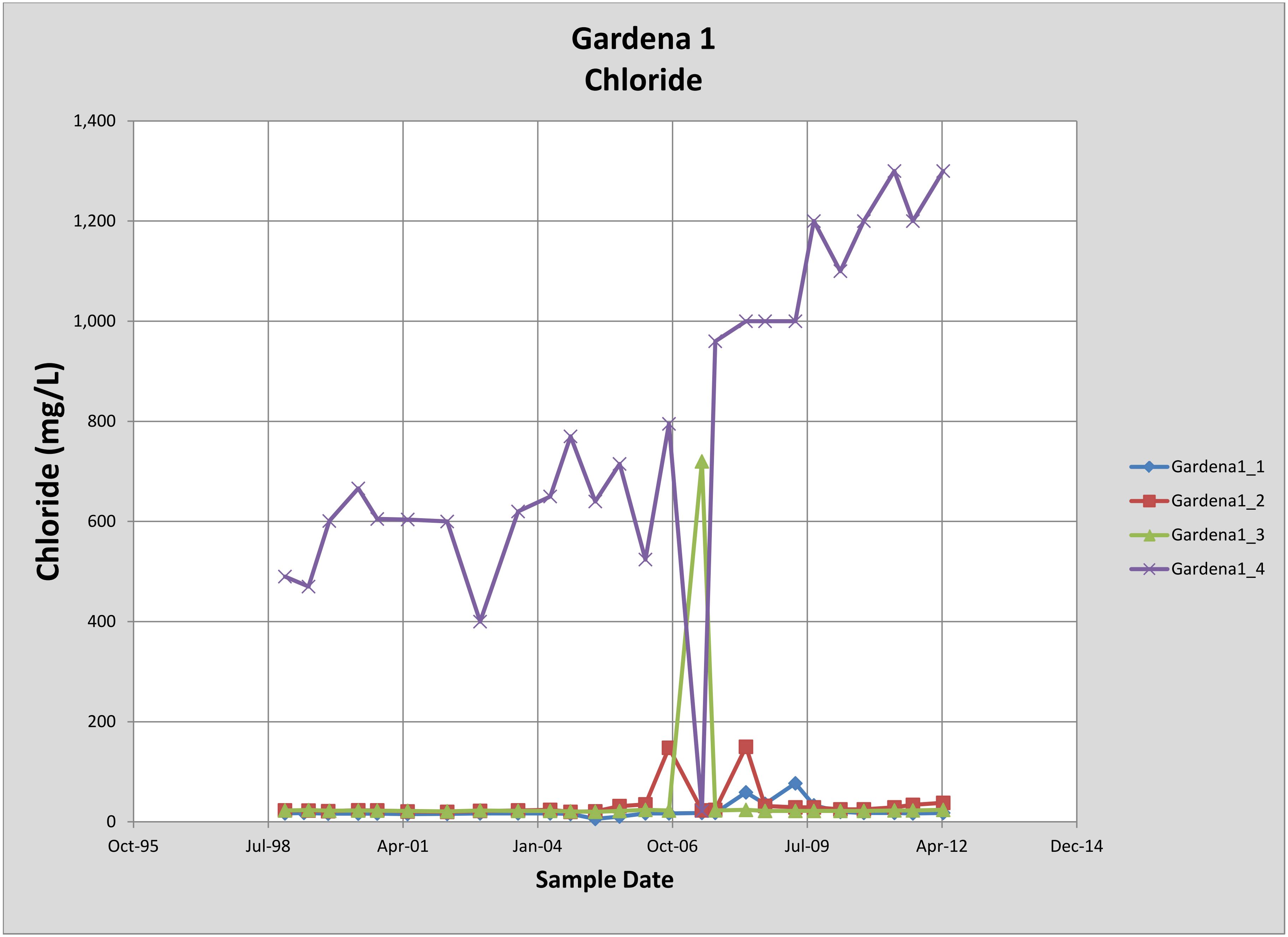
Downey 1
Chloride
Chloride (mg/L)
120
100
80
60
40
20
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Downey1_1
Downey1_2
Downey1_3
Downey1_4
Downey1_5
Downey1_6

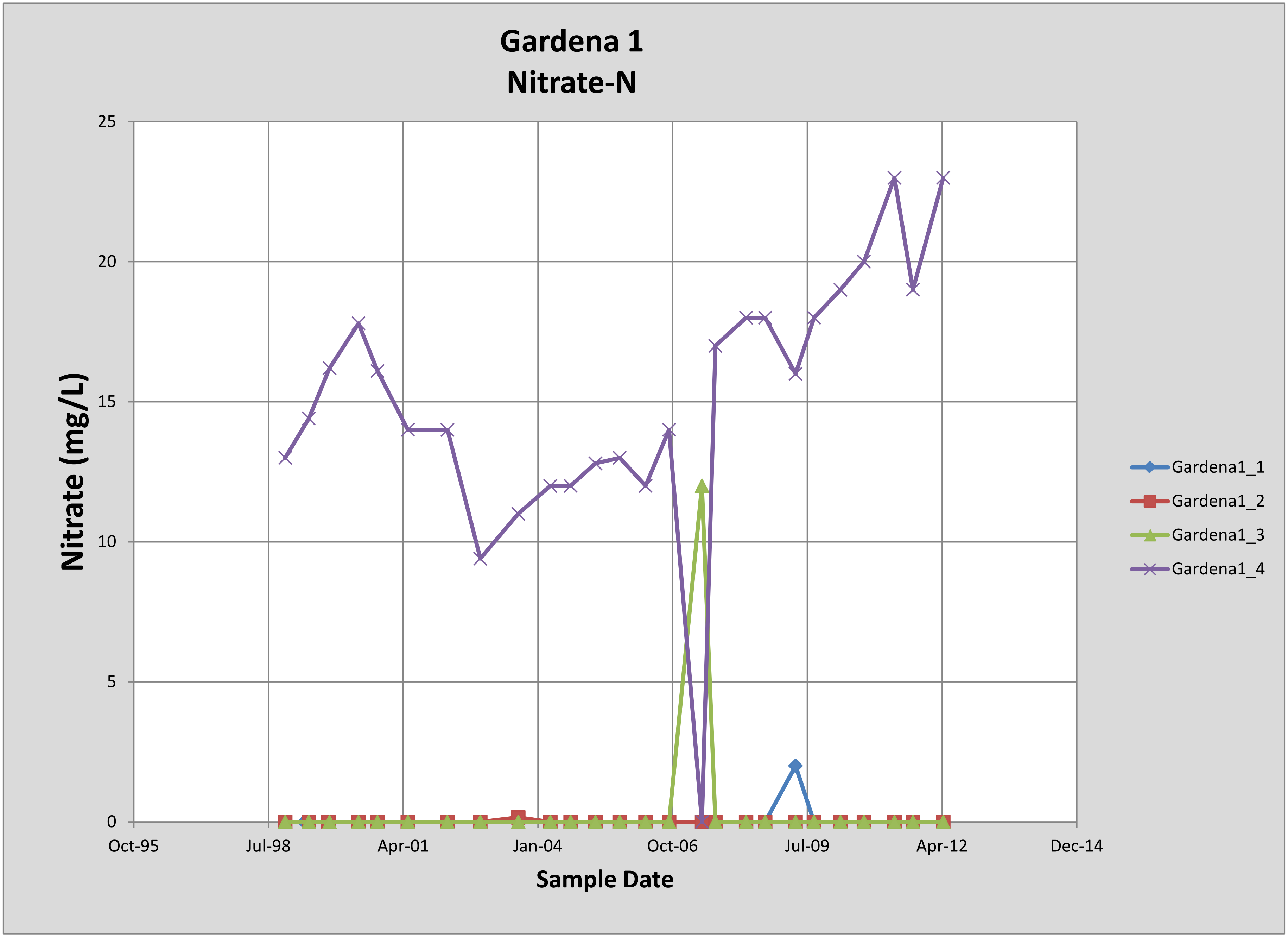


Downey 1
Nitrate-N
Nitrate (mg/L)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Downey1_1
Downey1_2
Downey1_3
Downey1_4
Downey1_5
Downey1_6

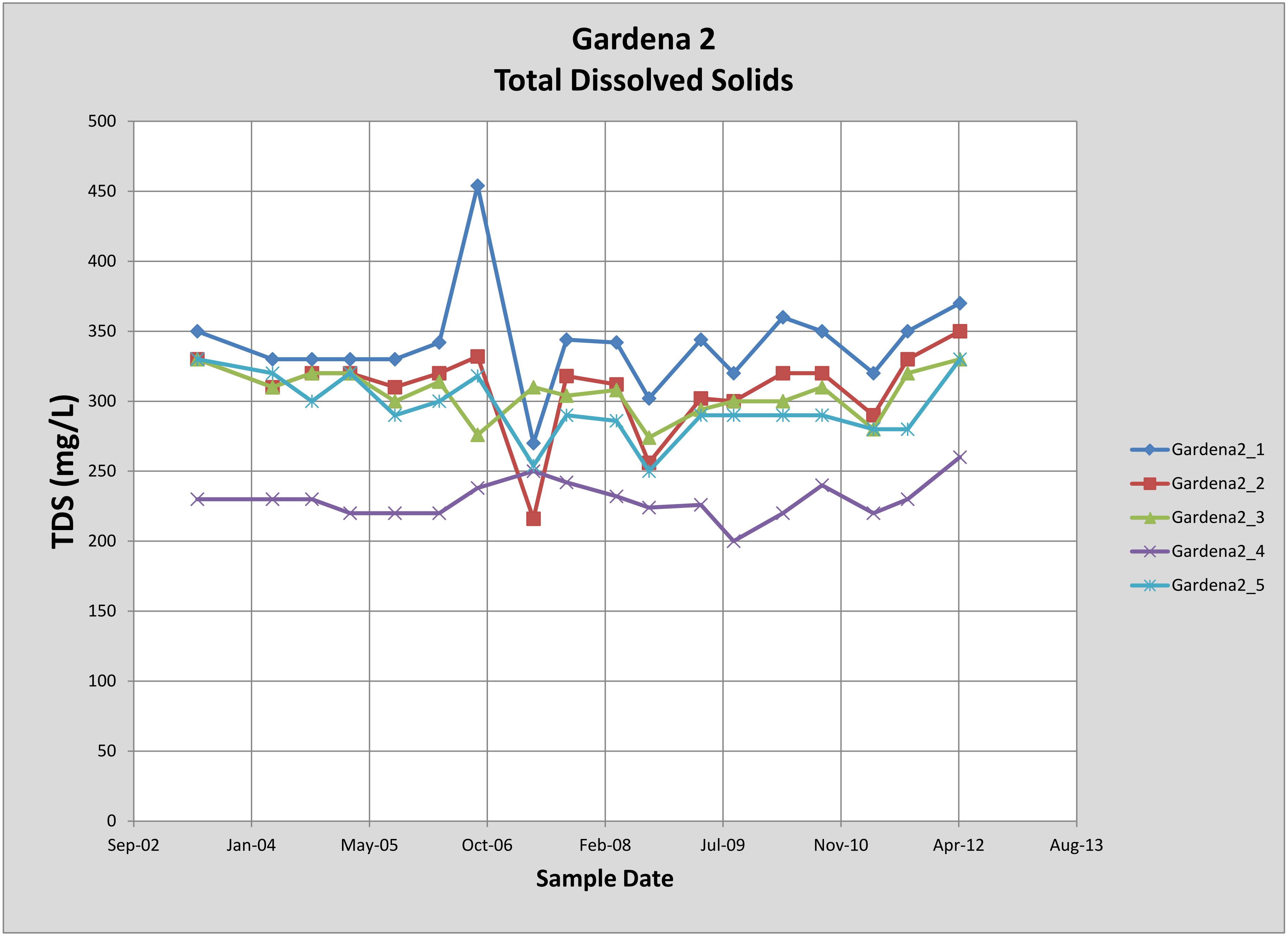


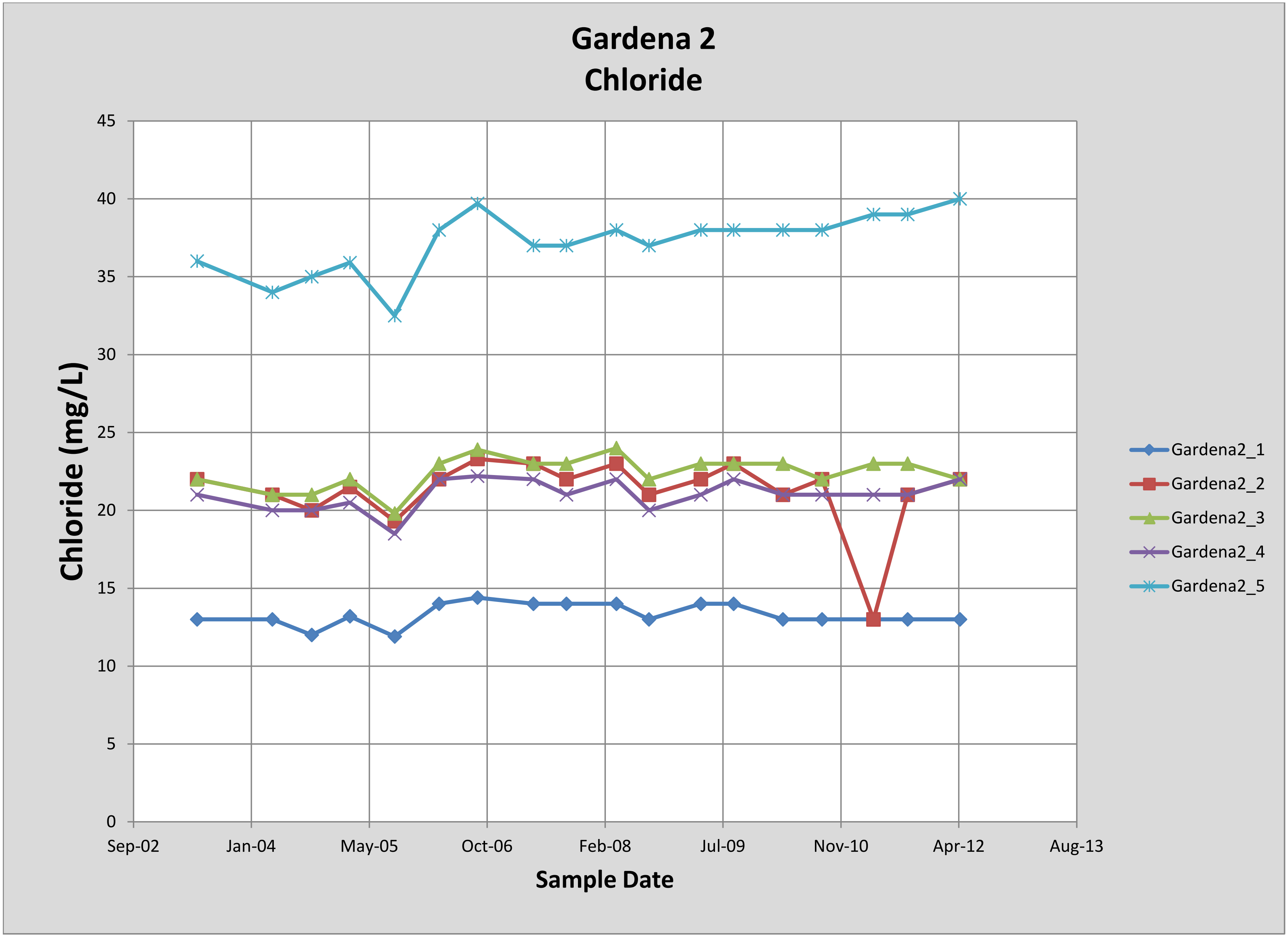
Gardena 1
Total Dissolved Solids
TDS (mg/L)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Gardena1_1
Gardena1_2
Gardena1_3
Gardena1_4


Gardena 1
Chloride
1,400
1,200
1,000
800
600
400
200
0
Chloride (mg/L)
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Gardena1_1
Gardena1_2
Gardena1_3
Gardena1_4

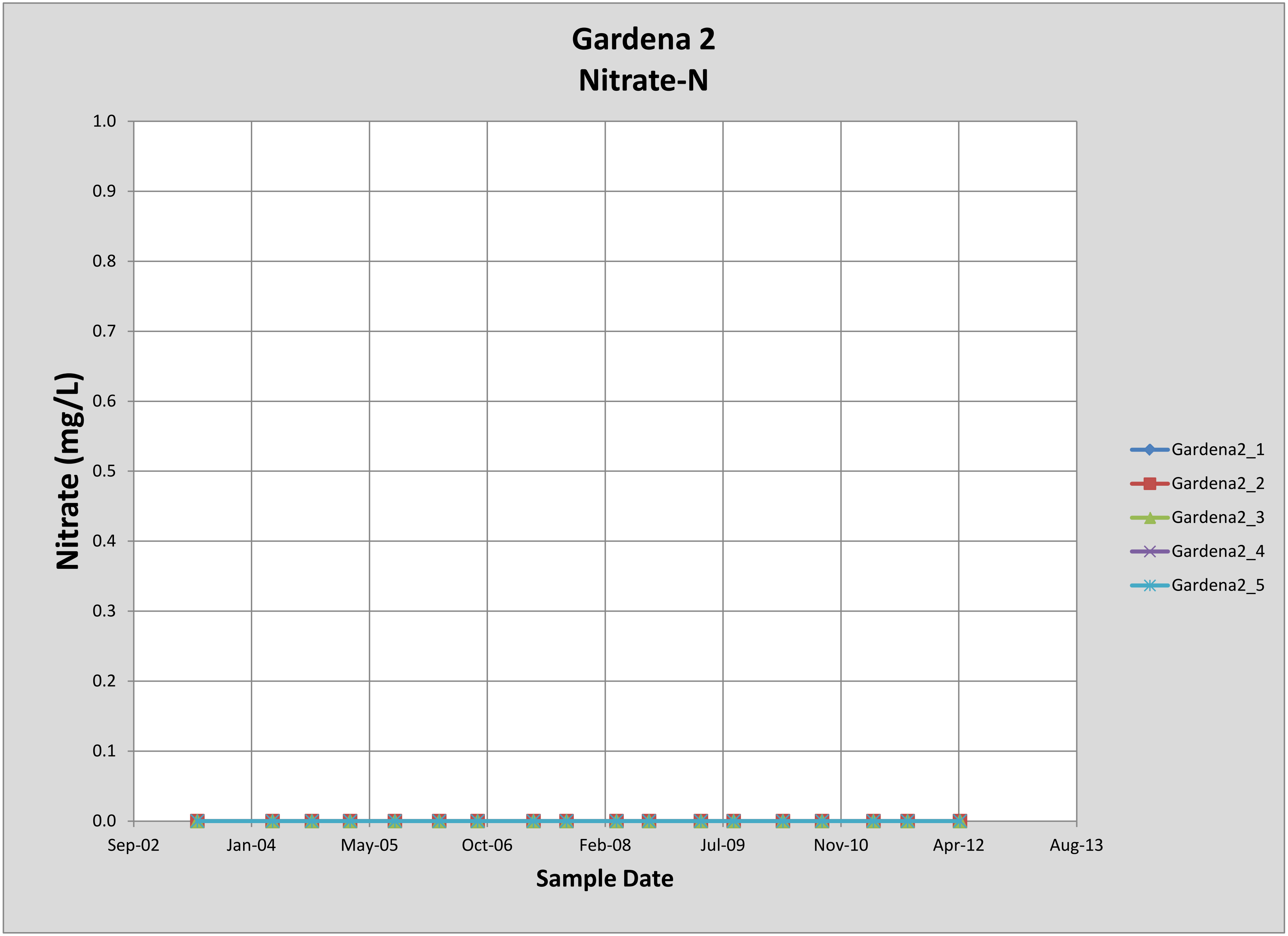


Gardena 1
Nitrate-N
Nitrate (mg/L)
25
20
15
10
5
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Gardena1_1
Gardena1_2
Gardena1_3
Gardena1_4

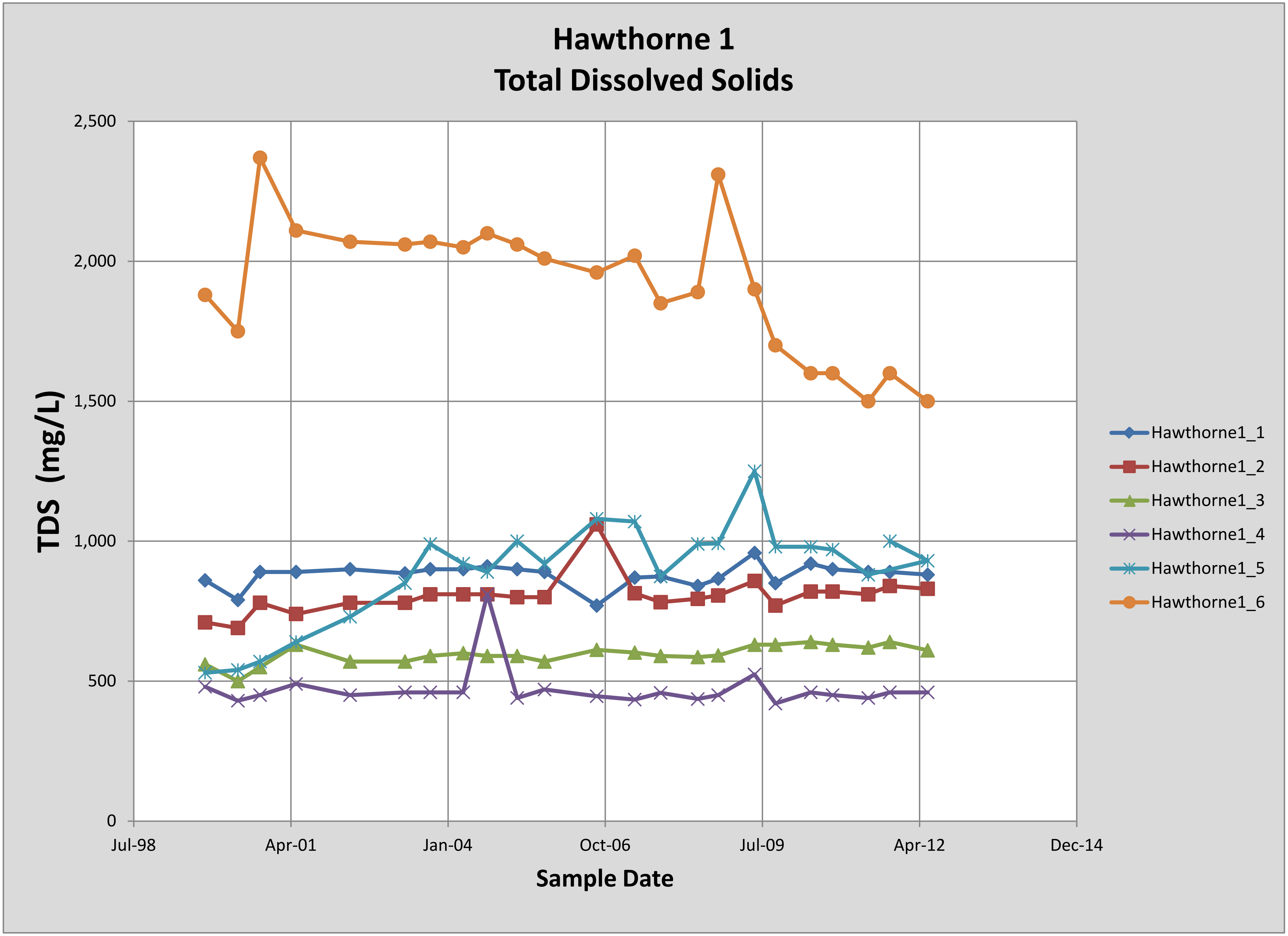

Gardena 2
Total Dissolved Solids
TDS (mg/L)
500
450
400
350
300
250
200
150
100
50
0
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Gardena2_1
Gardena2_2
Gardena2_3
Gardena2_4
Gardena2_5



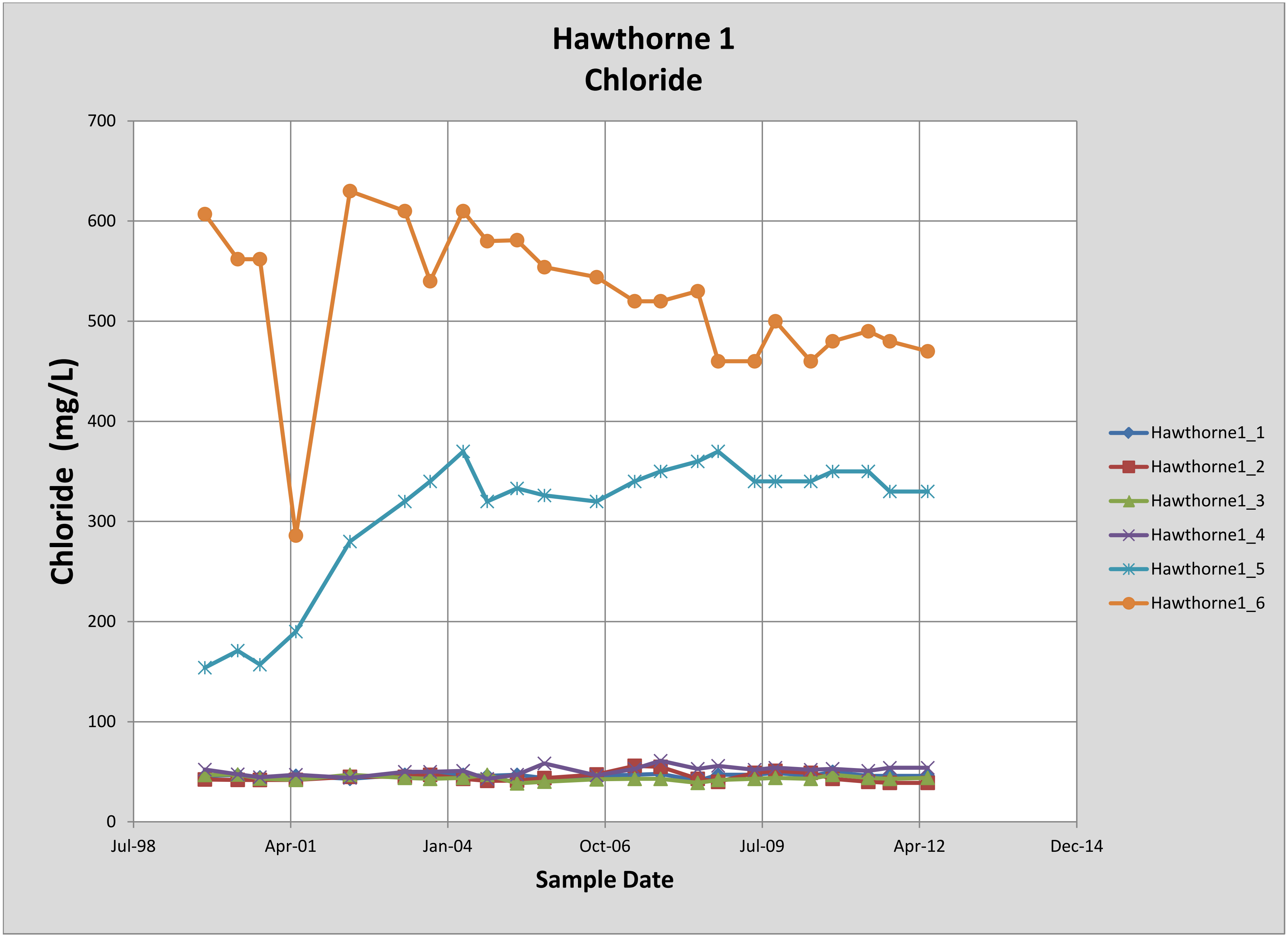
Gardena 2
Chloride
Chloride (mg/L)
45
40
35
30
25
20
15
10
5
0
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Gardena2_1
Gardena2_2
Gardena2_3
Gardena2_4
Gardena2_5

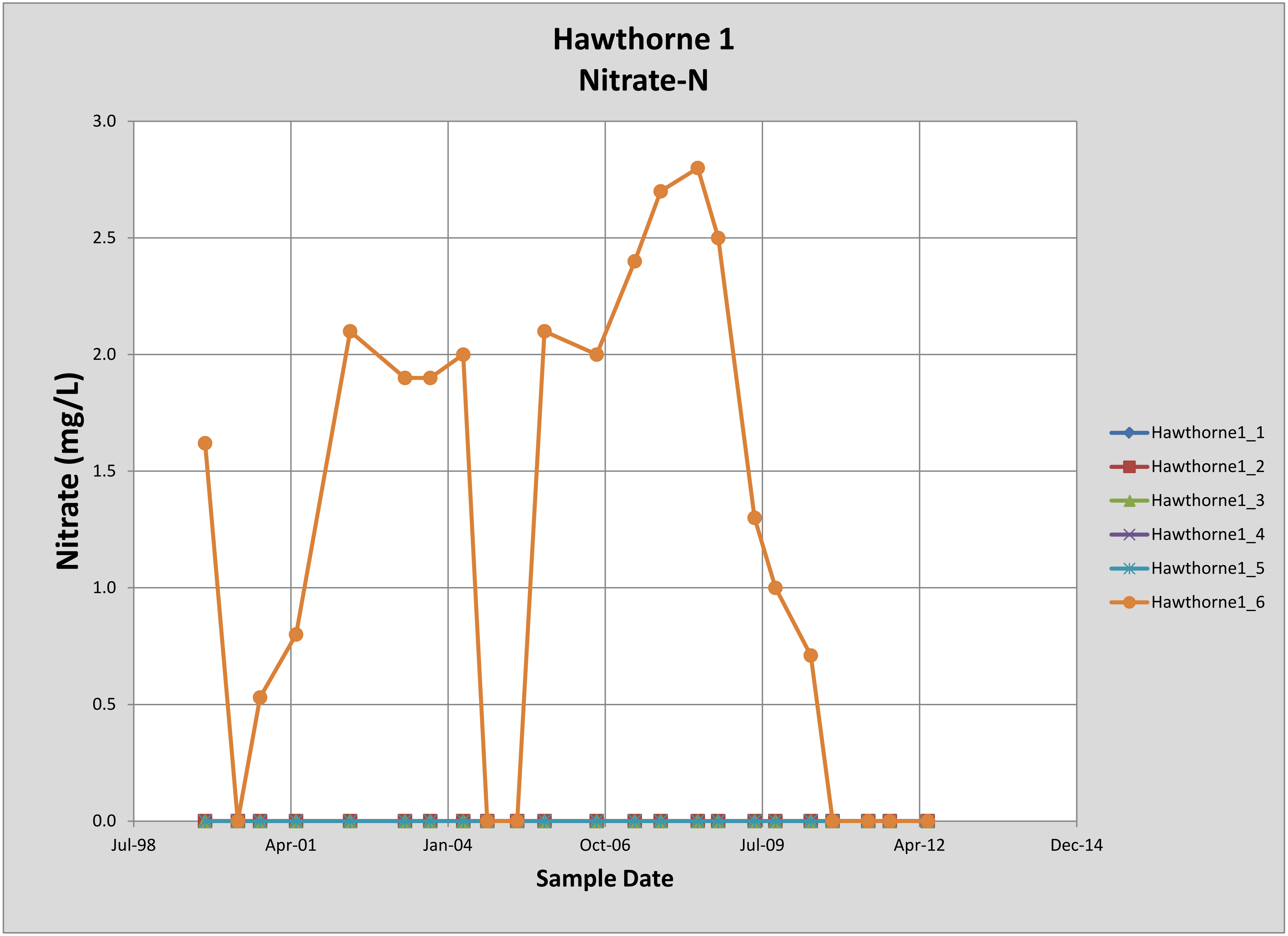


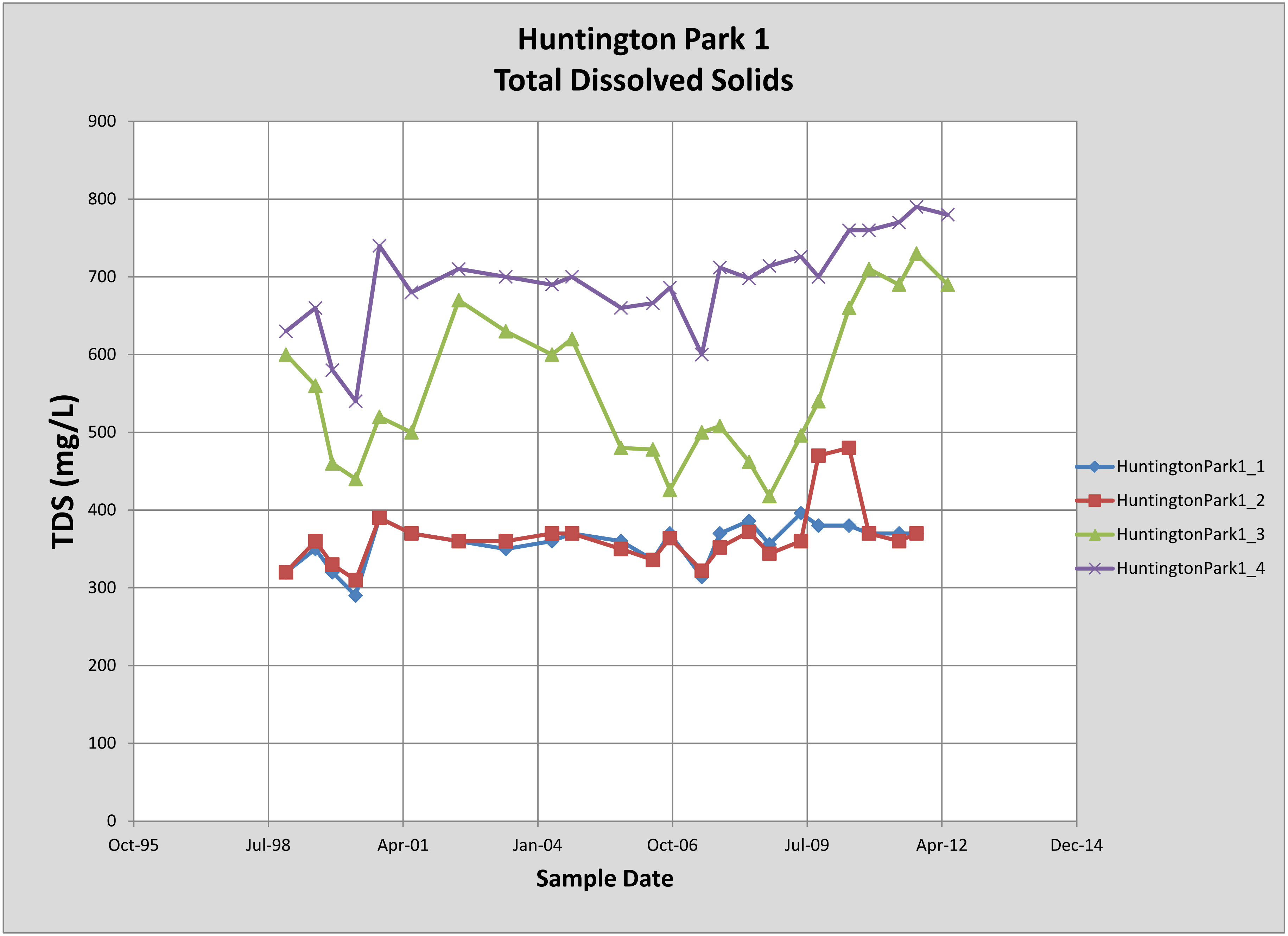
Gardena 2
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Gardena2_1
Gardena2_2
Gardena2_3
Gardena2_4
Gardena2_5

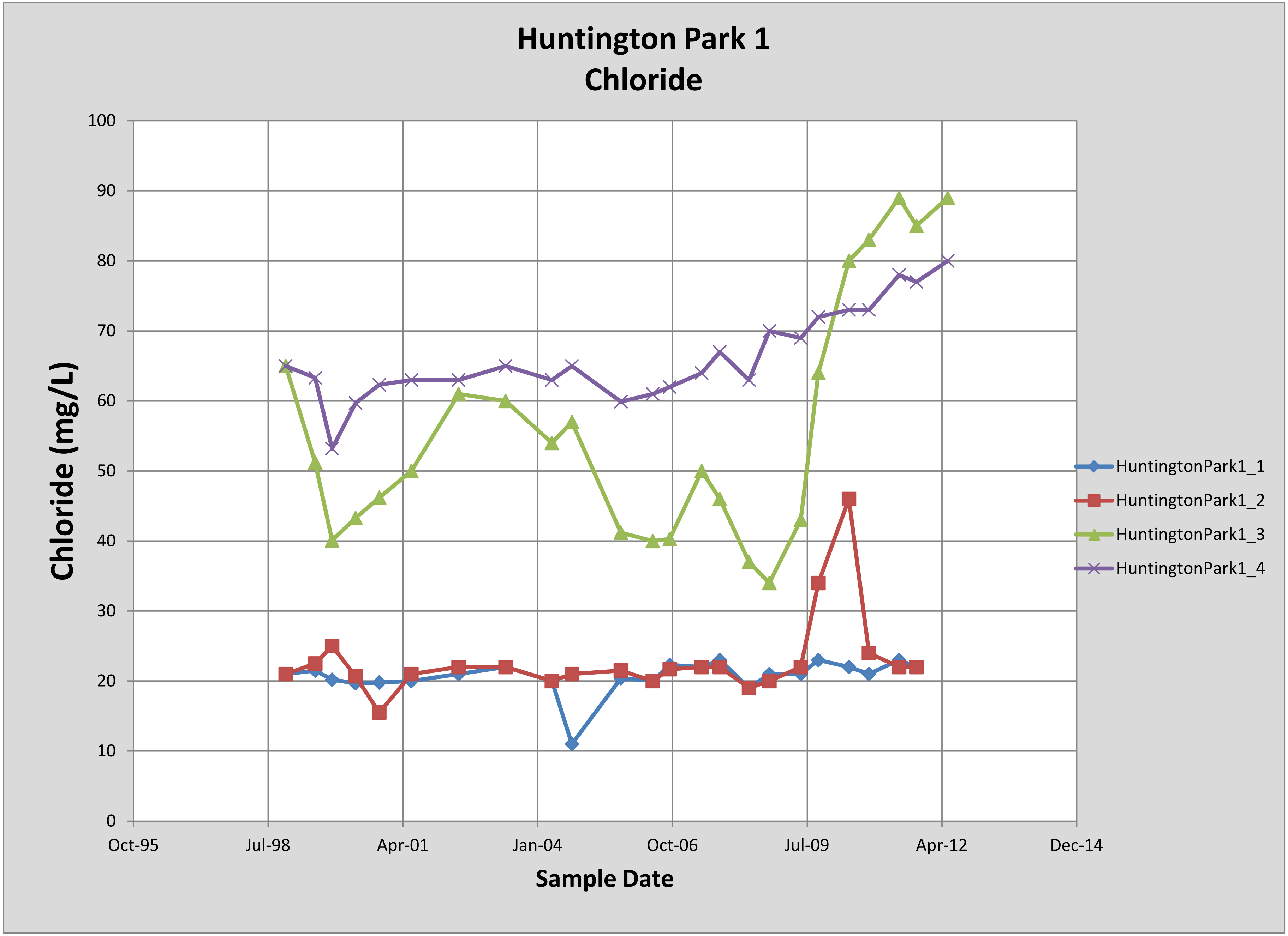


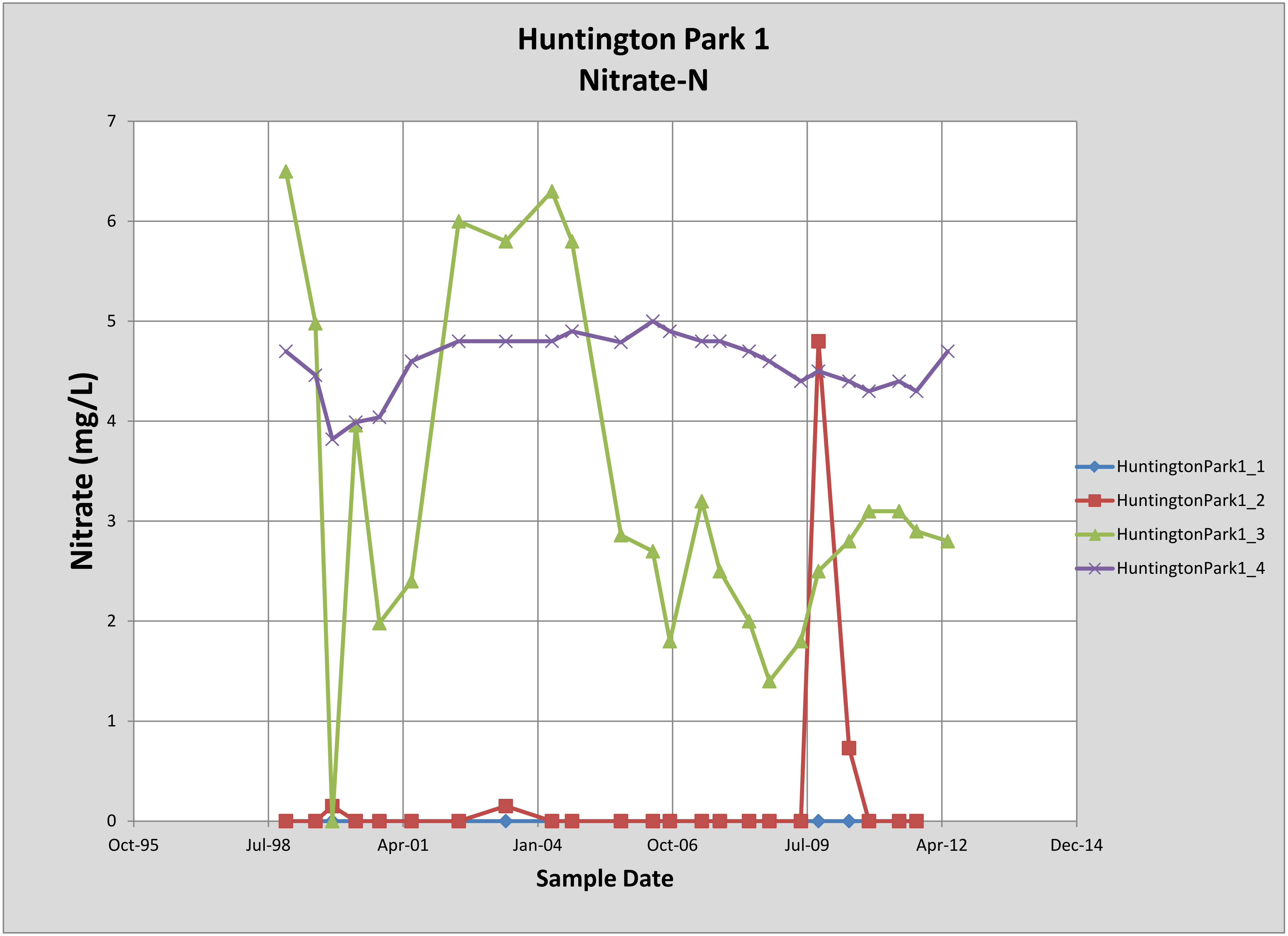
Hawthorne 1
Total Dissolved Solids
TDS (mg/L)
2,500
2,000
1,500
1,000
500
0
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Hawthorne1_1
Hawthorne1_2
Hawthorne1_3
Hawthorne1_4
Hawthorne1_5
Hawthorne1_6


Hawthorne 1
Chloride
Chloride (mg/L)
0
100
200
300
400
500
600
700
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Hawthorne1_1
Hawthorne1_2
Hawthorne1_3
Hawthorne1_4
Hawthorne1_5
Hawthorne1_6

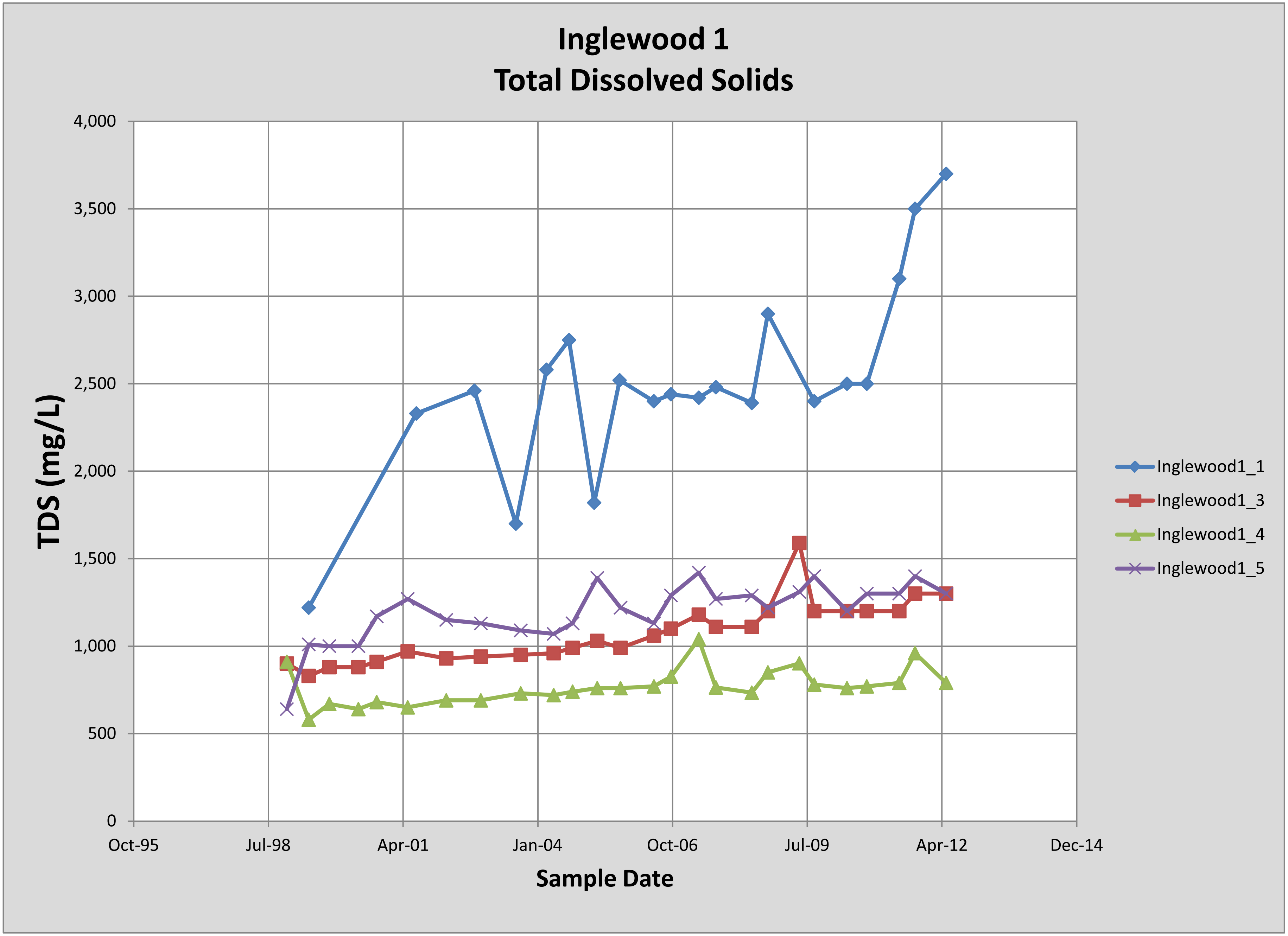

Hawthorne 1
Nitrate-N
Nitrate (mg/L)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Hawthorne1_1
Hawthorne1_2
Hawthorne1_3
Hawthorne1_4
Hawthorne1_5
Hawthorne1_6


Huntington Park 1
Total Dissolved Solids
TDS (mg/L)
900
800
700
600
500
400
300
200
100
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
HuntingtonPark1_1
HuntingtonPark1_2
HuntingtonPark1_3
HuntingtonPark1_4

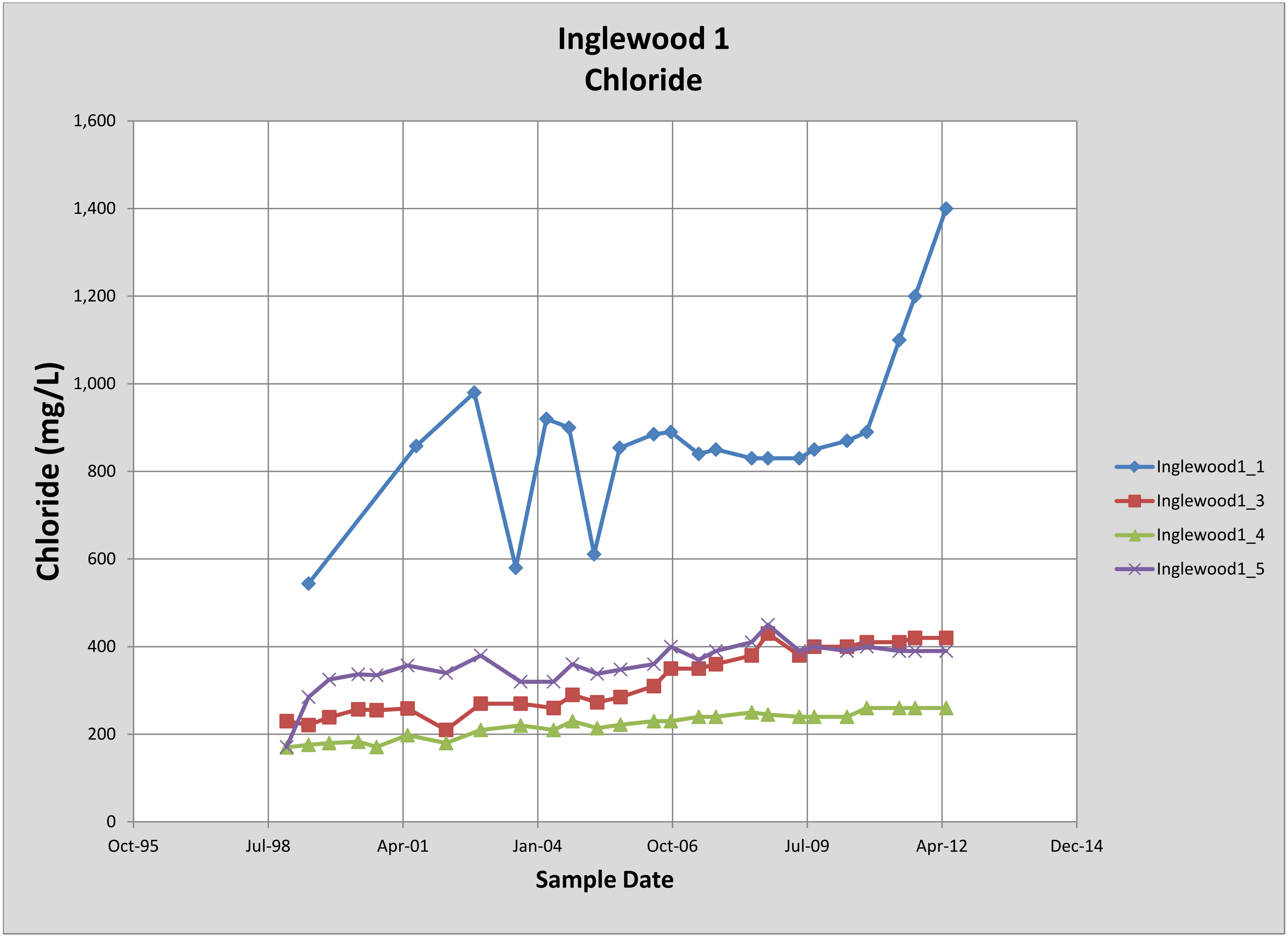

Huntington Park 1
Chloride
Chloride (mg/L)
100
90
80
70
60
50
40
30
20
10
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
HuntingtonPark1_1
HuntingtonPark1_2
HuntingtonPark1_3
HuntingtonPark1_4



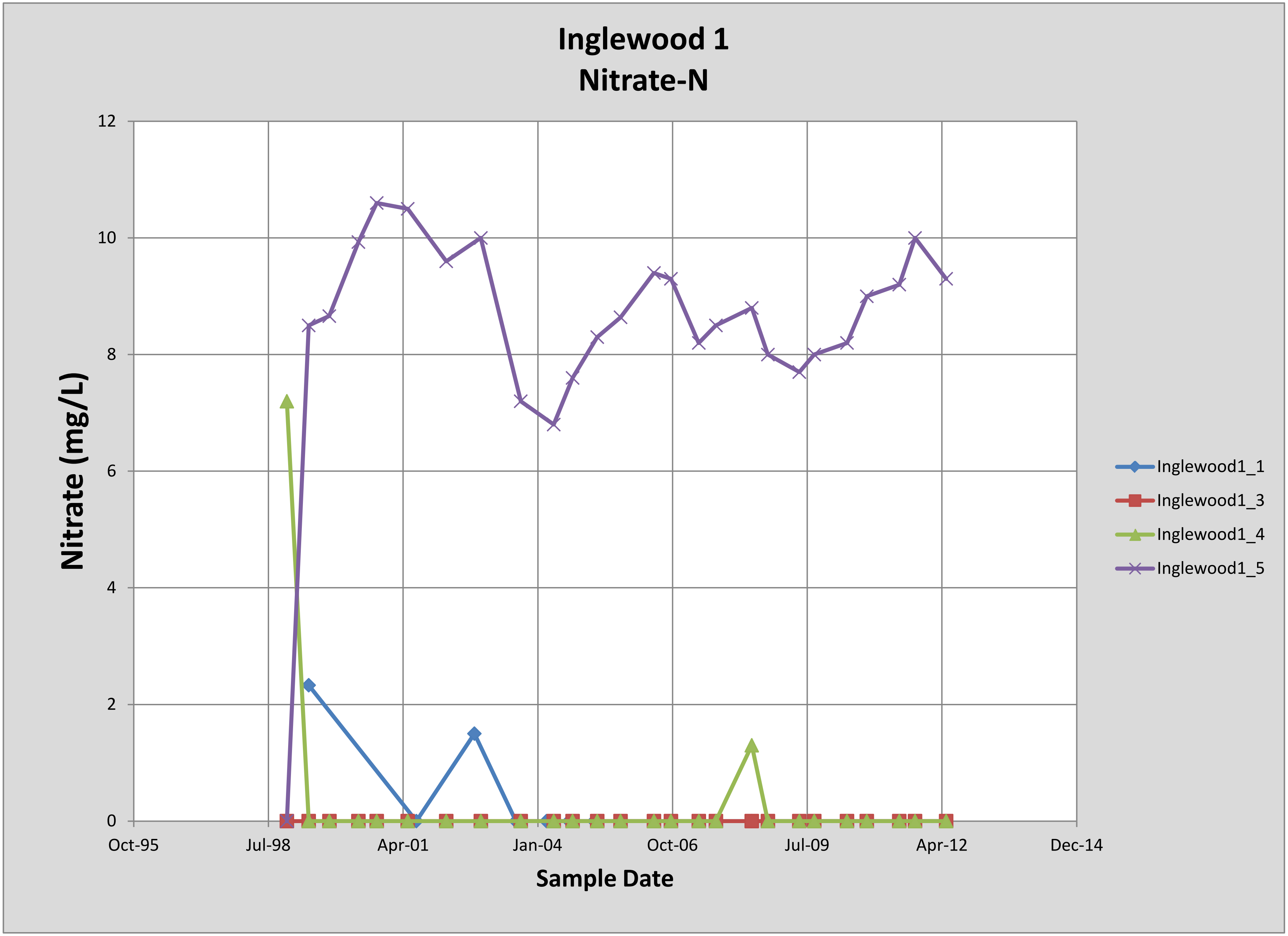
Huntington Park 1
Nitrate-N
Nitrate (mg/L)
0
1
2
3
4
5
6
7
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
HuntingtonPark1_1
HuntingtonPark1_2
HuntingtonPark1_3
HuntingtonPark1_4



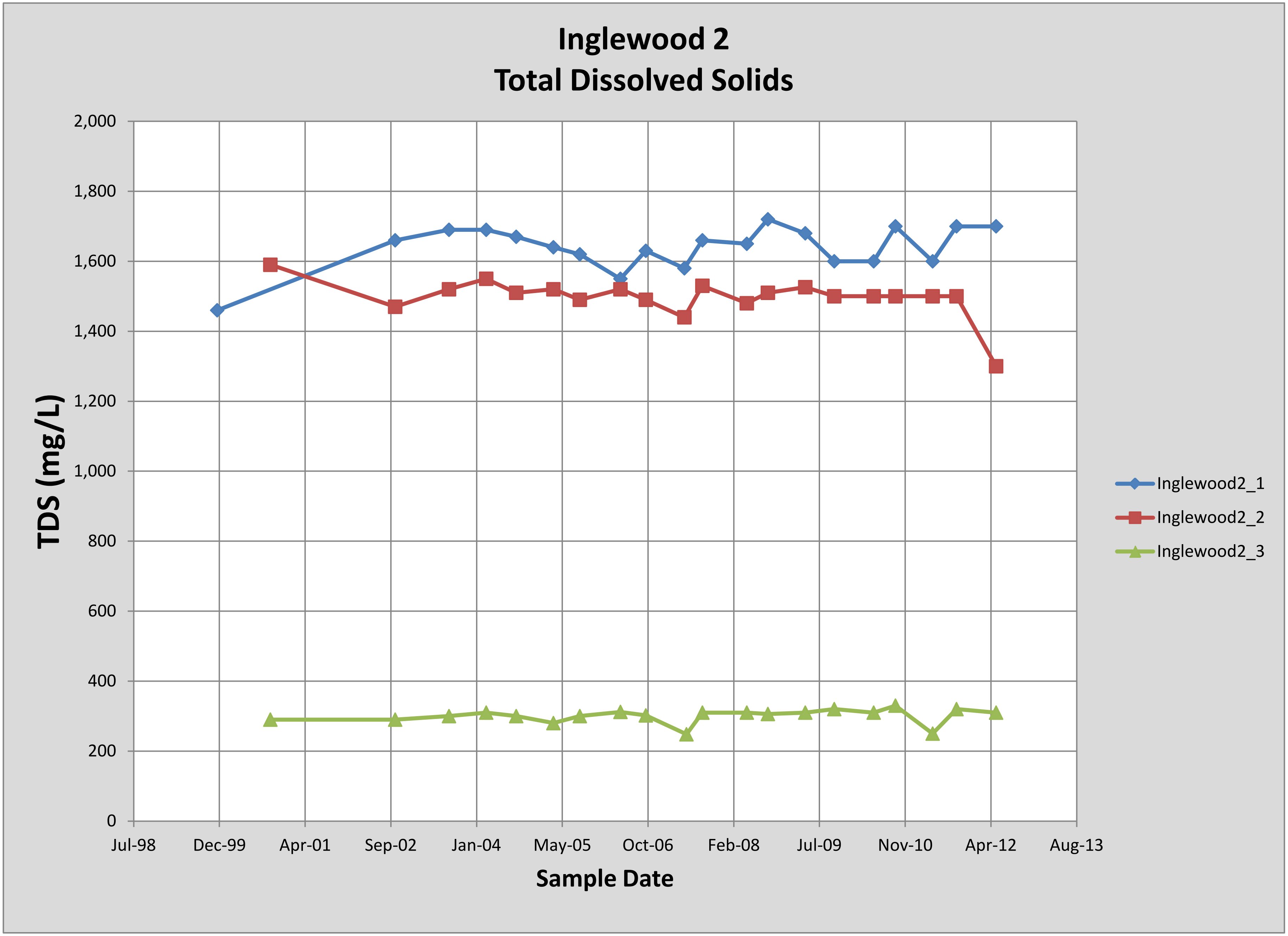
Inglewood 1
Total Dissolved Solids
TDS (mg/L)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Inglewood1_1
Inglewood1_3
Inglewood1_4
Inglewood1_5



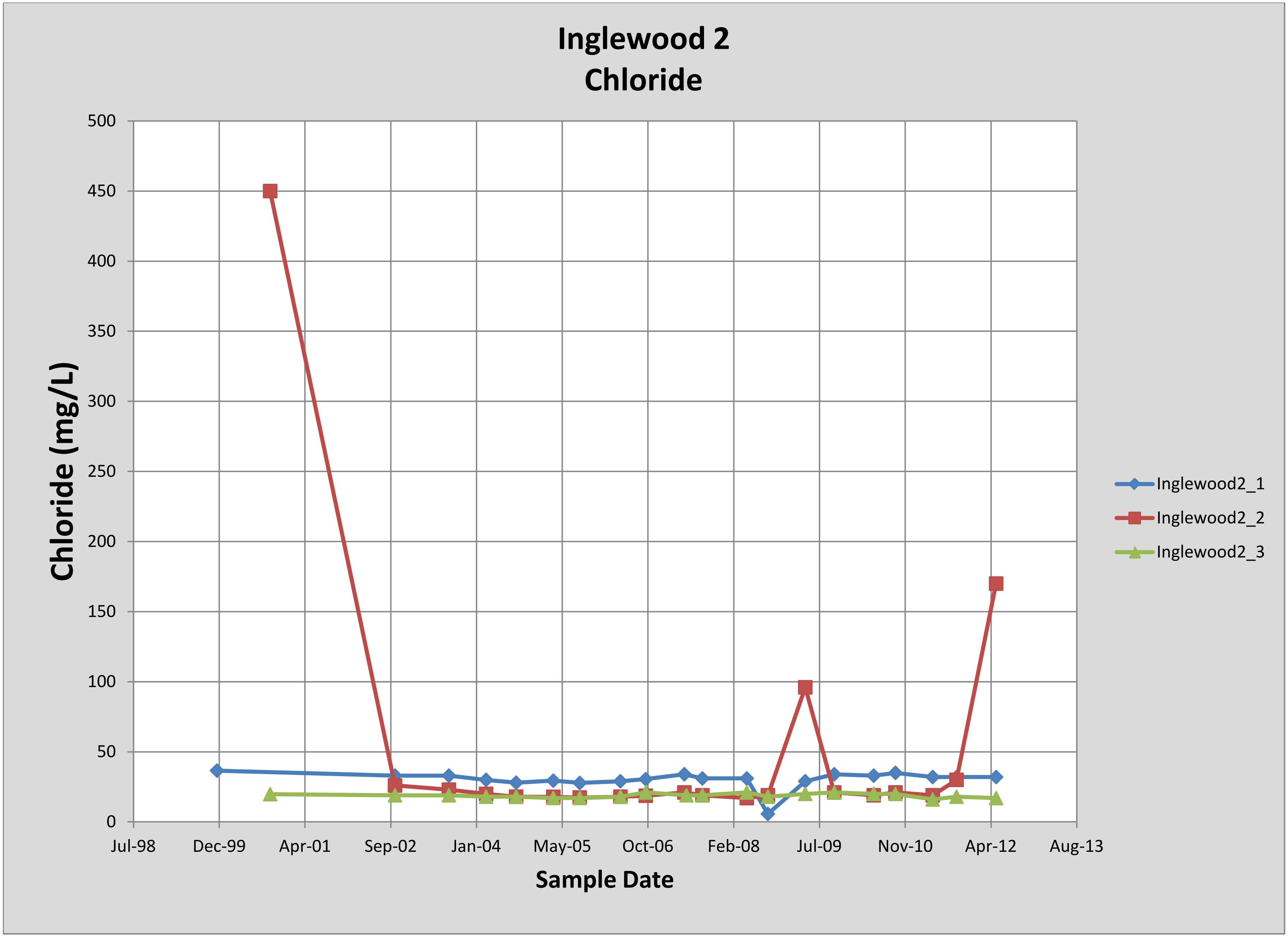
Inglewood 1
Chloride
Chloride (mg/L)
1,600
1,400
1,200
1,000
800
600
400
200
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Inglewood1_1
Inglewood1_3
Inglewood1_4
Inglewood1_5



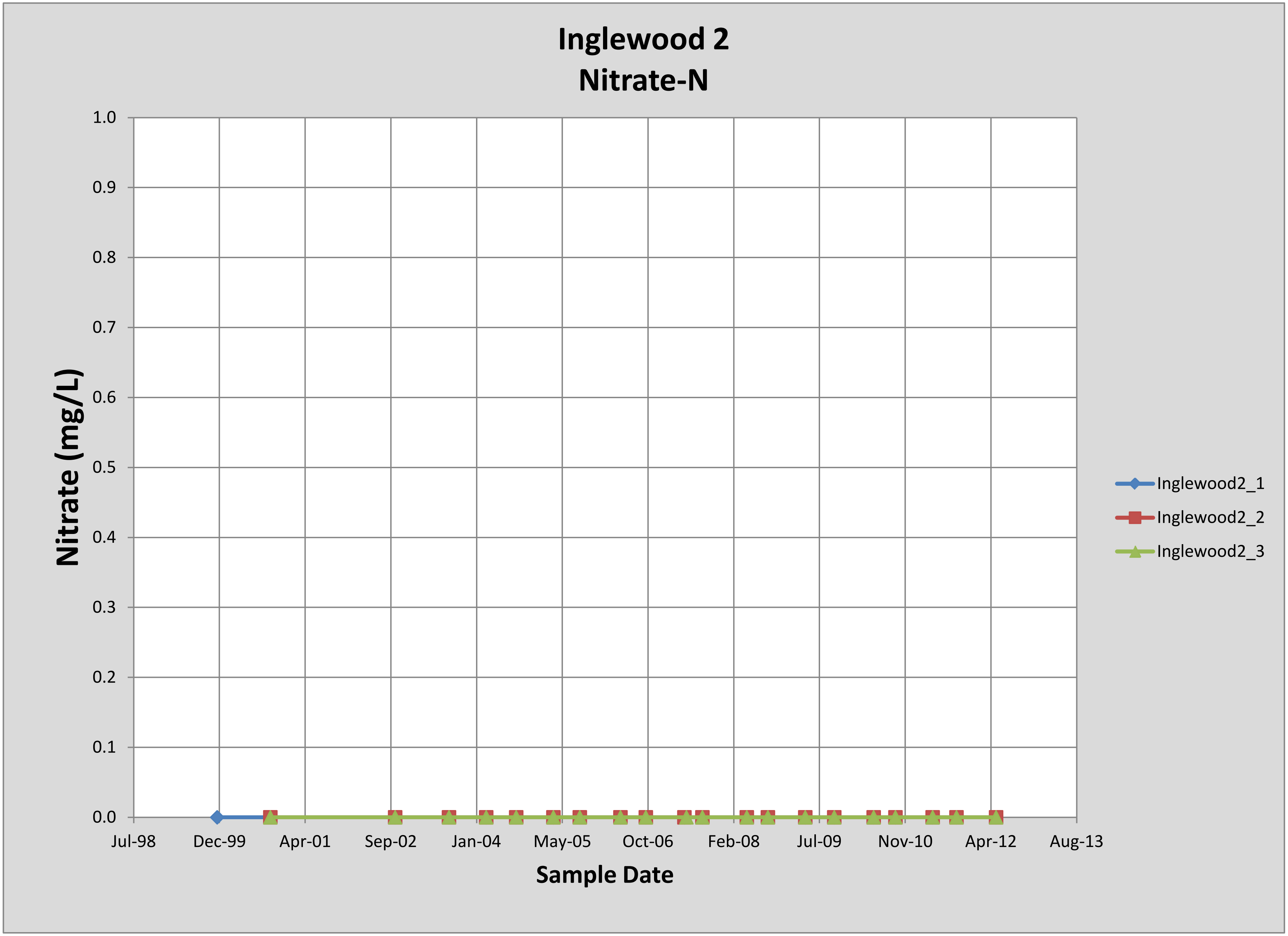
Inglewood 1
Nitrate-N
Nitrate (mg/L)
0
2
4
6
8
10
12
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Inglewood1_1
Inglewood1_3
Inglewood1_4
Inglewood1_5

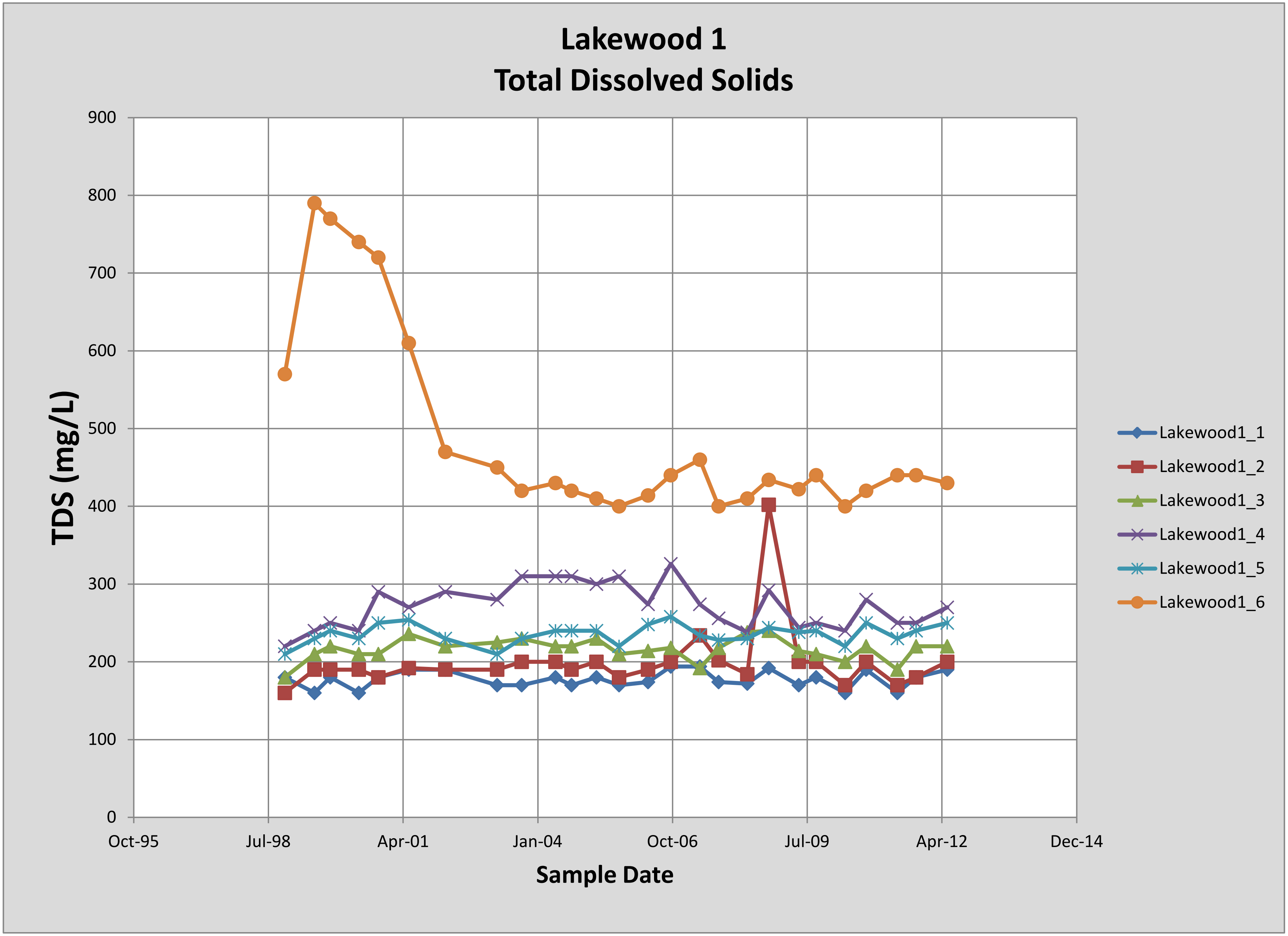


Inglewood 2
Total Dissolved Solids
TDS (mg/L)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Inglewood2_1
Inglewood2_2
Inglewood2_3

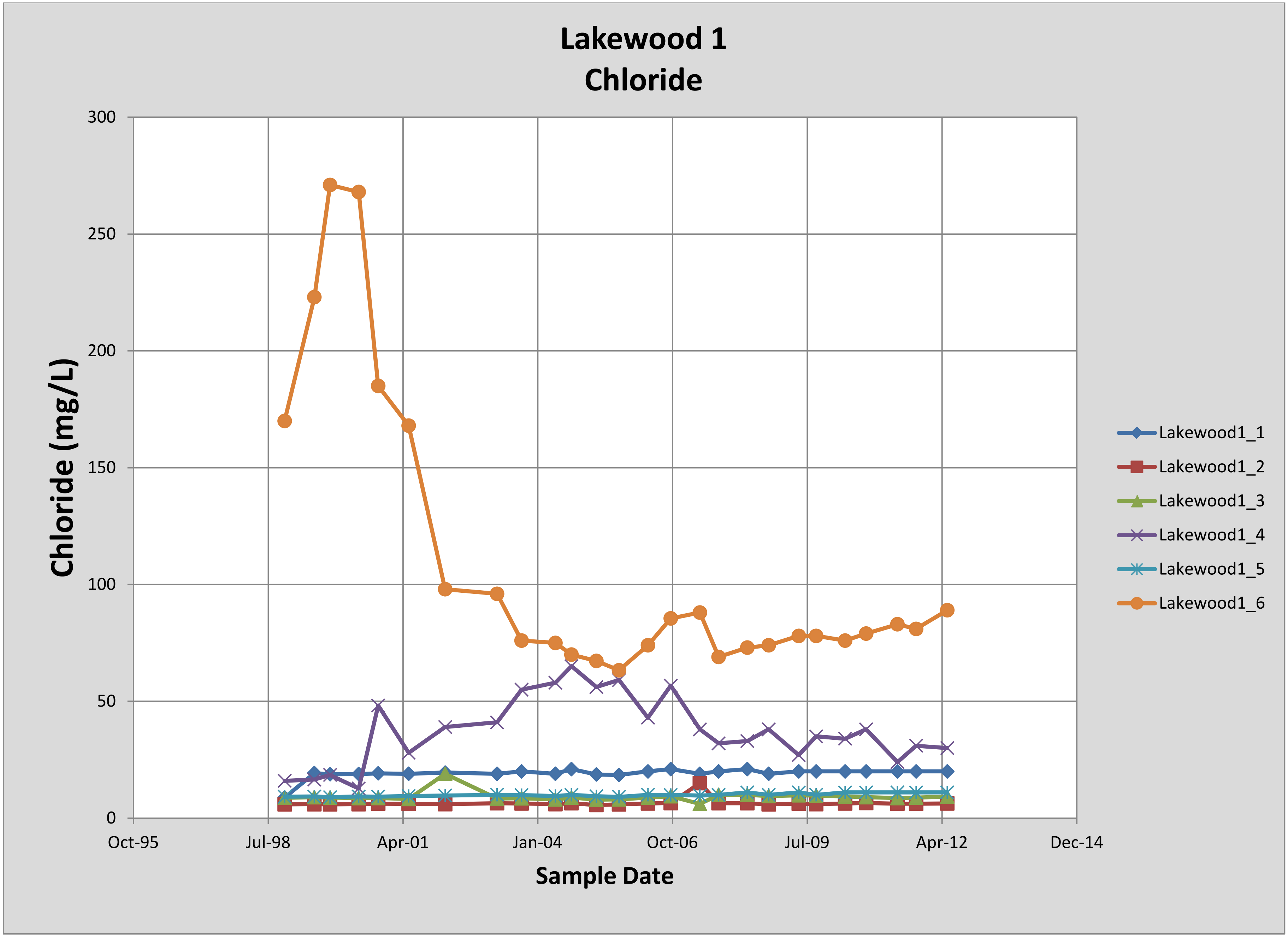


Inglewood 2
Chloride
Chloride (mg/L)
500
450
400
350
300
250
200
150
100
50
0
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Inglewood2_1
Inglewood2_2
Inglewood2_3

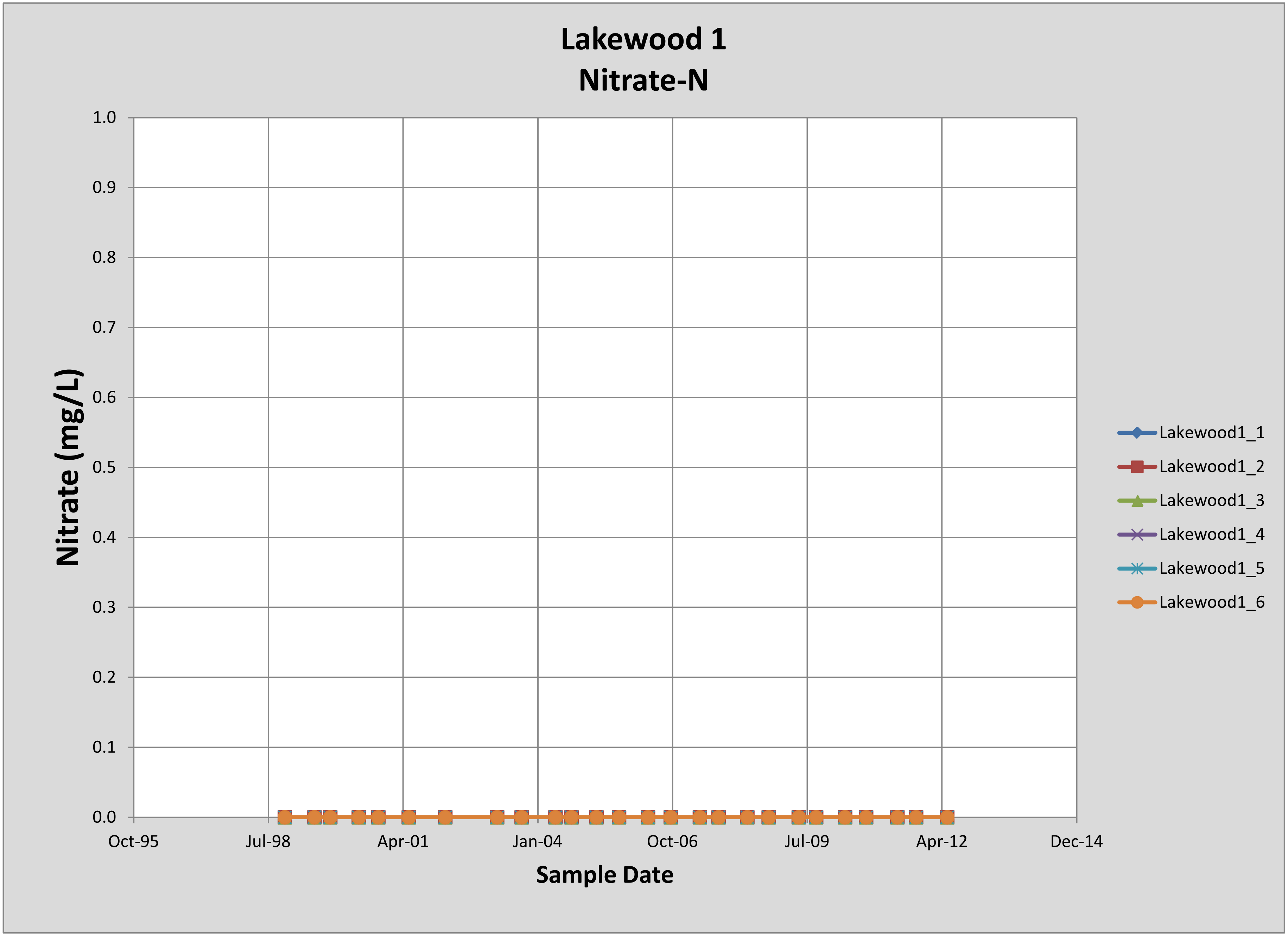

Inglewood 2
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Inglewood2_1
Inglewood2_2
Inglewood2_3



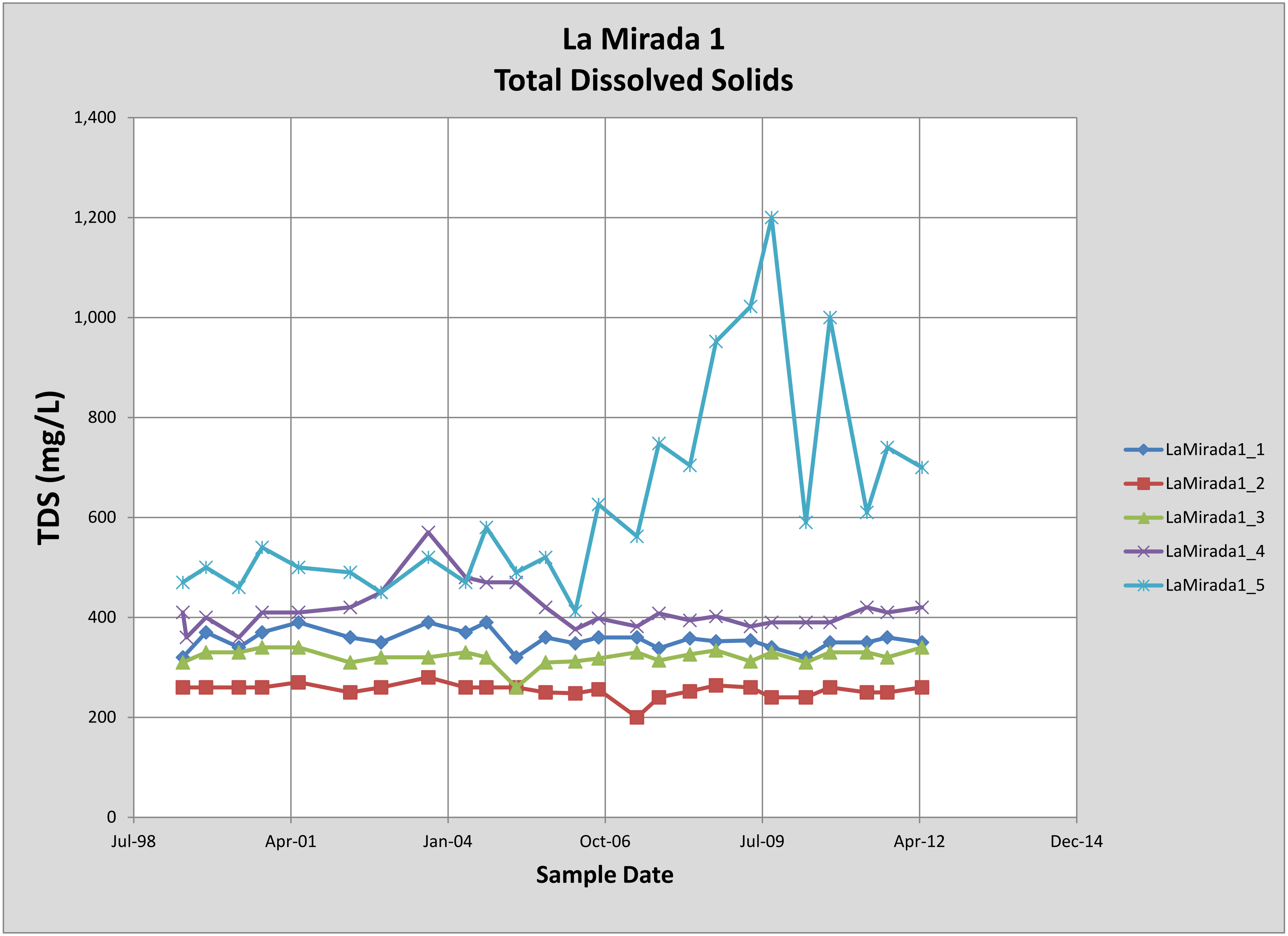
Lakewood 1
Total Dissolved Solids
TDS (mg/L)
900
800
700
600
500
400
300
200
100
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Lakewood1_1
Lakewood1_2
Lakewood1_3
Lakewood1_4
Lakewood1_5
Lakewood1_6



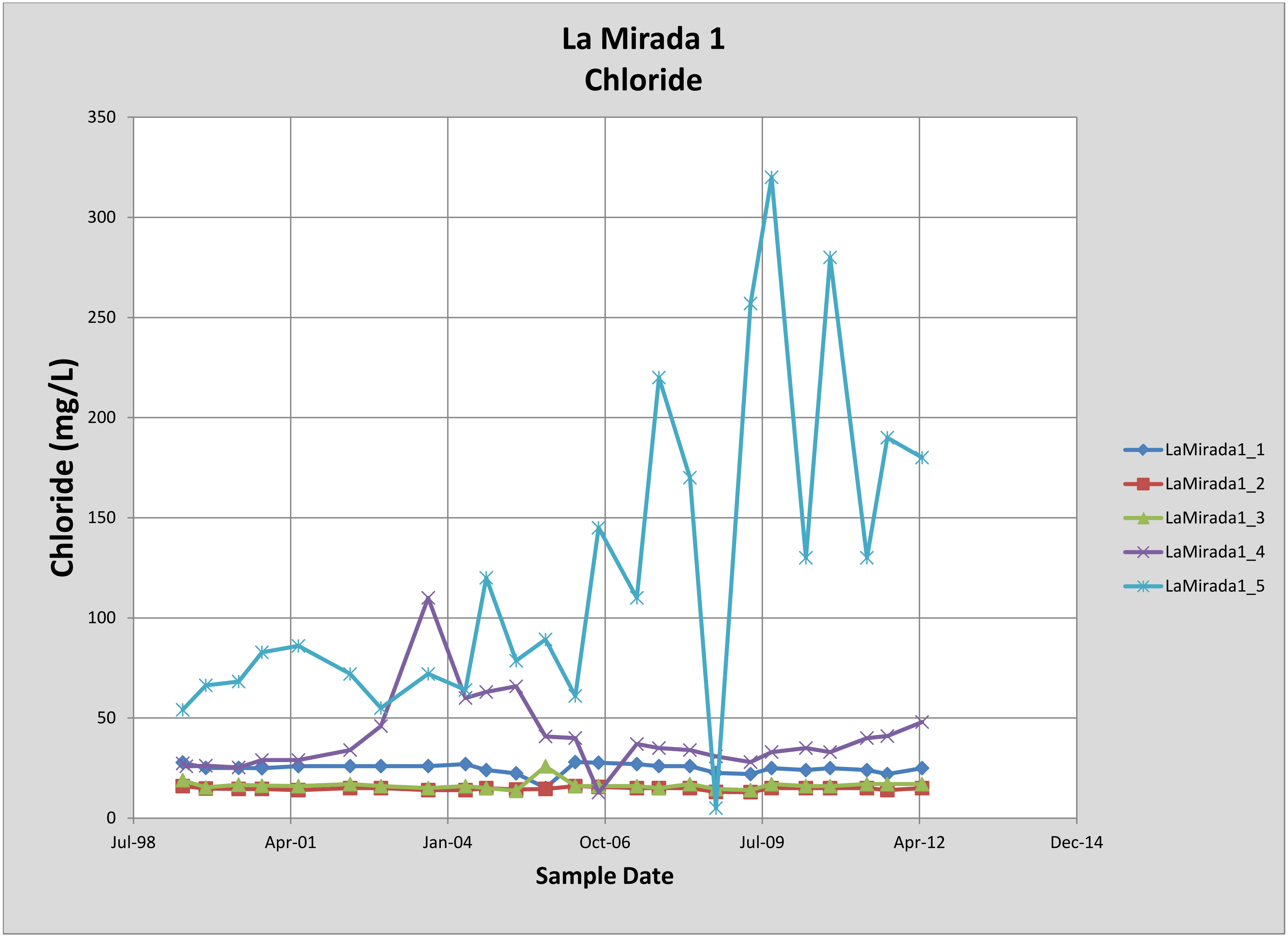
Lakewood 1
Chloride
Chloride (mg/L)
300
250
200
150
100
50
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Lakewood1_1
Lakewood1_2
Lakewood1_3
Lakewood1_4
Lakewood1_5
Lakewood1_6

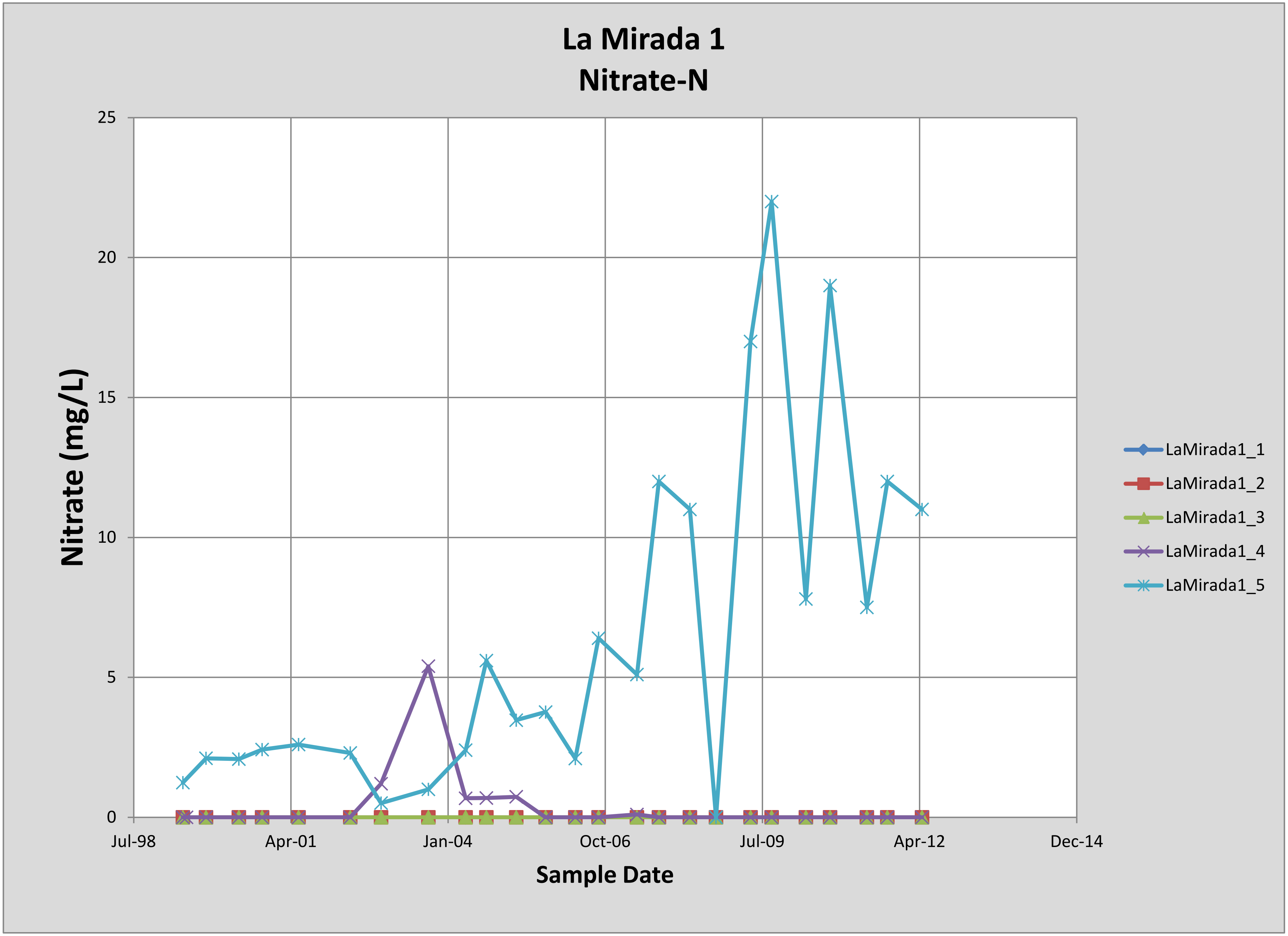


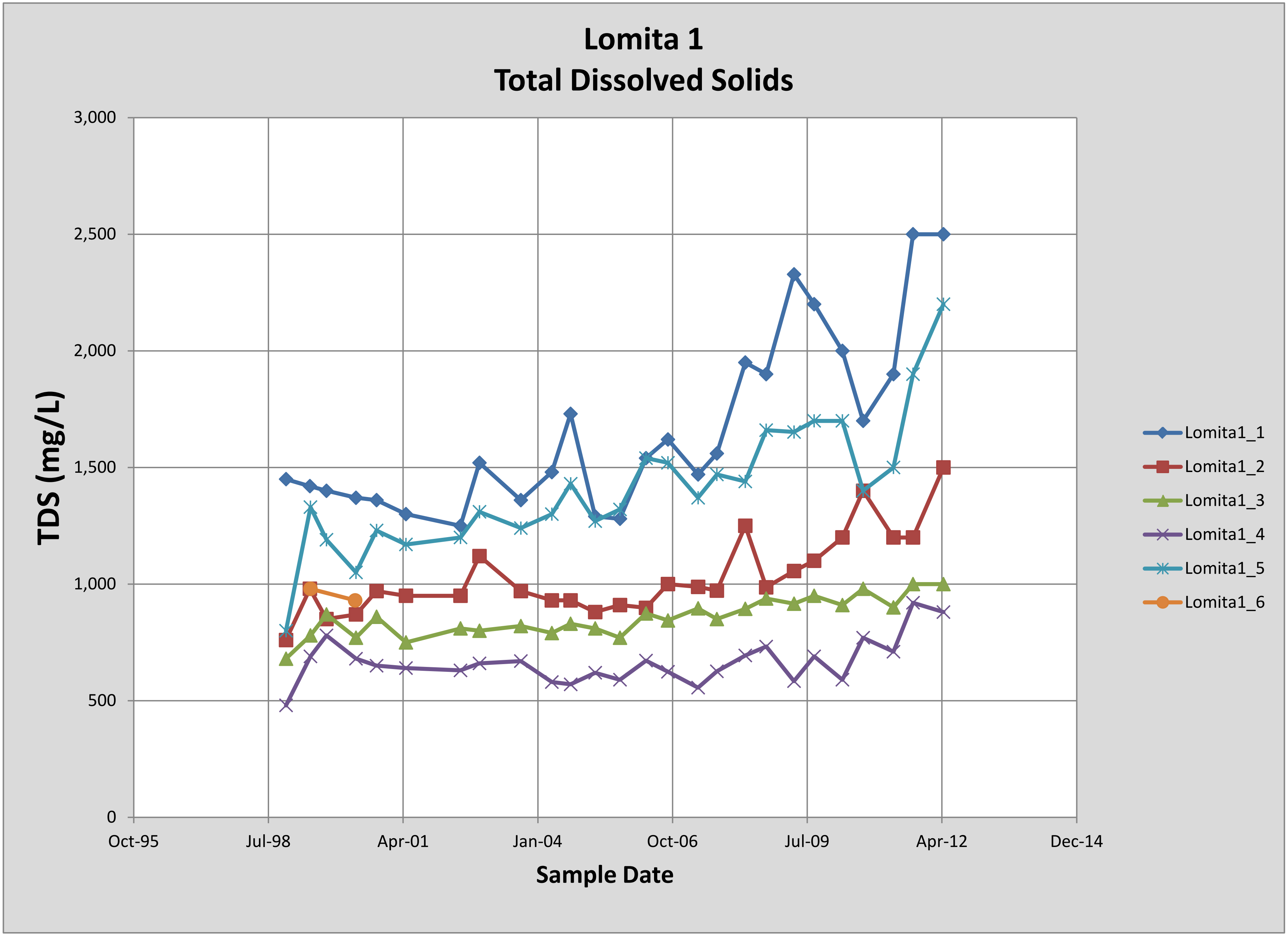
Lakewood 1
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Lakewood1_1
Lakewood1_2
Lakewood1_3
Lakewood1_4
Lakewood1_5
Lakewood1_6



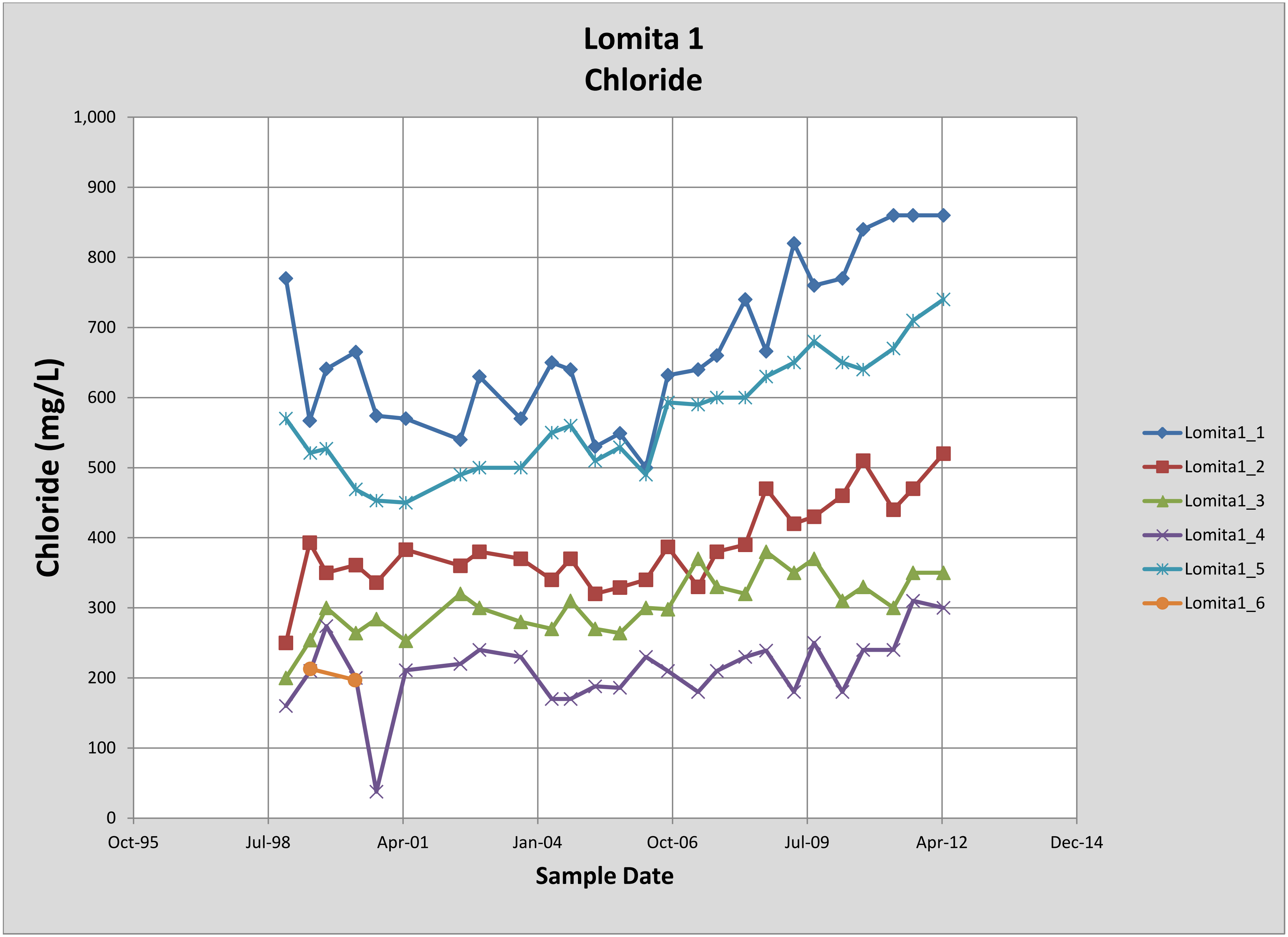
La Mirada 1
Total Dissolved Solids
TDS (mg/L)
1,400
1,200
1,000
800
600
400
200
0
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
LaMirada1_1
LaMirada1_2
LaMirada1_3
LaMirada1_4
LaMirada1_5

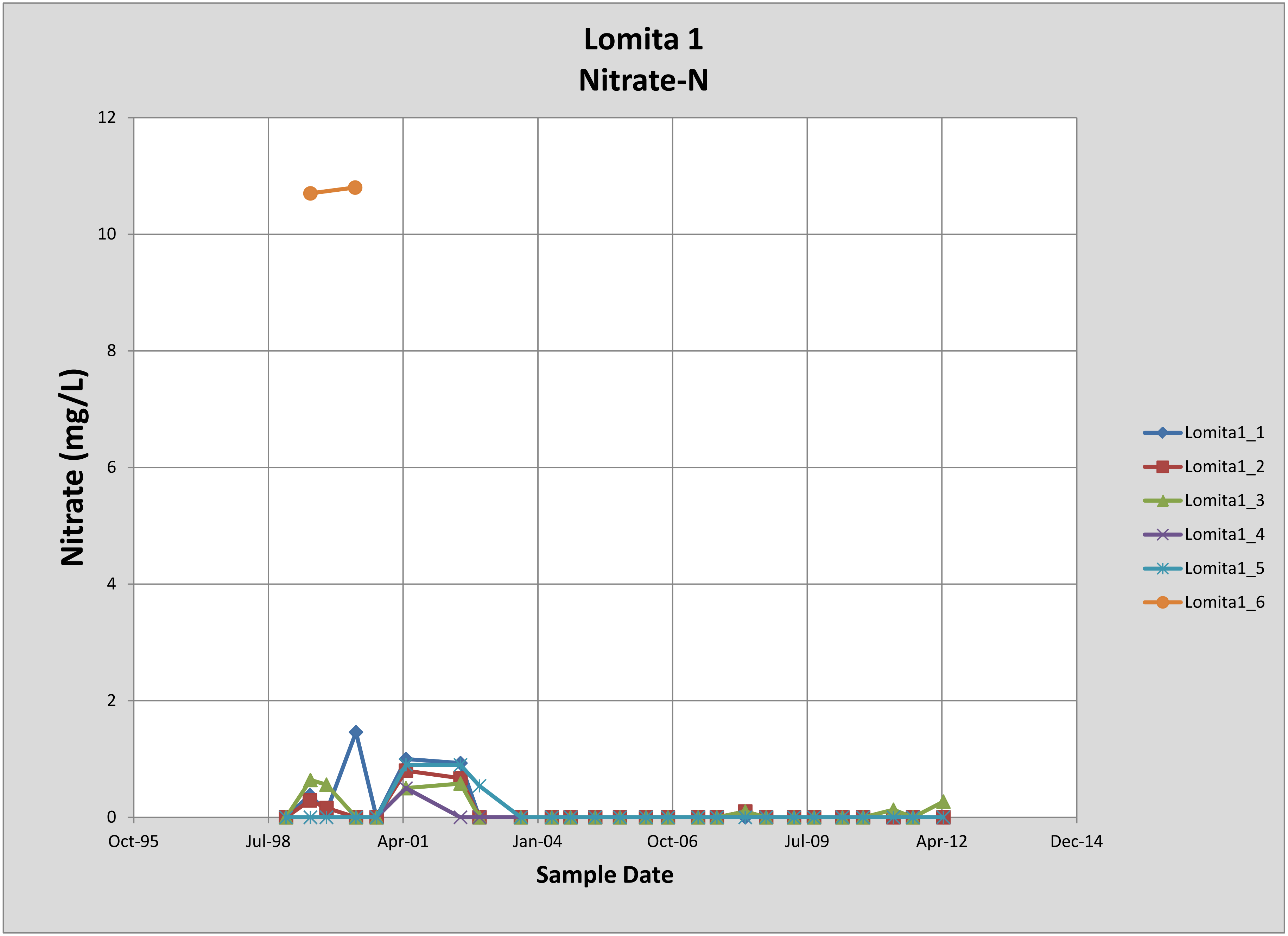

La Mirada 1
Chloride
Chloride (mg/L)
350
300
250
200
150
100
50
0
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
LaMirada1_1
LaMirada1_2
LaMirada1_3
LaMirada1_4
LaMirada1_5


La Mirada 1
Nitrate-N
Nitrate (mg/L)
25
20
15
10
5
0
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
LaMirada1_1
LaMirada1_2
LaMirada1_3
LaMirada1_4
LaMirada1_5

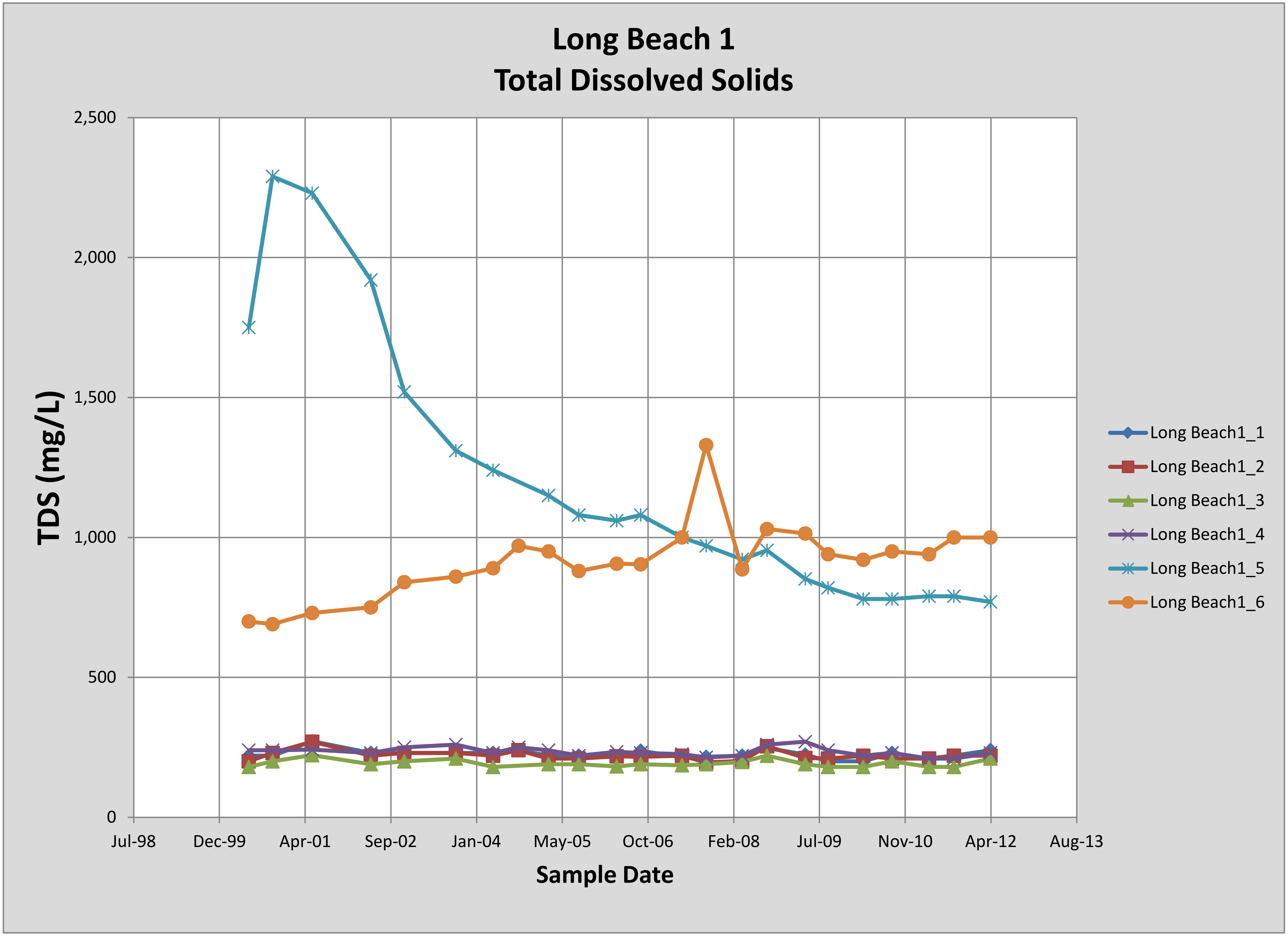


Lomita 1
Total Dissolved Solids
3,000
2,500
2,000
1,500
1,000
500
0
TDS (mg/L)
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Lomita1_1
Lomita1_2
Lomita1_3
Lomita1_4
Lomita1_5
Lomita1_6

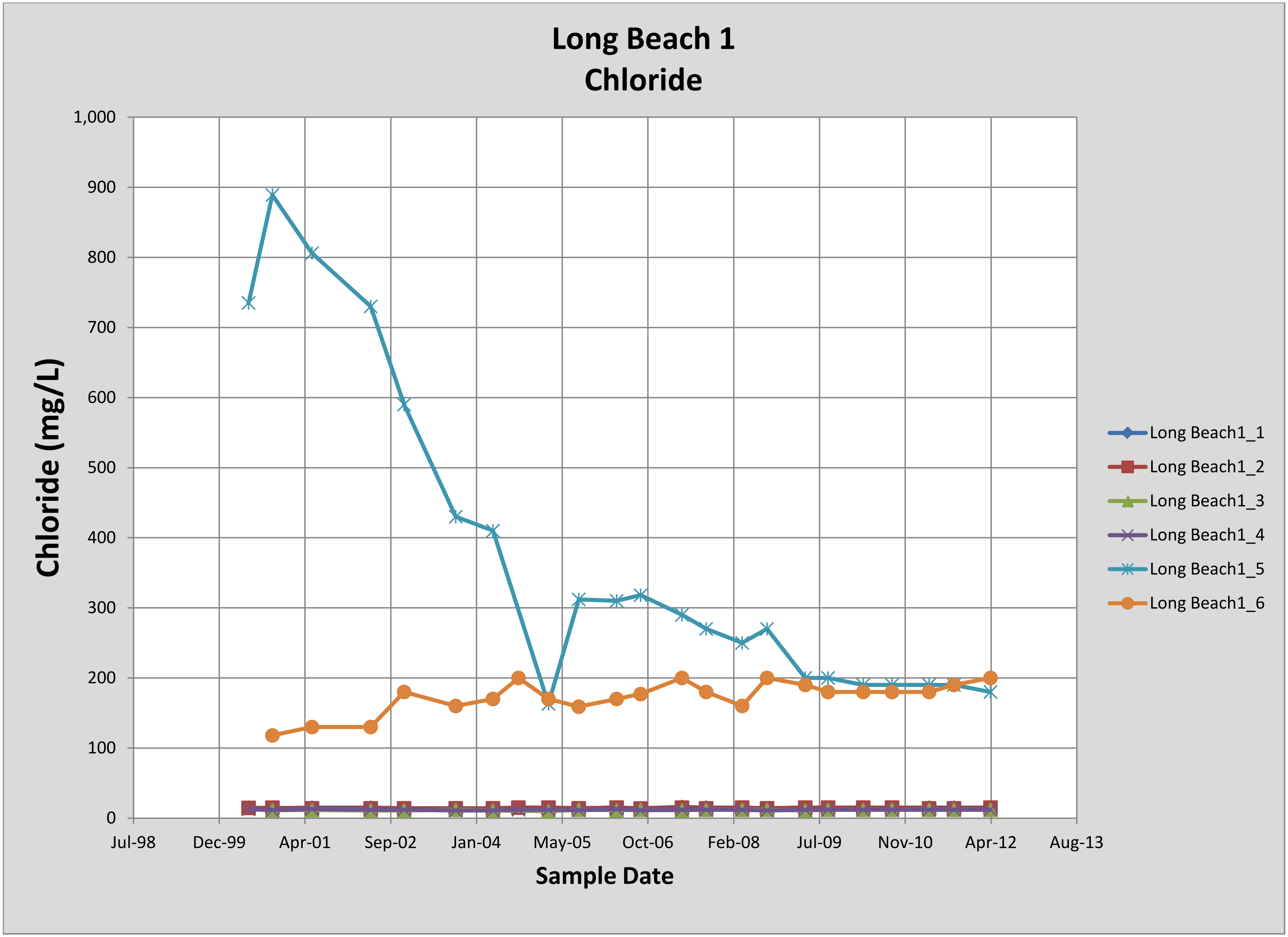

Lomita 1
Chloride
Chloride (mg/L)
1,000
900
800
700
600
500
400
300
200
100
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Lomita1_1
Lomita1_2
Lomita1_3
Lomita1_4
Lomita1_5
Lomita1_6

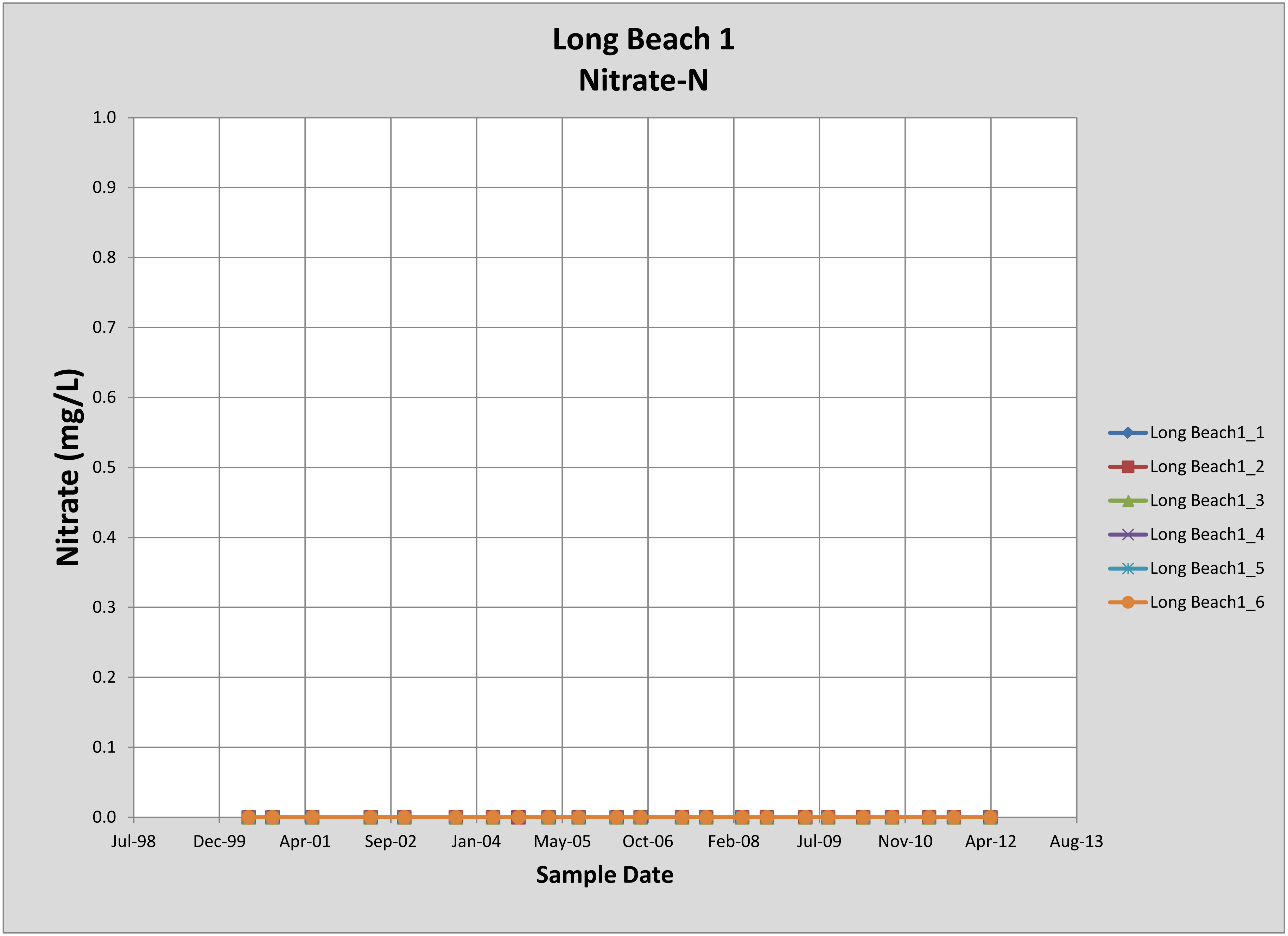


Lomita 1
Nitrate-N
Nitrate (mg/L)
Sample Date
0
2
4
6
8
10
12
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Lomita1_1
Lomita1_2
Lomita1_3
Lomita1_4
Lomita1_5
Lomita1_6

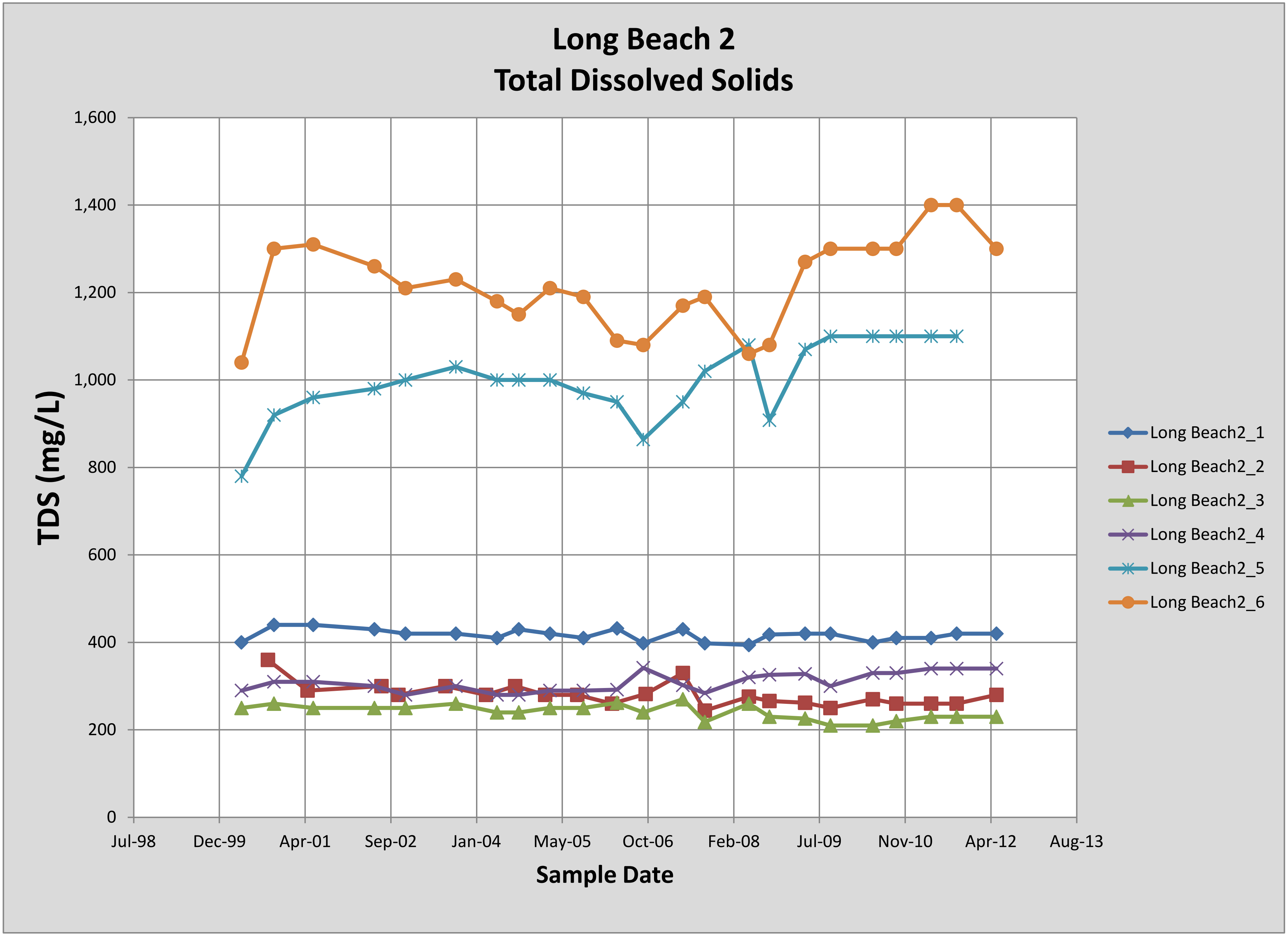


Long Beach 1
Total Dissolved Solids
TDS (mg/L)
2,500
2,000
1,500
1,000
500
0
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Long Beach1_1
Long Beach1_2
Long Beach1_3
Long Beach1_4
Long Beach1_5
Long Beach1_6

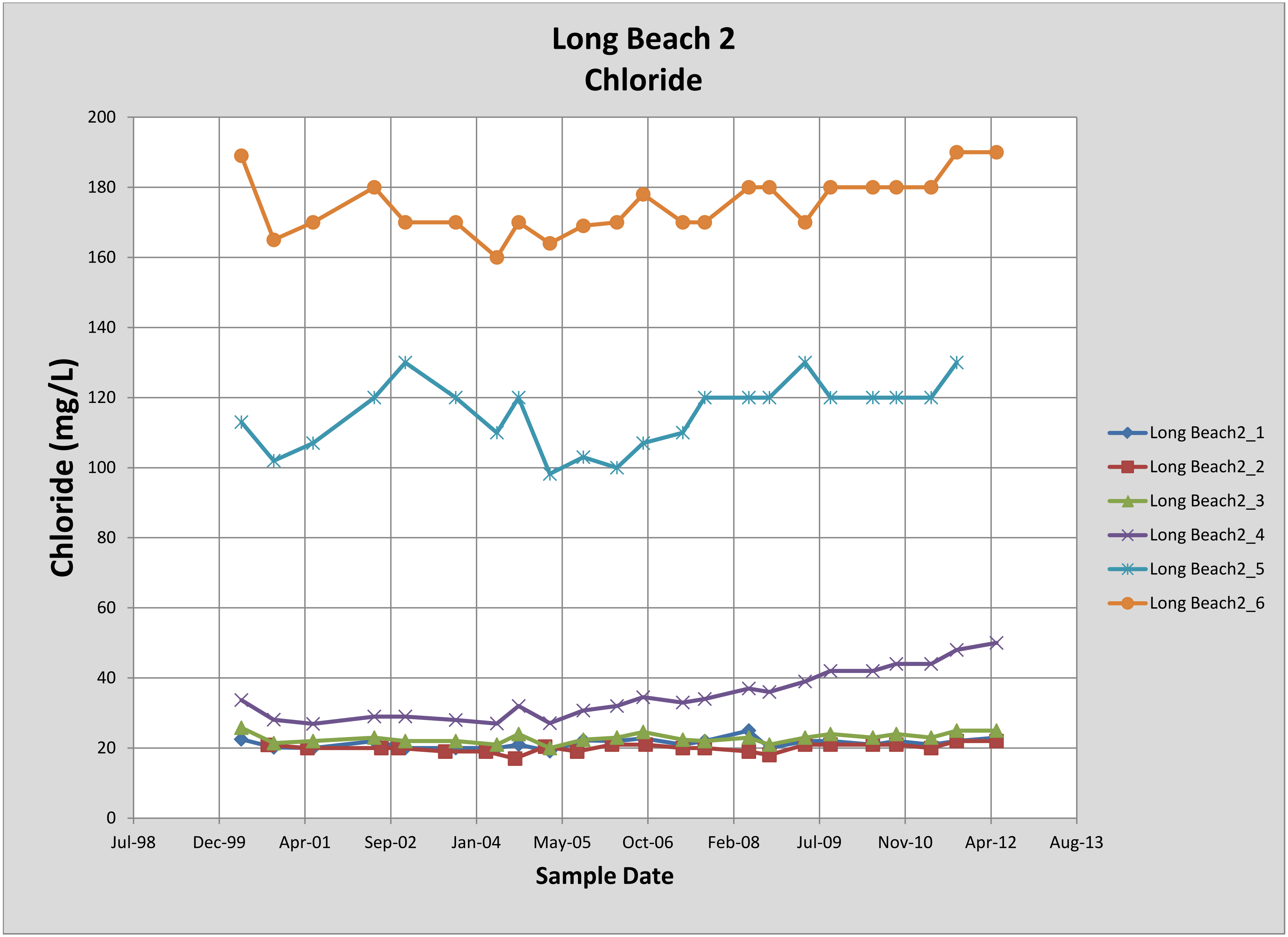

Long Beach 1
Chloride
Chloride (mg/L)
1,000
900
800
700
600
500
400
300
200
100
0
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Long Beach1_1
Long Beach1_2
Long Beach1_3
Long Beach1_4
Long Beach1_5
Long Beach1_6

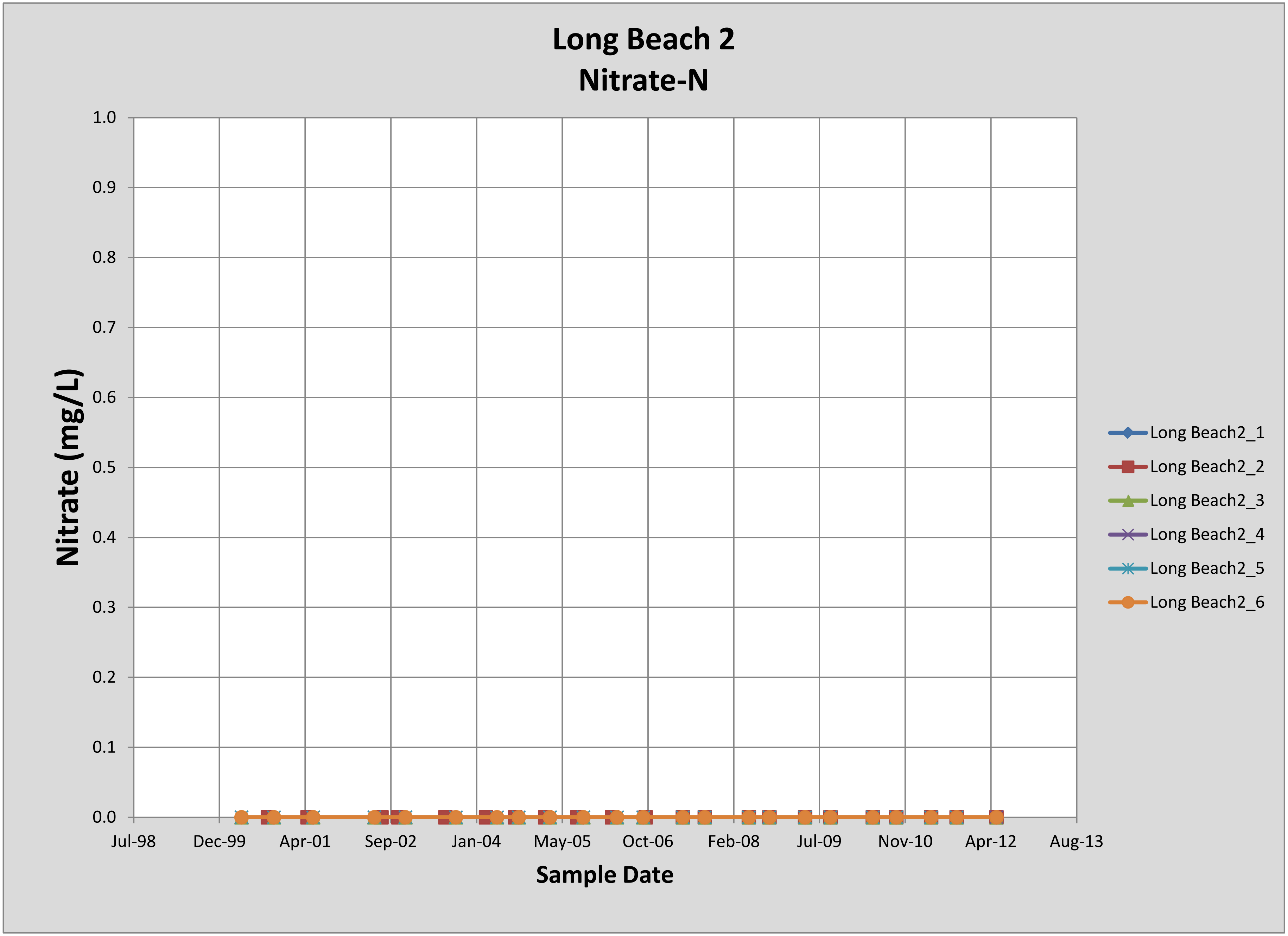


Long Beach 1
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Long Beach1_1
Long Beach1_2
Long Beach1_3
Long Beach1_4
Long Beach1_5
Long Beach1_6

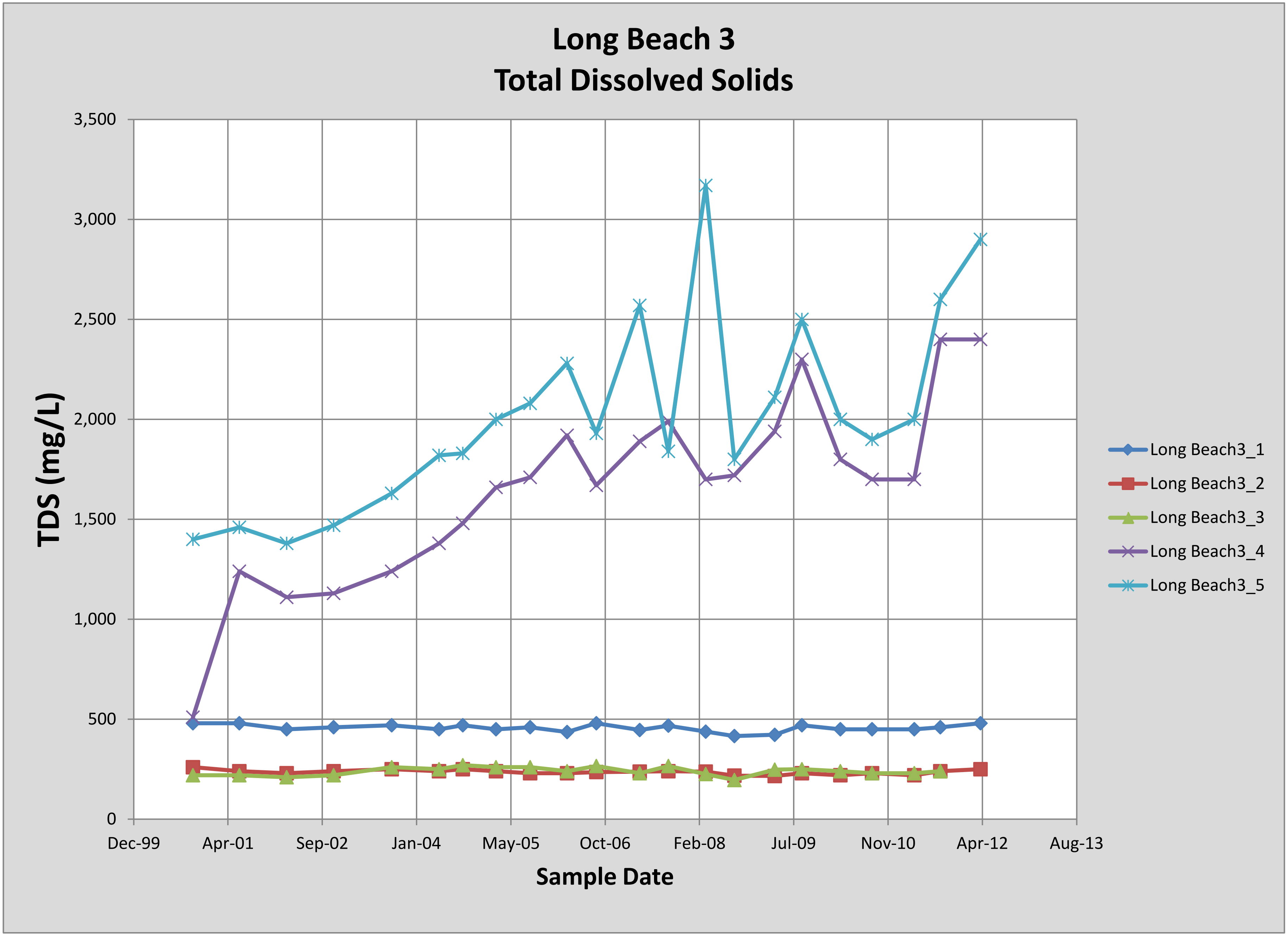


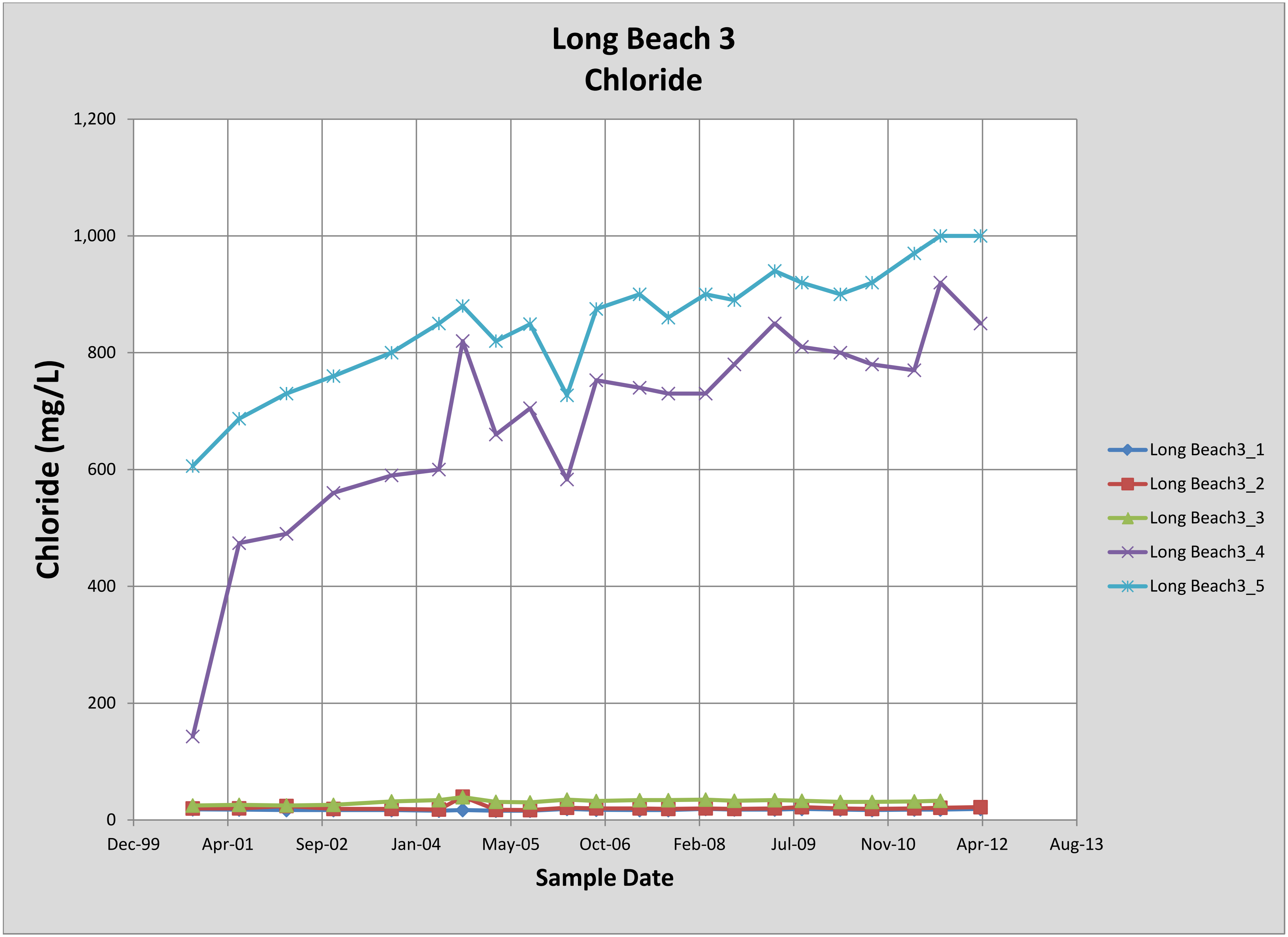
Long Beach 2
Total Dissolved Solids
TDS (mg/L)
1,600
1,400
1,200
1,000
800
600
400
200
0
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Long Beach2_1
Long Beach2_2
Long Beach2_3
Long Beach2_4
Long Beach2_5
Long Beach2_6


Long Beach 2
Chloride
Chloride (mg/L)
200
180
160
140
120
100
80
60
40
20
0
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Long Beach2_1
Long Beach2_2
Long Beach2_3
Long Beach2_4
Long Beach2_5
Long Beach2_6

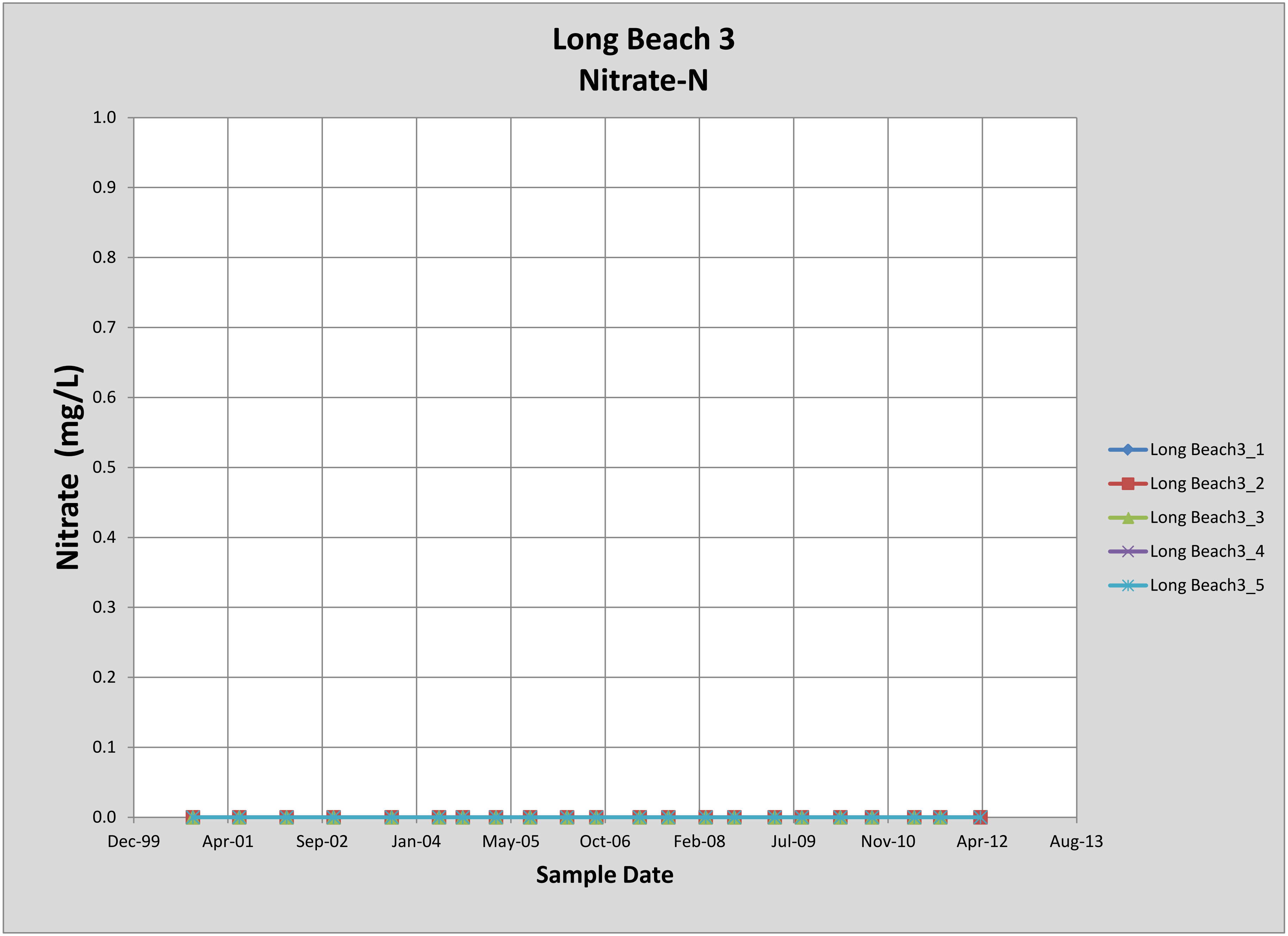


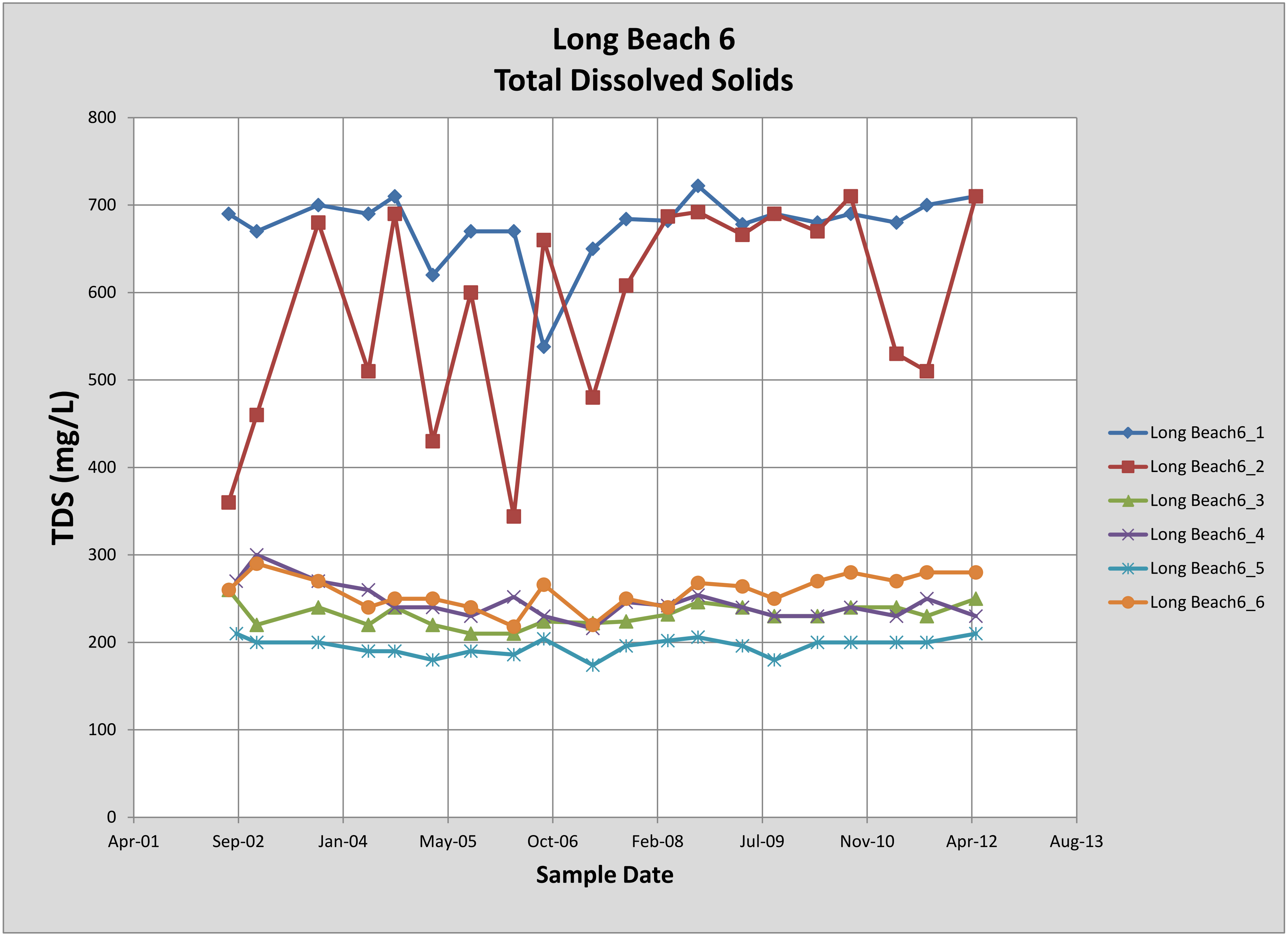
Long Beach 2
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Long Beach2_1
Long Beach2_2
Long Beach2_3
Long Beach2_4
Long Beach2_5
Long Beach2_6

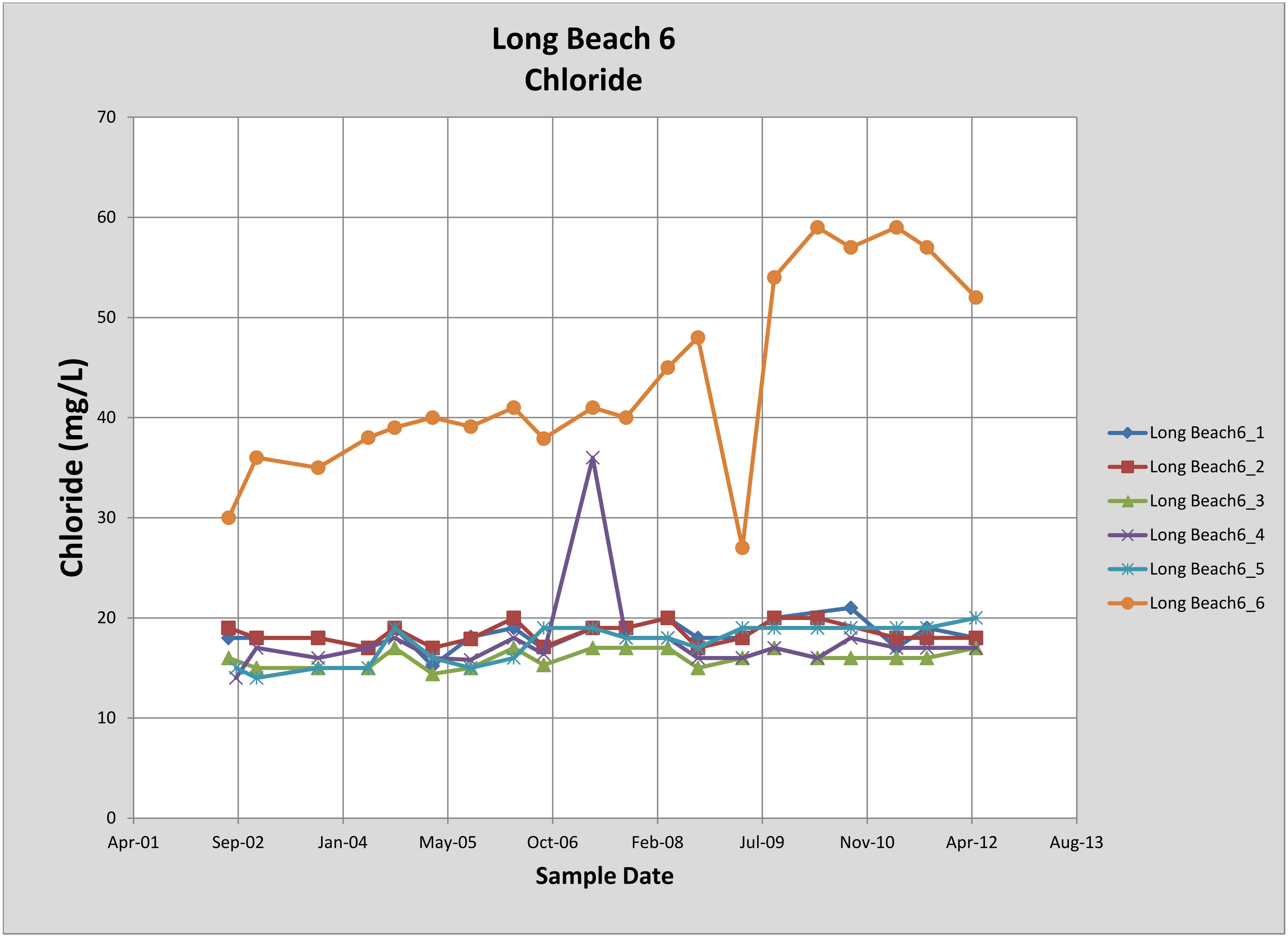

Long Beach 3
Total Dissolved Solids
TDS (mg/L)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Long Beach3_1
Long Beach3_2
Long Beach3_3
Long Beach3_4
Long Beach3_5



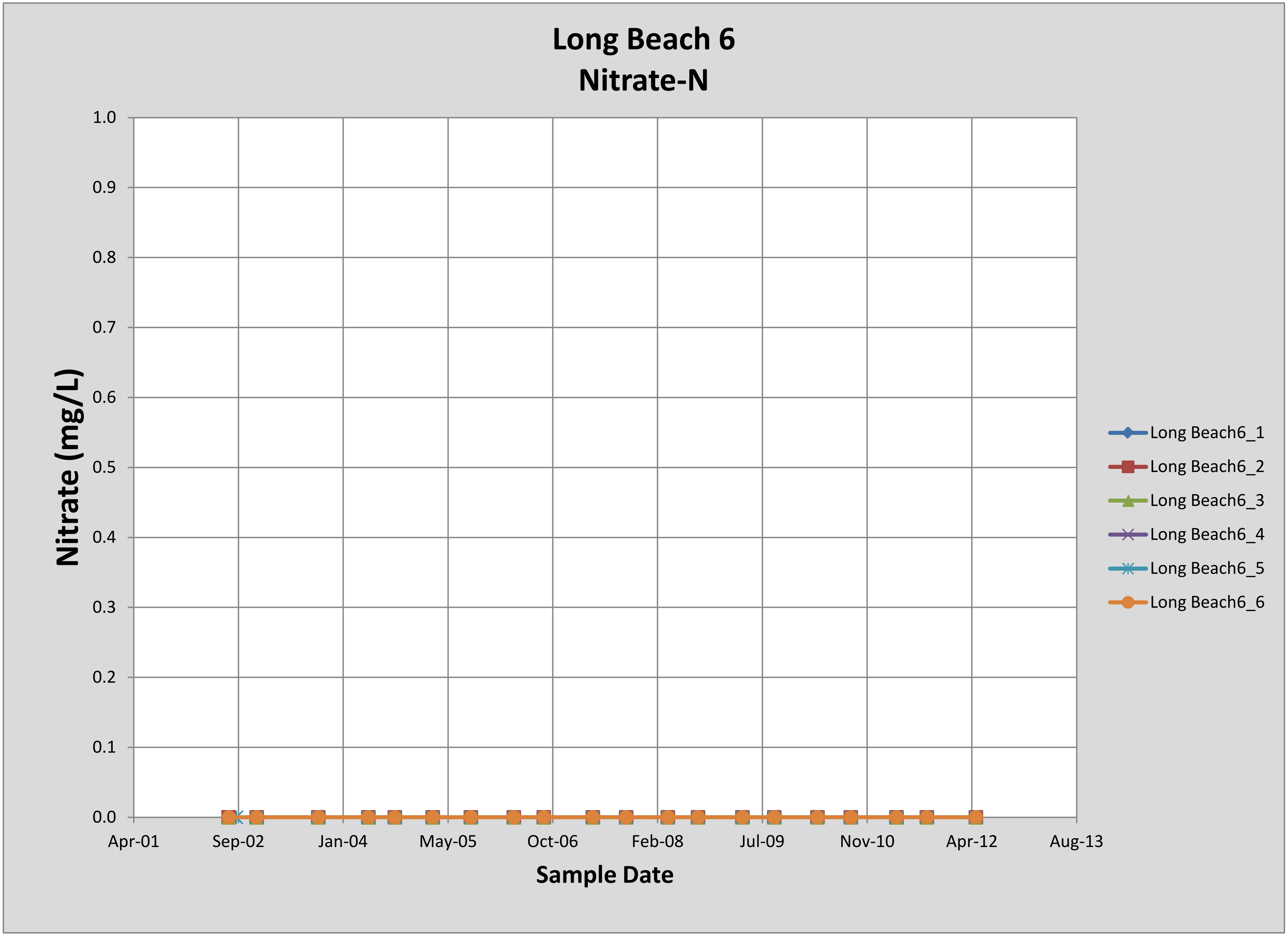
Long Beach 3
Chloride
1,200
1,000
800
600
400
200
0
Chloride (mg/L)
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Long Beach3_1
Long Beach3_2
Long Beach3_3
Long Beach3_4
Long Beach3_5


Long Beach 3
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Long Beach3_1
Long Beach3_2
Long Beach3_3
Long Beach3_4
Long Beach3_5

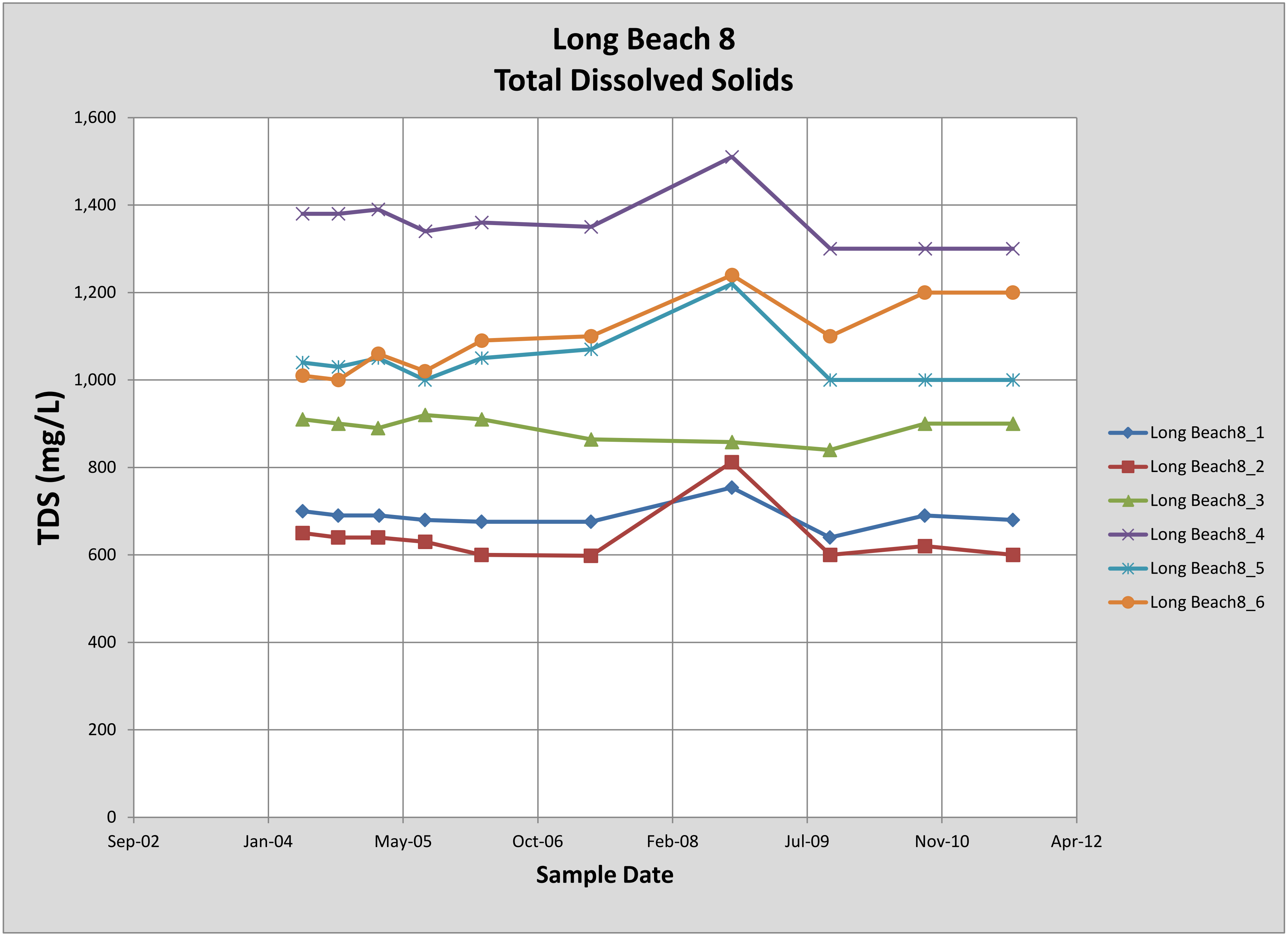

Long Beach 6
Total Dissolved Solids
TDS (mg/L)
800
700
600
500
400
300
200
100
0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Long Beach6_1
Long Beach6_2
Long Beach6_3
Long Beach6_4
Long Beach6_5
Long Beach6_6



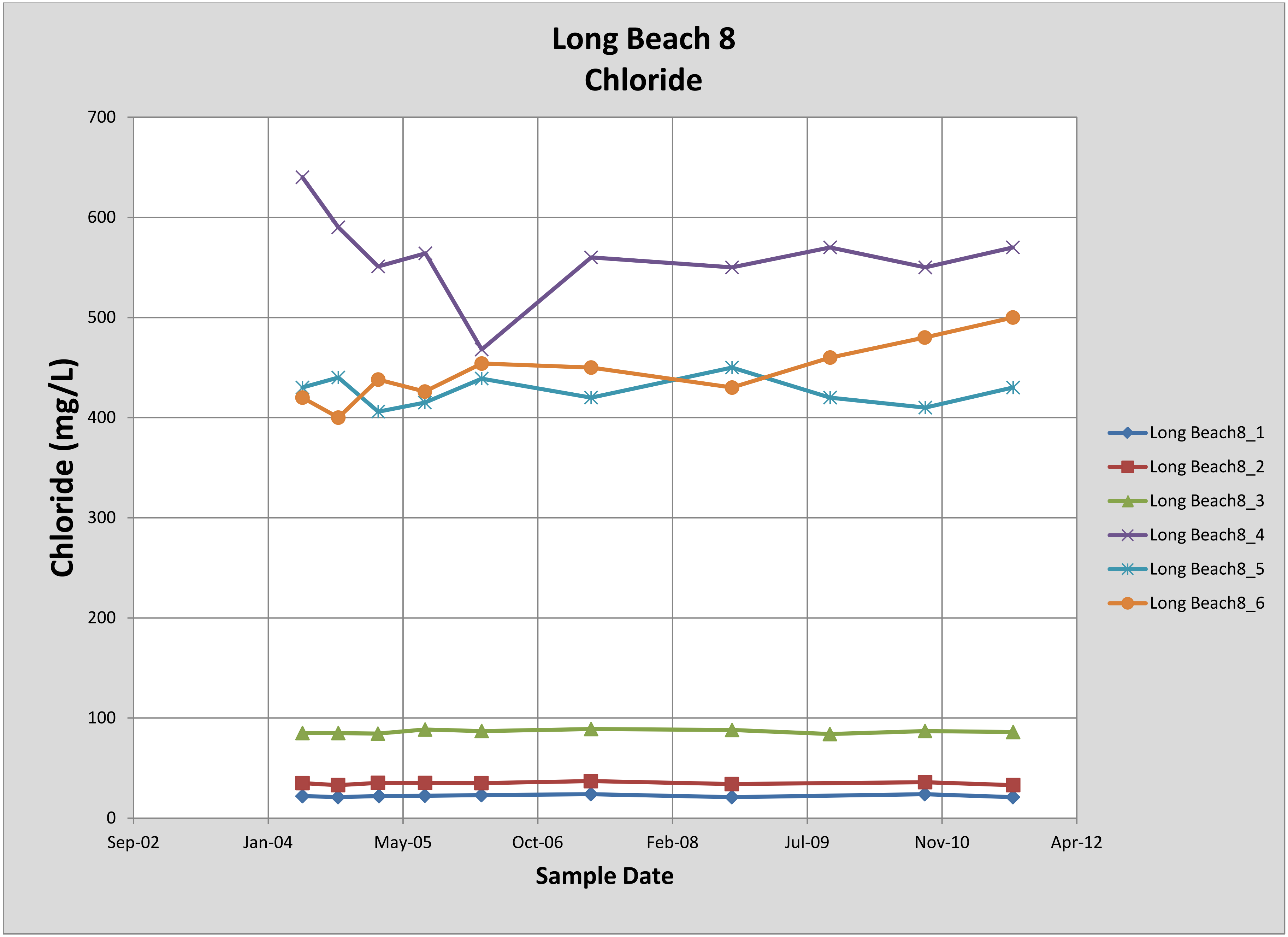
Long Beach 6
Chloride
Chloride (mg/L)
70
60
50
40
30
20
10
0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Long Beach6_1
Long Beach6_2
Long Beach6_3
Long Beach6_4
Long Beach6_5
Long Beach6_6

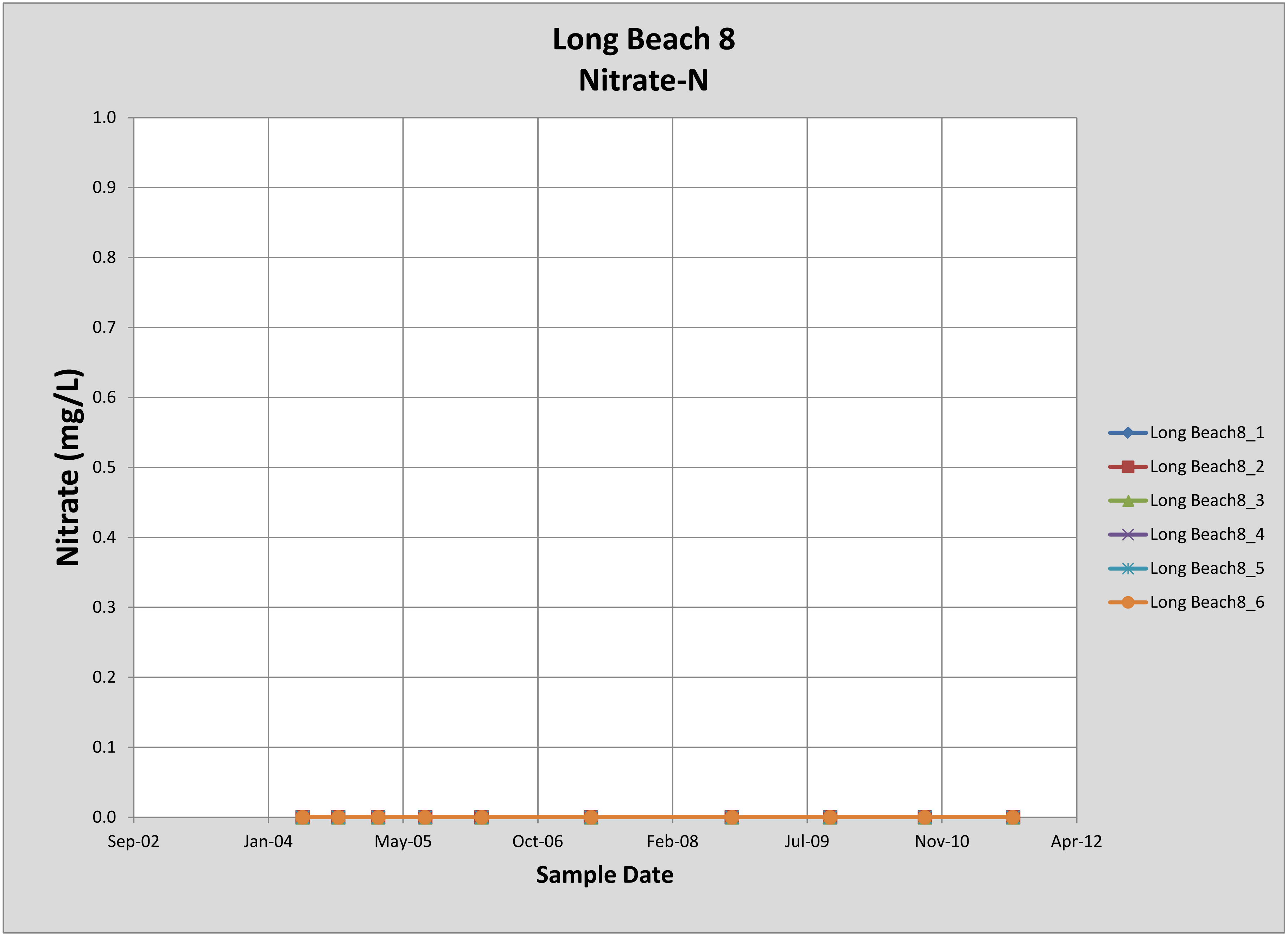


Long Beach 6
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Long Beach6_1
Long Beach6_2
Long Beach6_3
Long Beach6_4
Long Beach6_5
Long Beach6_6

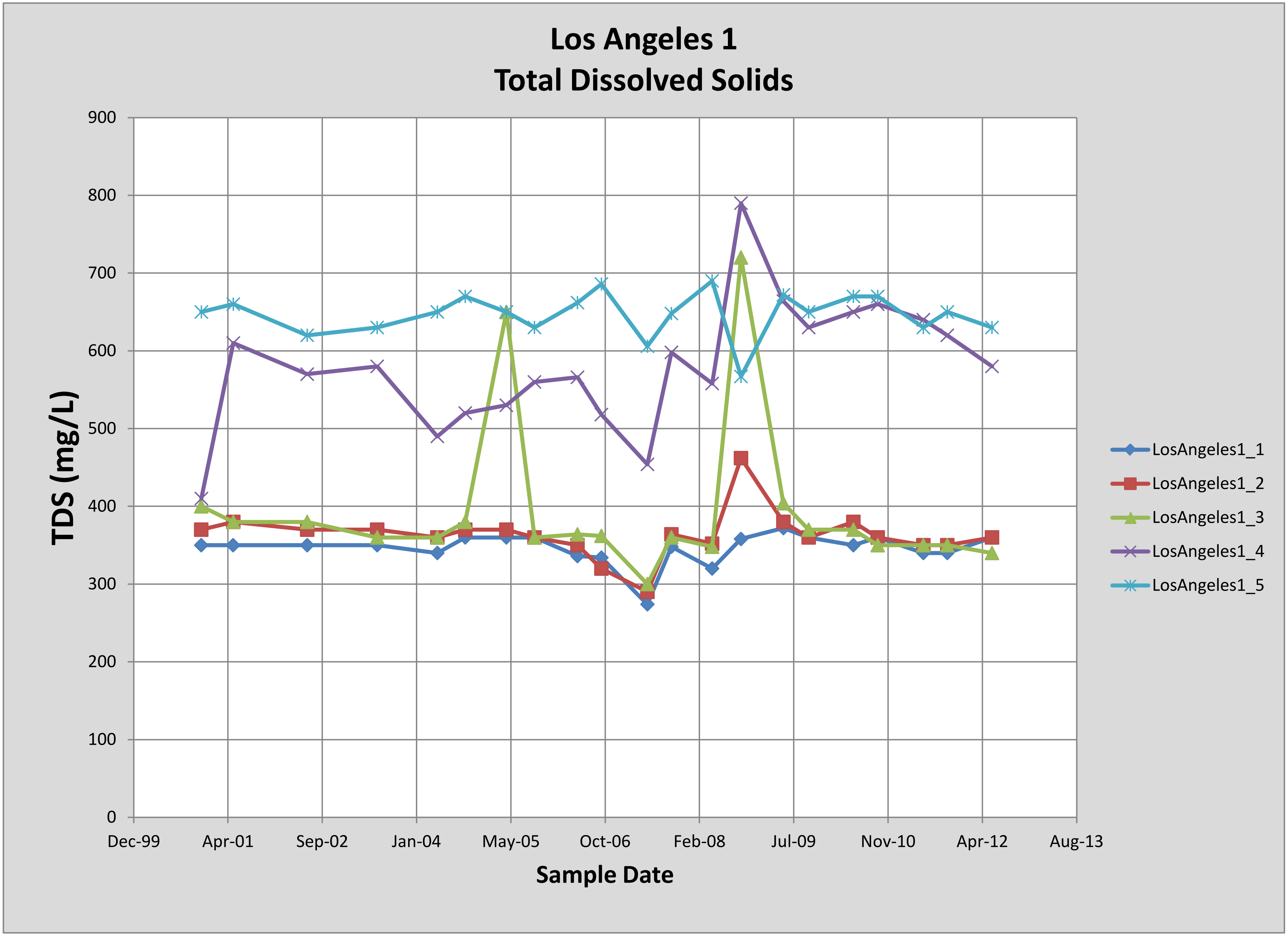


Long Beach 8
Total Dissolved Solids
TDS (mg/L)
1,600
1,400
1,200
1,000
800
600
400
200
0
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Sample Date
Long Beach8_1
Long Beach8_2
Long Beach8_3
Long Beach8_4
Long Beach8_5
Long Beach8_6

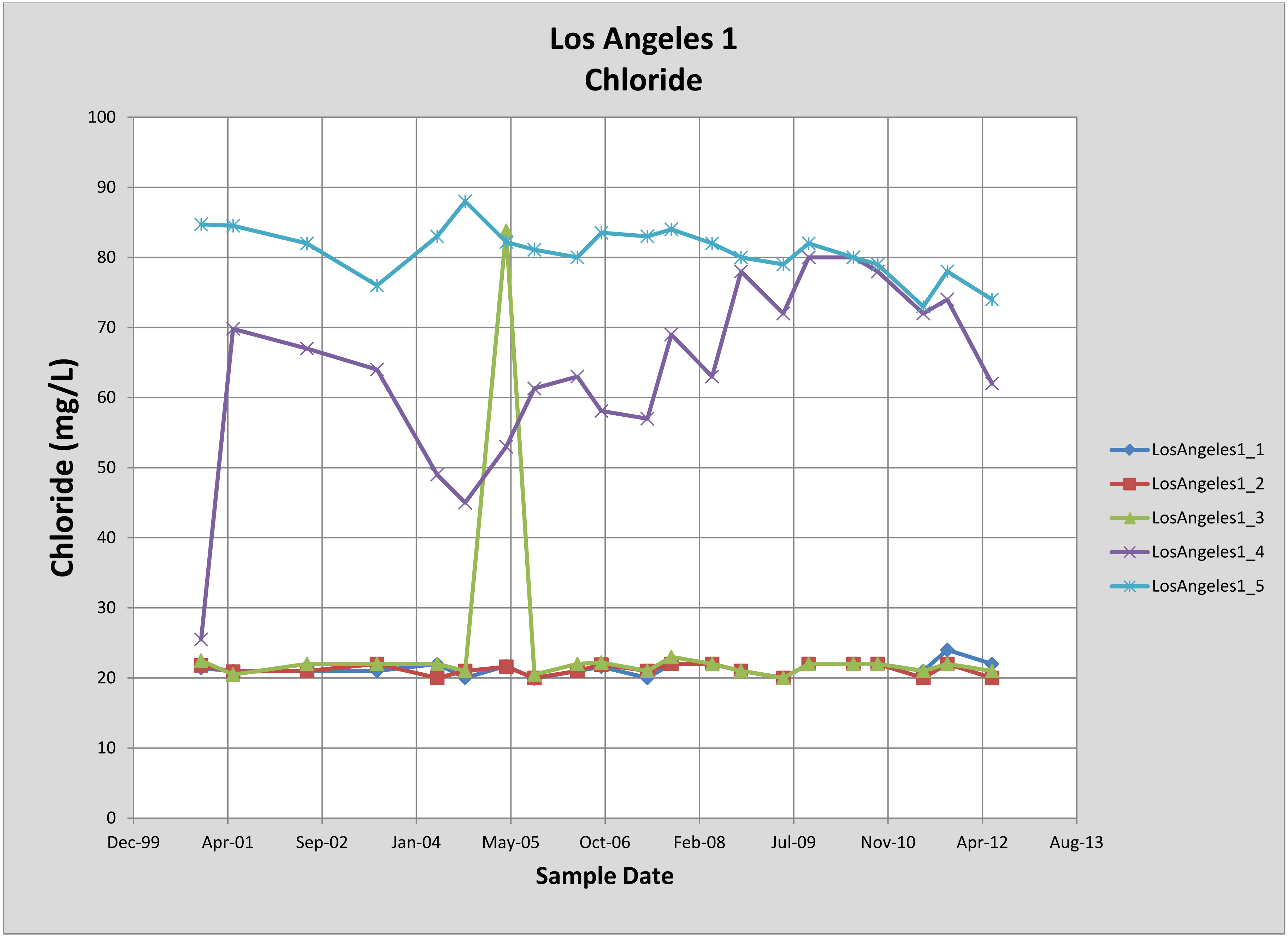

Long Beach 8
Chloride
Chloride (mg/L)
0
100
200
300
400
500
600
700
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Sample Date
Long Beach8_1
Long Beach8_2
Long Beach8_3
Long Beach8_4
Long Beach8_5
Long Beach8_6

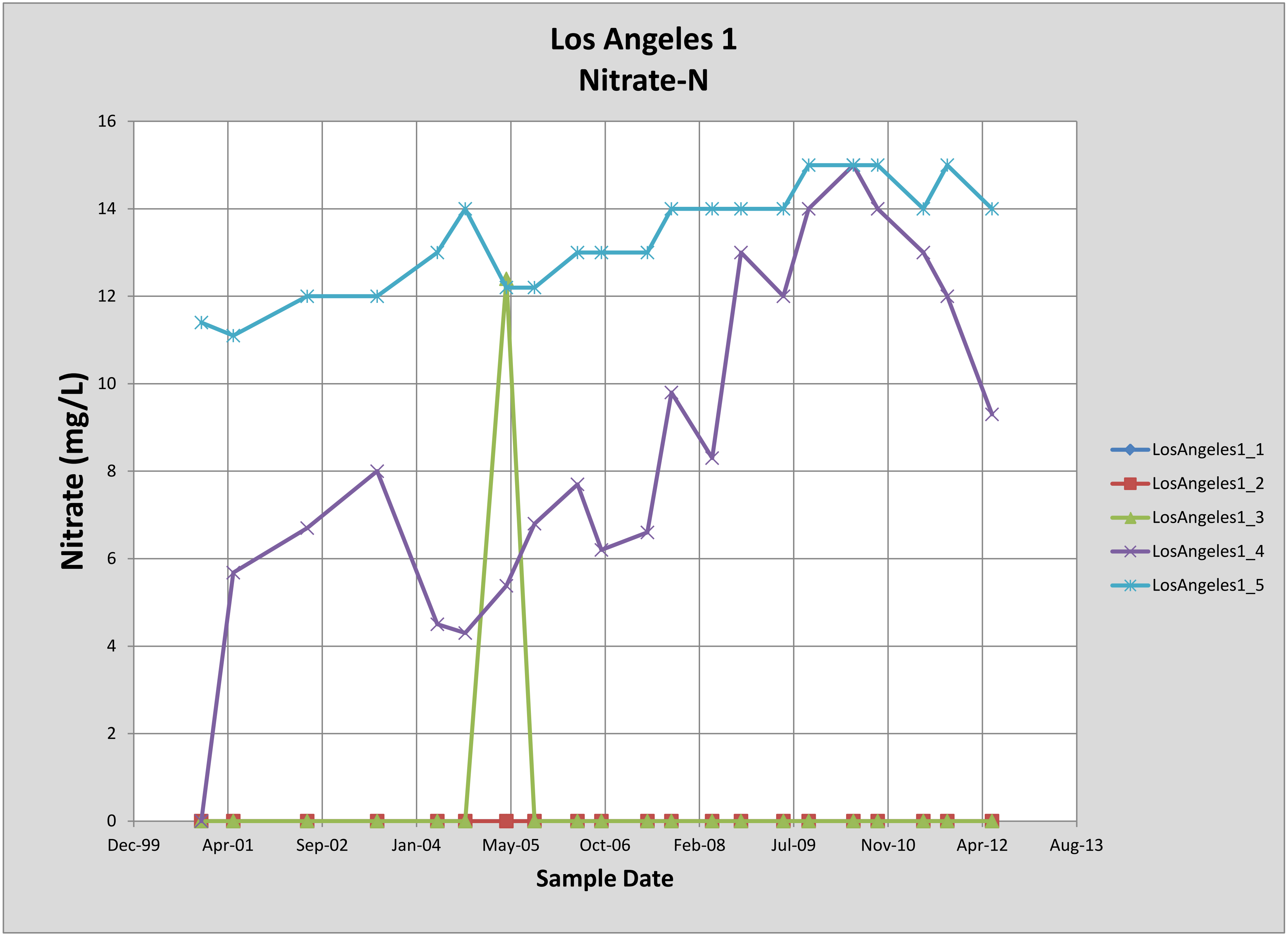


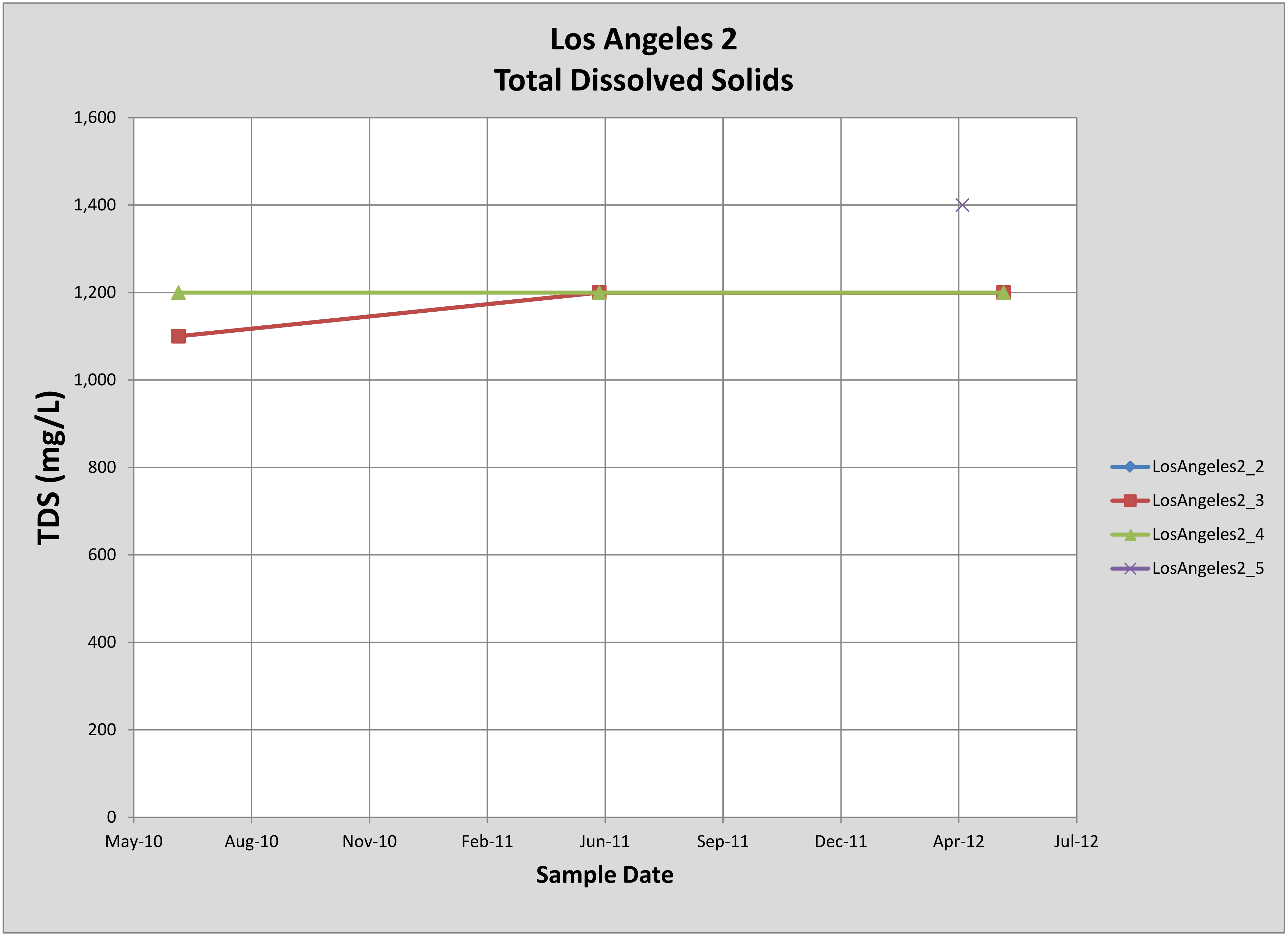
Long Beach 8
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Sample Date
Long Beach8_1
Long Beach8_2
Long Beach8_3
Long Beach8_4
Long Beach8_5
Long Beach8_6



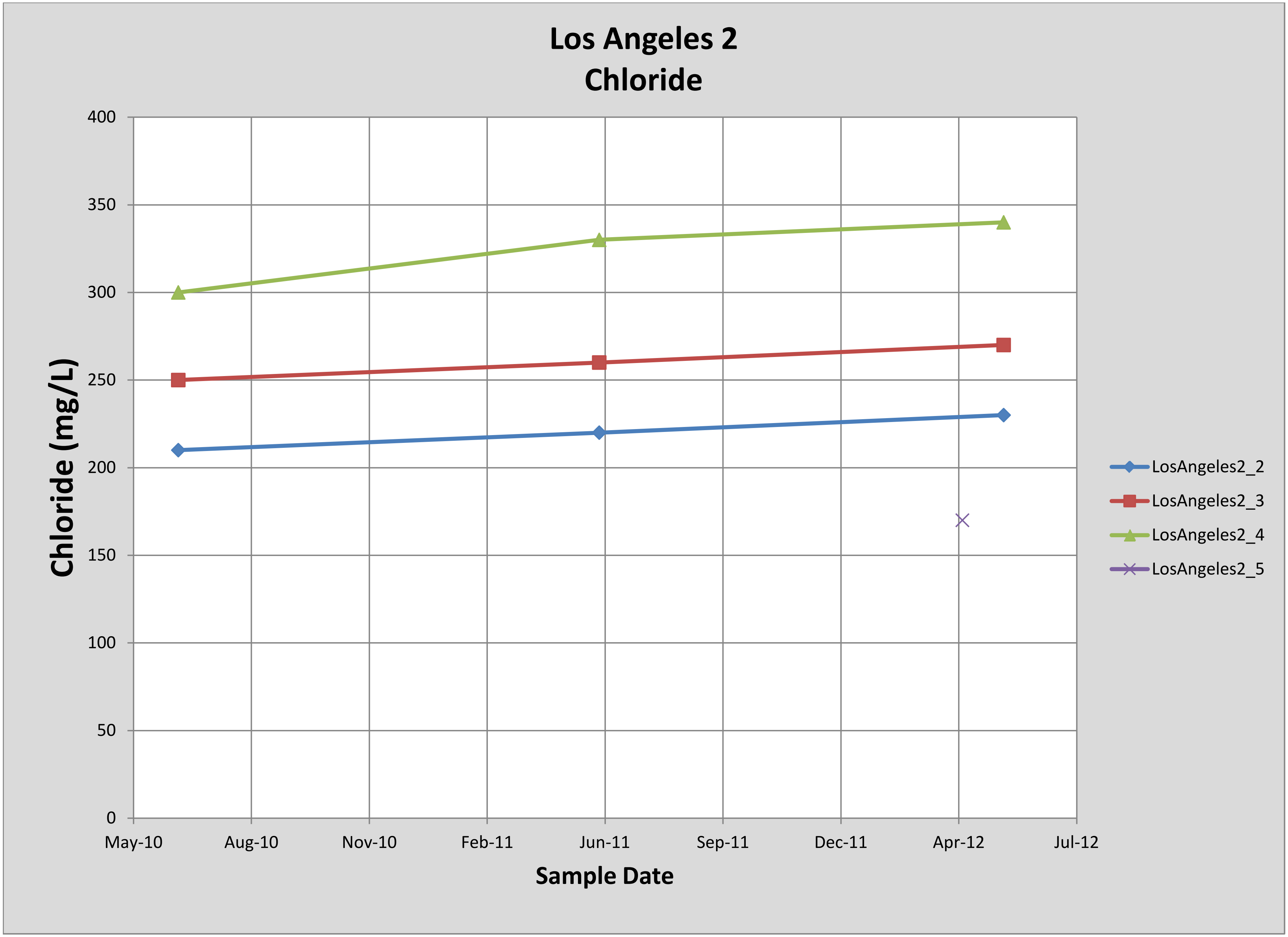
Los Angeles 1
Total Dissolved Solids
TDS (mg/L)
900
800
700
600
500
400
300
200
100
0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
LosAngeles1_1
LosAngeles1_2
LosAngeles1_3
LosAngeles1_4
LosAngeles1_5

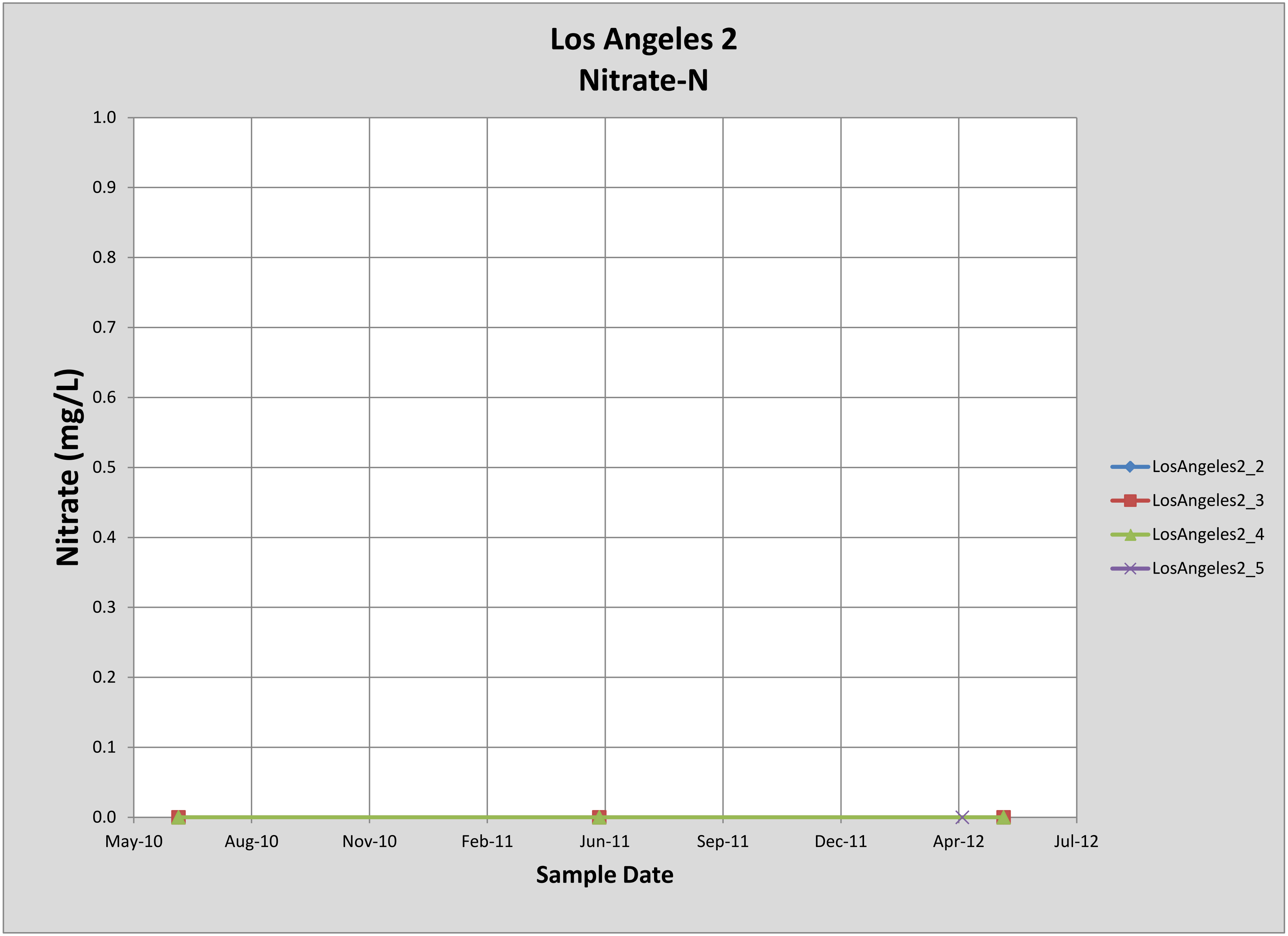

Los Angeles 1
Chloride
Chloride (mg/L)
100
90
80
70
60
50
40
30
20
10
0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
LosAngeles1_1
LosAngeles1_2
LosAngeles1_3
LosAngeles1_4
LosAngeles1_5


Los Angeles 1
Nitrate-N
Nitrate (mg/L)
0
2
4
6
8
10
12
14
16
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
LosAngeles1_1
LosAngeles1_2
LosAngeles1_3
LosAngeles1_4
LosAngeles1_5

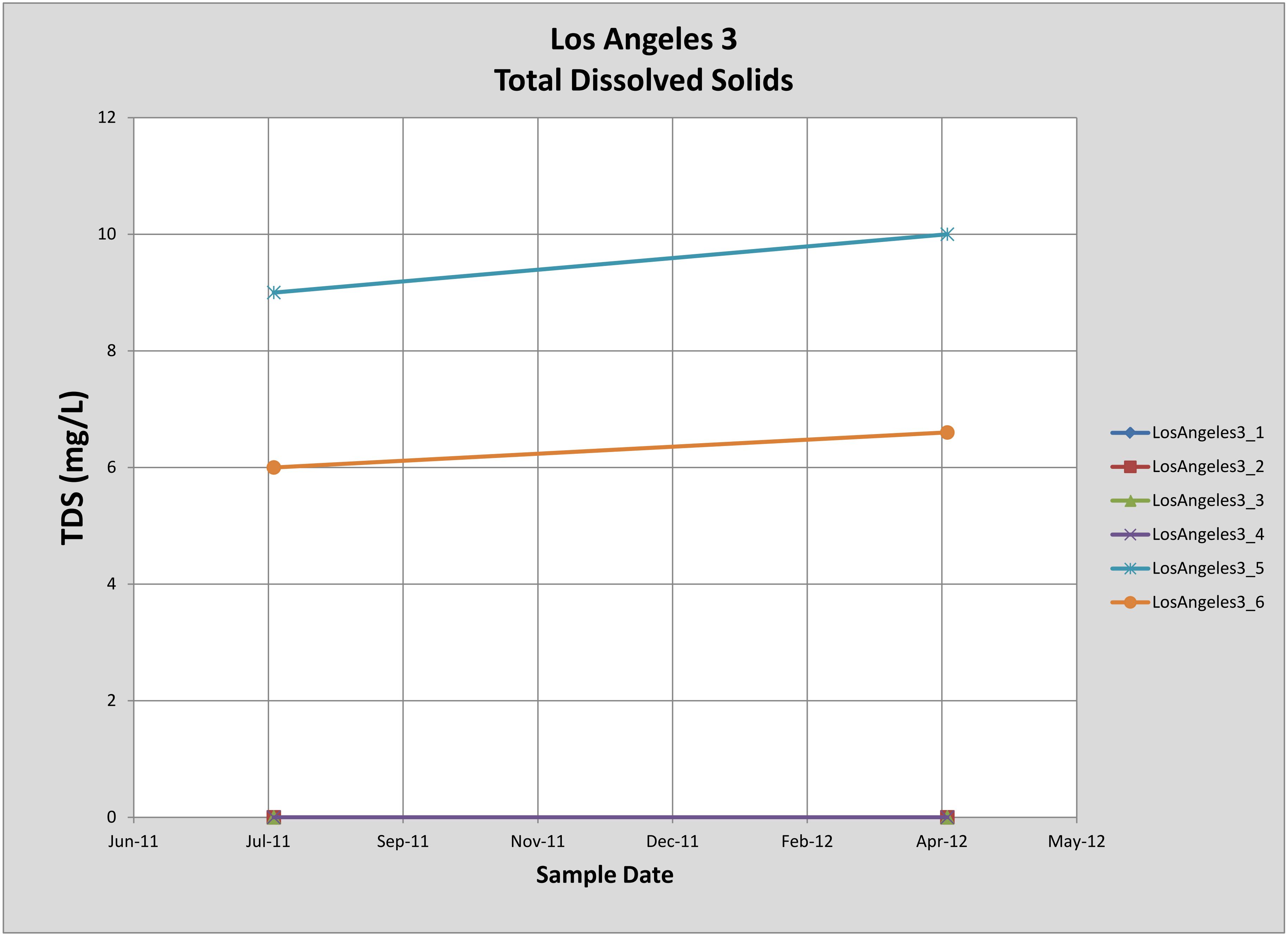


Los Angeles 2
Total Dissolved Solids
1,600
1,400
1,200
1,000
800
600
400
200
0
TDS (mg/L)
May-10
Aug-10
Nov-10
Feb-11
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Sample Date
LosAngeles2_2
LosAngeles2_3
LosAngeles2_4
LosAngeles2_5

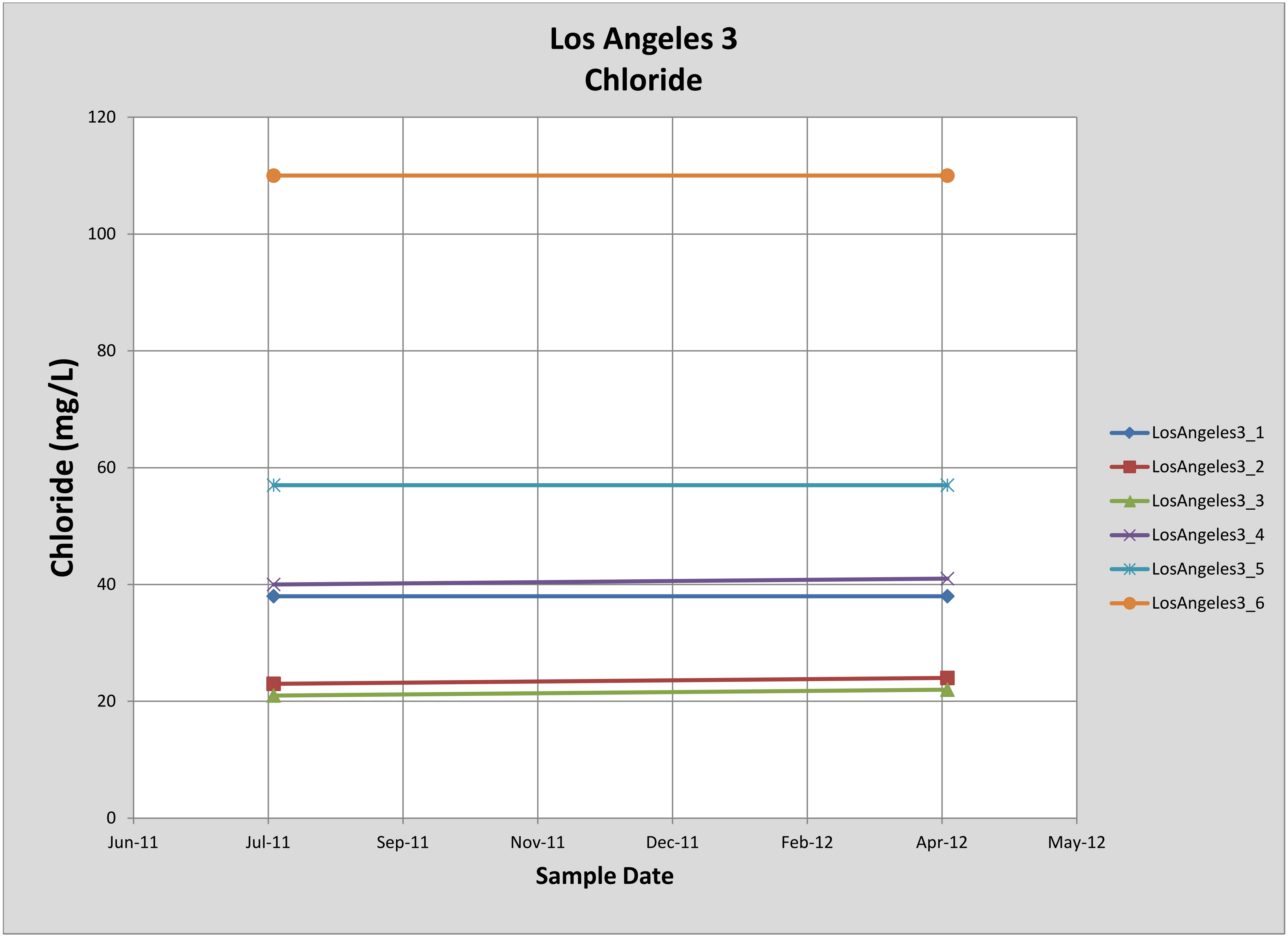

Los Angeles 2
Chloride
Chloride (mg/L)
400
350
300
250
200
150
100
50
0
May-10
Aug-10
Nov-10
Feb-11
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Sample Date
LosAngeles2_2
LosAngeles2_3
LosAngeles2_4
LosAngeles2_5



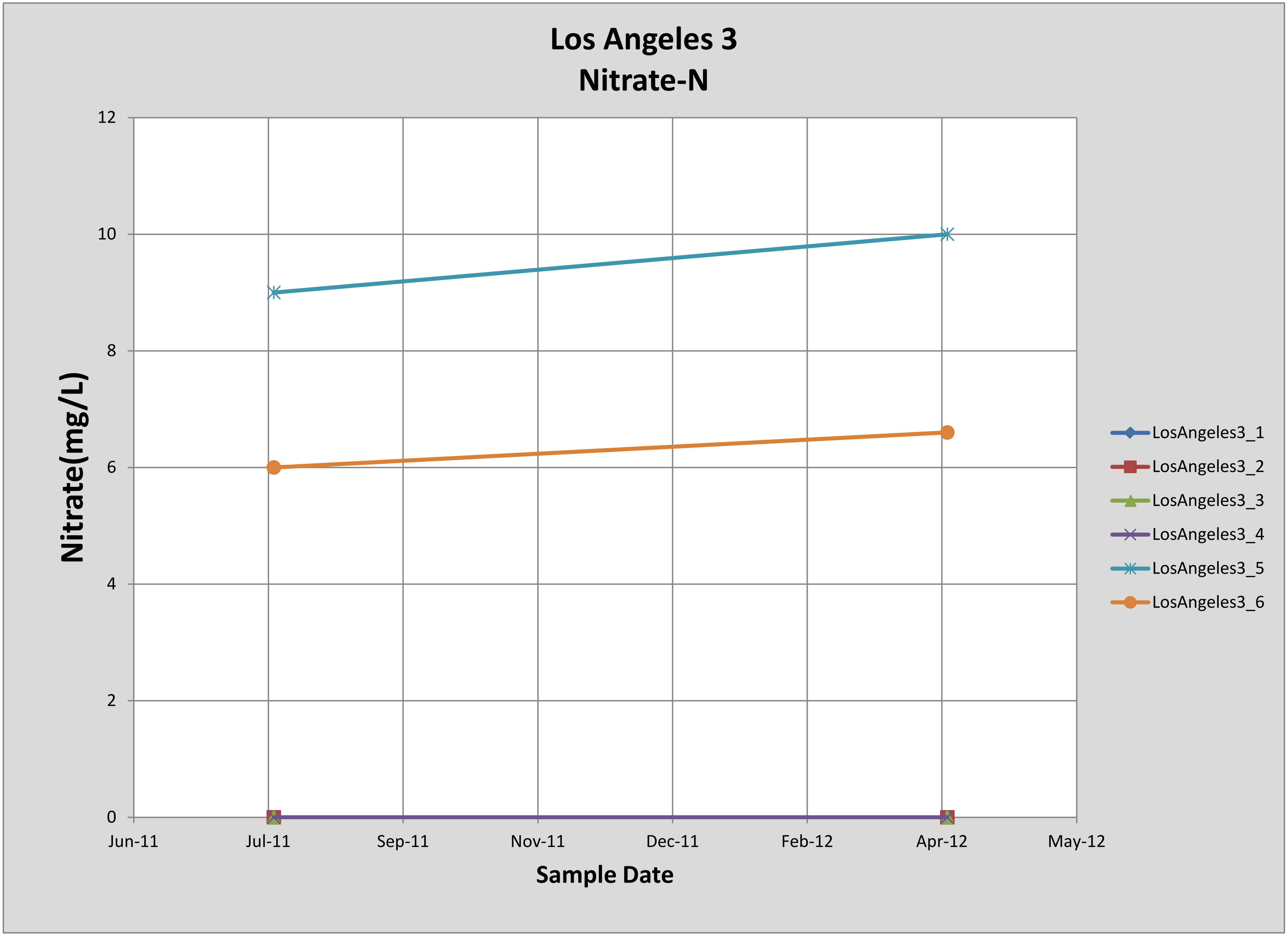
Los Angeles 2
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
May-10
Aug-10
Nov-10
Feb-11
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Sample Date
LosAngeles2_2
LosAngeles2_3
LosAngeles2_4
LosAngeles2_5

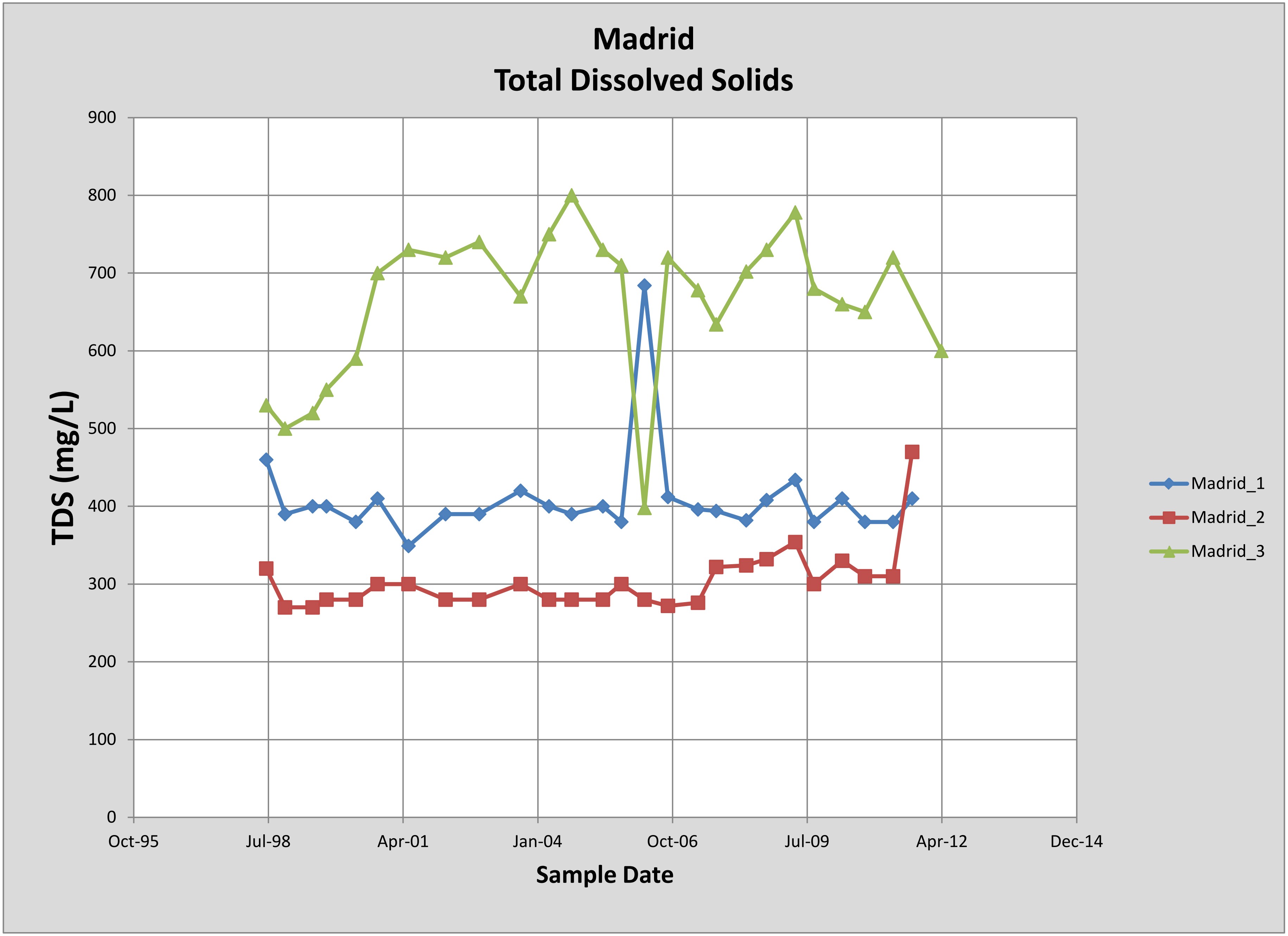


Los Angeles 3
Total Dissolved Solids
TDS (mg/L)
0
2
4
6
8
10
12
Jun-11
Jul-11
Sep-11
Nov-11
Dec-11
Feb-12
Apr-12
May-12
Sample Date
LosAngeles3_1
LosAngeles3_2
LosAngeles3_3
LosAngeles3_4
LosAngeles3_5
LosAngeles3_6

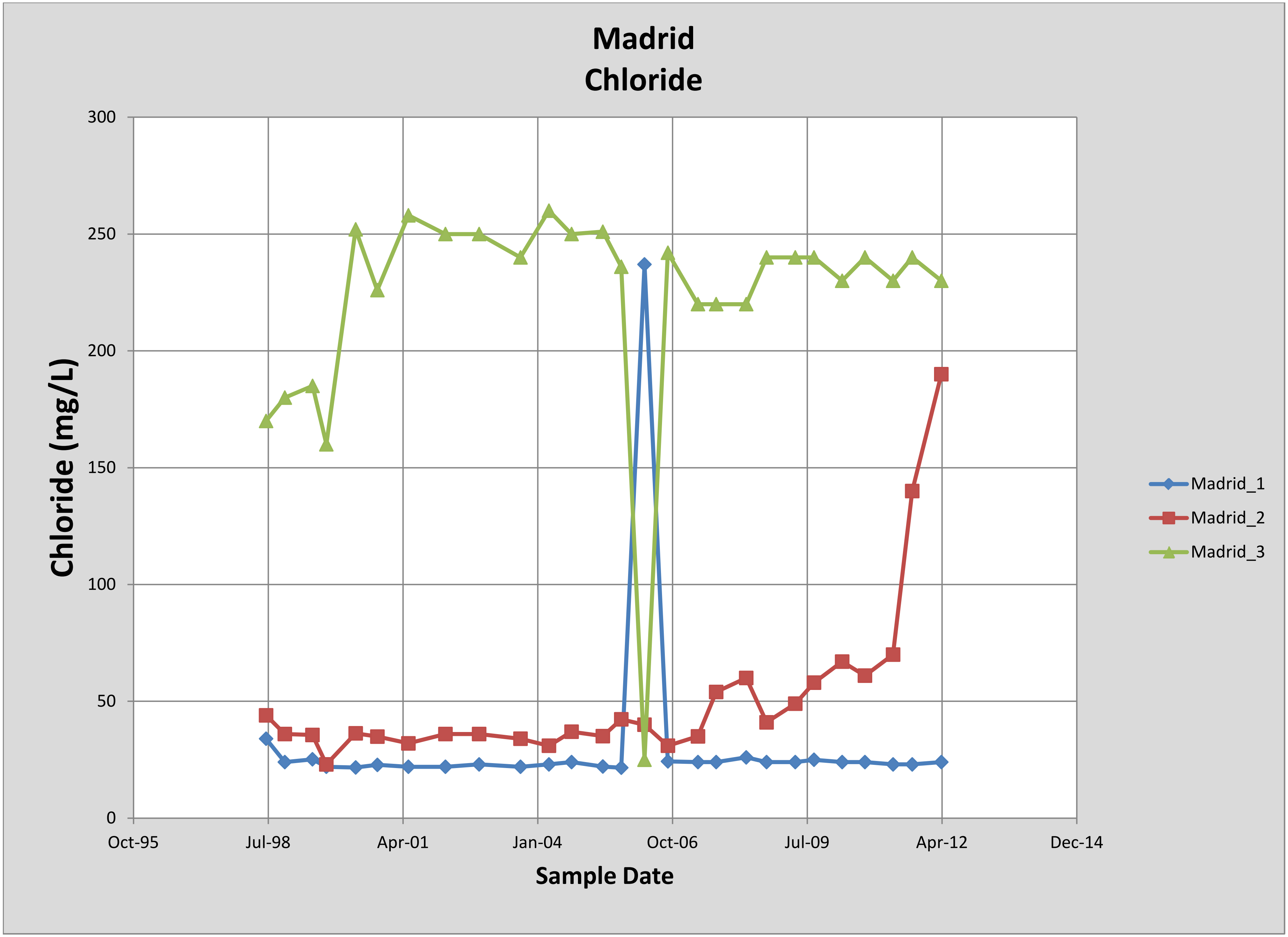


Los Angeles 3
Chloride
Chloride (mg/L)
0
20
40
60
80
100
120
Jun-11
Jul-11
Sep-11
Nov-11
Dec-11
Feb-12
Apr-12
May-12
Sample Date
LosAngeles3_1
LosAngeles3_2
LosAngeles3_3
LosAngeles3_4
LosAngeles3_5
LosAngeles3_6

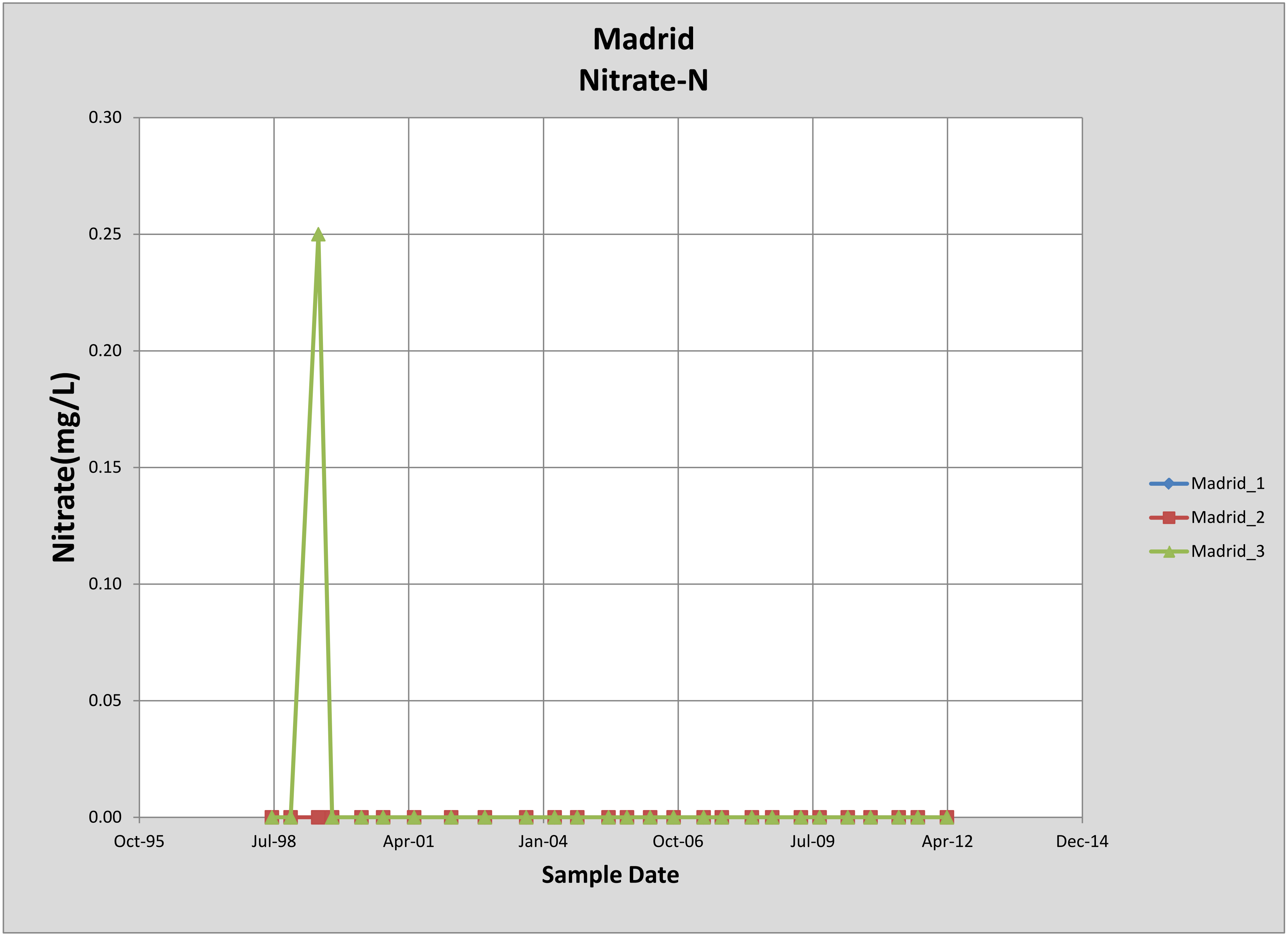

Los Angeles 3
Nitrate-N
Nitrate(mg/L)
12
10
8
6
4
2
0
Jun-11
Jul-11
Sep-11
Nov-11
Dec-11
Feb-12
Apr-12
May-12
Sample Date
LosAngeles3_1
LosAngeles3_2
LosAngeles3_3
LosAngeles3_4
LosAngeles3_5
LosAngeles3_6



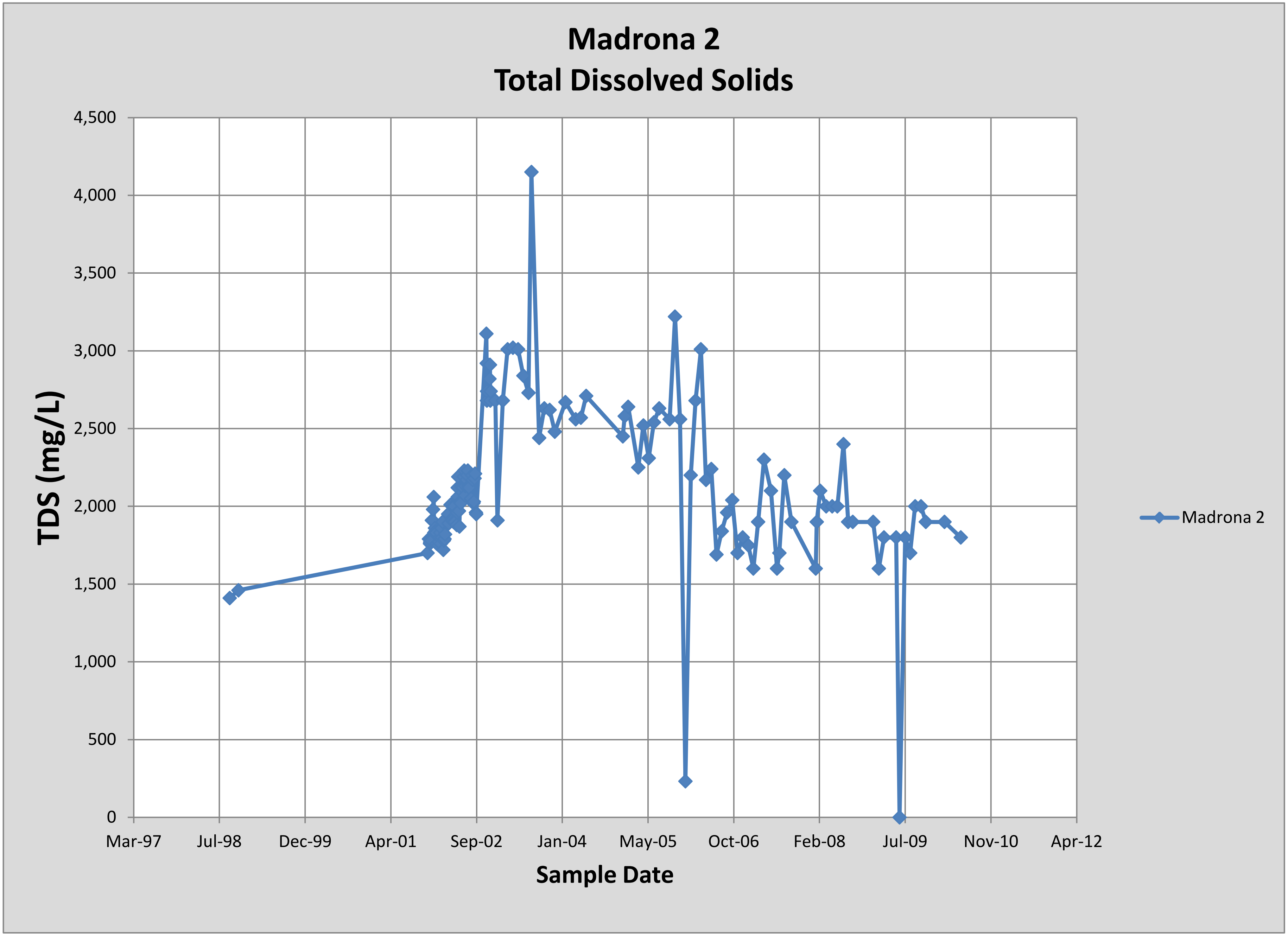
Madrid
Total Dissolved Solids
TDS (mg/L)
900
800
700
600
500
400
300
200
100
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Madrid_1
Madrid_2
Madrid_3



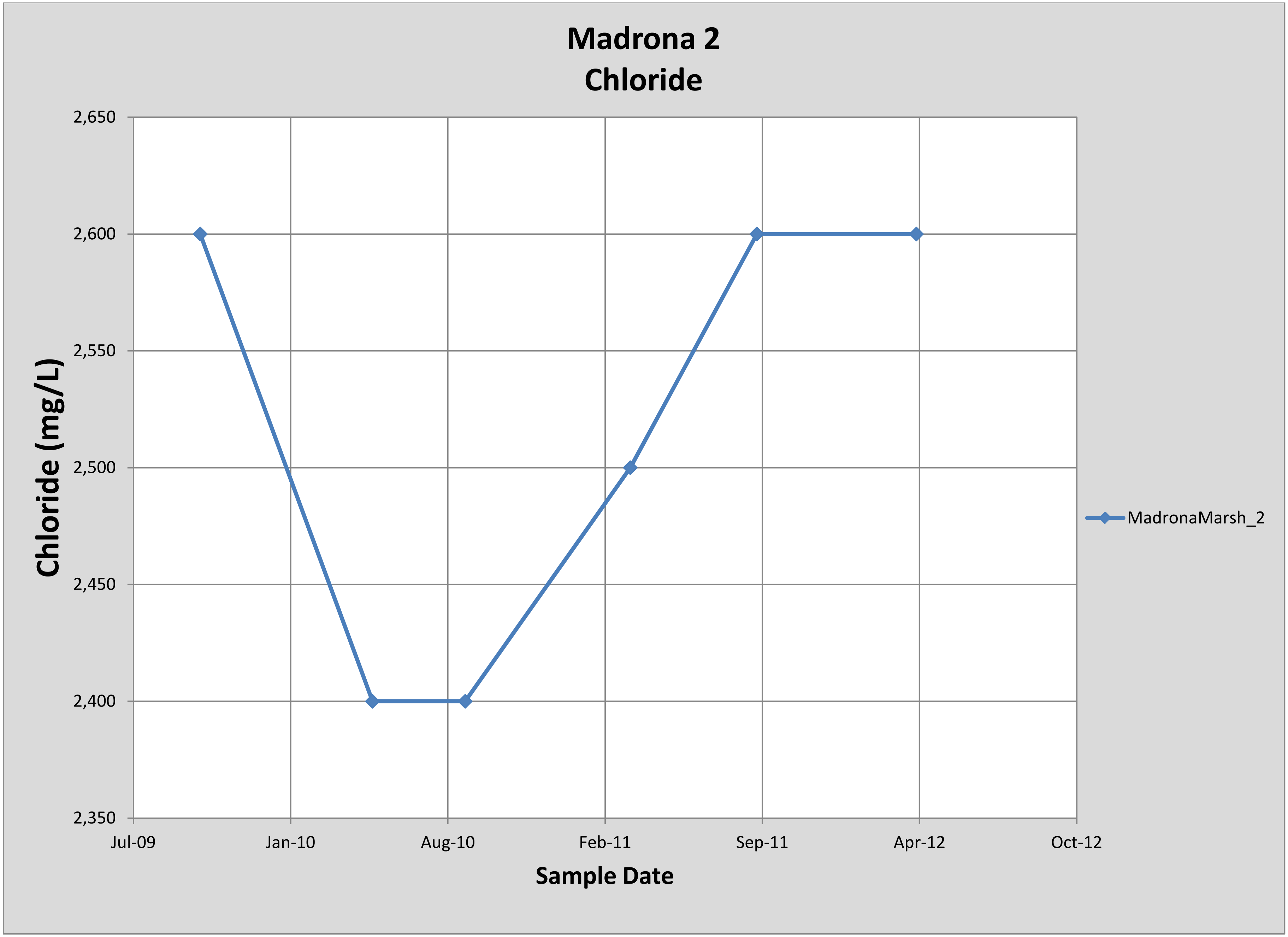
Madrid
Chloride
Chloride (mg/L)
300
250
200
150
100
50
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Madrid_1
Madrid_2
Madrid_3

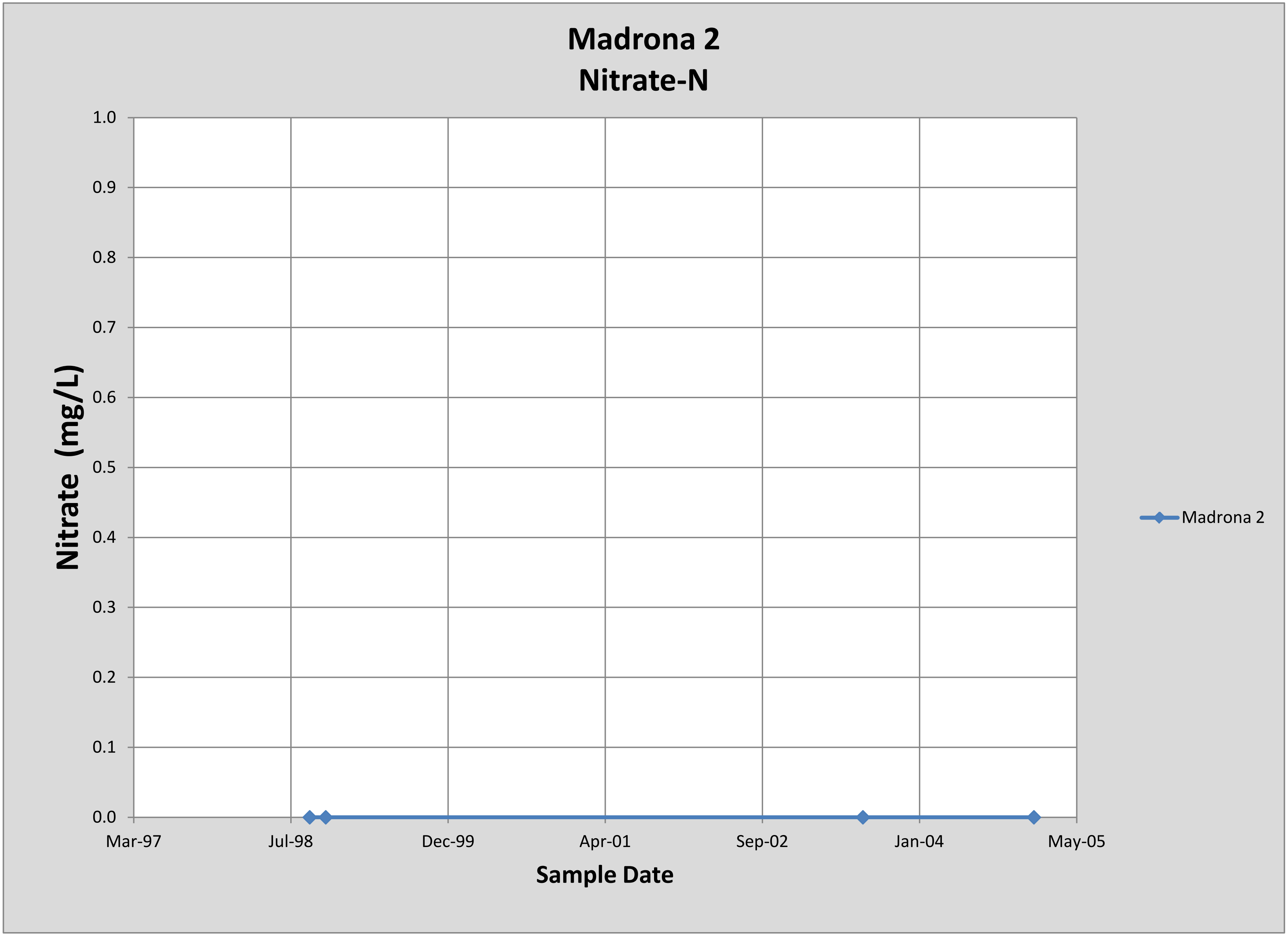


Madrid
Nitrate-N
Nitrate(mg/L)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Madrid_1
Madrid_2
Madrid_3

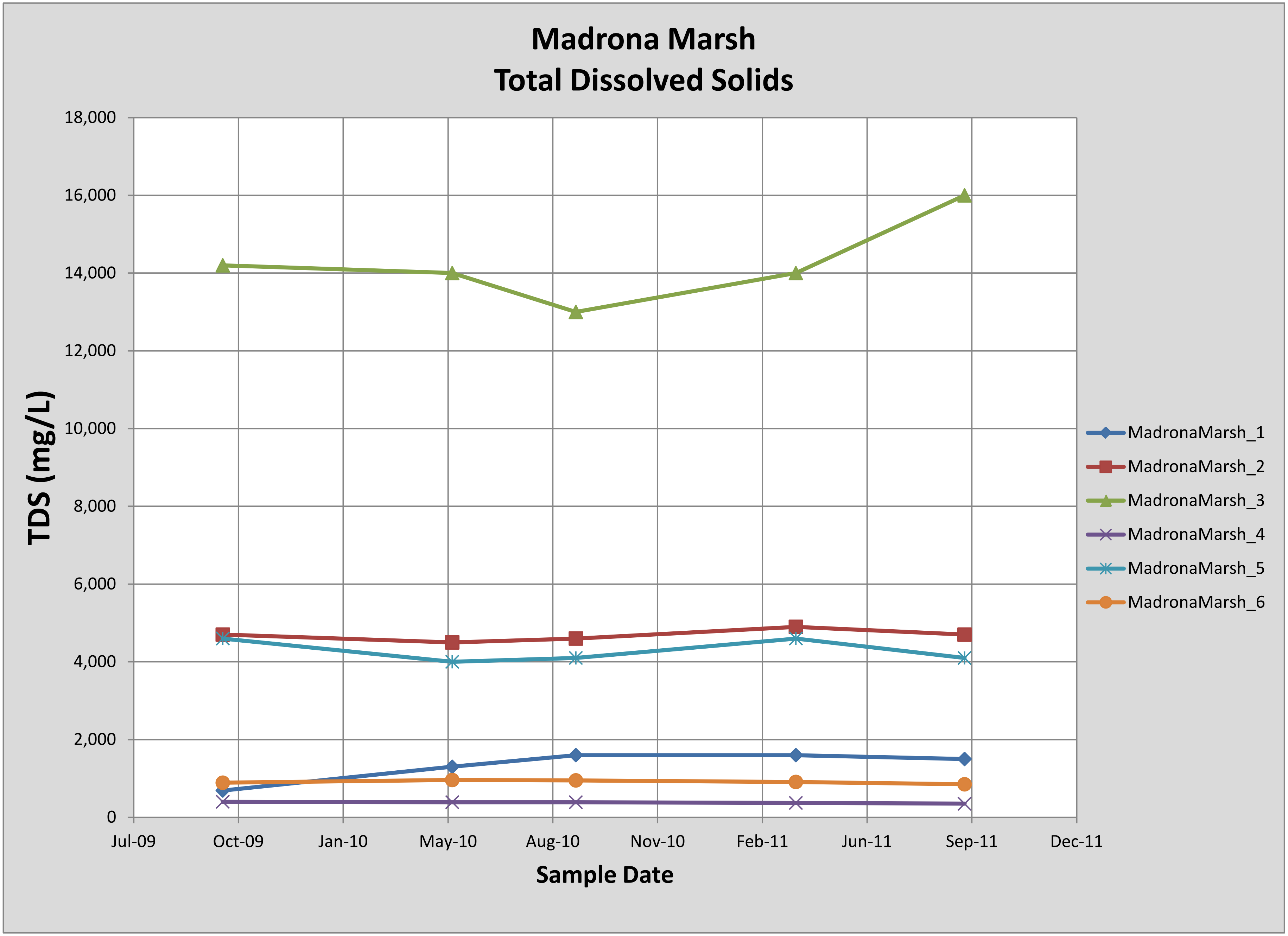


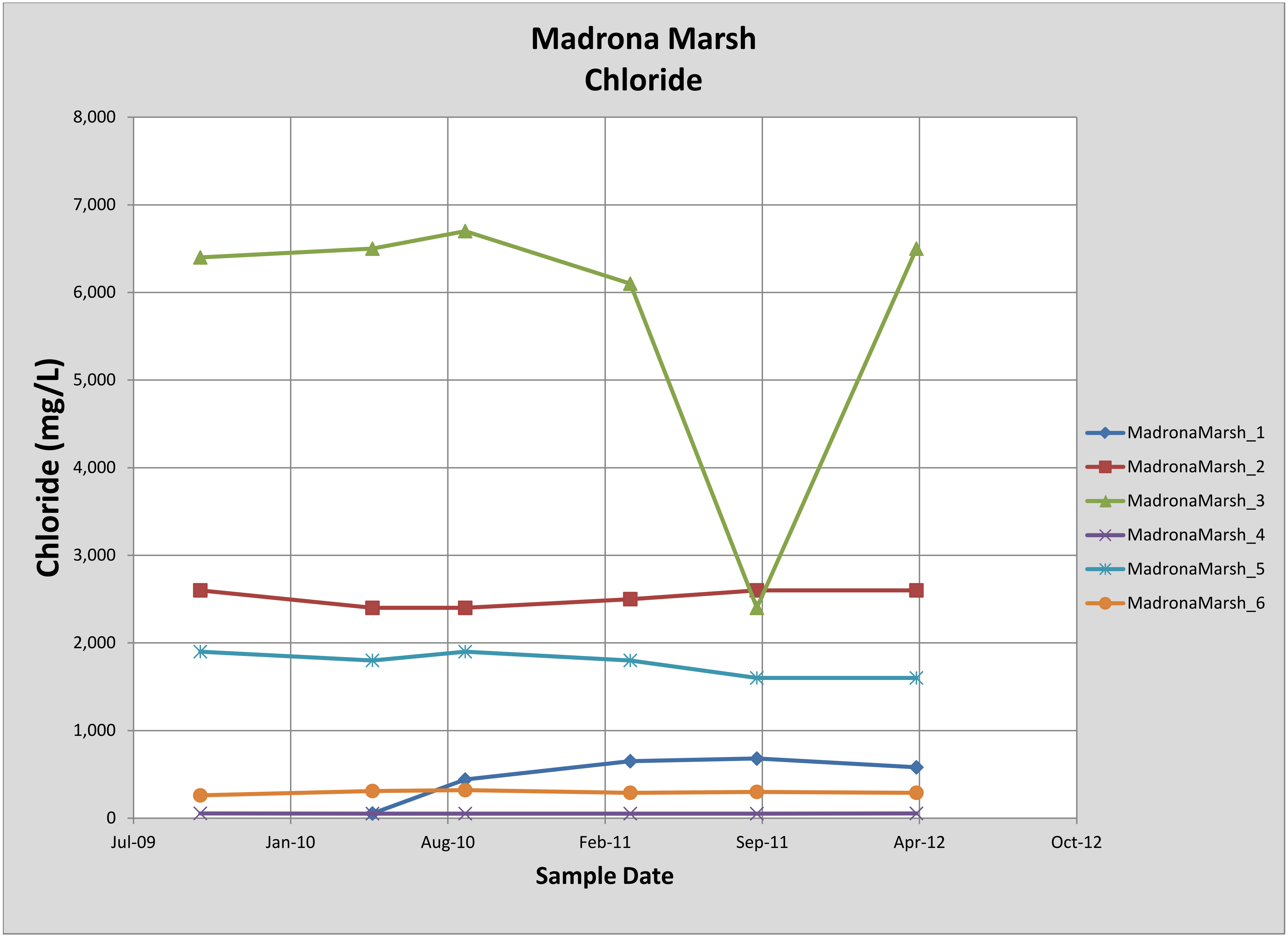
Madrona 2
Total Dissolved Solids
TDS (mg/L)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Sample Date
Madrona 2


Madrona 2
Chloride
Chloride (mg/L)
2,650
2,600
2,550
2,500
2,450
2,400
2,350
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Oct-12
Sample Date
MadronaMarsh_2

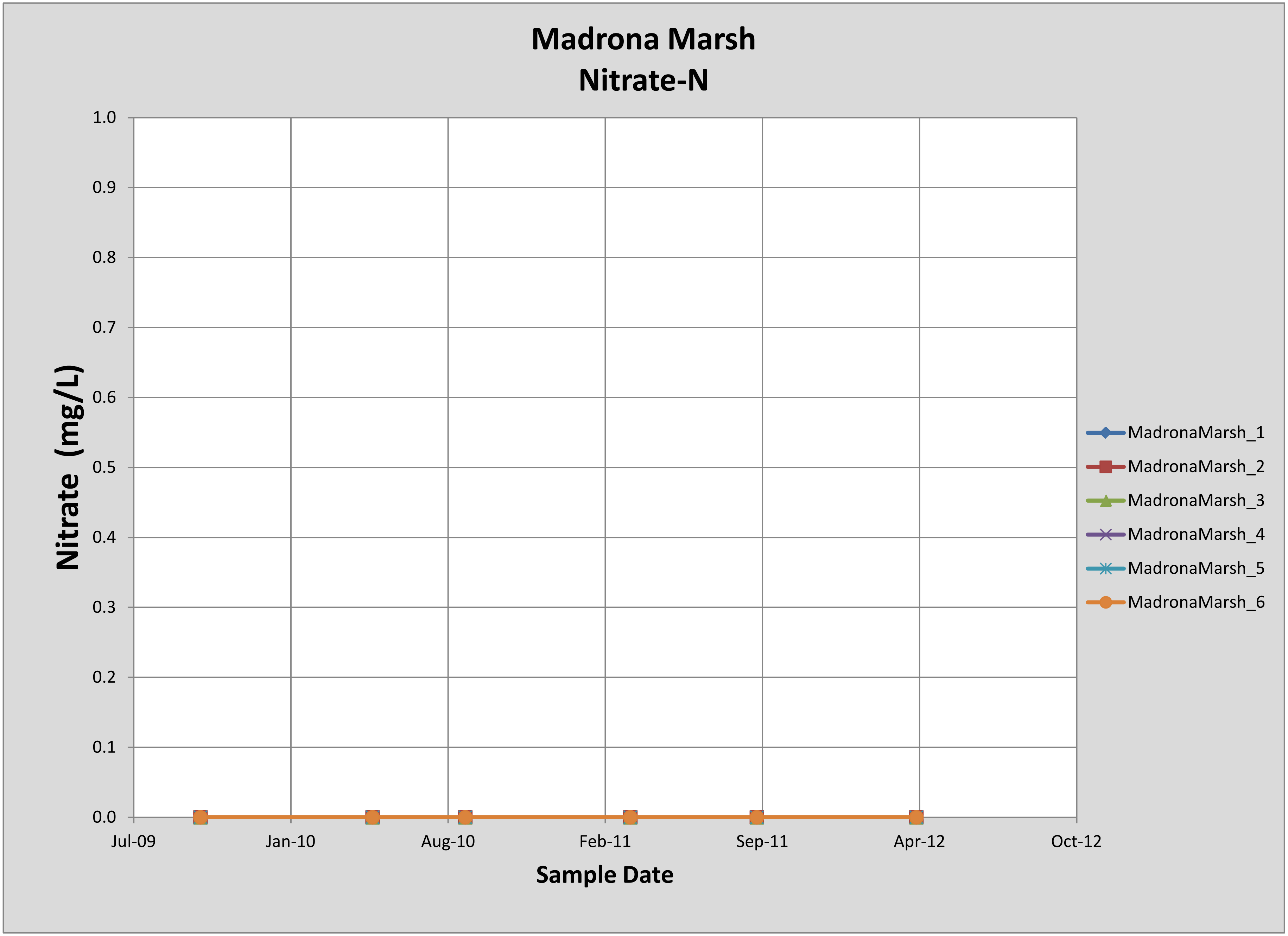


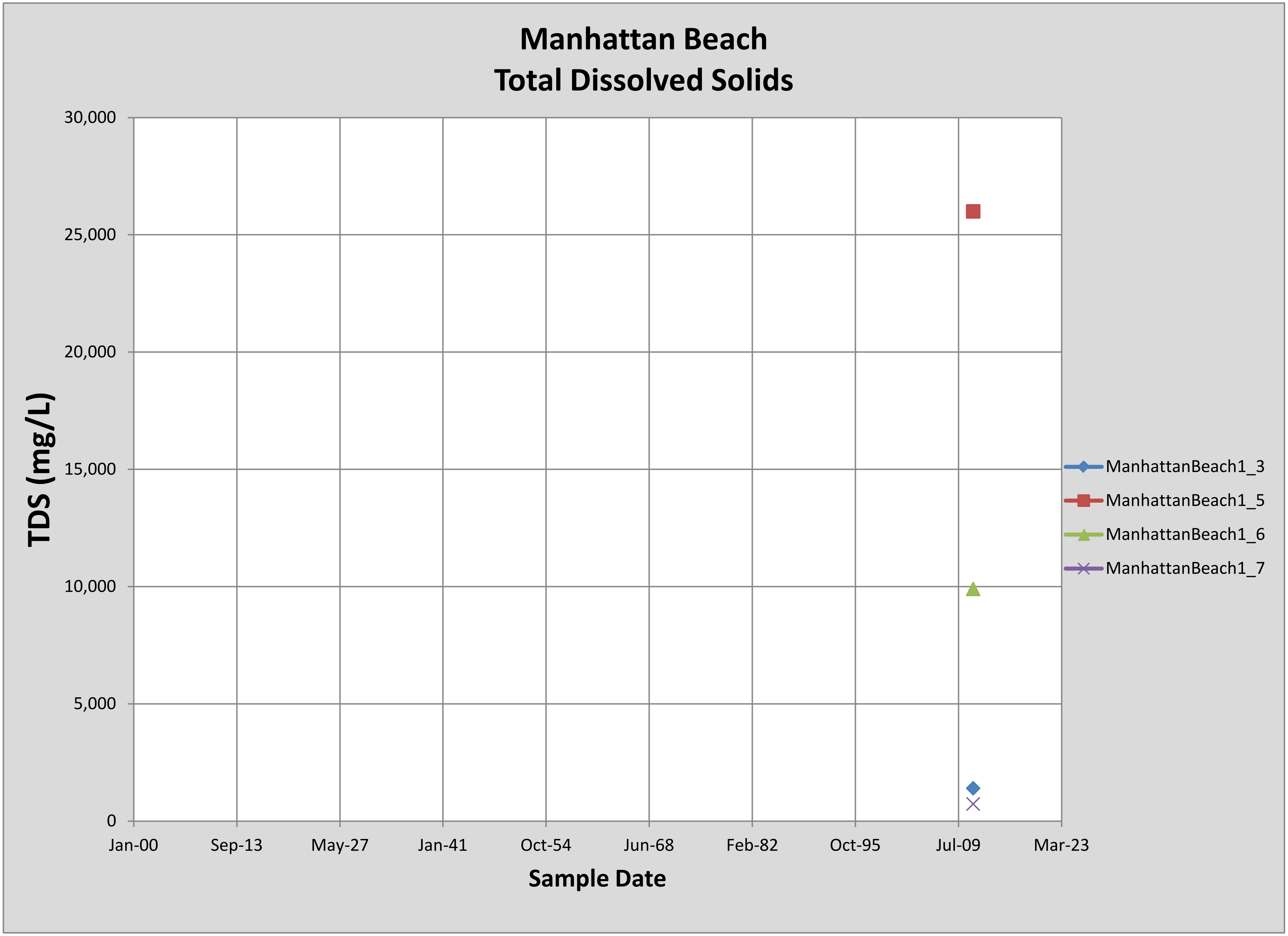
Madrona 2
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Sample Date
Madrona 2


Madrona Marsh
Total Dissolved Solids
TDS (mg/L)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Jul-09
Oct-09
Jan-10
May-10
Aug-10
Nov-10
Feb-11
Jun-11
Sep-11
Dec-11
Sample Date
MadronaMarsh_1
MadronaMarsh_2
MadronaMarsh_3
MadronaMarsh_4
MadronaMarsh_5
MadronaMarsh_6

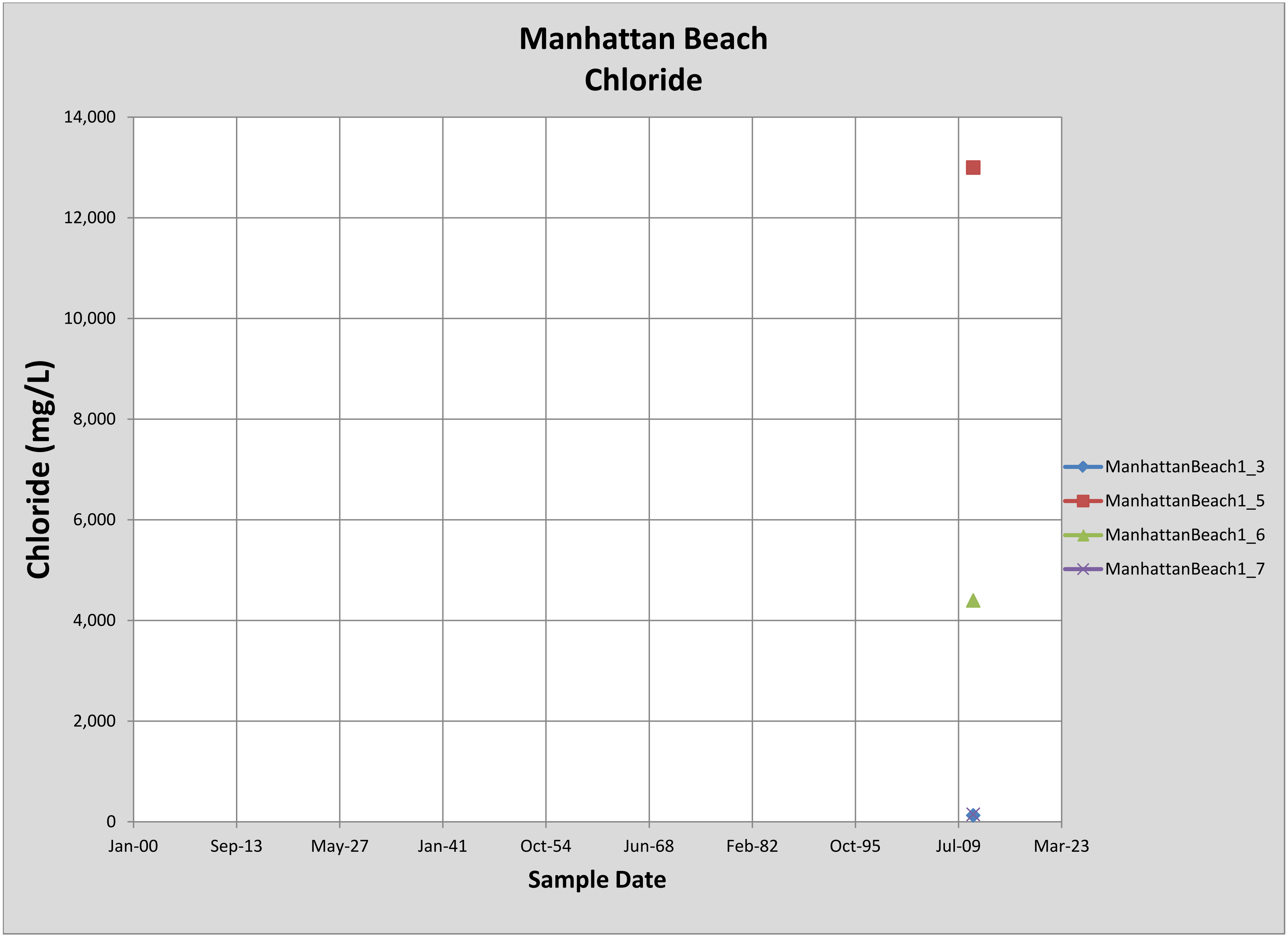


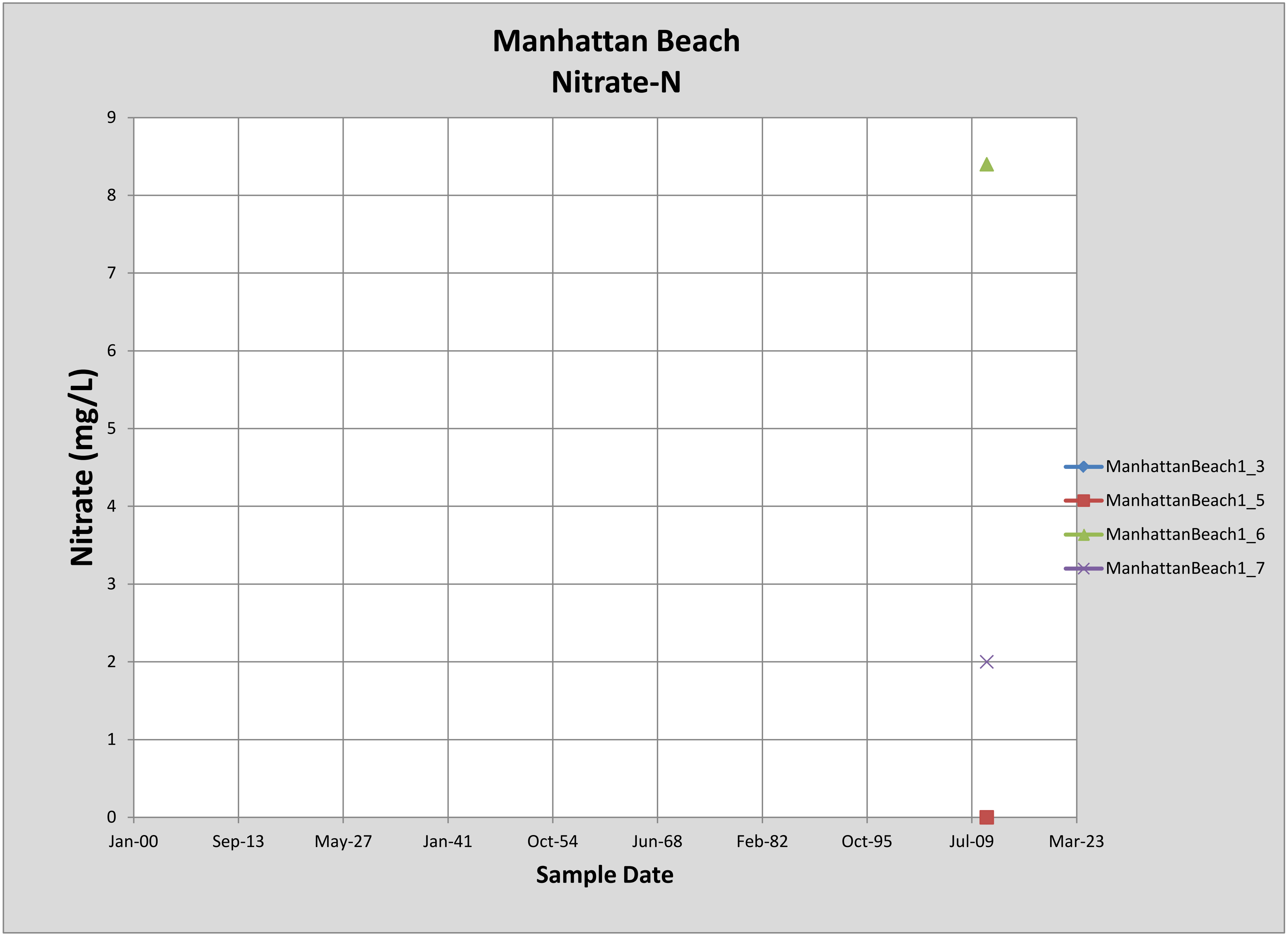
Madrona Marsh
Chloride
Chloride (mg/L)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Oct-12
Sample Date
MadronaMarsh_1
MadronaMarsh_2
MadronaMarsh_3
MadronaMarsh_4
MadronaMarsh_5
MadronaMarsh_6


Madrona Marsh
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Oct-12
Sample Date
MadronaMarsh_1
MadronaMarsh_2
MadronaMarsh_3
MadronaMarsh_4
MadronaMarsh_5
MadronaMarsh_6

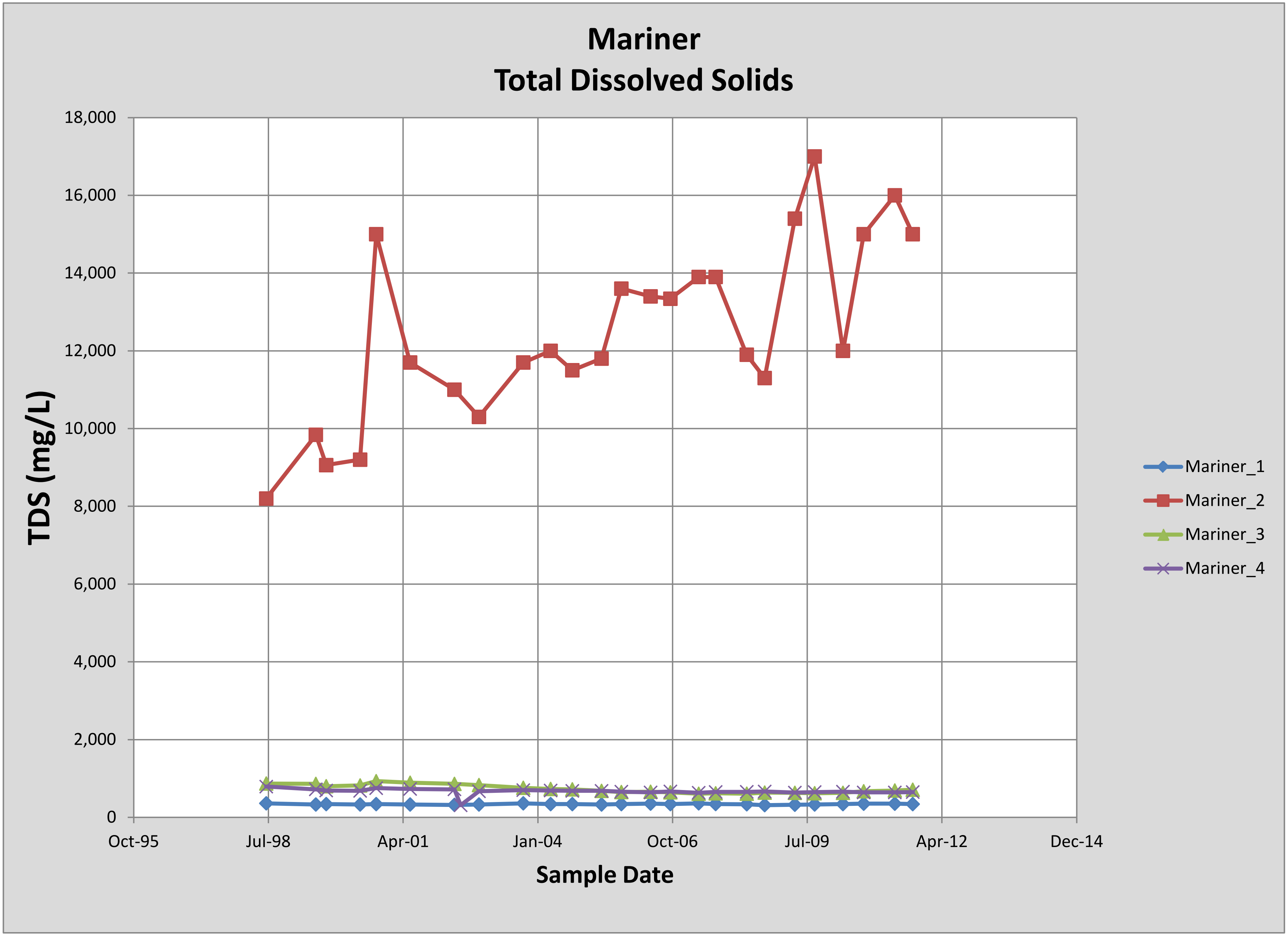


Manhattan Beach
Total Dissolved Solids
TDS (mg/L)
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan-00
Sep-13
May-27
Jan-41
Oct-54
Jun-68
Feb-82
Oct-95
Jul-09
Mar-23
Sample Date
ManhattanBeach1_3
ManhattanBeach1_5
ManhattanBeach1_6
ManhattanBeach1_7

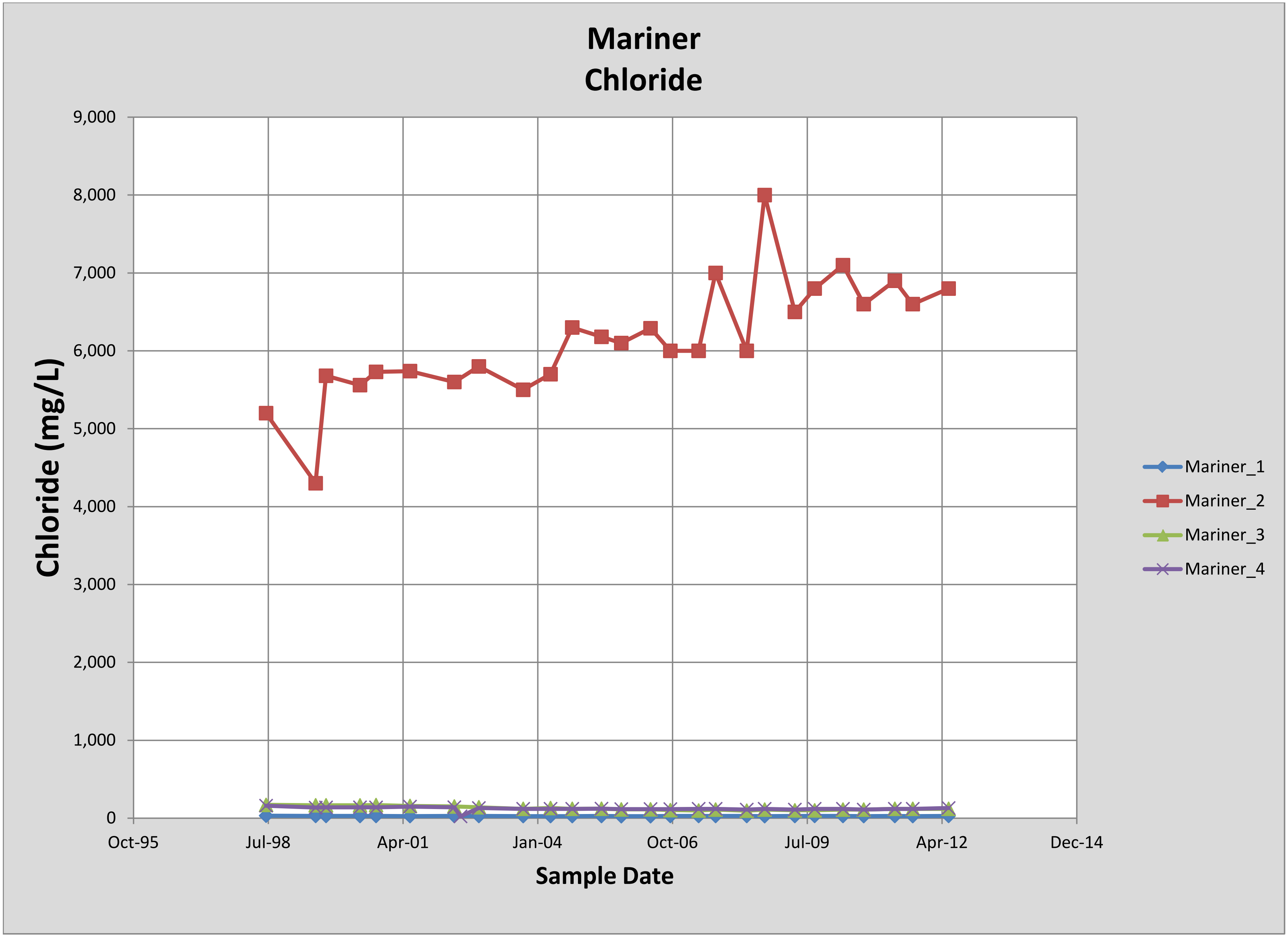

Manhattan Beach
Chloride
Chloride (mg/L)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan-00
Sep-13
May-27
Jan-41
Oct-54
Jun-68
Feb-82
Oct-95
Jul-09
Mar-23
Sample Date
ManhattanBeach1_3
ManhattanBeach1_5
ManhattanBeach1_6
ManhattanBeach1_7



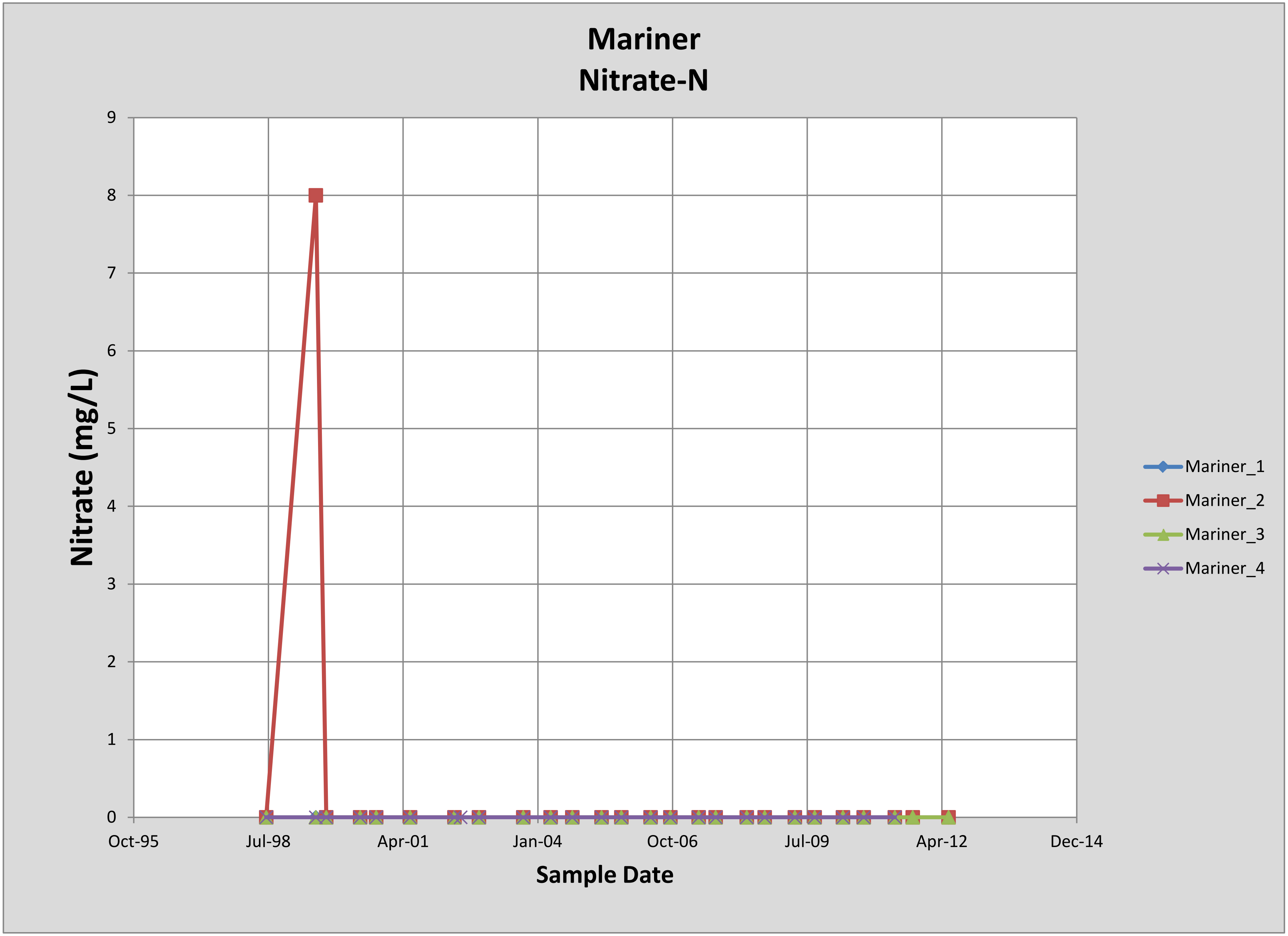
Manhattan Beach
Nitrate-N
Nitrate (mg/L)
9
8
7
6
5
4
3
2
1
0
Jan-00
Sep-13
May-27
Jan-41
Oct-54
Jun-68
Feb-82
Oct-95
Jul-09
Mar-23
Sample Date
ManhattanBeach1_3
ManhattanBeach1_5
ManhattanBeach1_6
ManhattanBeach1_7



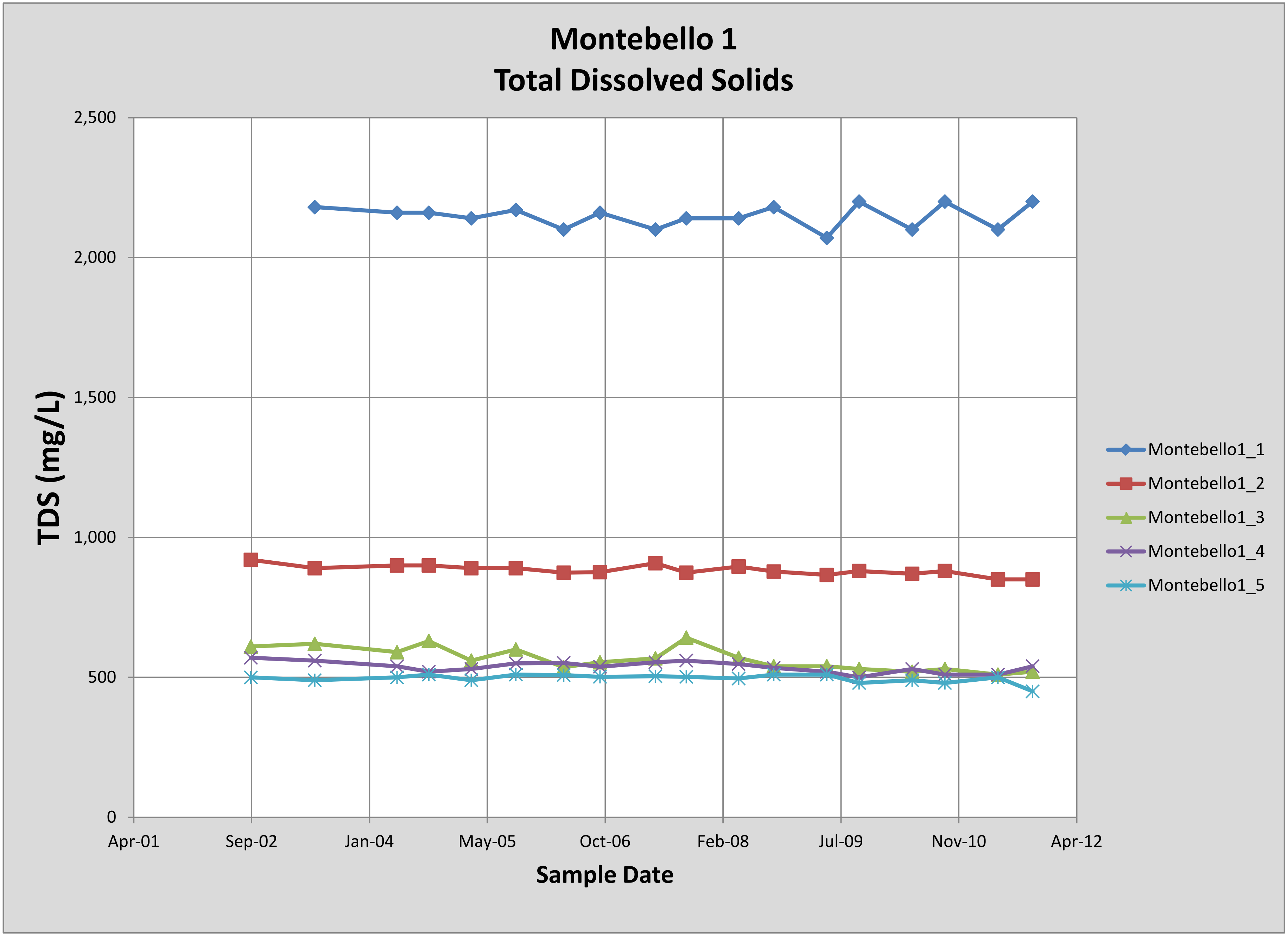
Mariner
Total Dissolved Solids
TDS (mg/L)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Mariner_1
Mariner_2
Mariner_3
Mariner_4



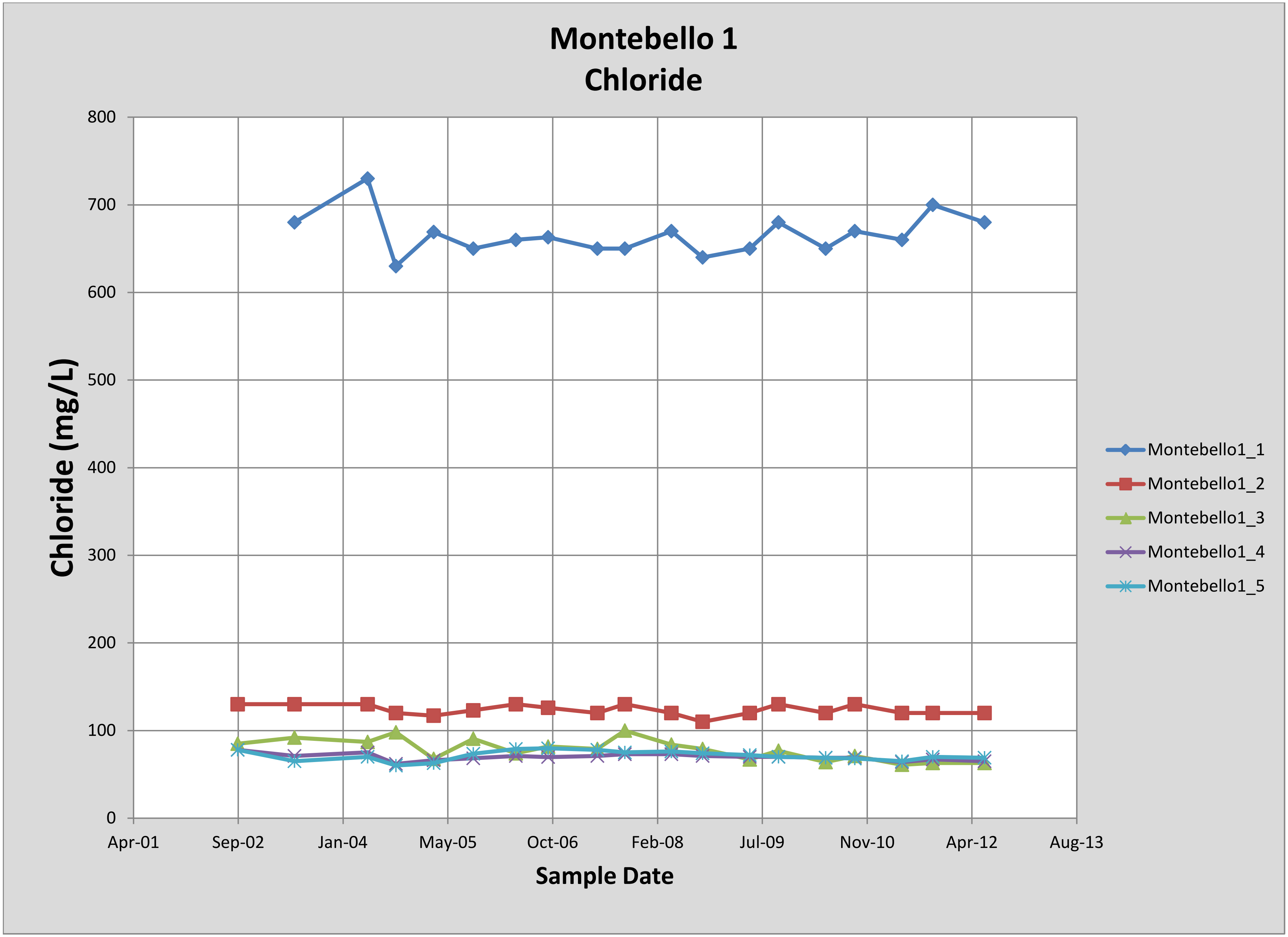
Mariner
Chloride
Chloride (mg/L)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Mariner_1
Mariner_2
Mariner_3
Mariner_4

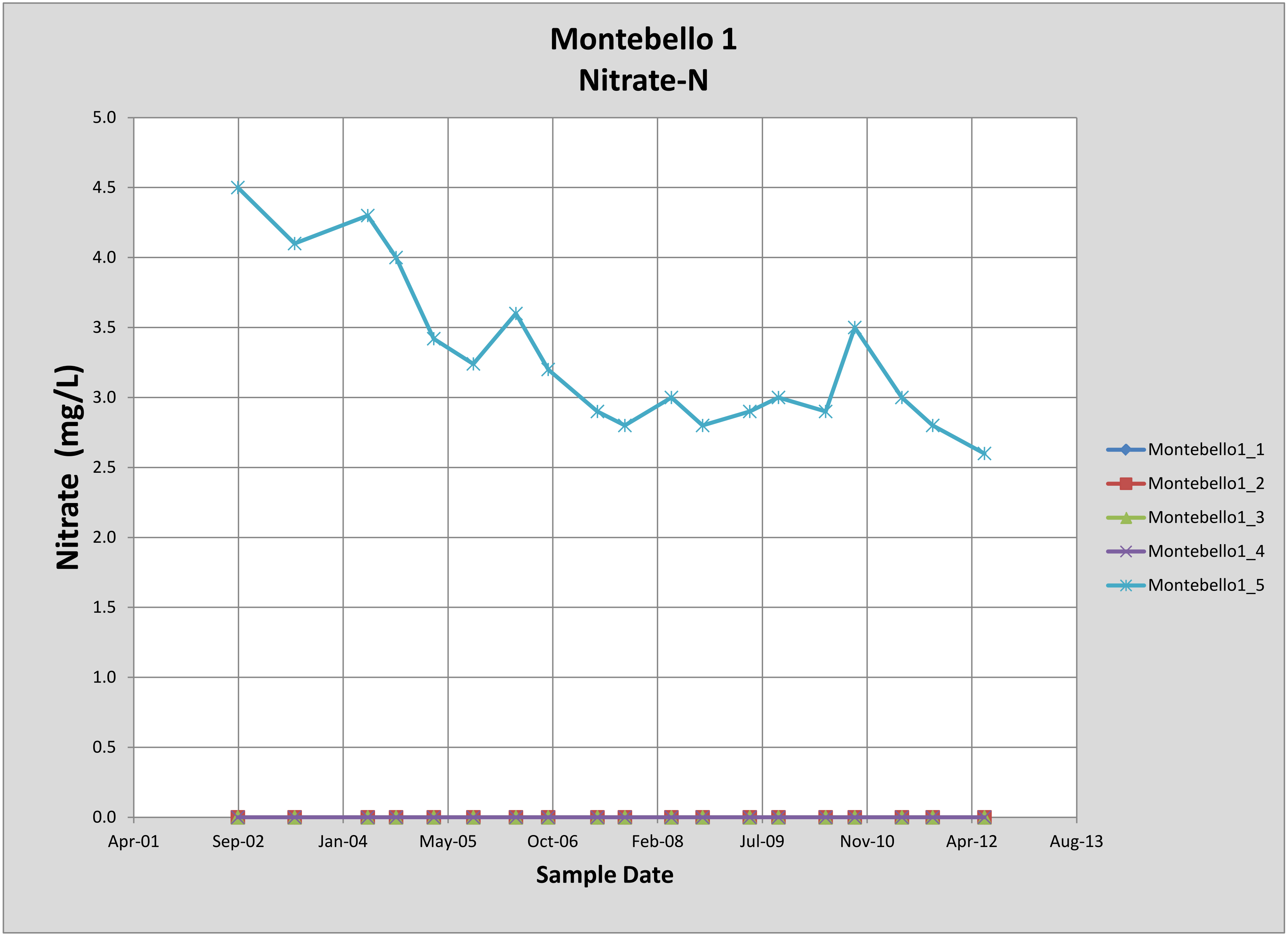


Mariner
Nitrate-N
Nitrate (mg/L)
9
8
7
6
5
4
3
2
1
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Mariner_1
Mariner_2
Mariner_3
Mariner_4

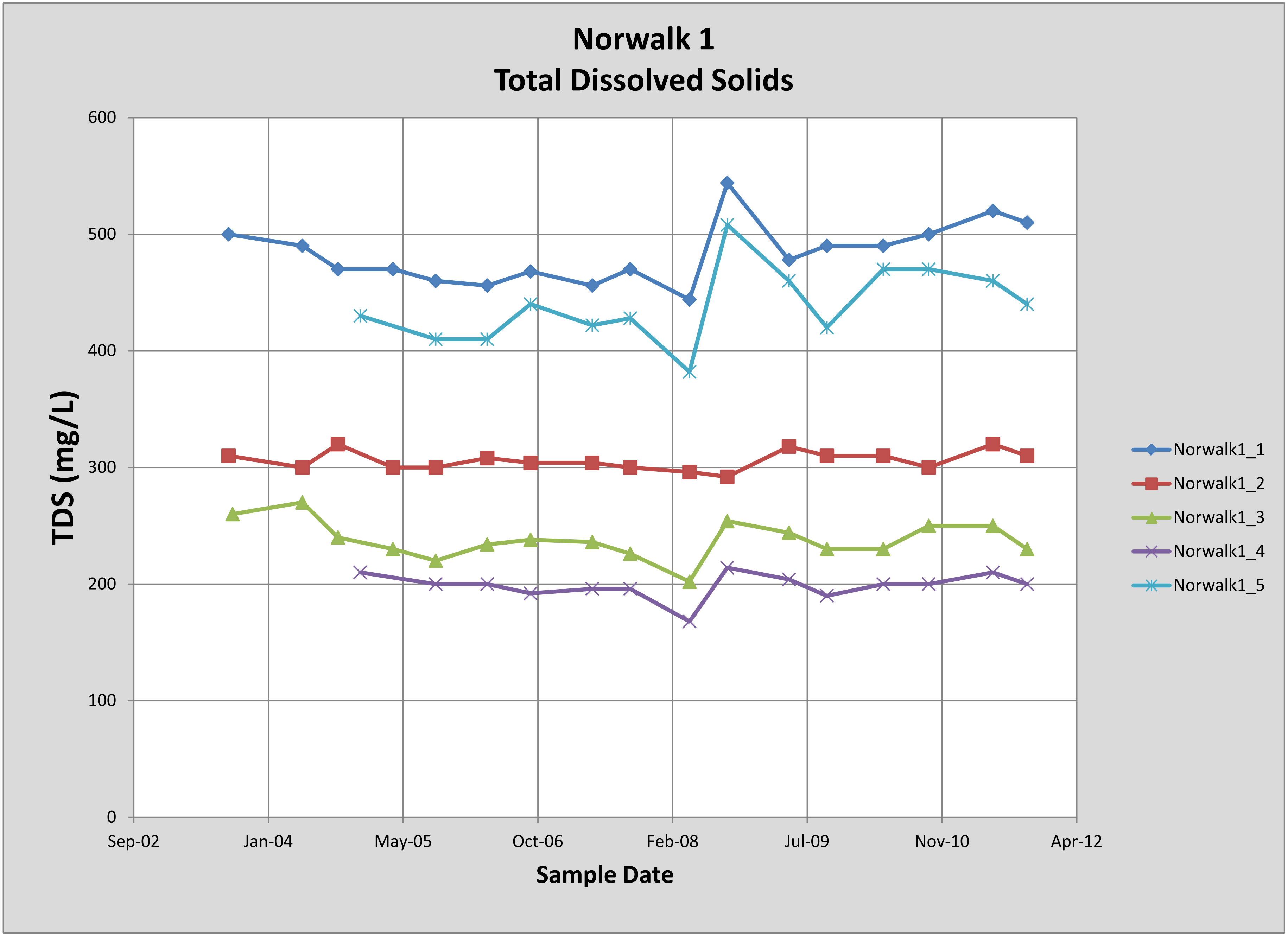


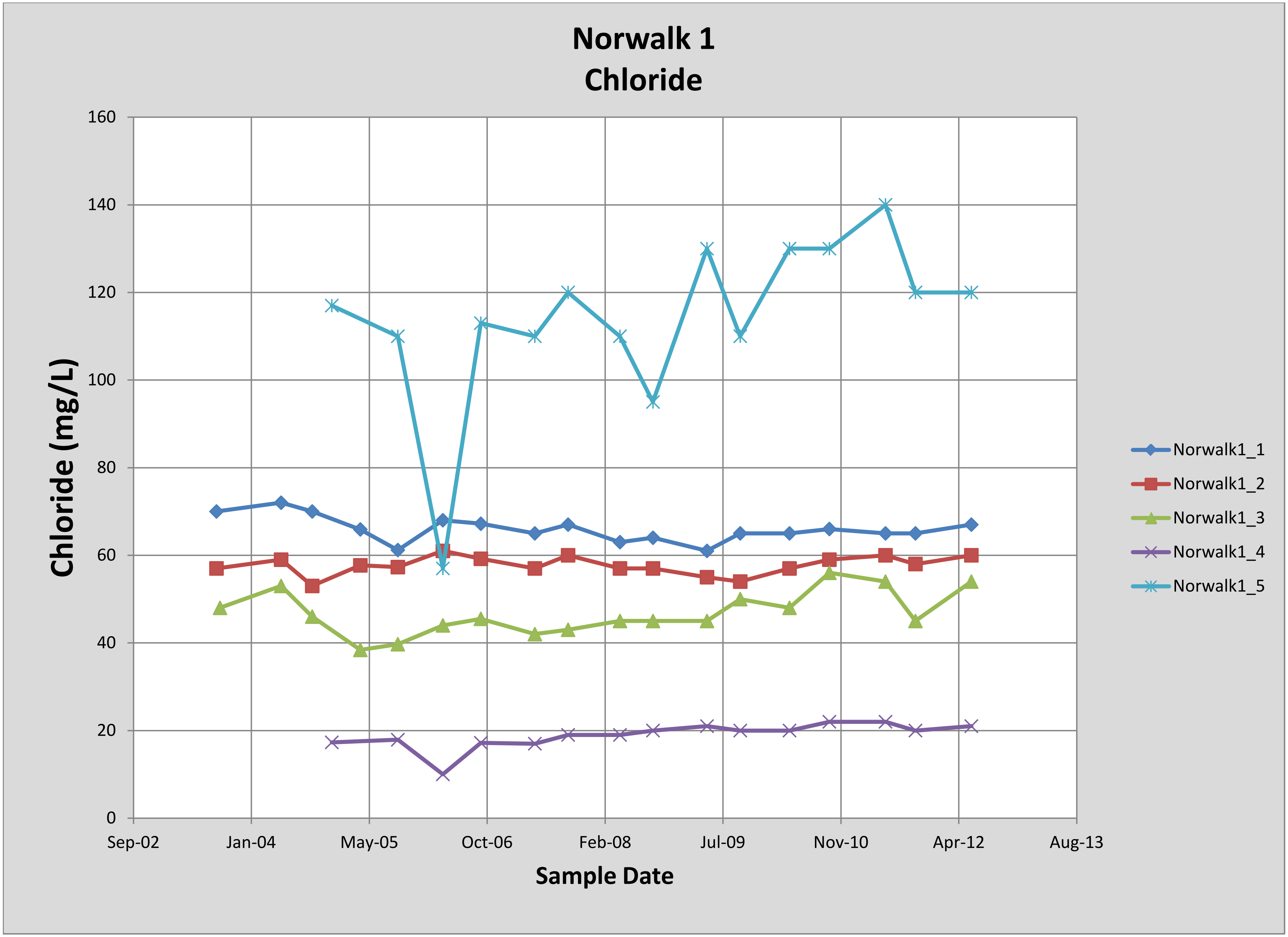
Montebello 1
Total Dissolved Solids
TDS (mg/L)
2,500
2,000
1,500
1,000
500
0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Sample Date
Montebello1_1
Montebello1_2
Montebello1_3
Montebello1_4
Montebello1_5


Montebello 1
Chloride
Chloride (mg/L)
800
700
600
500
400
300
200
100
0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Montebello1_1
Montebello1_2
Montebello1_3
Montebello1_4
Montebello1_5

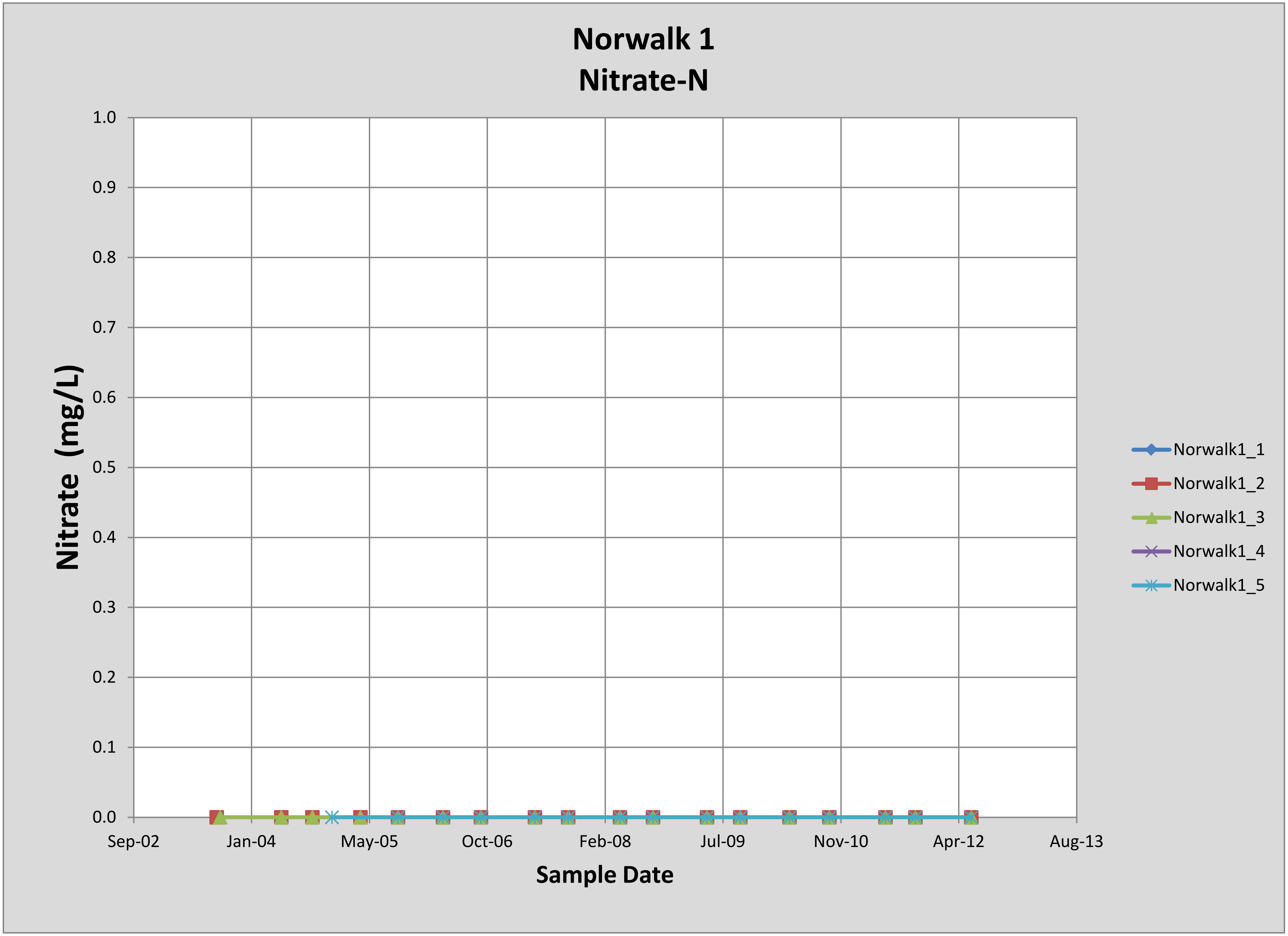


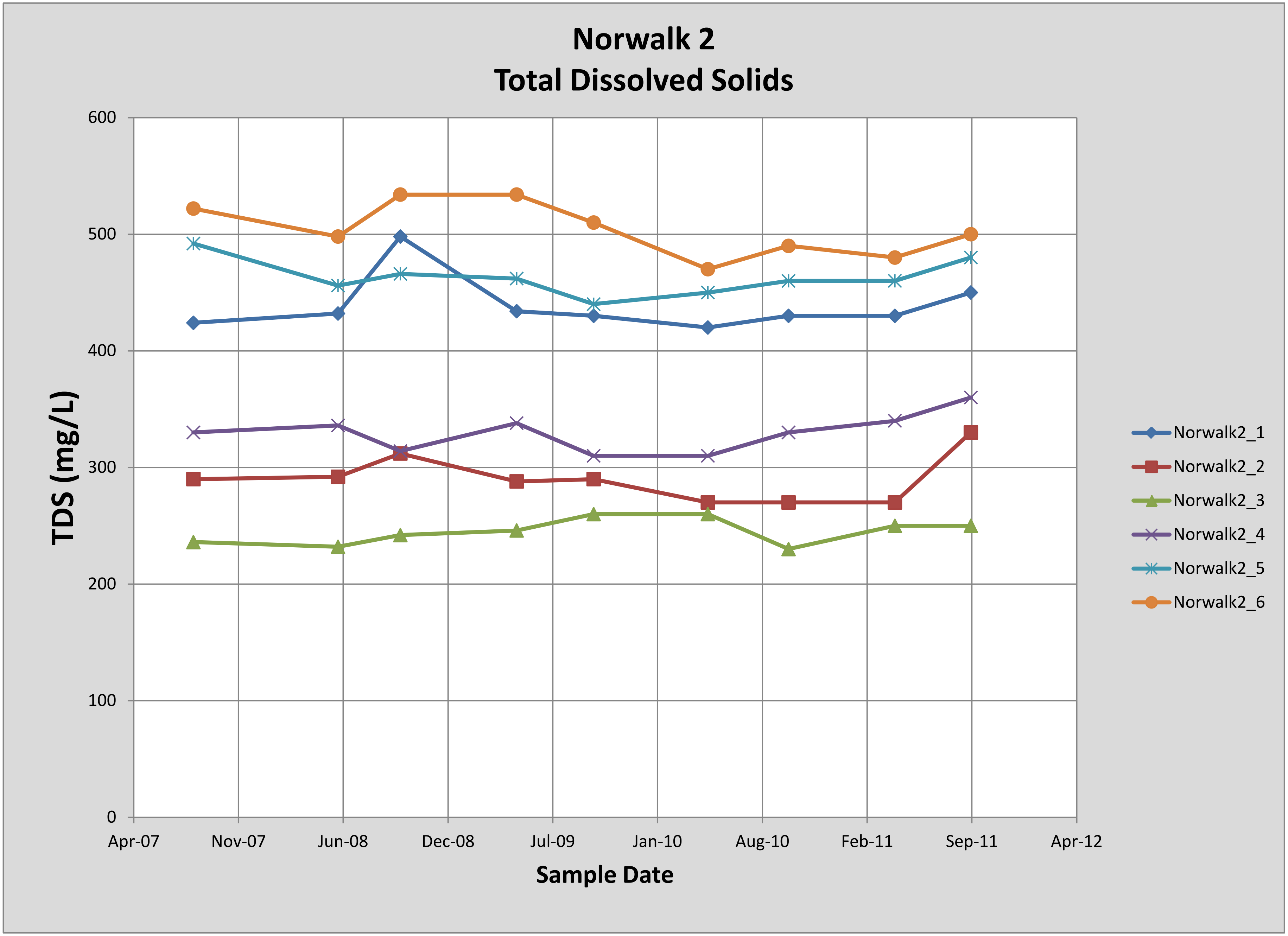
Montebello 1
Nitrate-N
Nitrate (mg/L)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Montebello1_1
Montebello1_2
Montebello1_3
Montebello1_4
Montebello1_5

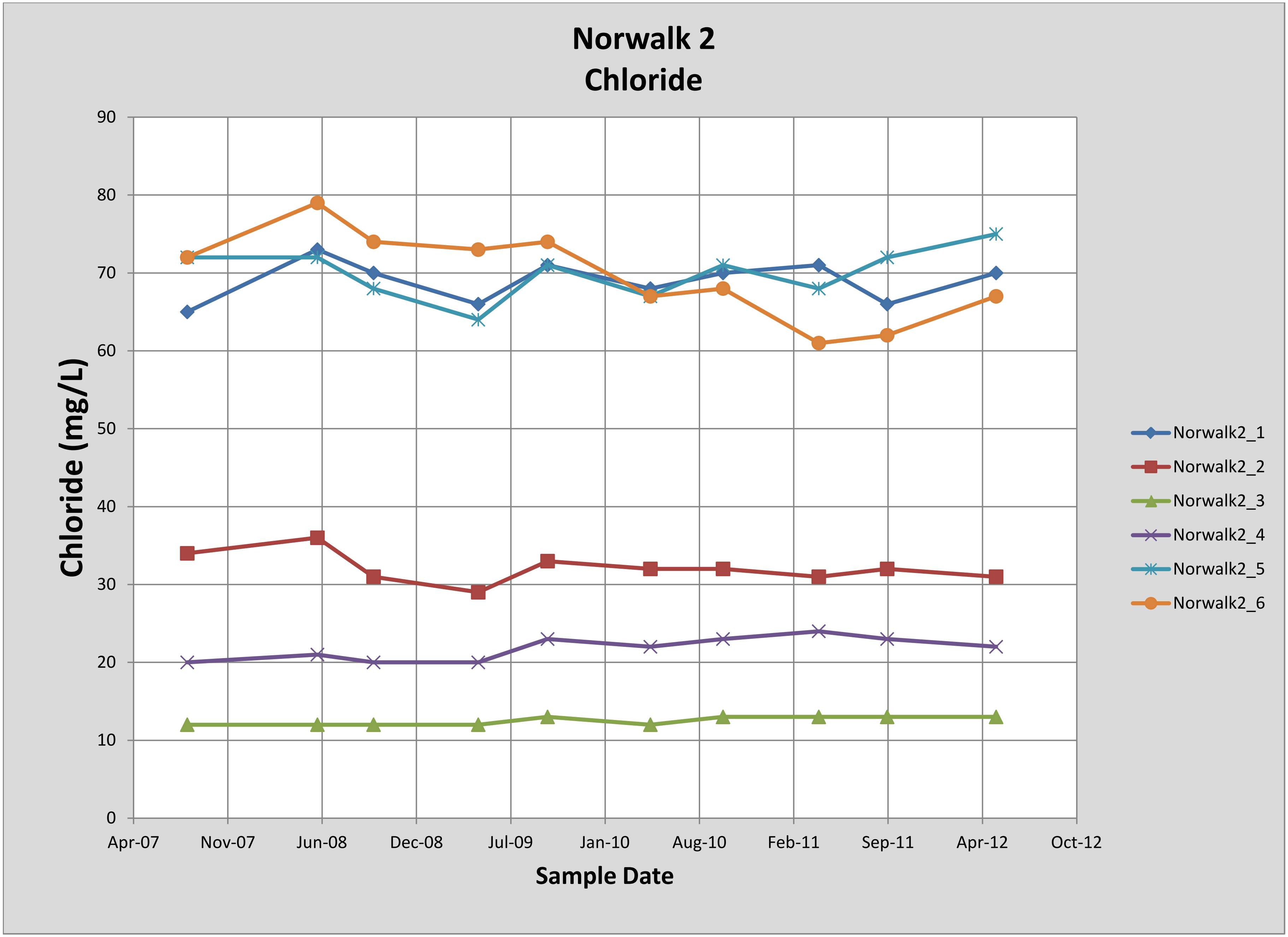

Norwalk 1
Total Dissolved Solids
TDS (mg/L)
0
100
200
300
400
500
600
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Sample Date
Norwalk1_1
Norwalk1_2
Norwalk1_3
Norwalk1_4
Norwalk1_5

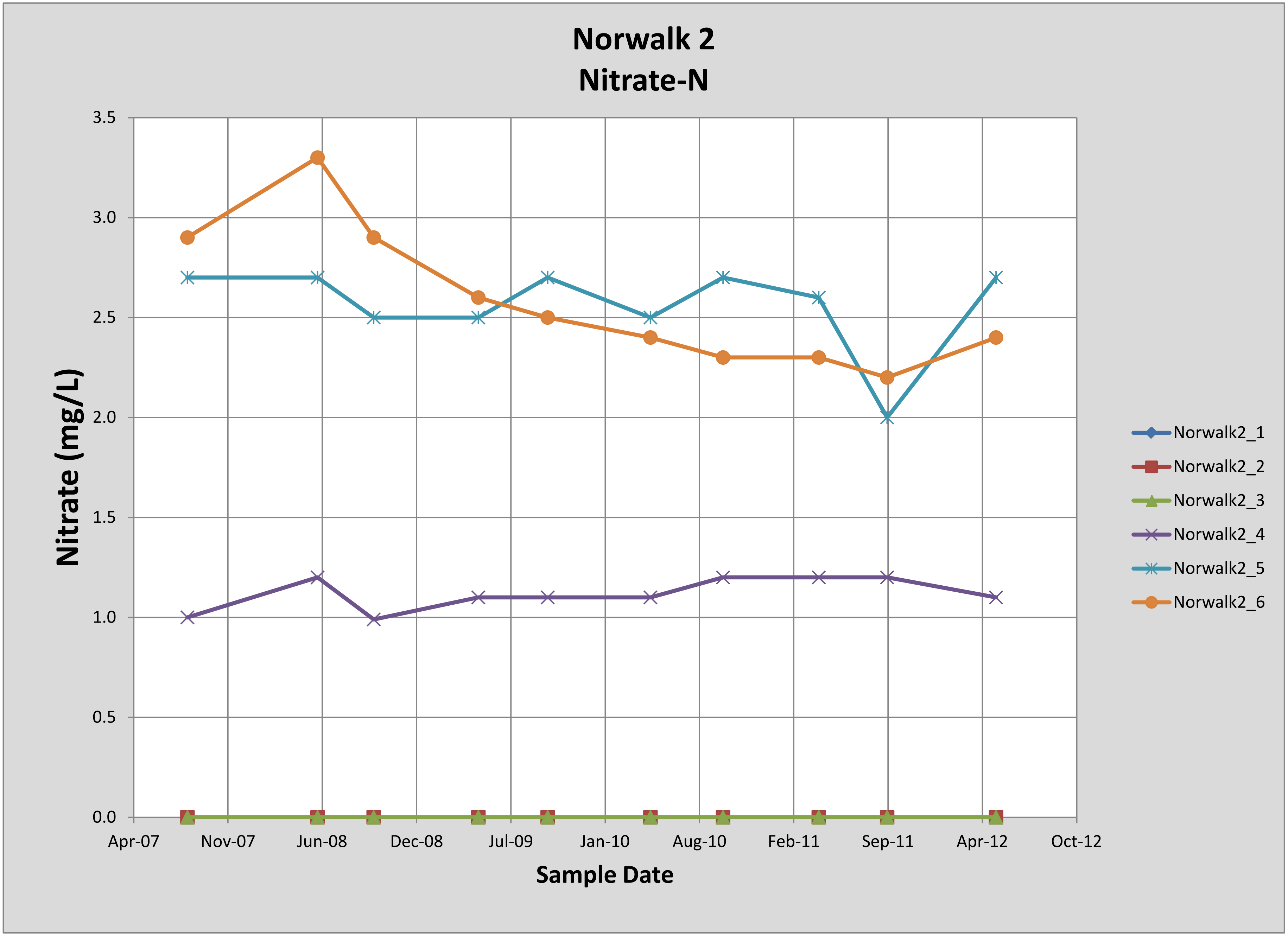


Norwalk 1
Chloride
Chloride (mg/L)
0
20
40
60
80
100
120
140
160
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Norwalk1_1
Norwalk1_2
Norwalk1_3
Norwalk1_4
Norwalk1_5

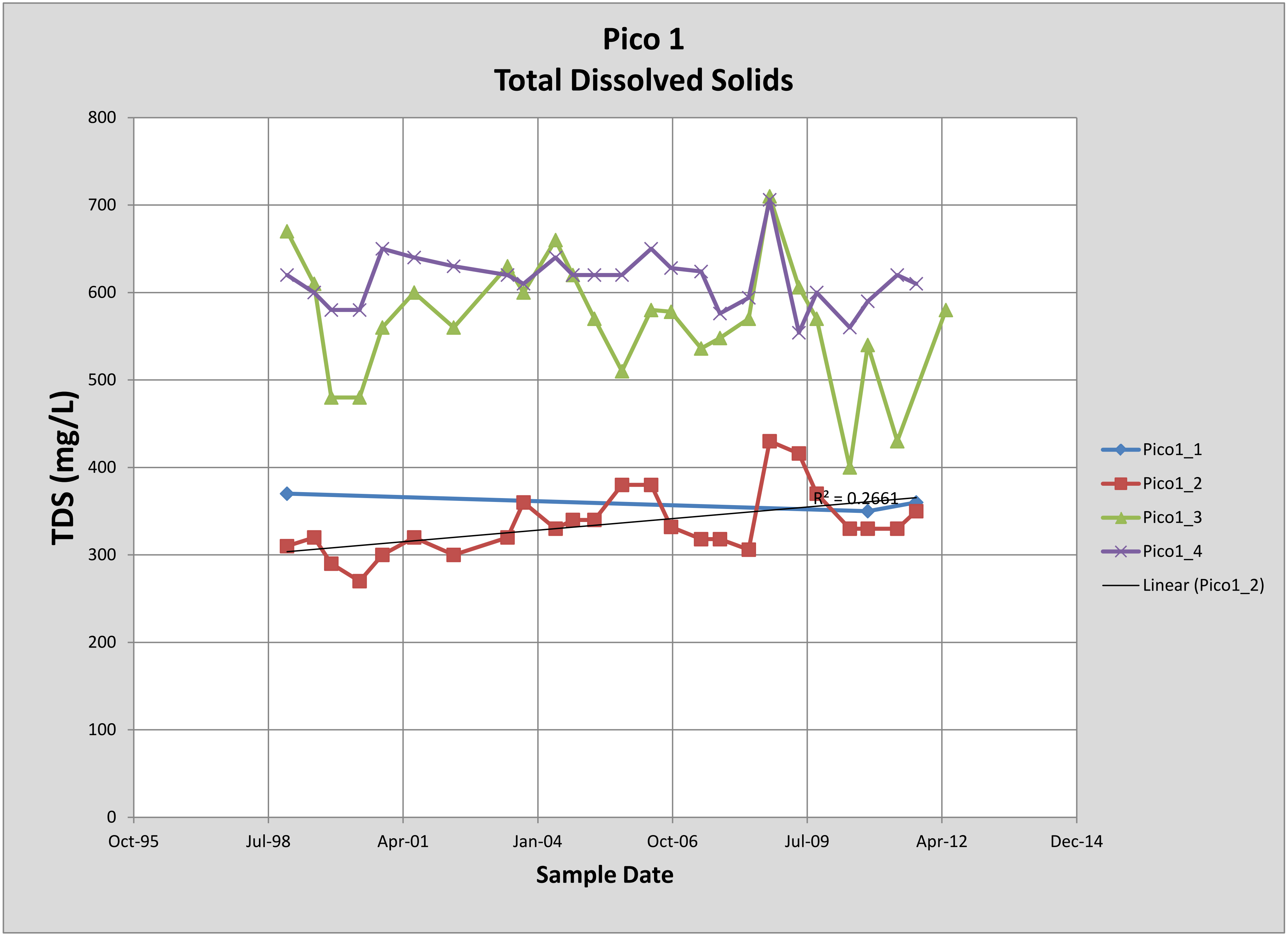

Norwalk 1
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Norwalk1_1
Norwalk1_2
Norwalk1_3
Norwalk1_4
Norwalk1_5


Norwalk 2
Total Dissolved Solids
TDS (mg/L)
0
100
200
300
400
500
600
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Sample Date
Norwalk2_1
Norwalk2_2
Norwalk2_3
Norwalk2_4
Norwalk2_5
Norwalk2_6

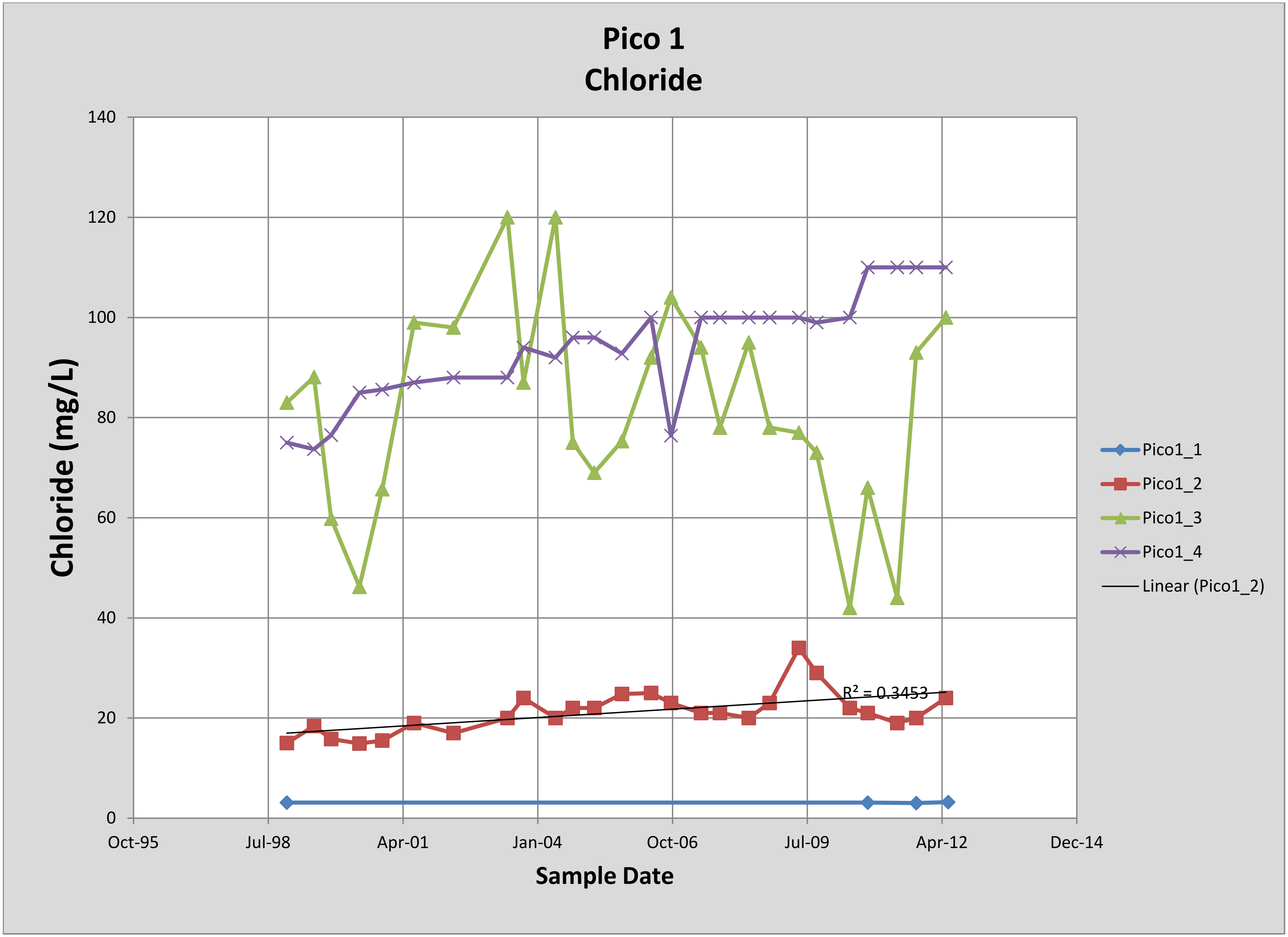

Norwalk 2
Chloride
Chloride (mg/L)
90
80
70
60
50
40
30
20
10
0
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Oct-12
Sample Date
Norwalk2_1
Norwalk2_2
Norwalk2_3
Norwalk2_4
Norwalk2_5
Norwalk2_6



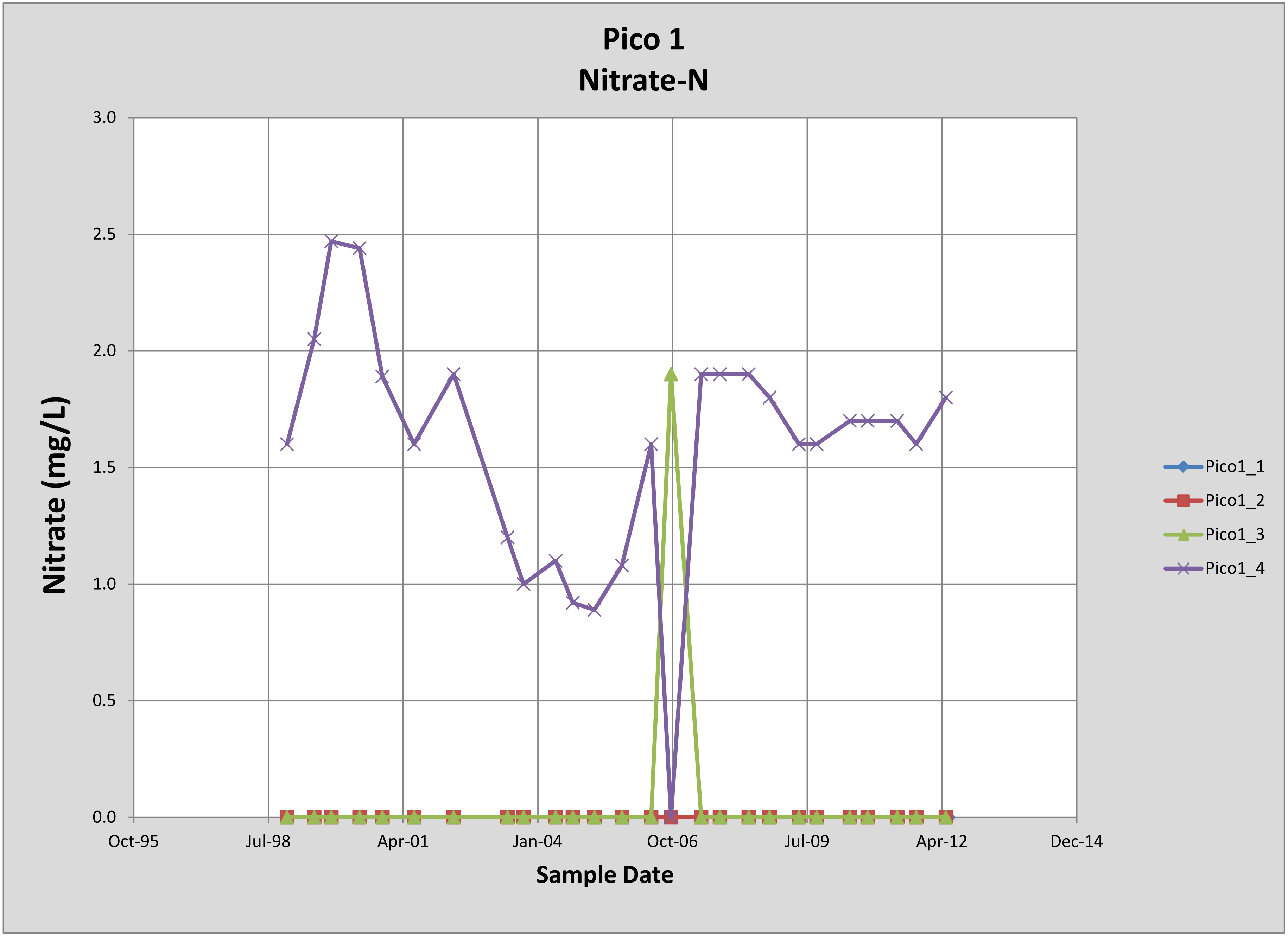
Norwalk 2
Nitrate-N
Nitrate (mg/L)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Oct-12
Sample Date
Norwalk2_1
Norwalk2_2
Norwalk2_3
Norwalk2_4
Norwalk2_5
Norwalk2_6



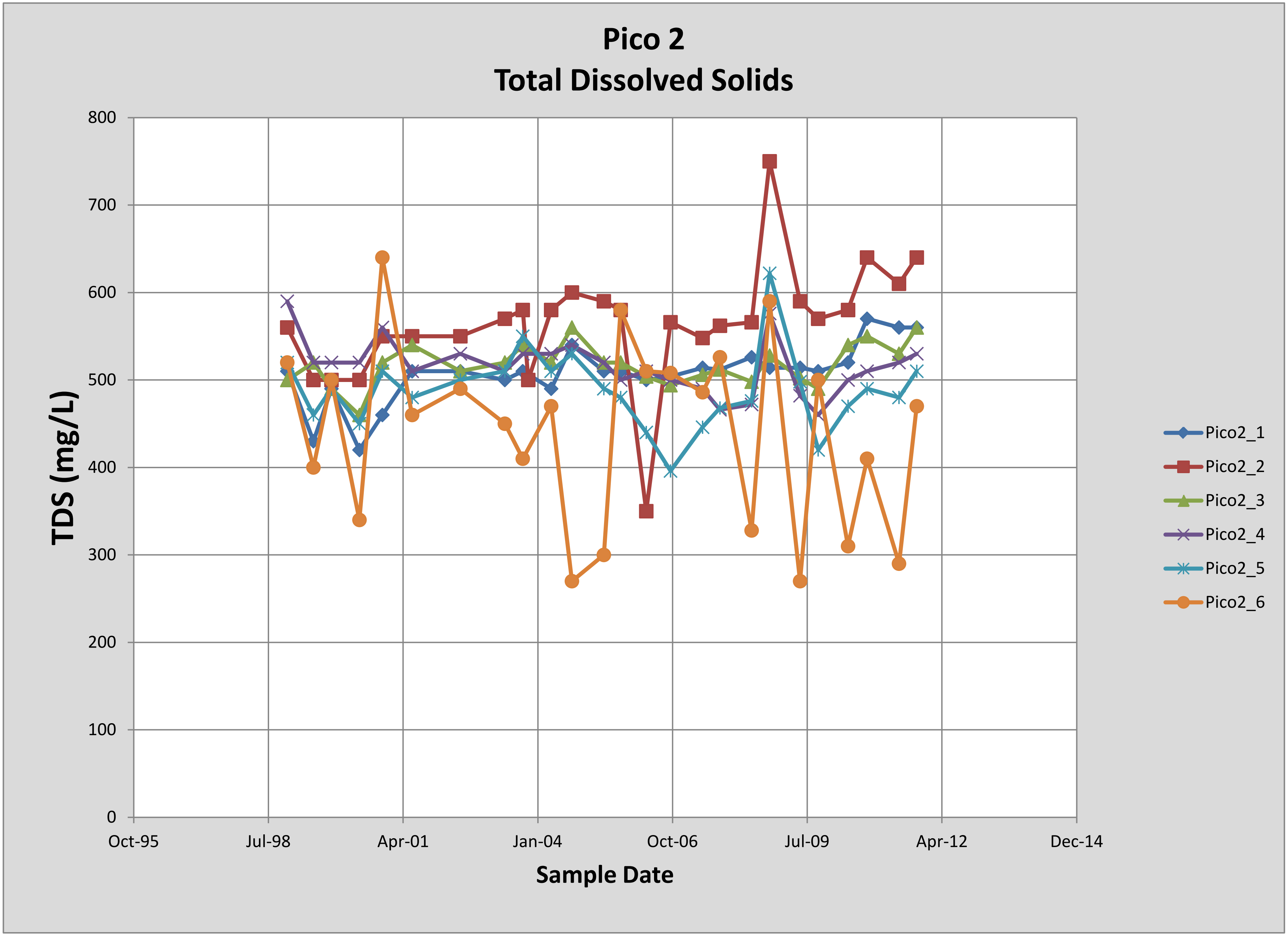
Pico 1
Total Dissolved Solids
TDS (mg/L)
800
700
600
500
400
300
200
100
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
R^2 = 0.2661
Pico1_1
Pico1_2
Pico1_3
Pico1_4
Linear (Pico1_2)



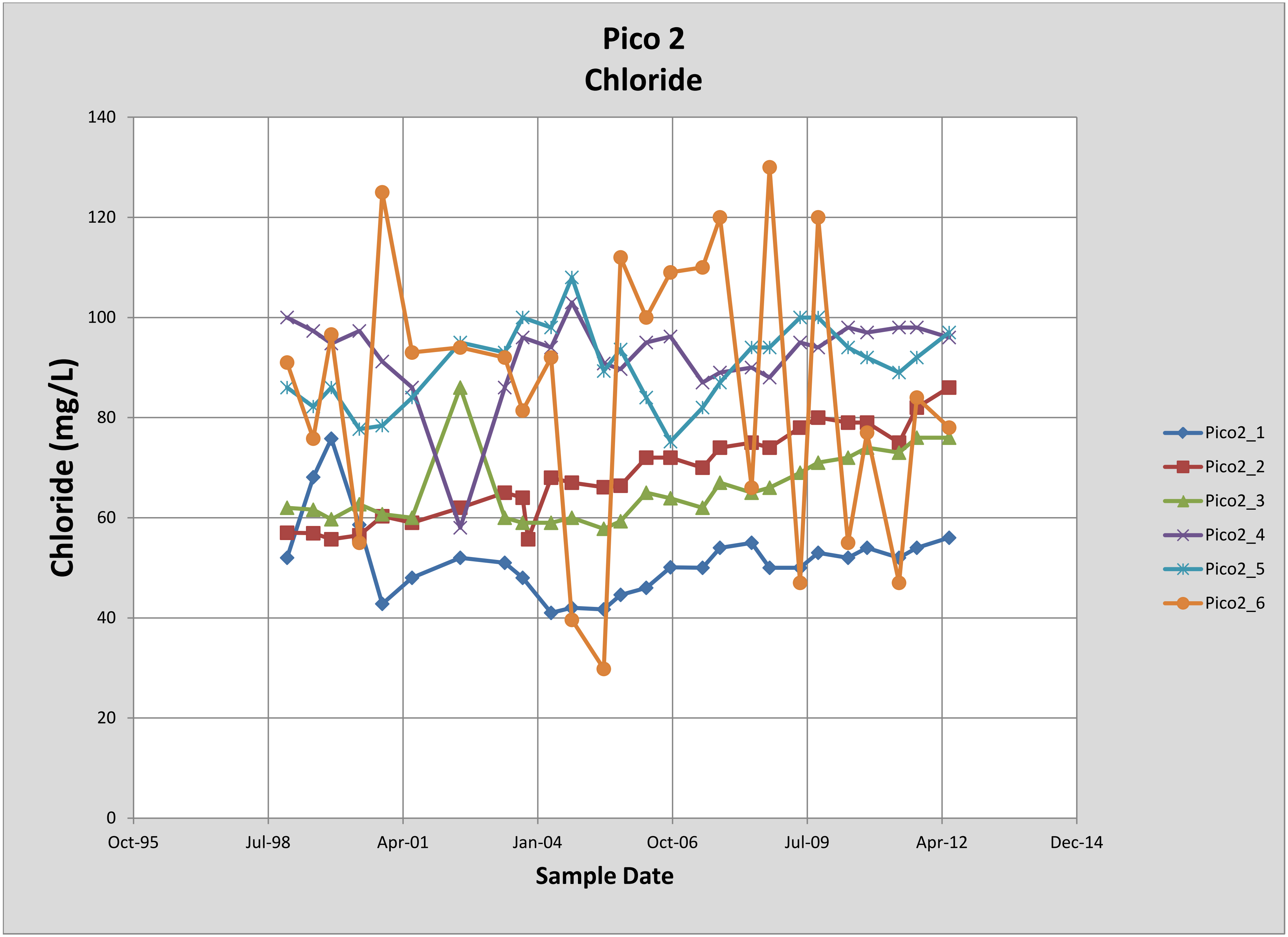
Pico 1
Chloride
Chloride (mg/L)
140
120
100
80
60
40
20
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
R² = 0.3453
Pico1_1
Pico1_2
Pico1_3
Pico1_4
Linear (Pico1_2)



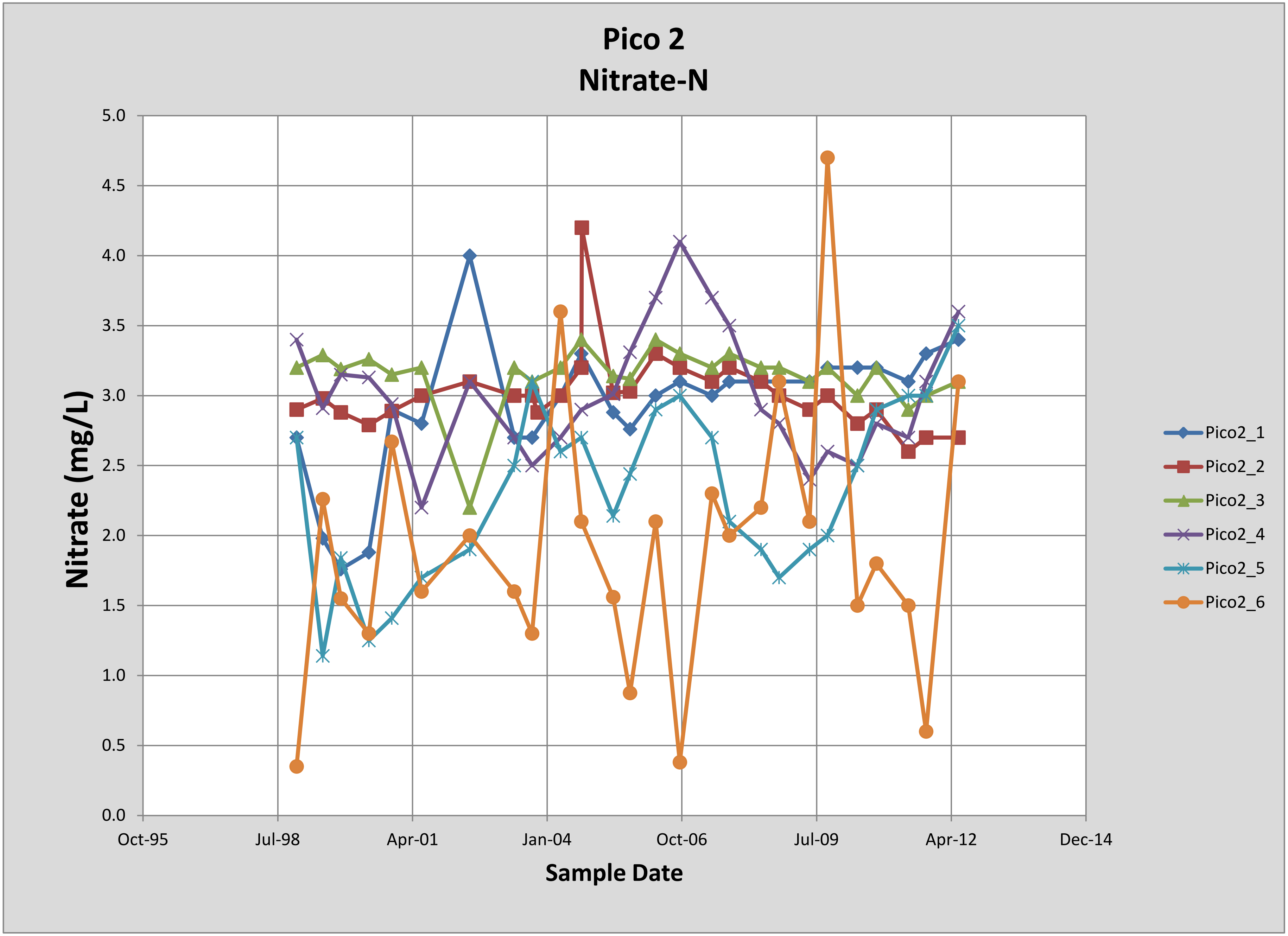
Pico 1
Nitrate-N
Nitrate (mg/L)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Pico1_1
Pico1_2
Pico1_3
Pico1_4



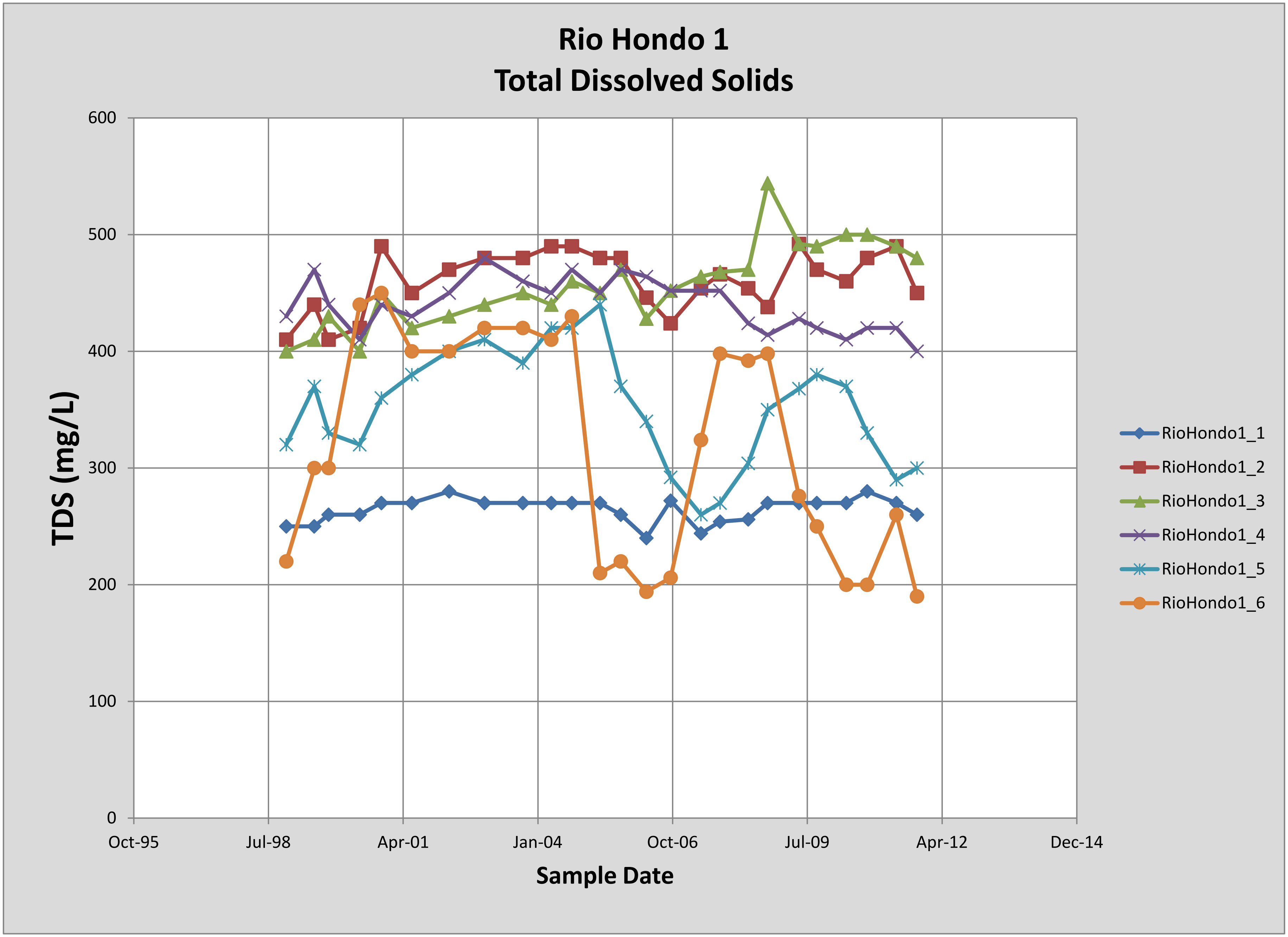
Pico 2
Total Dissolved Solids
TDS (mg/L)
800
700
600
500
400
300
200
100
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Pico2_1
Pico2_2
Pico2_3
Pico2_4
Pico2_5
Pico2_6

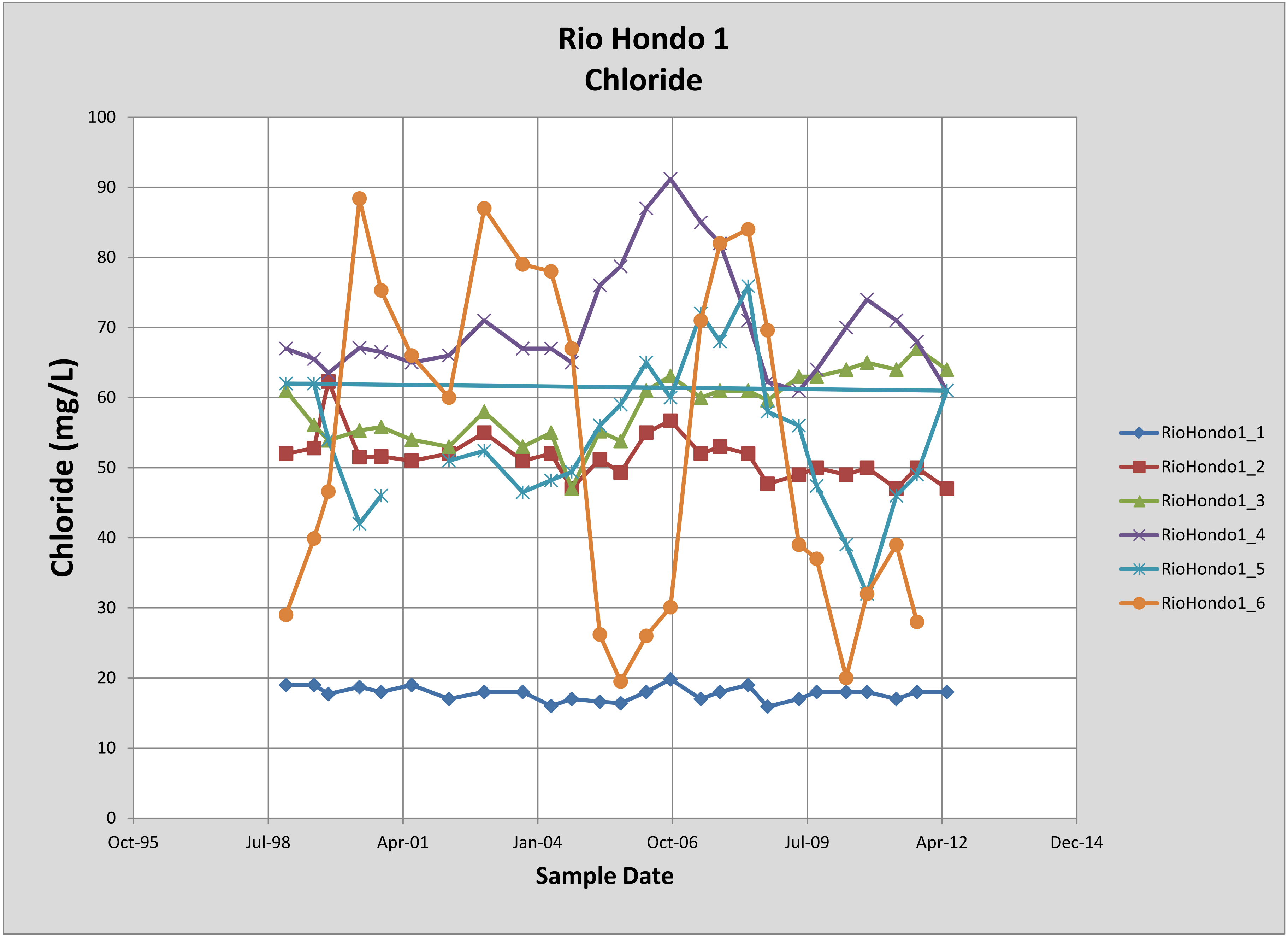


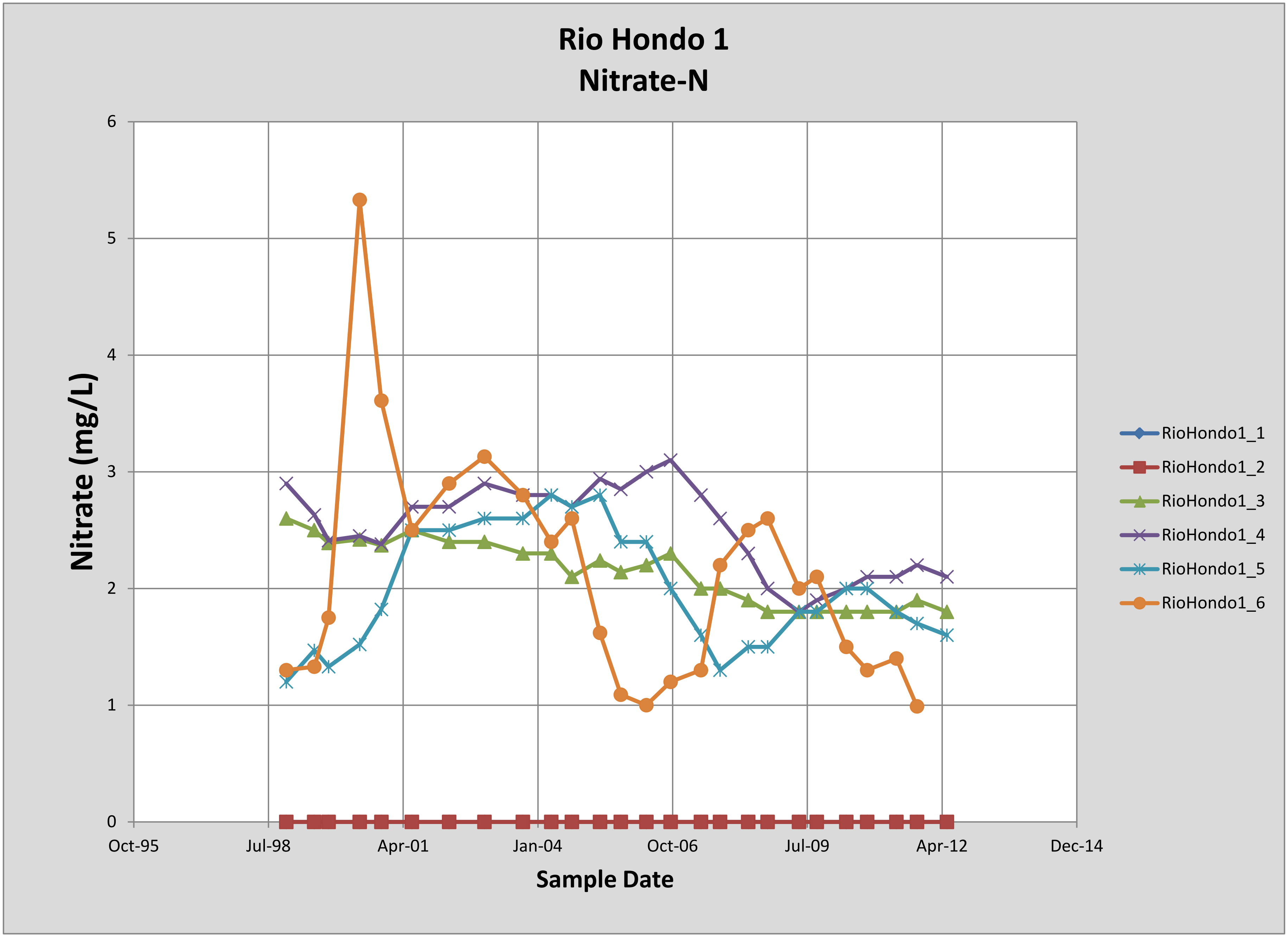
Pico 2
Chloride
Chloride (mg/L)
0
20
40
60
80
100
120
140
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Pico2_1
Pico2_2
Pico2_3
Pico2_4
Pico2_5
Pico2_6

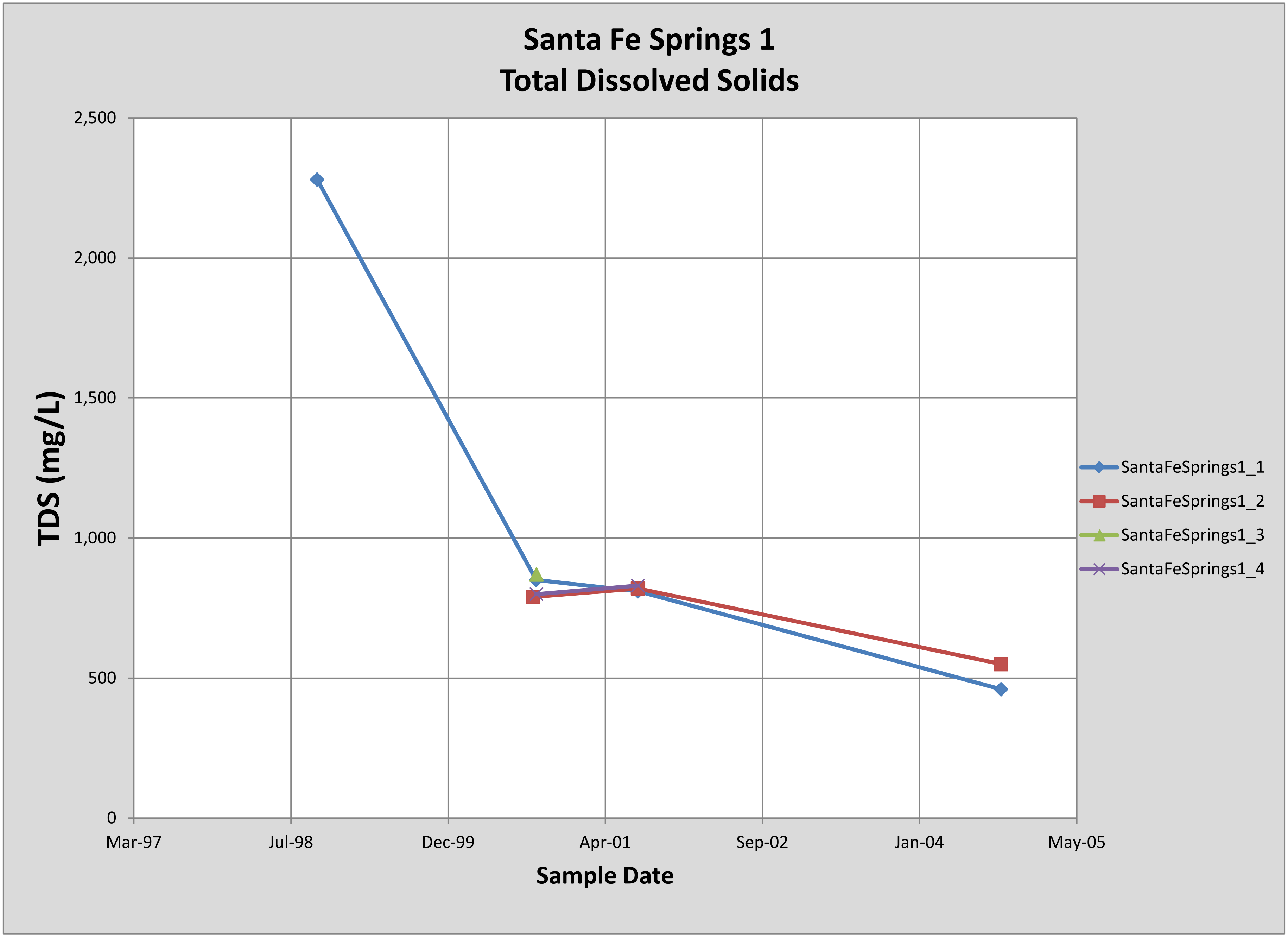


Pico 2
Nitrate-N
Nitrate (mg/L)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Pico2_1
Pico2_2
Pico2_3
Pico2_4
Pico2_5
Pico2_6

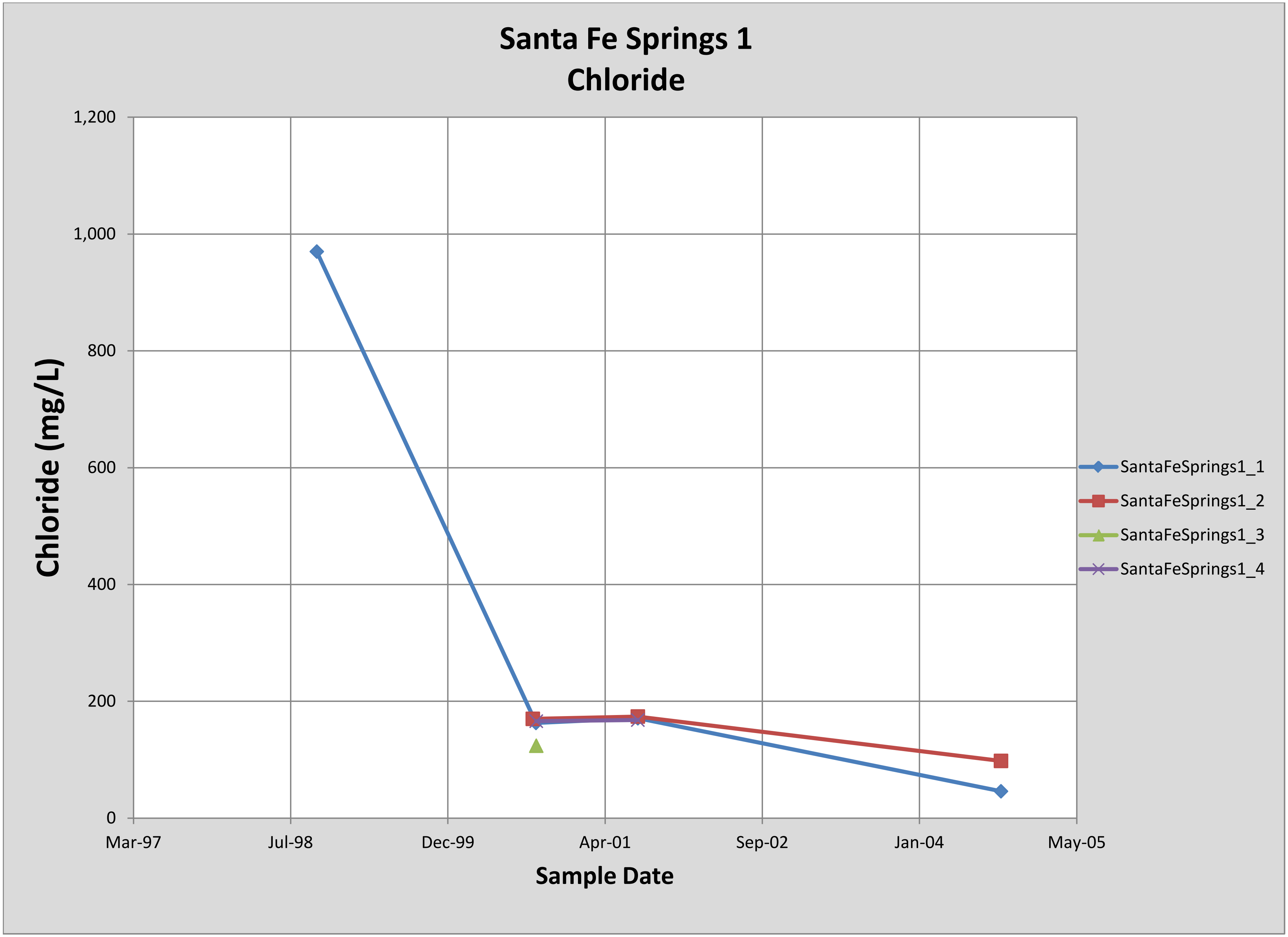

Rio Hondo 1
Total Dissolved Solids
TDS (mg/L)
600
500
400
300
200
100
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
RioHondo1_1
RioHondo1_2
RioHondo1_3
RioHondo1_4
RioHondo1_5
RioHondo1_6

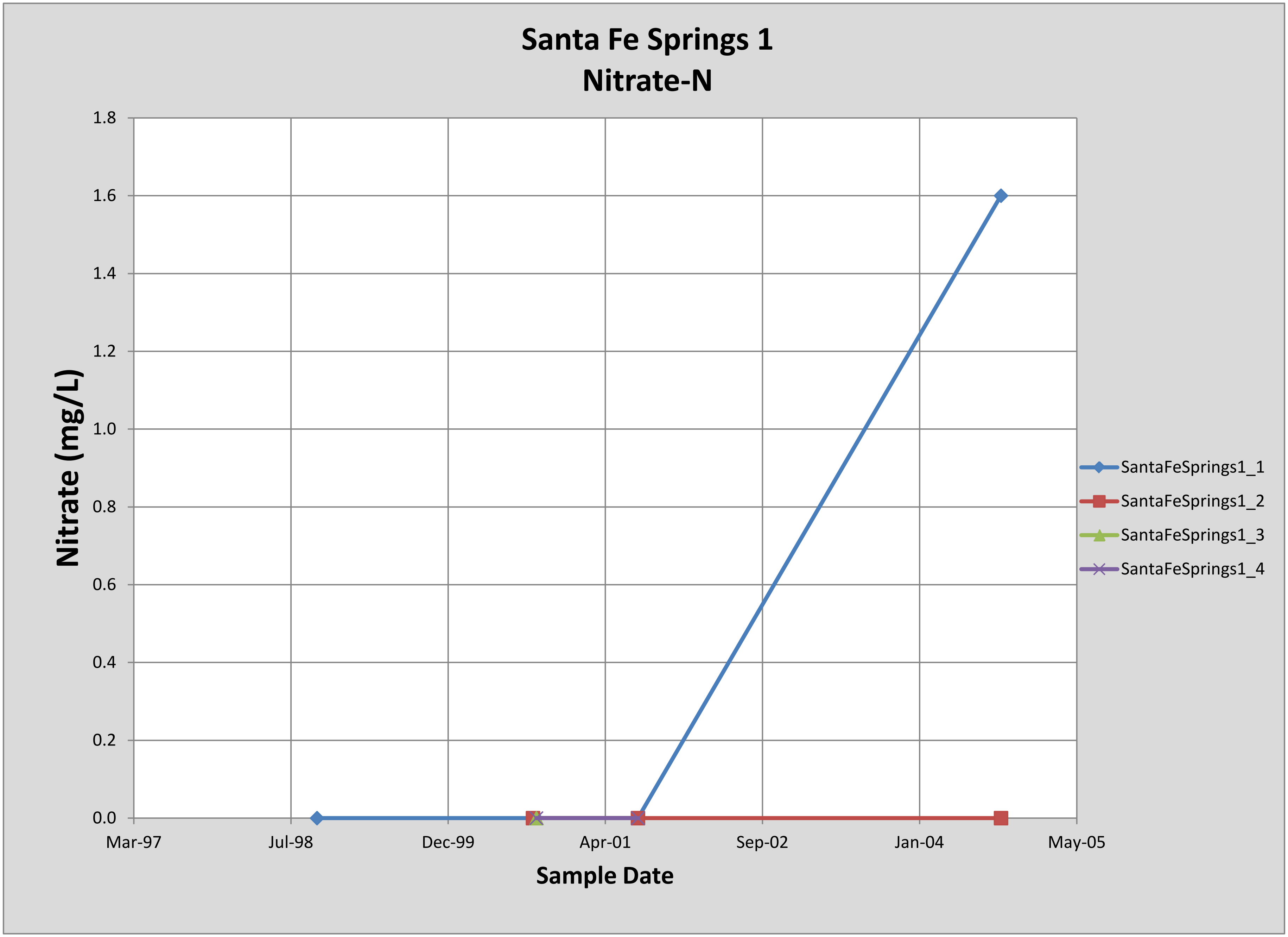

Rio Hondo 1
Chloride
Chloride (mg/L)
100
90
80
70
60
50
40
30
20
10
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
RioHondo1_1
RioHondo1_2
RioHondo1_3
RioHondo1_4
RioHondo1_5
RioHondo1_6


Rio Hondo 1
Nitrate-N
Nitrate (mg/L)
0
1
2
3
4
5
6
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
RioHondo1_1
RioHondo1_2
RioHondo1_3
RioHondo1_4
RioHondo1_5
RioHondo1_6

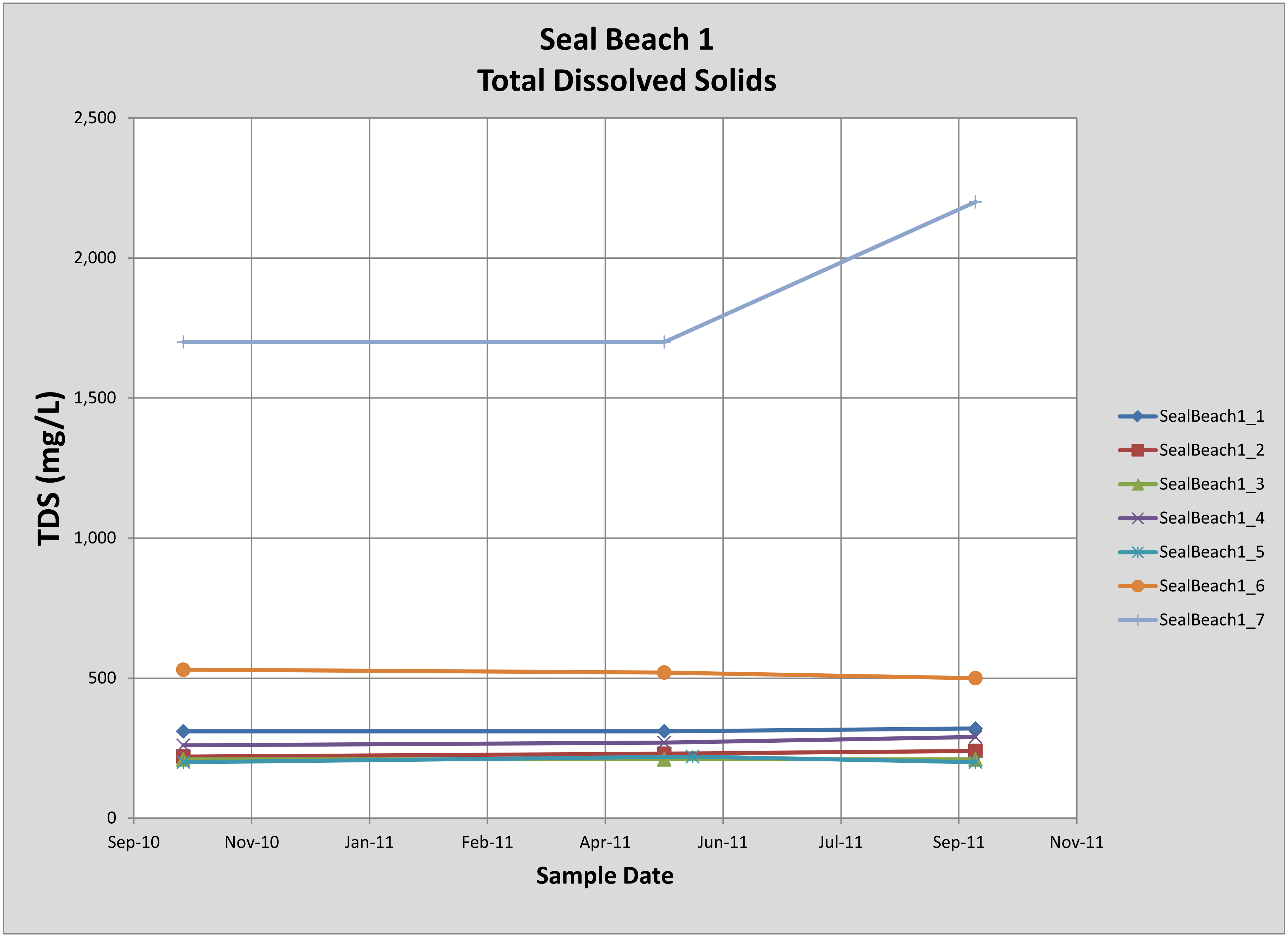


Santa Fe Springs 1
Total Dissolved Solids
TDS (mg/L)
2,500
2,000
1,500
1,000
500
0
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Sample Date
SantaFeSprings1_1
SantaFeSprings1_2
SantaFeSprings1_3
SantaFeSprings1_4

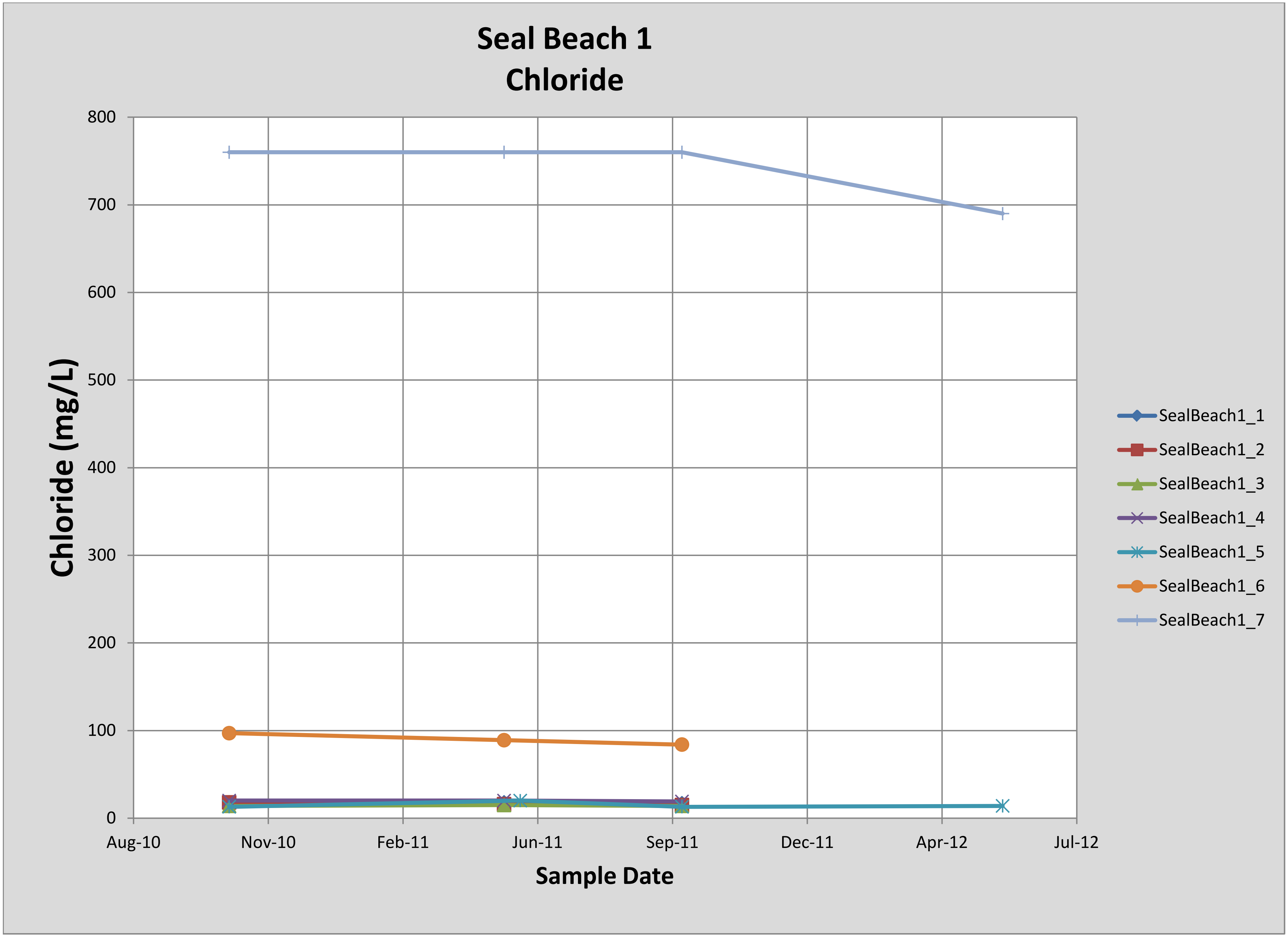

Santa Fe Springs 1
Chloride
Chloride (mg/L)
1,200
1,000
800
600
400
200
0
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Sample Date
SantaFeSprings1_1
SantaFeSprings1_2
SantaFeSprings1_3
SantaFeSprings1_4



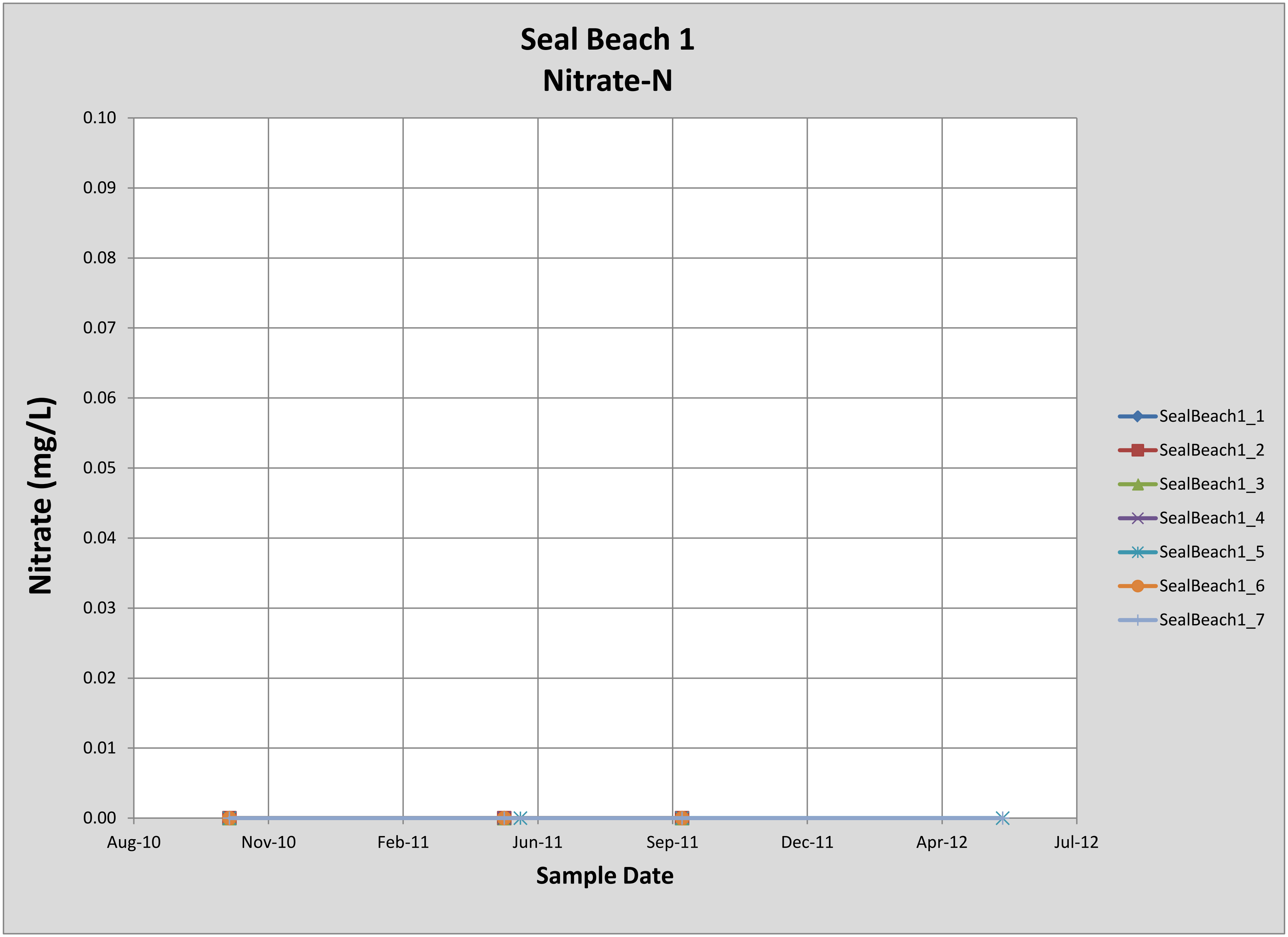
Santa Fe Springs 1
Nitrate-N
Nitrate (mg/L)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Sample Date
SantaFeSprings1_1
SantaFeSprings1_2
SantaFeSprings1_3
SantaFeSprings1_4



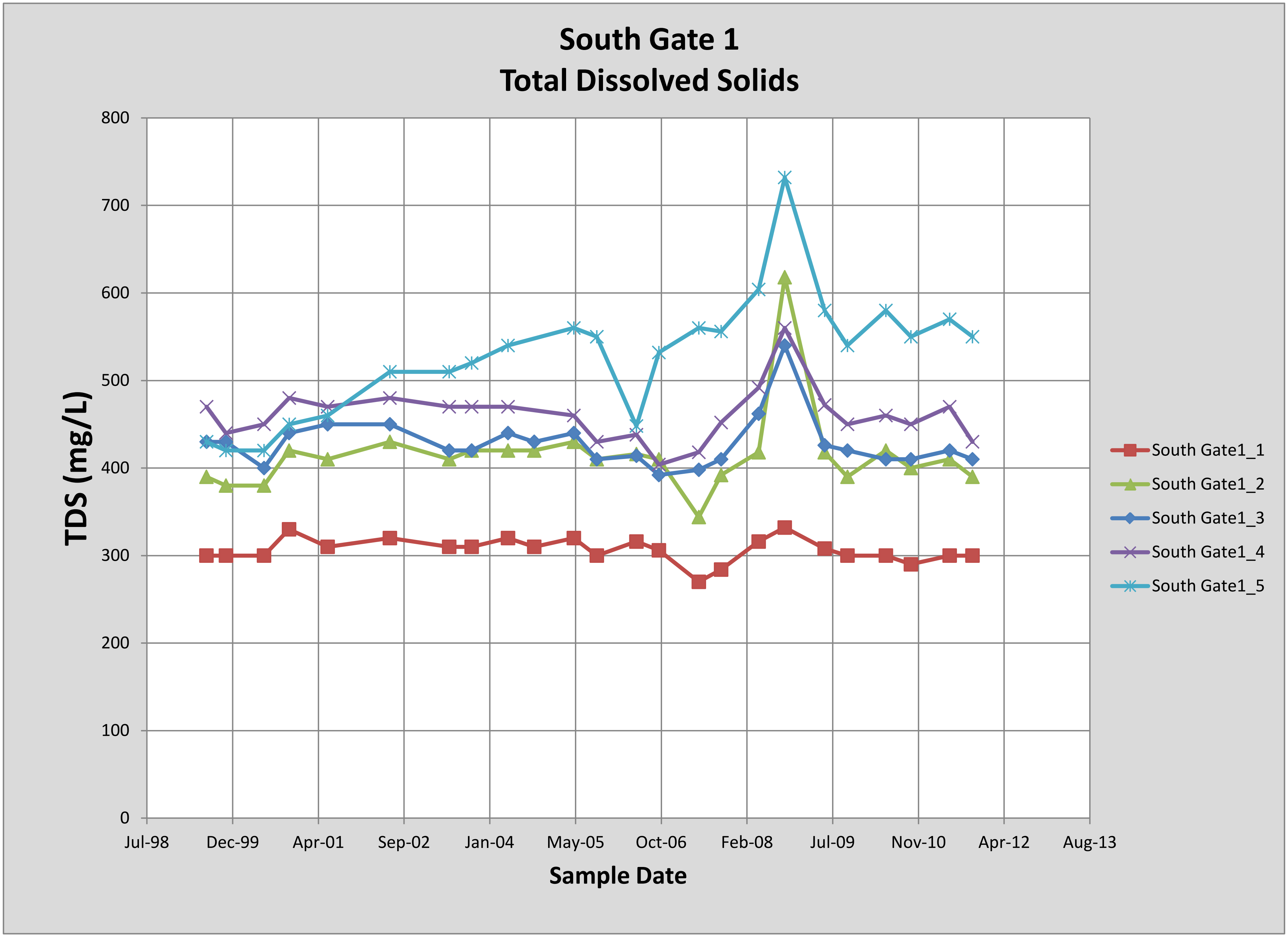
Seal Beach 1
Total Dissolved Solids
TDS (mg/L)
2,500
2,000
1,500
1,000
500
0
Sep-10
Nov-10
Jan-11
Feb-11
Apr-11
Jun-11
Jul-11
Sep-11
Nov-11
Sample Date
SealBeach1_1
SealBeach1_2
SealBeach1_3
SealBeach1_4
SealBeach1_5
SealBeach1_6
SealBeach1_7

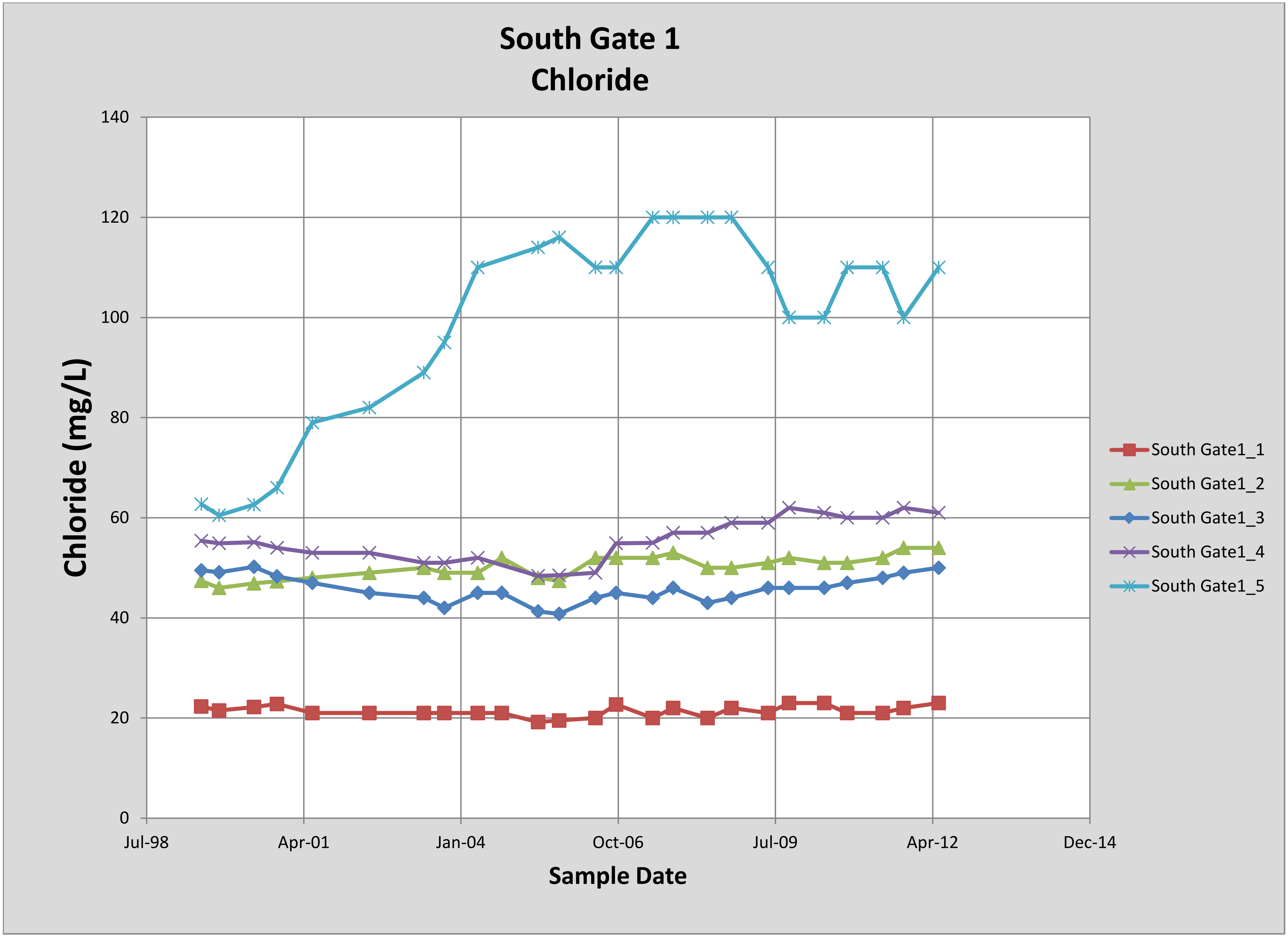


Seal Beach 1
Chloride
Chloride (mg/L)
800
700
600
500
400
300
200
100
0
Aug-10
Nov-10
Feb-11
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Sample Date
SealBeach1_1
SealBeach1_2
SealBeach1_3
SealBeach1_4
SealBeach1_5
SealBeach1_6
SealBeach1_7

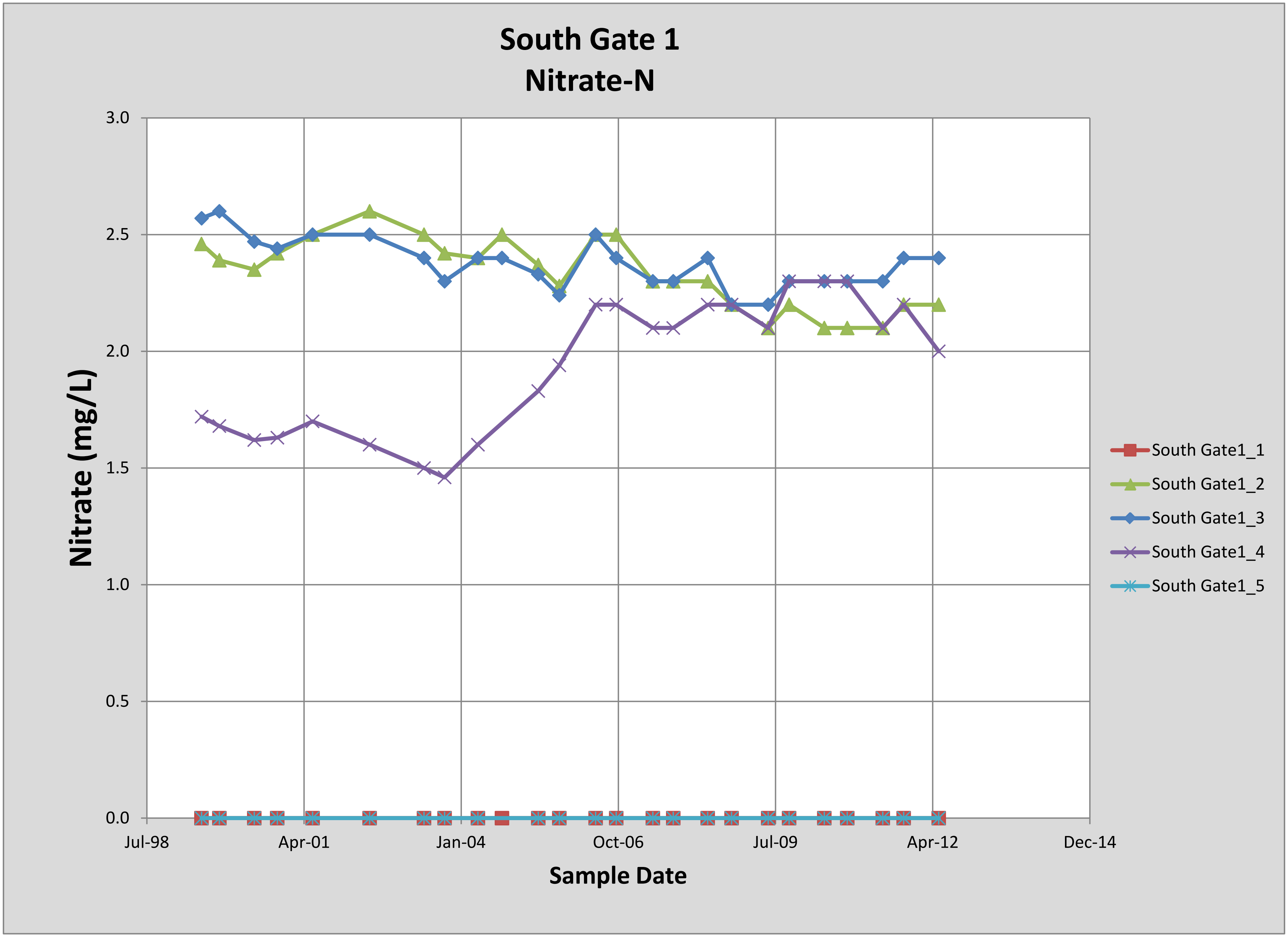


Seal Beach 1
Nitrate-N
Nitrate (mg/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Aug-10
Nov-10
Feb-11
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Sample Date
SealBeach1_1
SealBeach1_2
SealBeach1_3
SealBeach1_4
SealBeach1_5
SealBeach1_6
SealBeach1_7

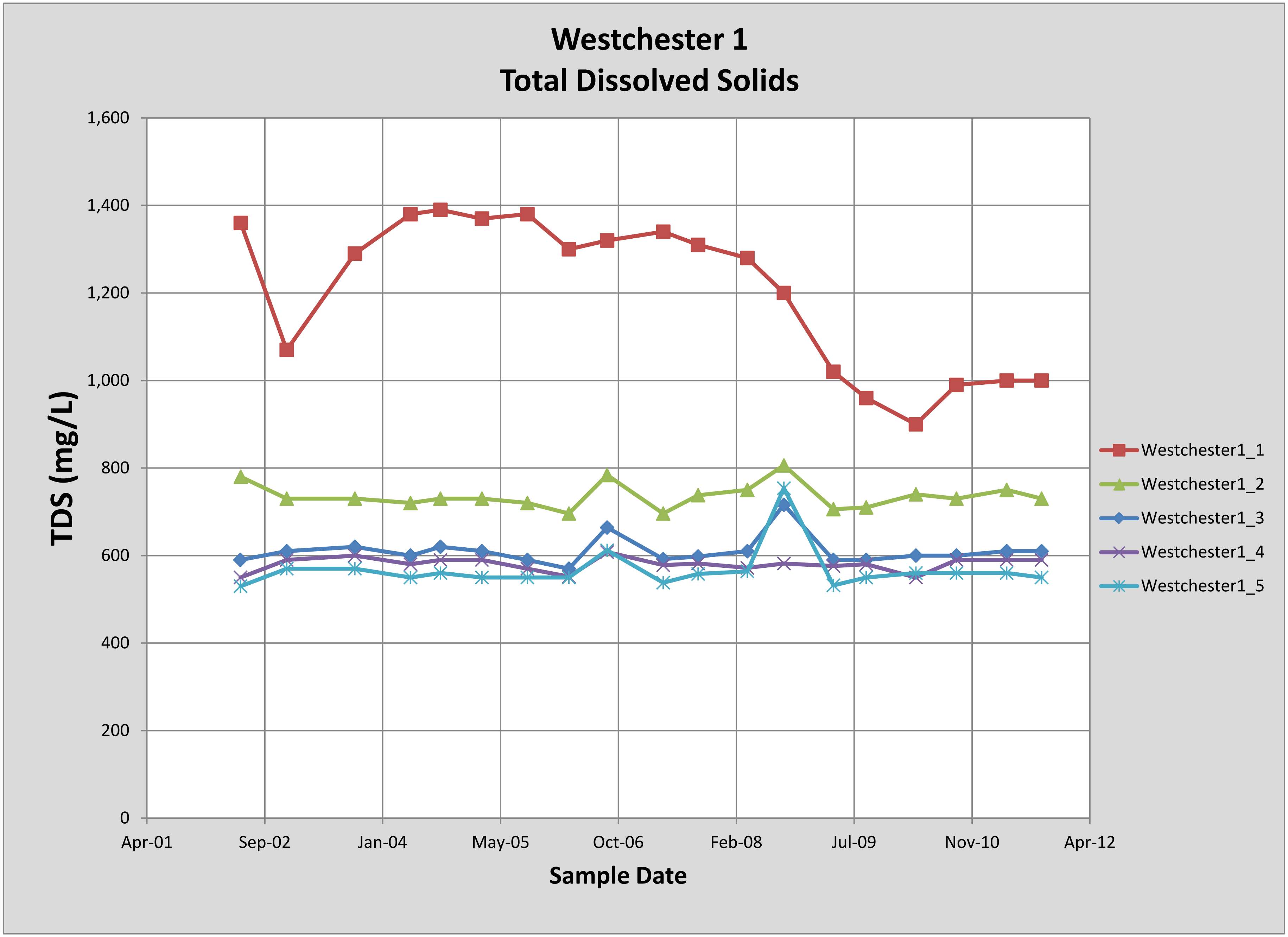

South Gate 1
Total Dissolved Solids
TDS (mg/L)
0
100
200
300
400
500
600
700
800
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
South Gate1_1
South Gate1_2
South Gate1_3
South Gate1_4
South Gate1_5



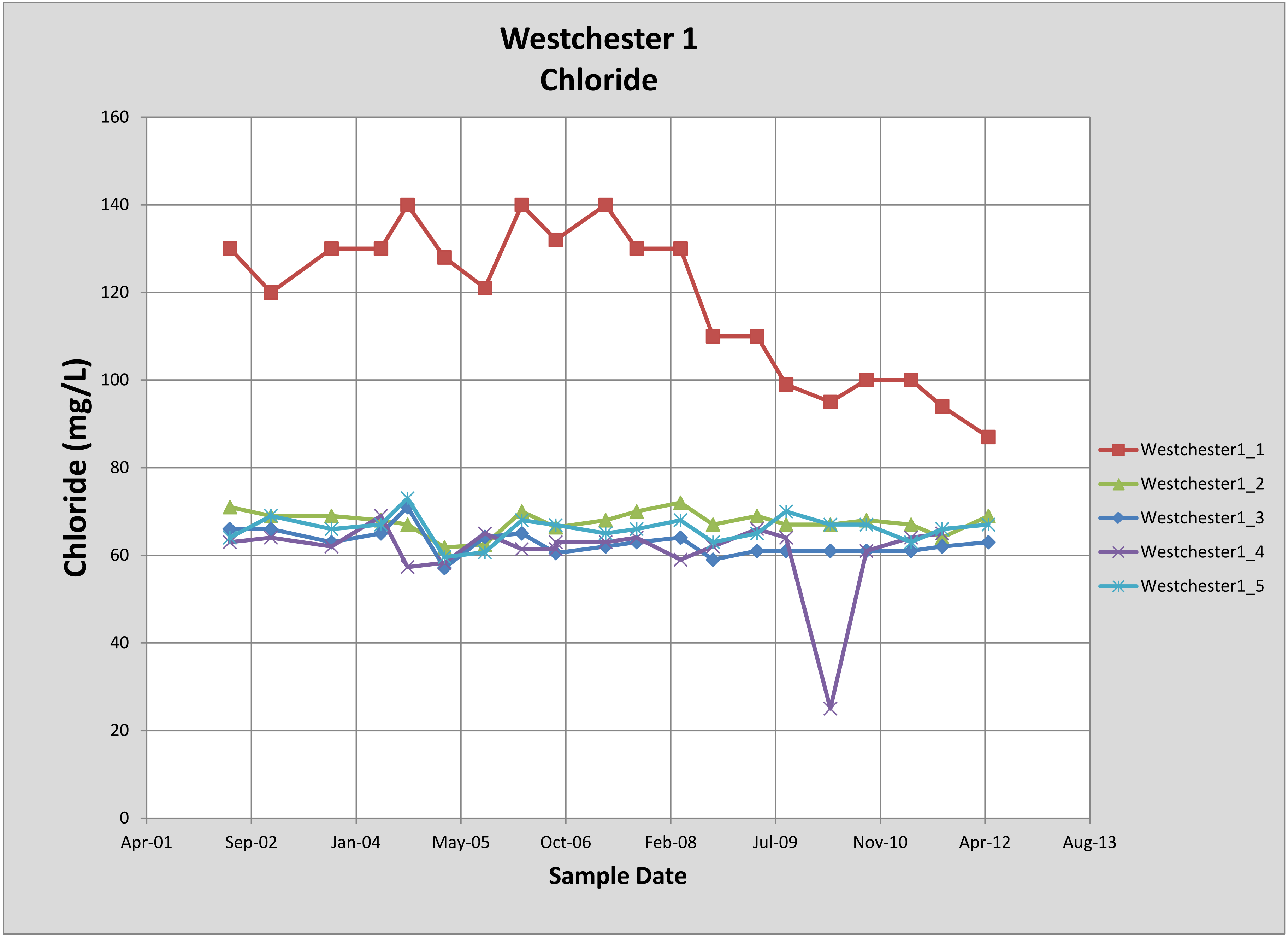
South Gate 1
Chloride
140
120
100
80
60
40
20
0
Chloride (mg/L)
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
South Gate1_1
South Gate1_2
South Gate1_3
South Gate1_4
South Gate1_5

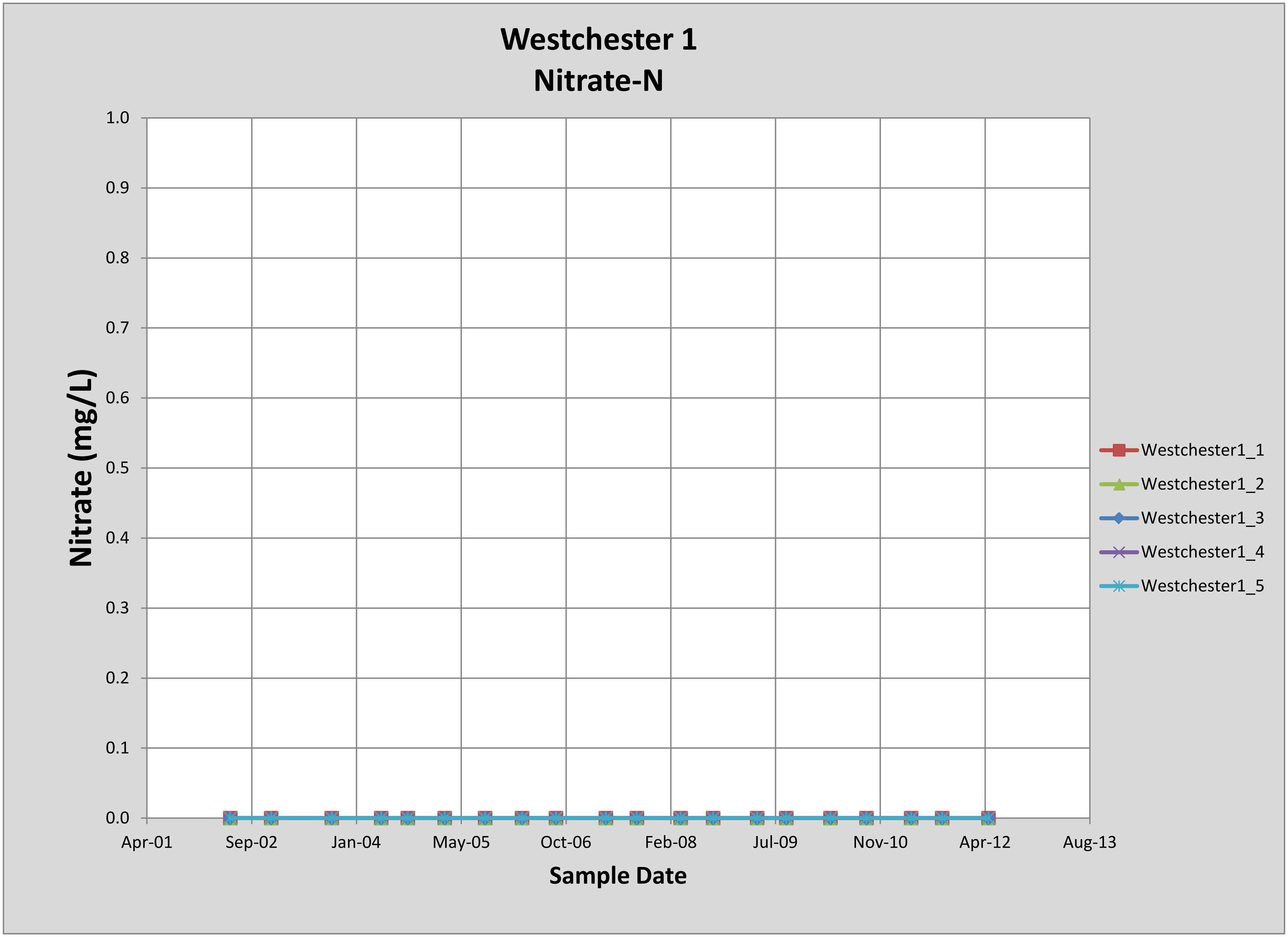


South Gate 1
Nitrate-N
Nitrate (mg/L)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
South Gate1_1
South Gate1_2
South Gate1_3
South Gate1_4
South Gate1_5

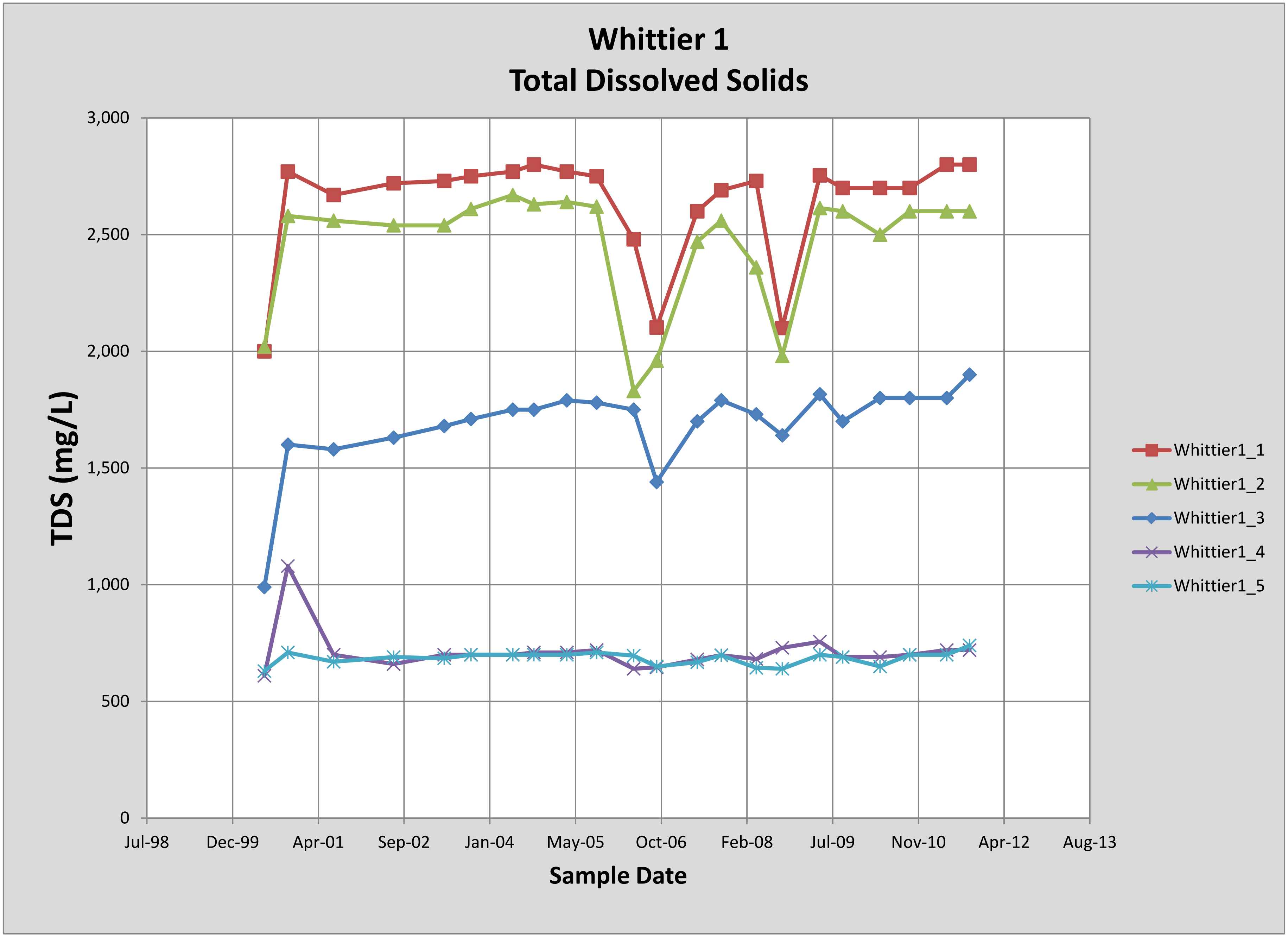


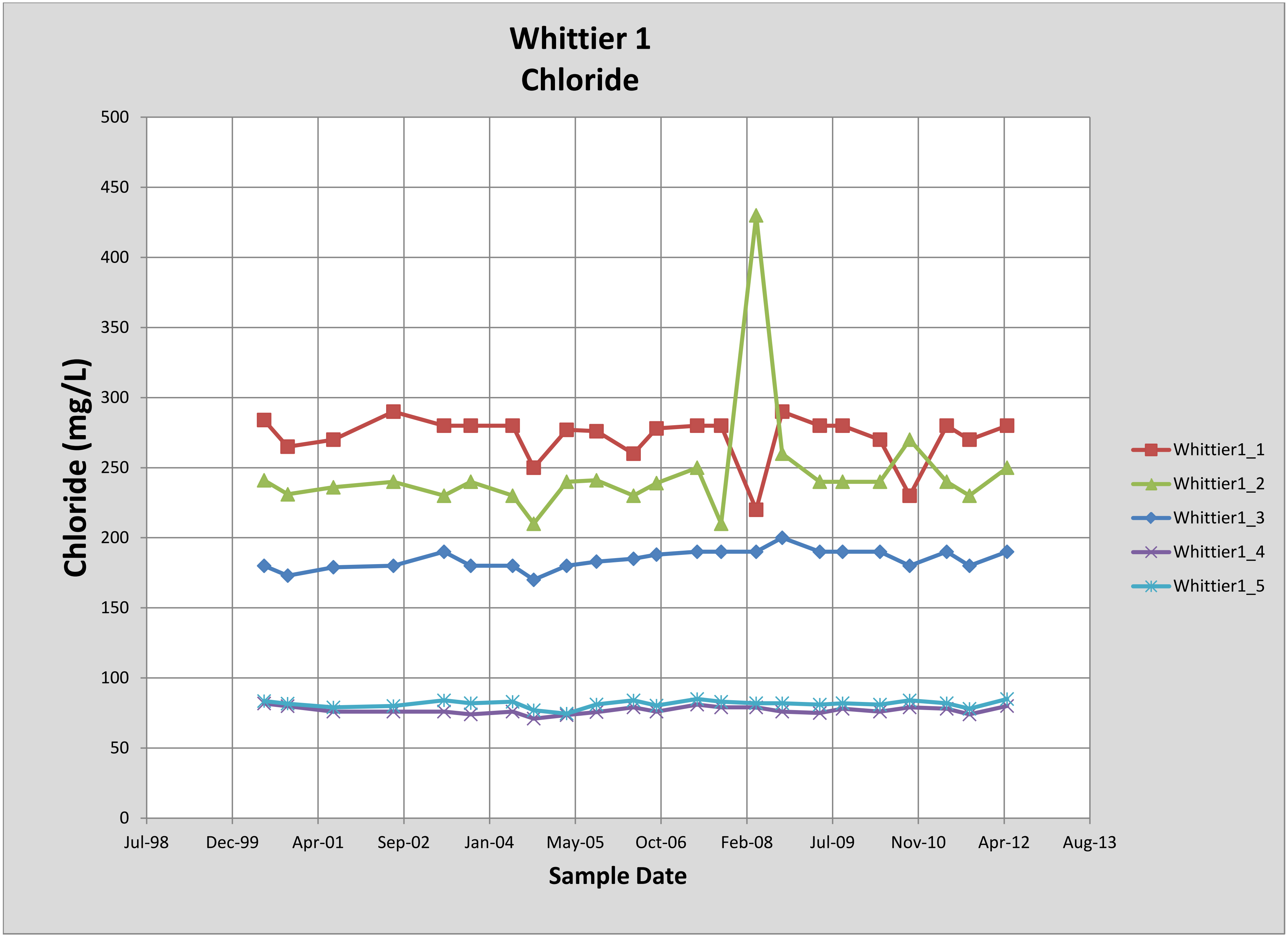
Westchester 1
Total Dissolved Solids
TDS (mg/L)
1,600
1,400
1,200
1,000
800
600
400
200
0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Sample Date
Westchester1_1
Westchester1_2
Westchester1_3
Westchester1_4
Westchester1_5


Westchester 1
Chloride
Chloride (mg/L)
160
140
120
100
80
60
40
20
0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Westchester1_1
Westchester1_2
Westchester1_3
Westchester1_4
Westchester1_5

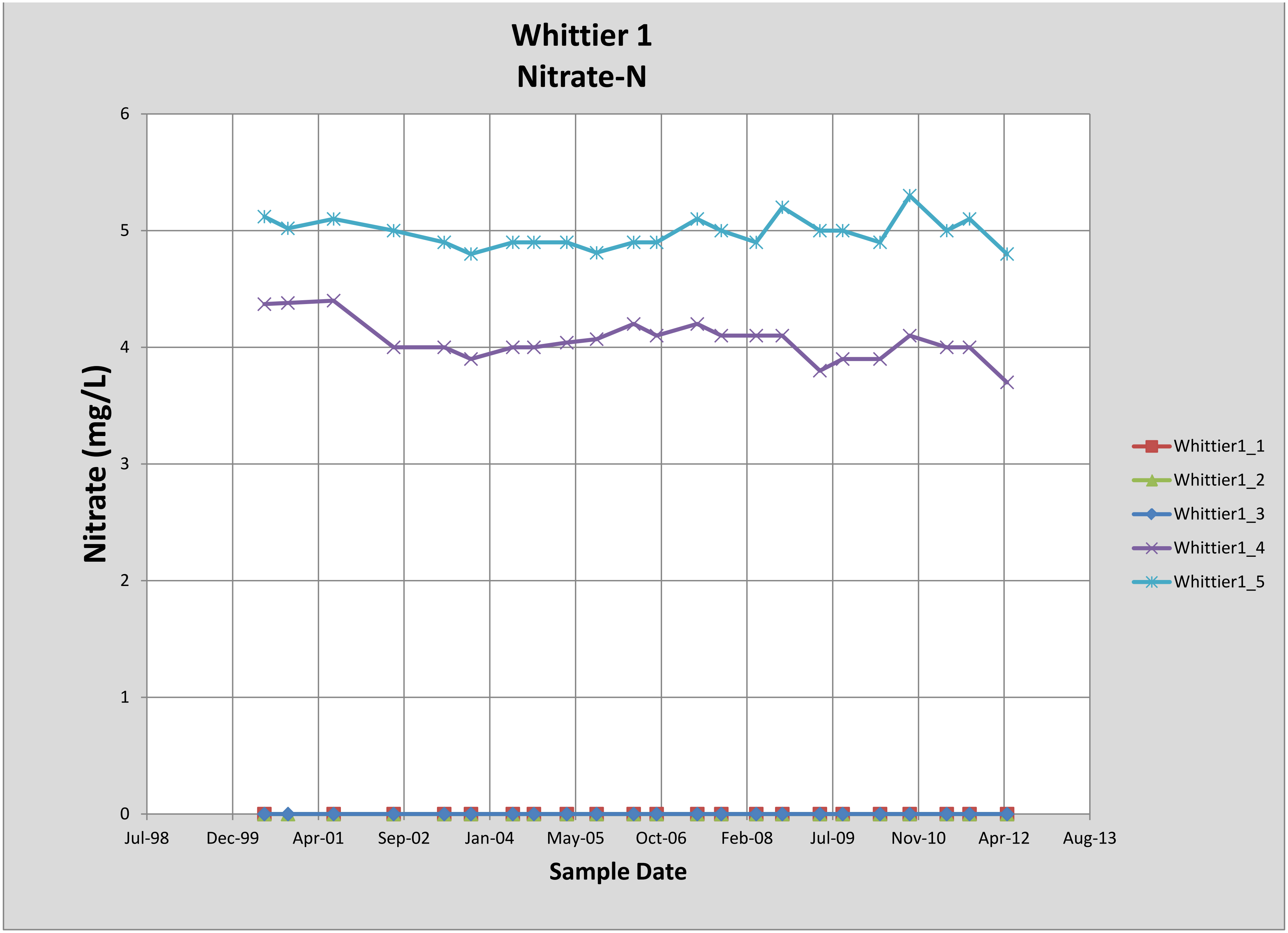


Westchester 1
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Westchester1_1
Westchester1_2
Westchester1_3
Westchester1_4
Westchester1_5

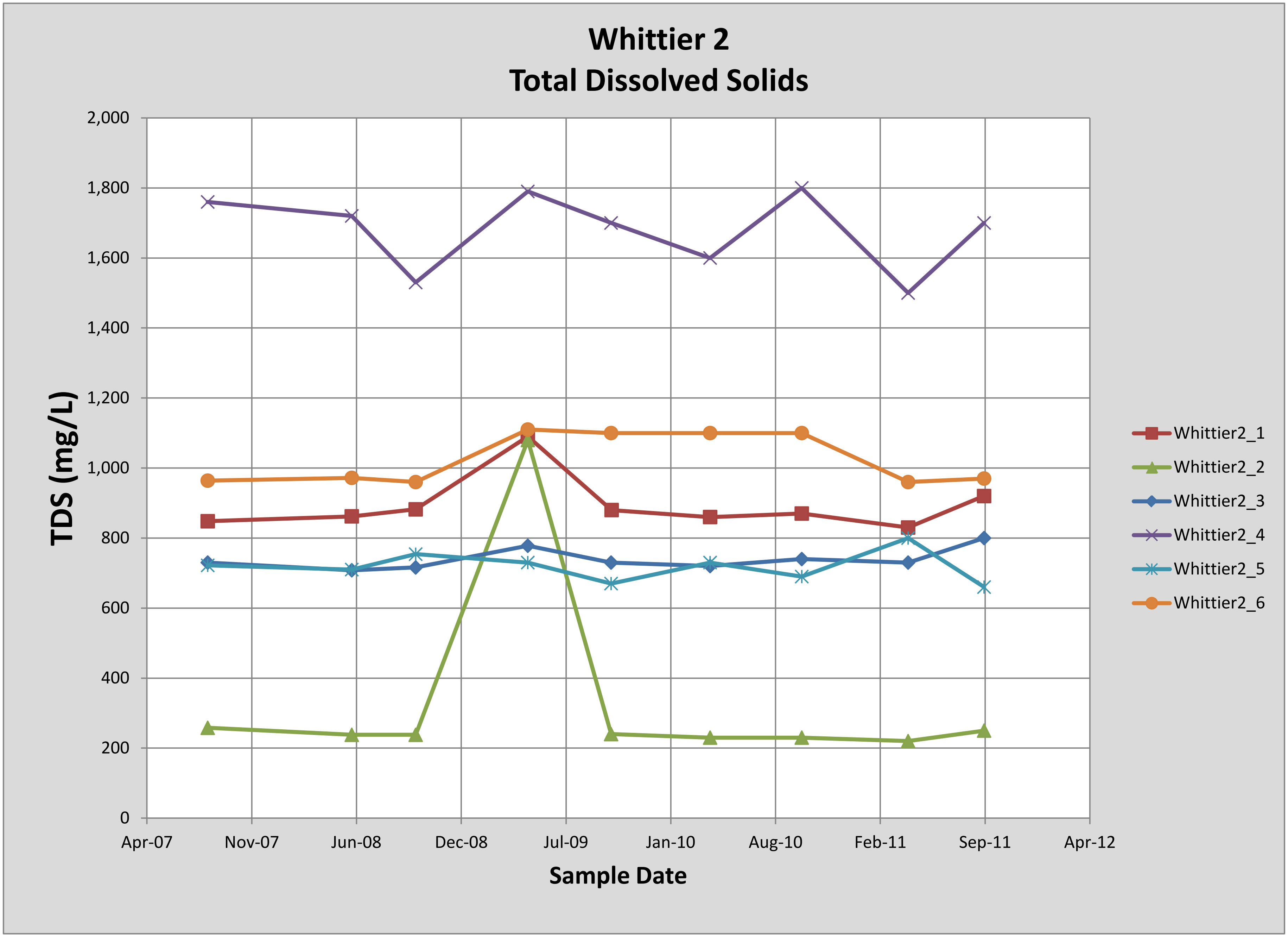

Whittier 1
Total Dissolved Solids
TDS (mg/L)
3,000
2,500
2,000
1,500
1,000
500
0
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Whittier1_1
Whittier1_2
Whittier1_3
Whittier1_4
Whittier1_5

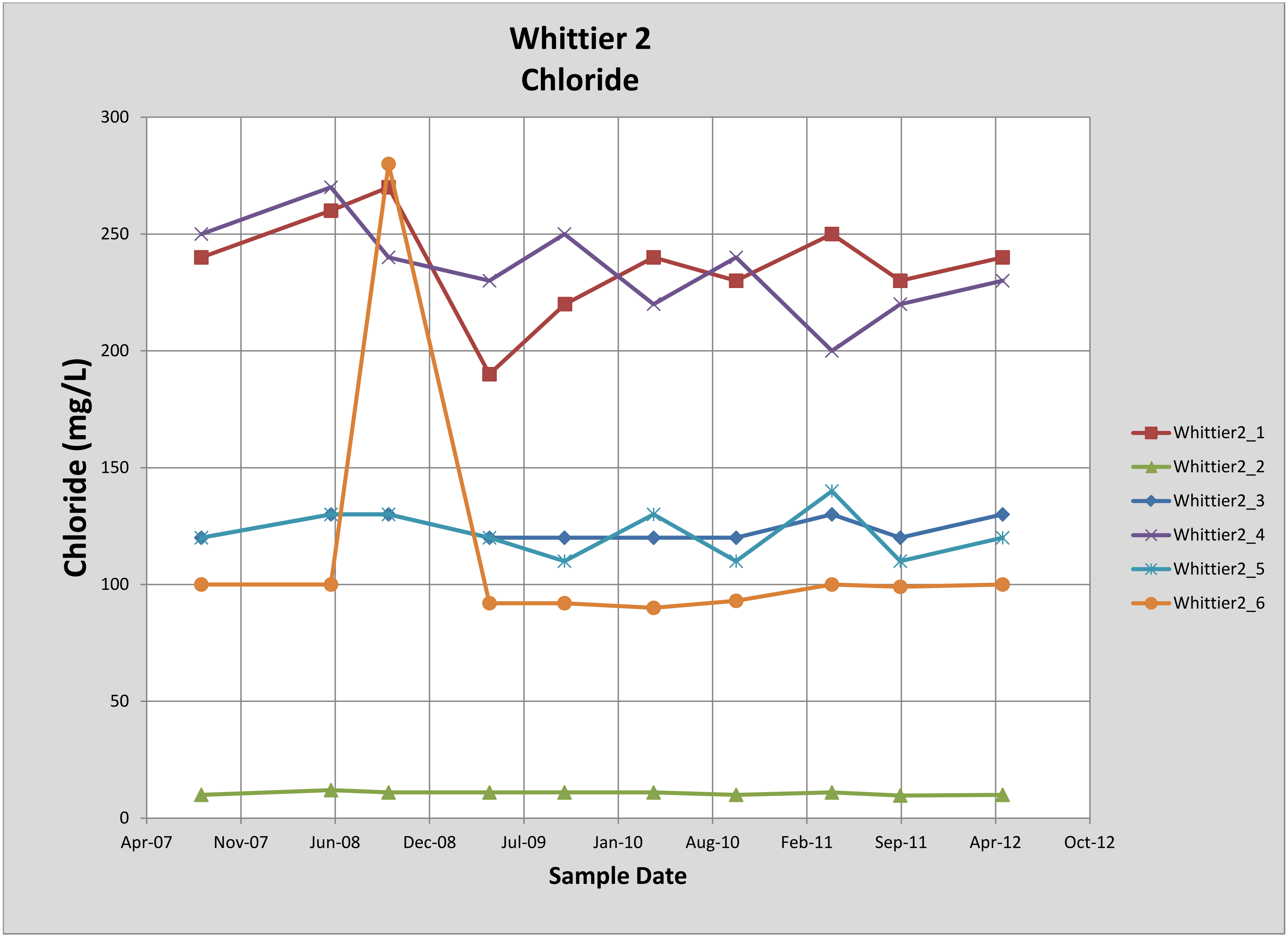


Whittier 1
Chloride
Chloride (mg/L)
500
450
400
350
300
250
200
150
100
50
0
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Whittier1_1
Whittier1_2
Whittier1_3
Whittier1_4
Whittier1_5

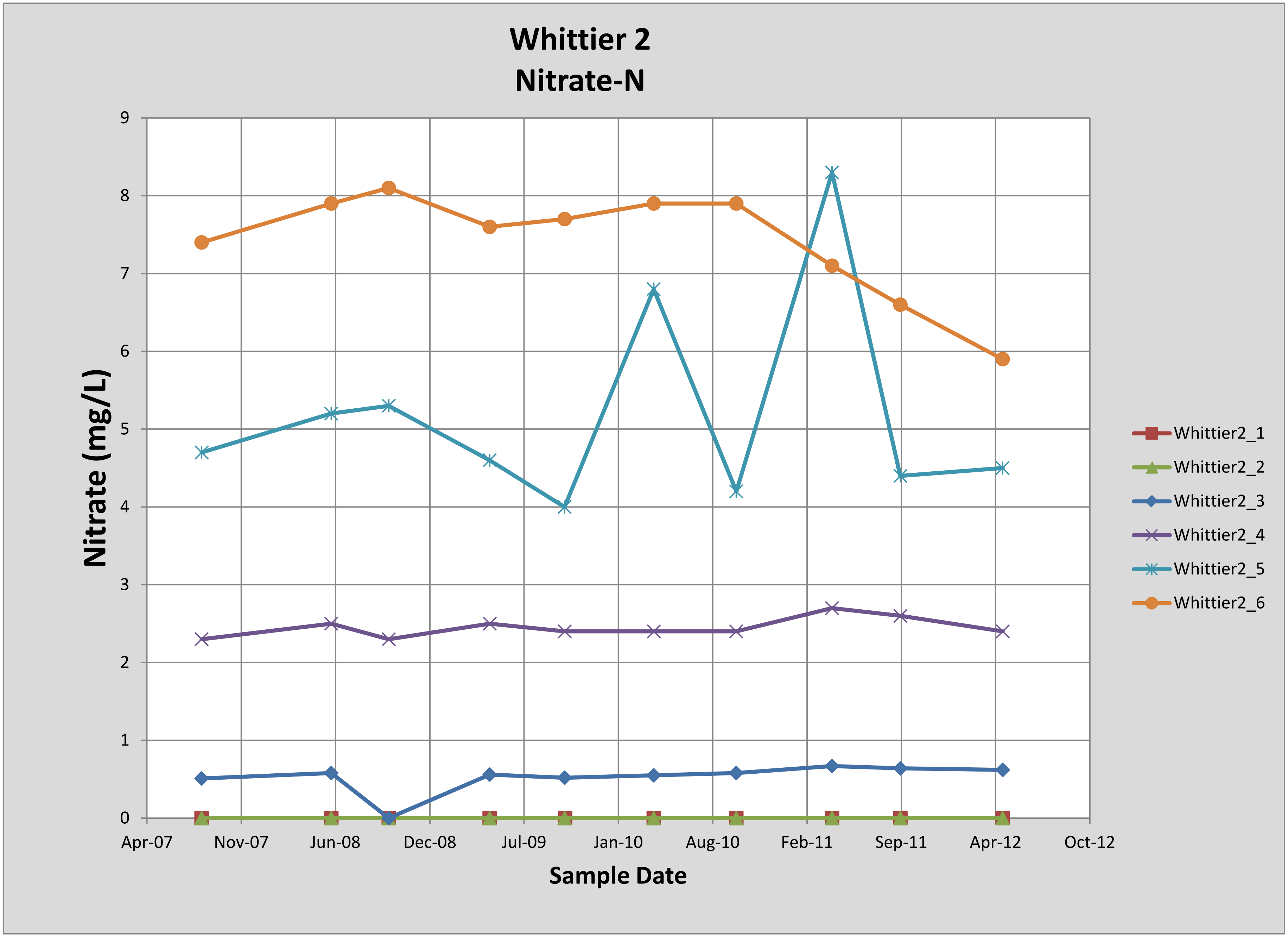


Whittier 1
Nitrate-N
Nitrate (mg/L)
6
5
4
3
2
1
0
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Sample Date
Whittier1_1
Whittier1_2
Whittier1_3
Whittier1_4
Whittier1_5

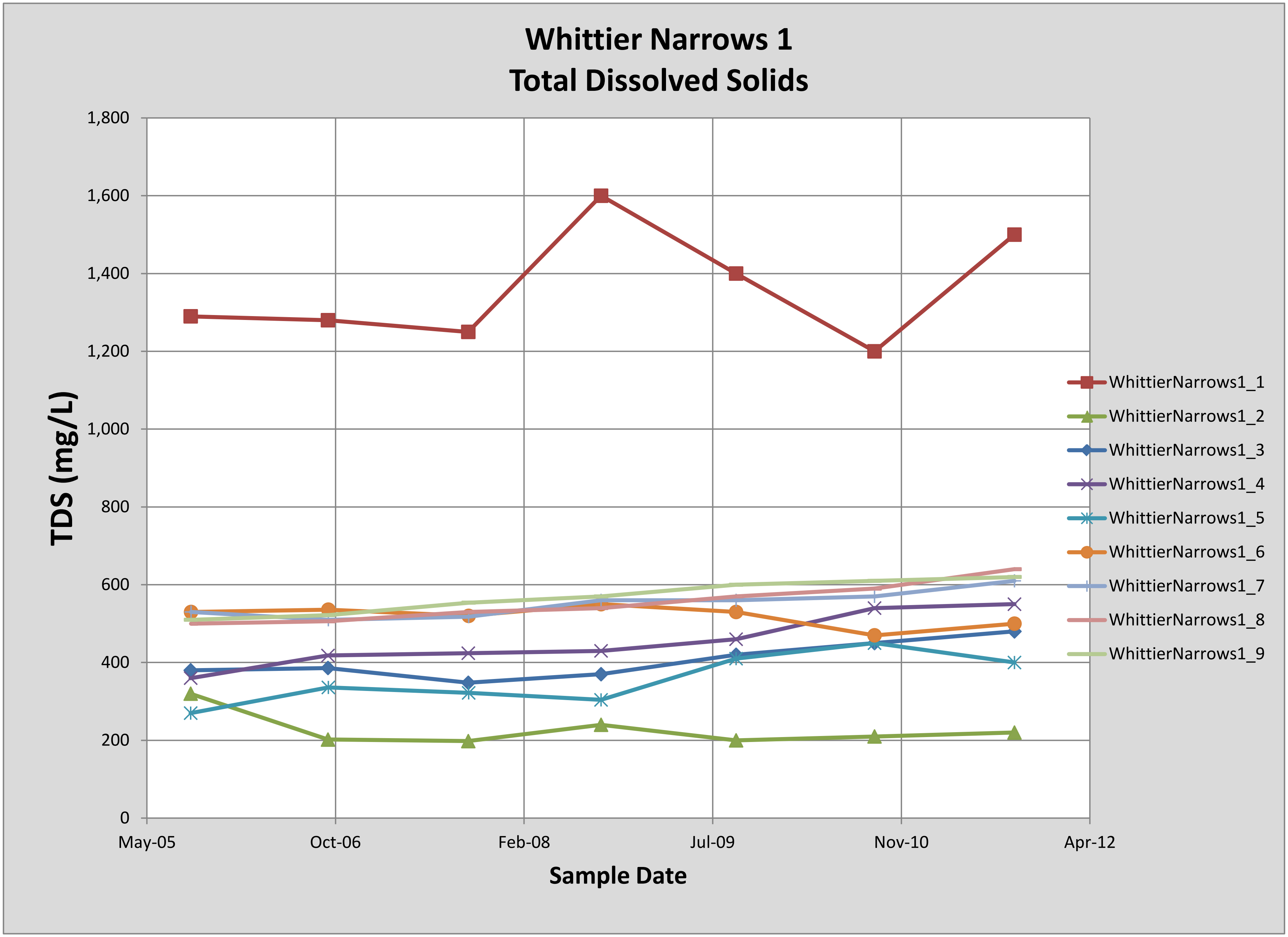

Whittier 2
Total Dissolved Solids
TDS (mg/L)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Sample Date
Whittier2_1
Whittier2_2
Whittier2_3
Whittier2_4
Whittier2_5
Whittier2_6



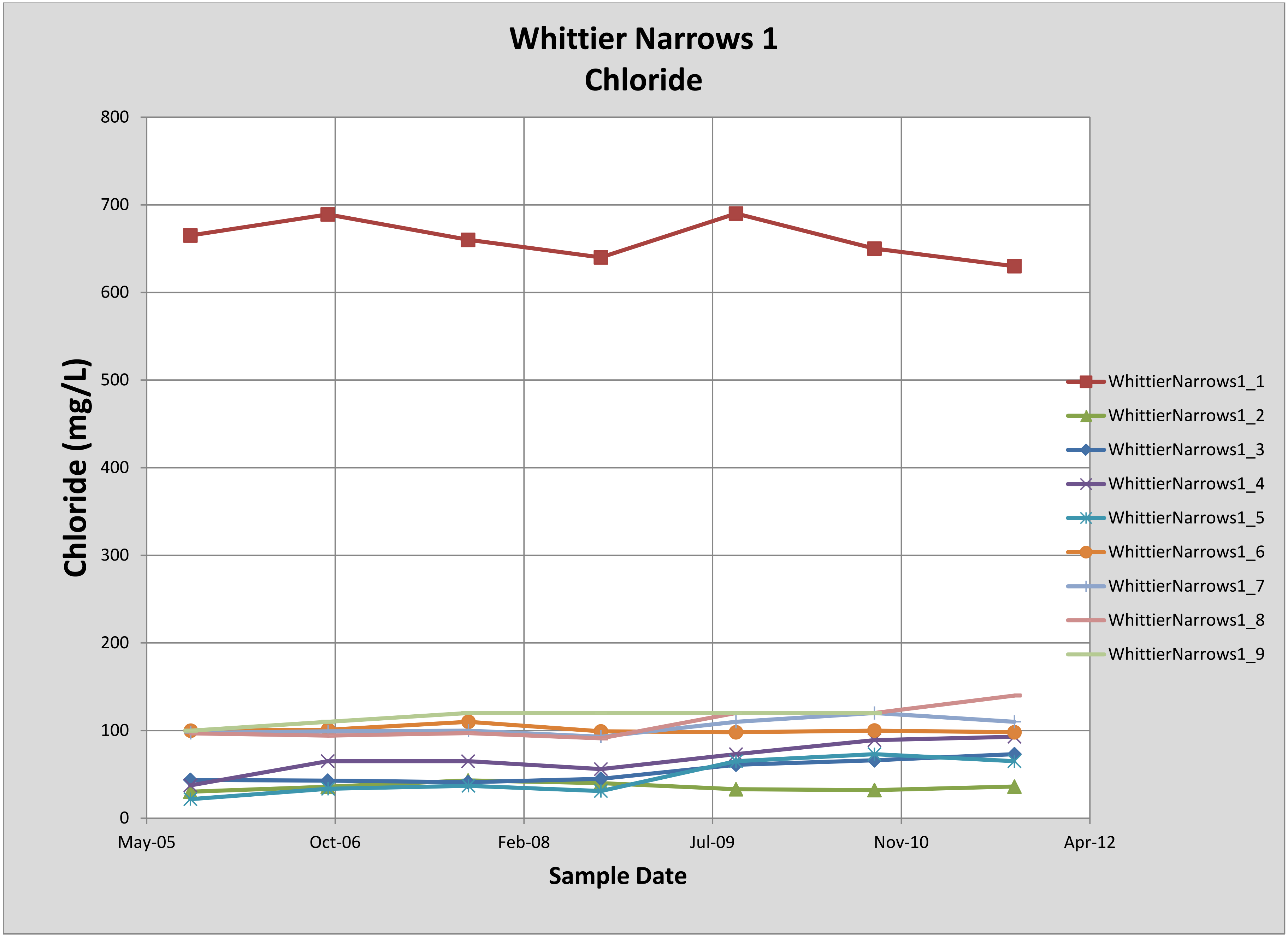
Whittier 2
Chloride
Chloride (mg/L)
300
250
200
150
100
50
0
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Oct-12
Sample Date
Whittier2_1
Whittier2_2
Whittier2_3
Whittier2_4
Whittier2_5
Whittier2_6



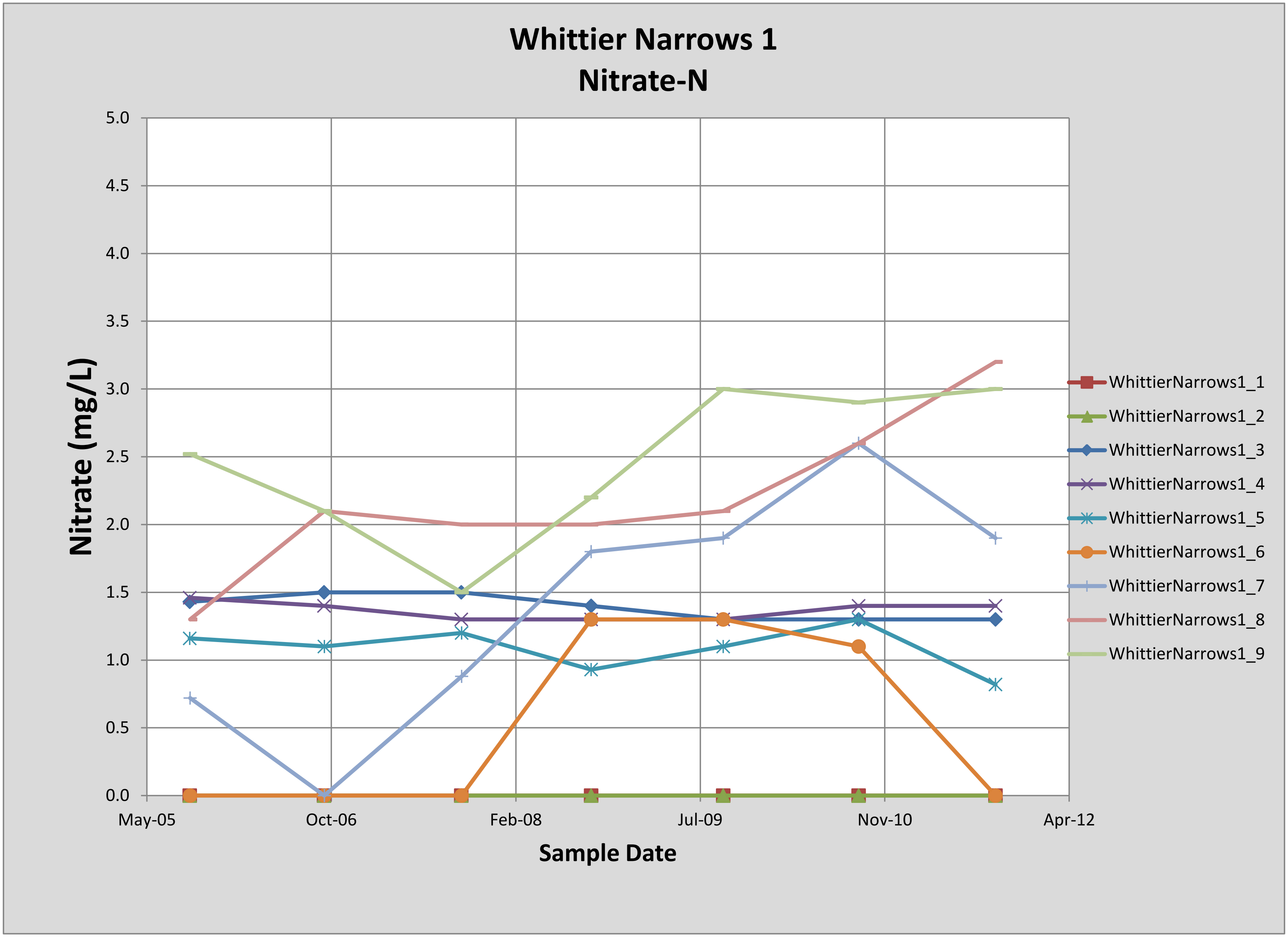
Whittier 2
Nitrate-N
Nitrate (mg/L)
0
1
2
3
4
5
6
7
8
9
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
Sep-11
Apr-12
Oct-12
Sample Date
Whittier2_1
Whittier2_2
Whittier2_3
Whittier2_4
Whittier2_5
Whittier2_6



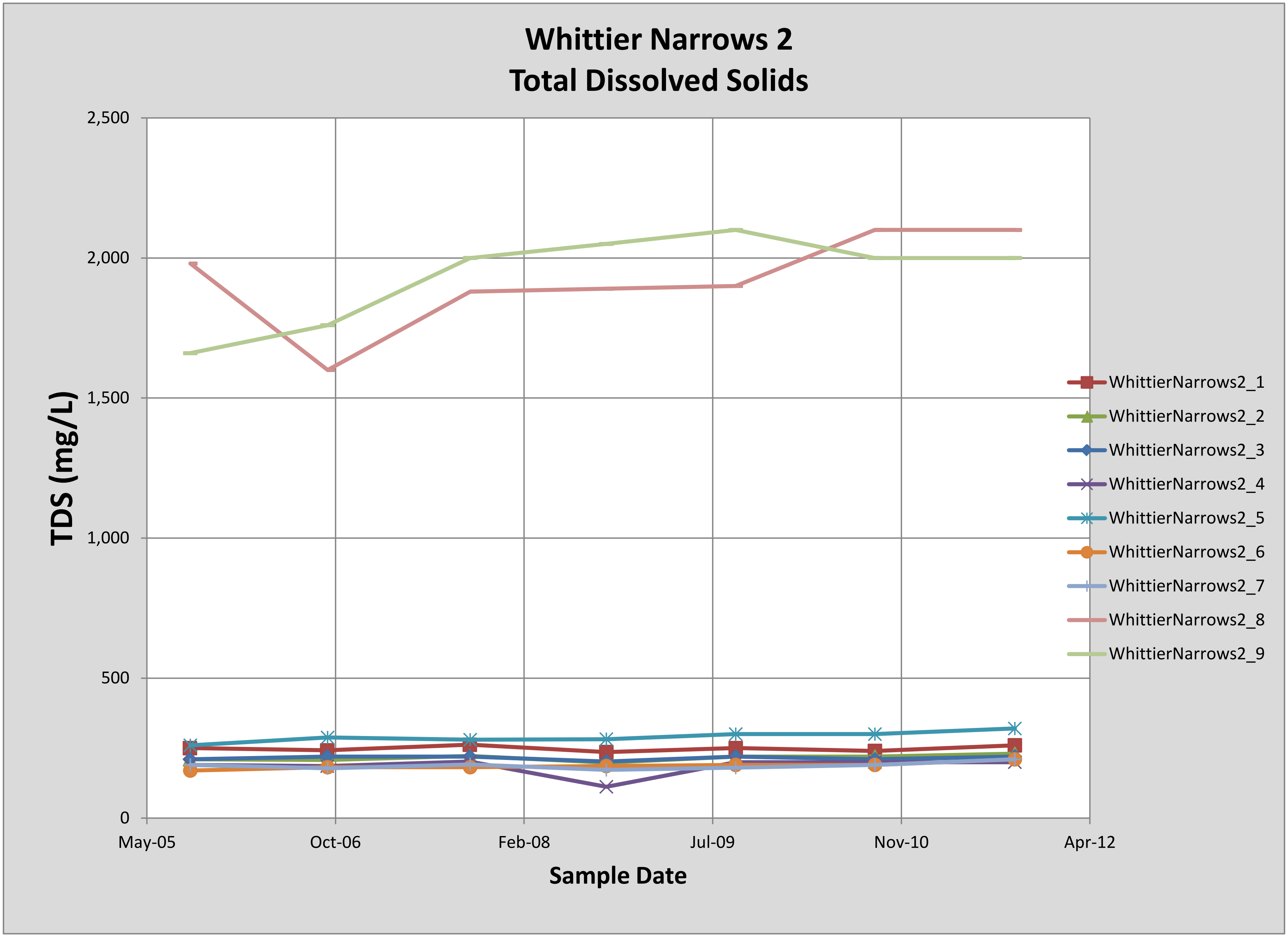
Whittier Narrows 1
Total Dissolved Solids
TDS (mg/L)
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Sample Date
WhittierNarrows1_1
WhittierNarrows1_2
WhittierNarrows1_3
WhittierNarrows1_4
WhittierNarrows1_5
WhittierNarrows1_6
WhittierNarrows1_7
WhittierNarrows1_8
WhittierNarrows1_9



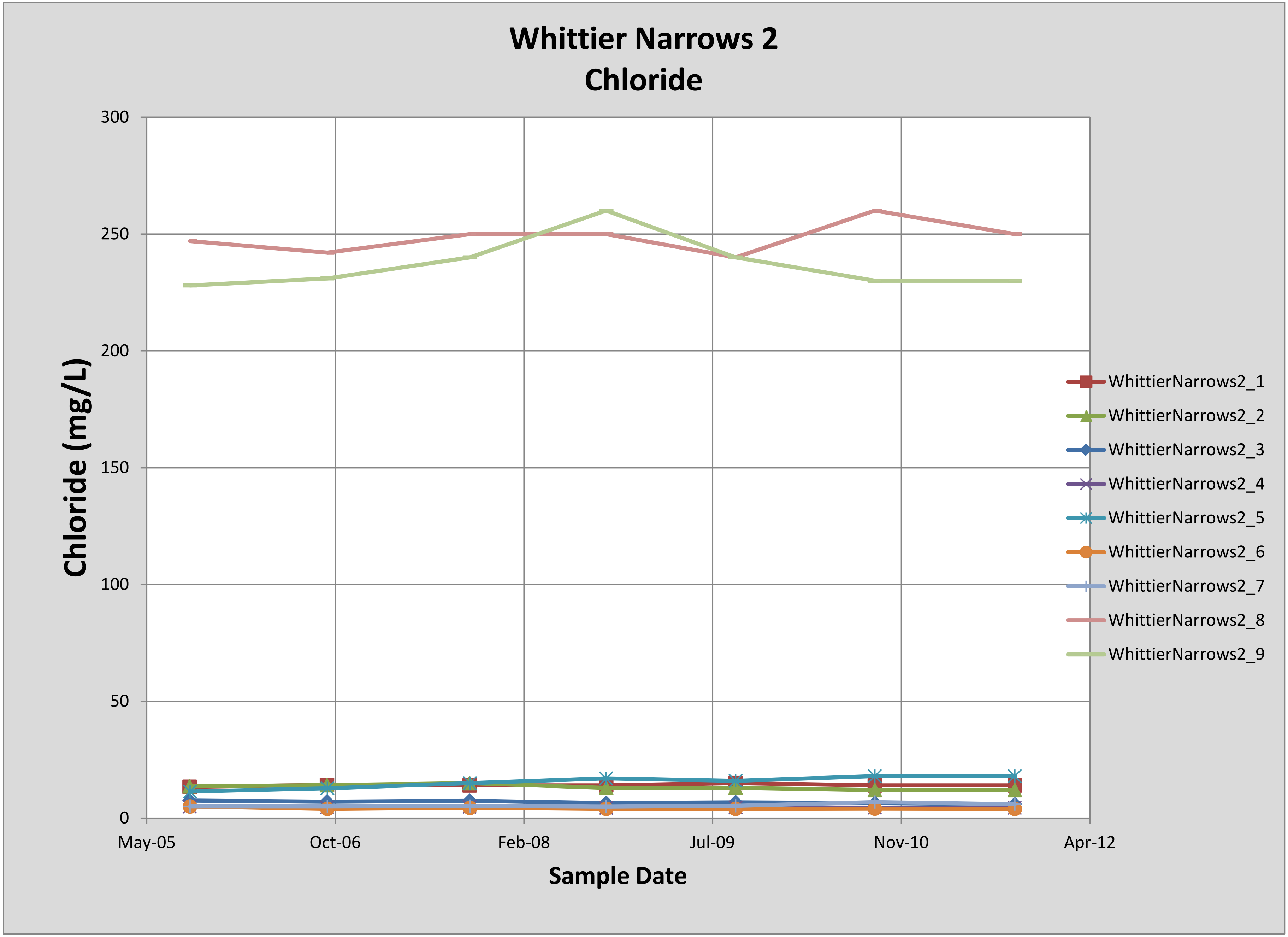
Whittier Narrows 1
Chloride
Chloride (mg/L)
800
700
600
500
400
300
200
100
0
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Sample Date
WhittierNarrows1_1
WhittierNarrows1_2
WhittierNarrows1_3
WhittierNarrows1_4
WhittierNarrows1_5
WhittierNarrows1_6
WhittierNarrows1_7
WhittierNarrows1_8
WhittierNarrows1_9



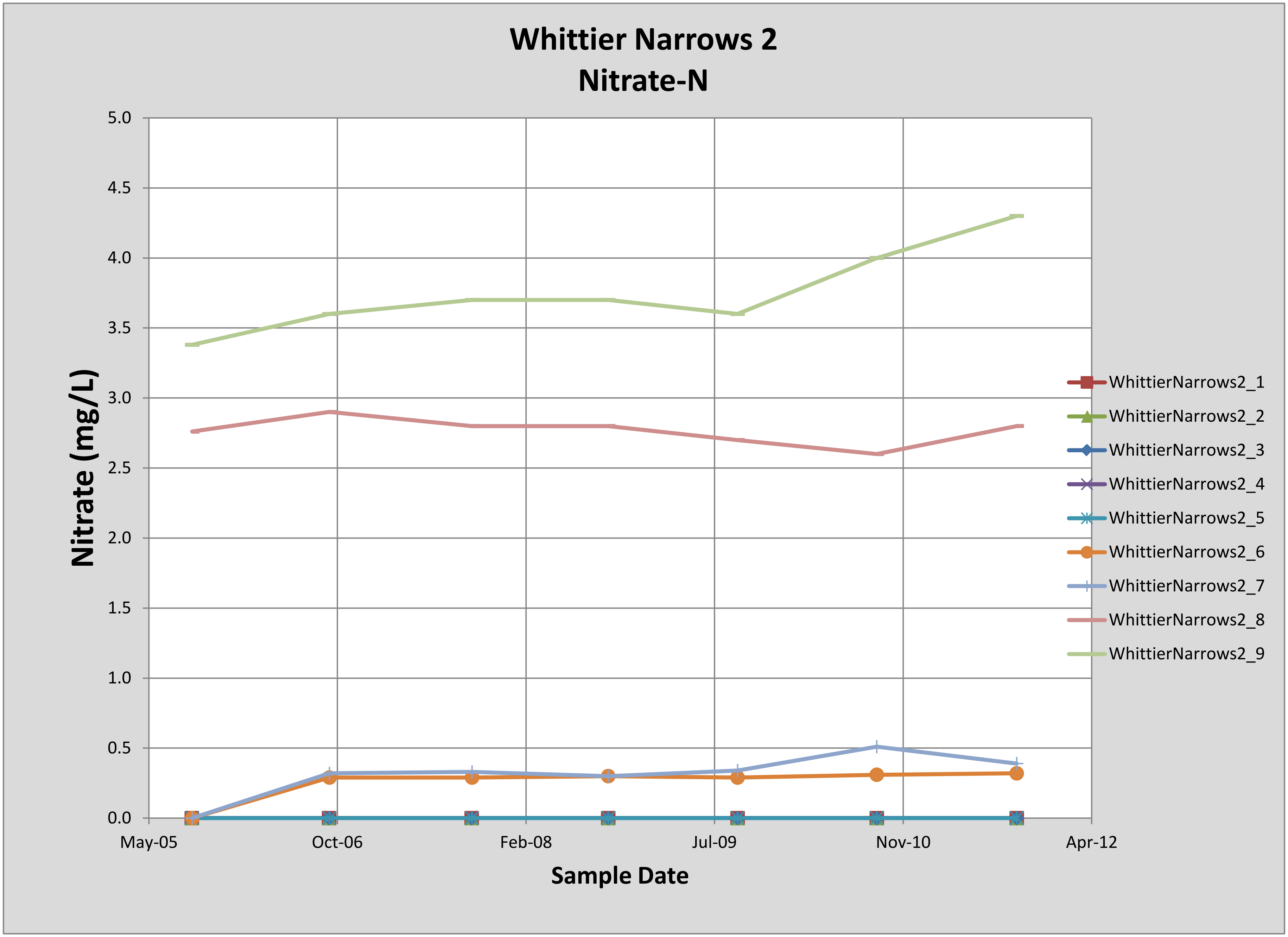
Whittier Narrows 1
Nitrate-N
Nitrate (mg/L)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Sample Date
WhittierNarrows1_1
WhittierNarrows1_2
WhittierNarrows1_3
WhittierNarrows1_4
WhittierNarrows1_5
WhittierNarrows1_6
WhittierNarrows1_7
WhittierNarrows1_8
WhittierNarrows1_9



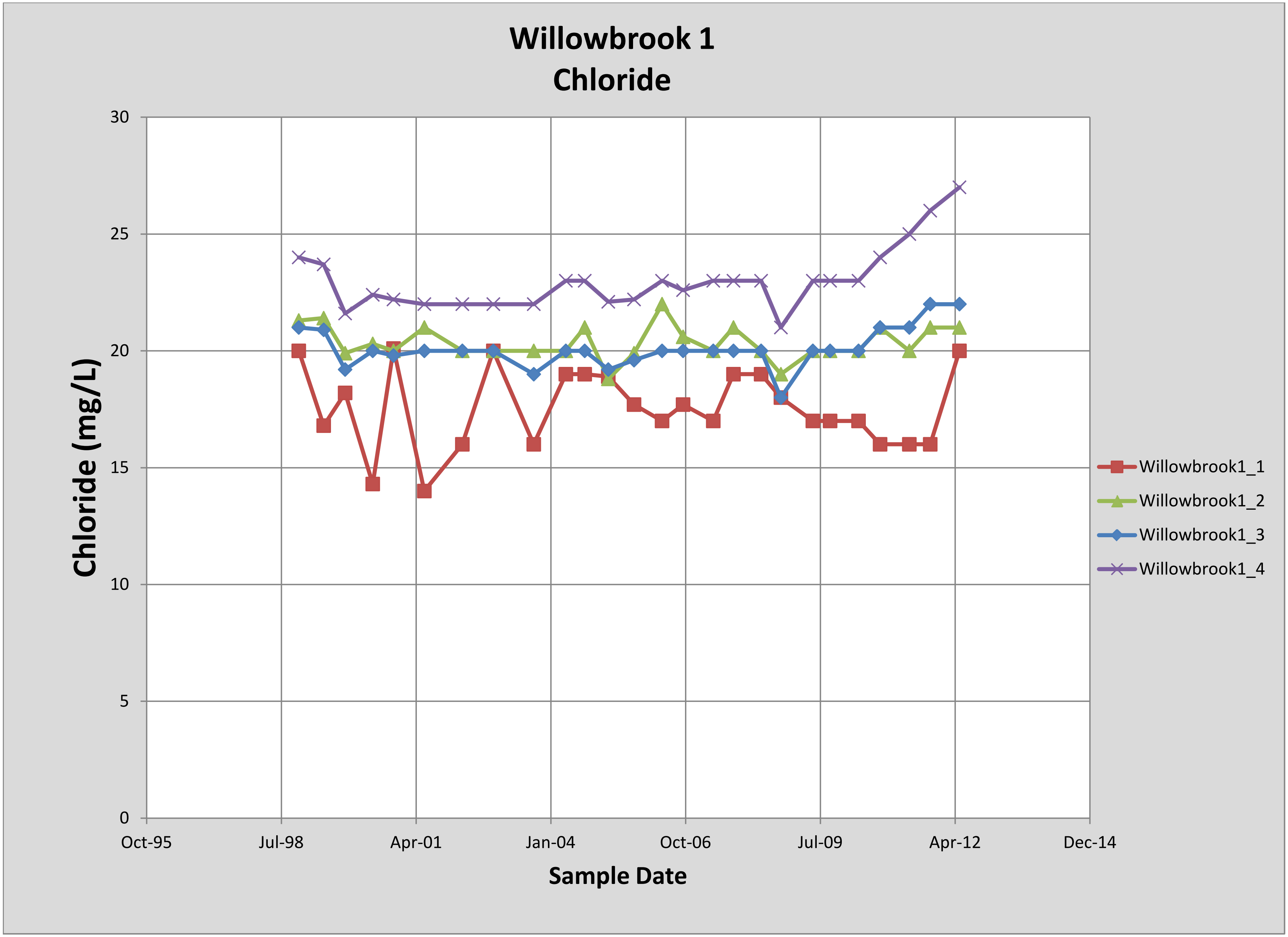
Whittier Narrows 2
Total Dissolved Solids
TDS (mg/L)
2,500
2,000
1,500
1,000
500
0
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Sample Date
WhittierNarrows2_1
WhittierNarrows2_2
WhittierNarrows2_3
WhittierNarrows2_4
WhittierNarrows2_5
WhittierNarrows2_6
WhittierNarrows2_7
WhittierNarrows2_8
WhittierNarrows2_9



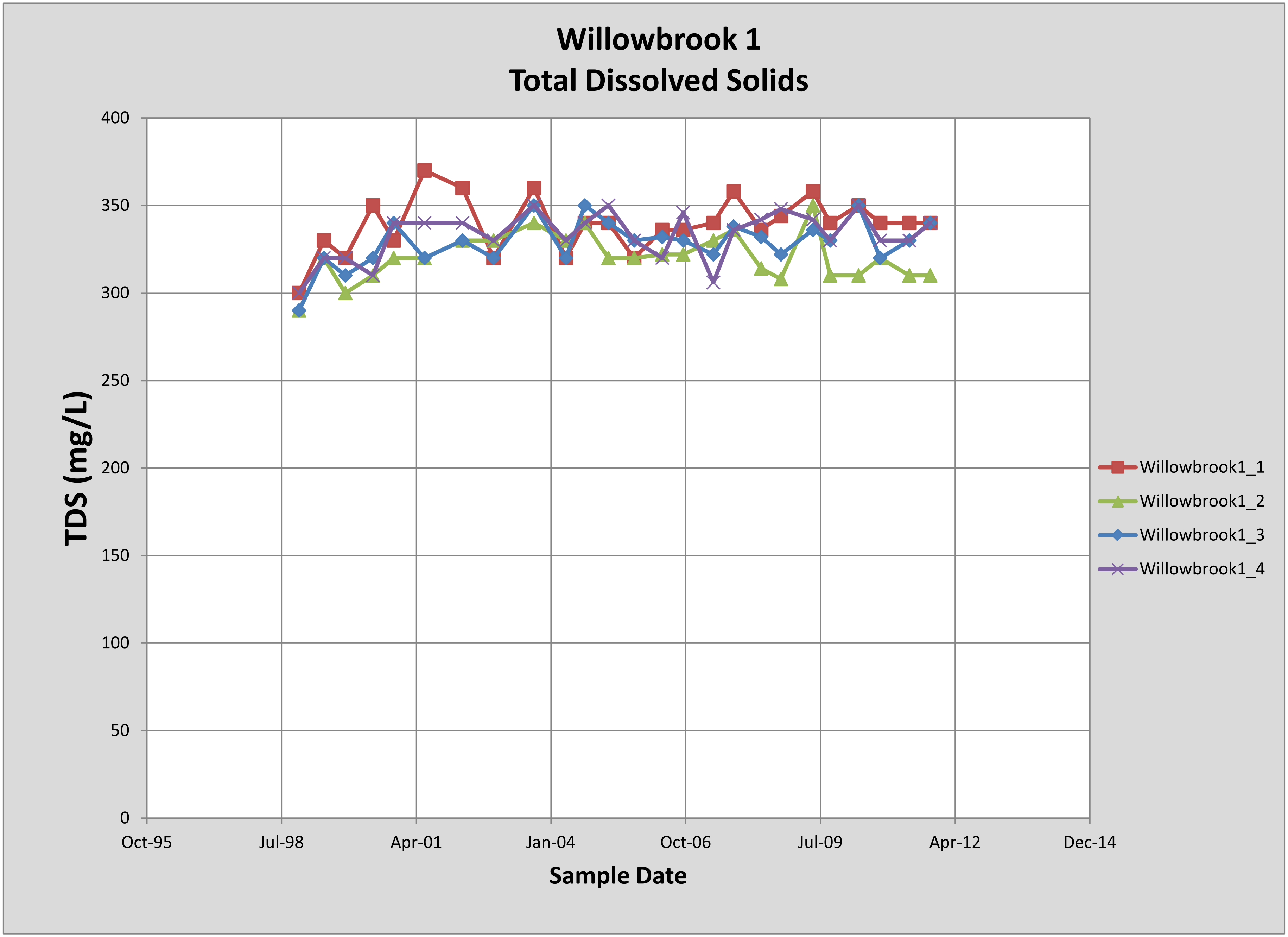
Whittier Narrows 2
Chloride
Chloride (mg/L)
300
250
200
150
100
50
0
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Sample Date
WhittierNarrows2_1
WhittierNarrows2_2
WhittierNarrows2_3
WhittierNarrows2_4
WhittierNarrows2_5
WhittierNarrows2_6
WhittierNarrows2_7
WhittierNarrows2_8
WhittierNarrows2_9

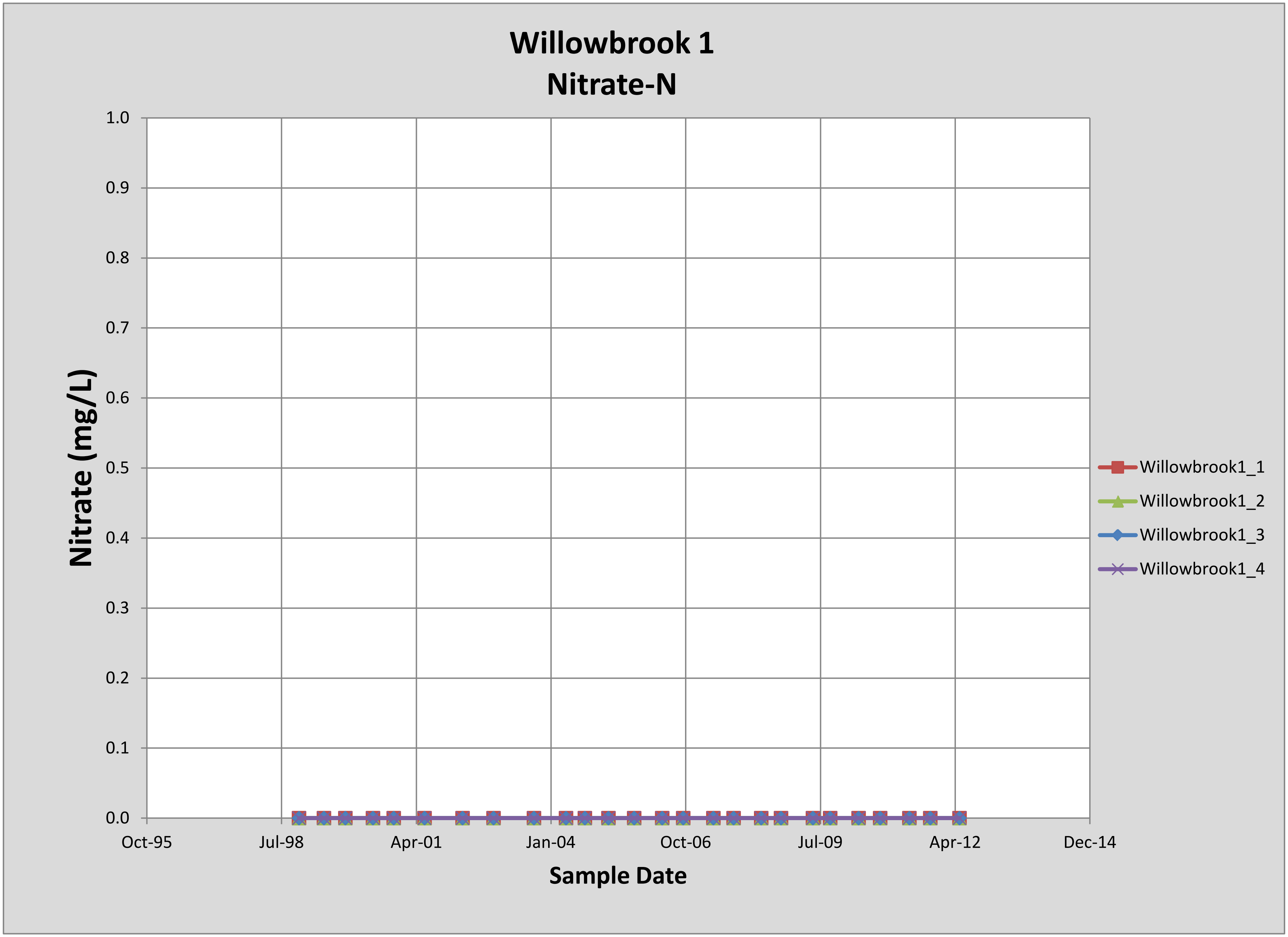


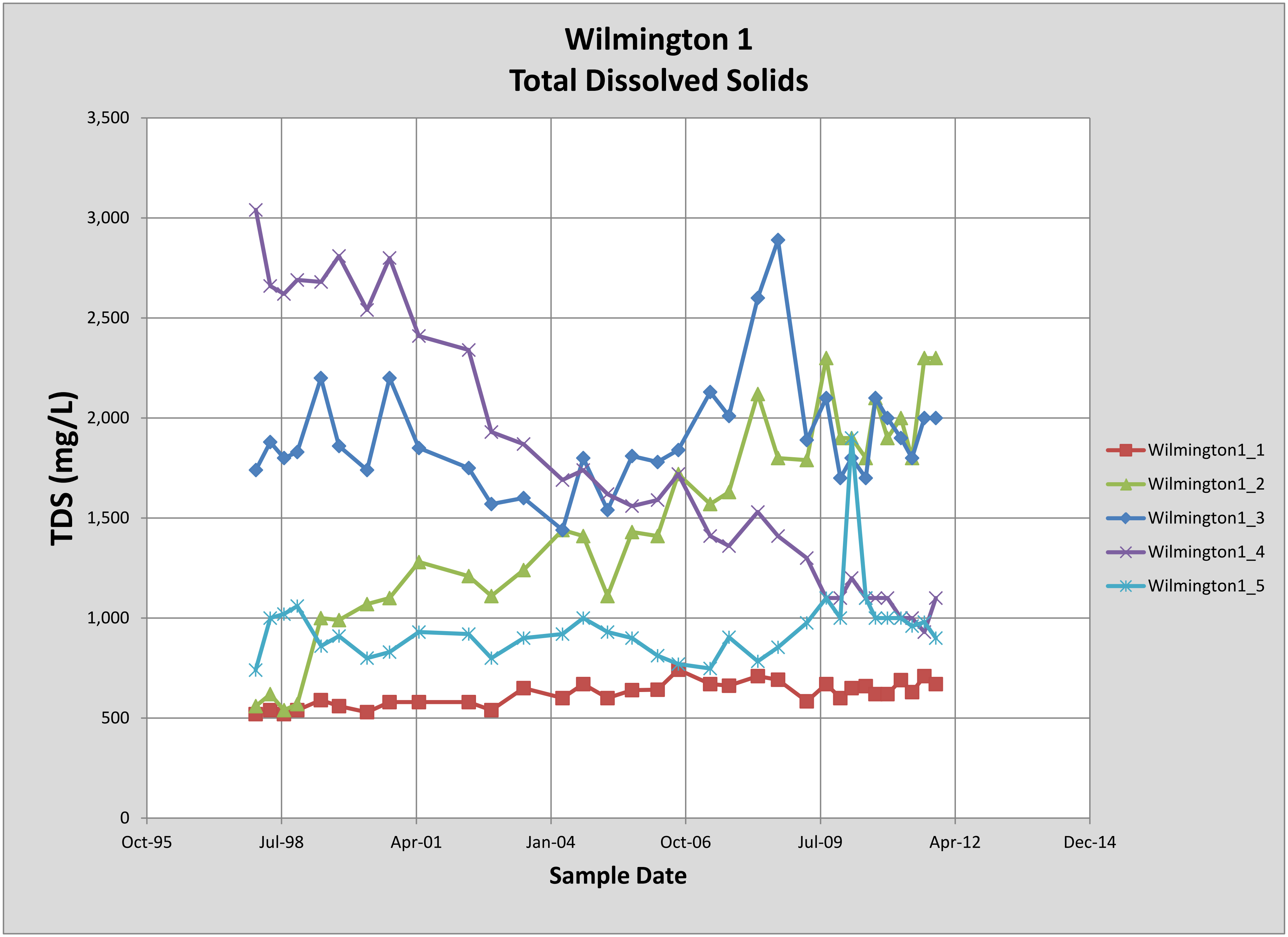
Whittier Narrows 2
Nitrate-N
Nitrate (mg/L)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Sample Date
WhittierNarrows2_1
WhittierNarrows2_2
WhittierNarrows2_3
WhittierNarrows2_4
WhittierNarrows2_5
WhittierNarrows2_6
WhittierNarrows2_7
WhittierNarrows2_8
WhittierNarrows2_9

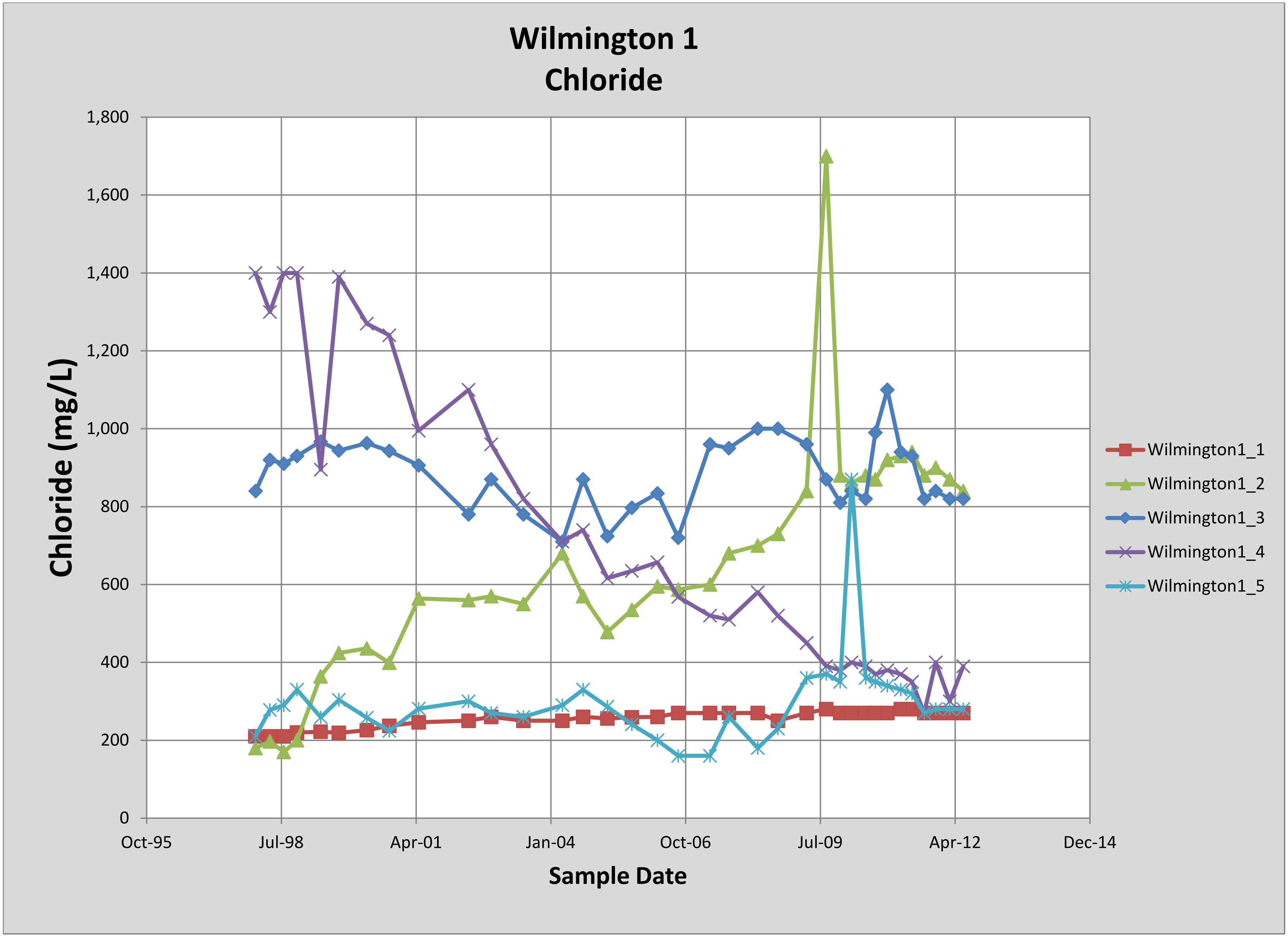


Willowbrook 1
Chloride
Chloride (mg/L)
30
25
20
15
10
5
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Willowbrook1_1
Willowbrook1_2
Willowbrook1_3
Willowbrook1_4

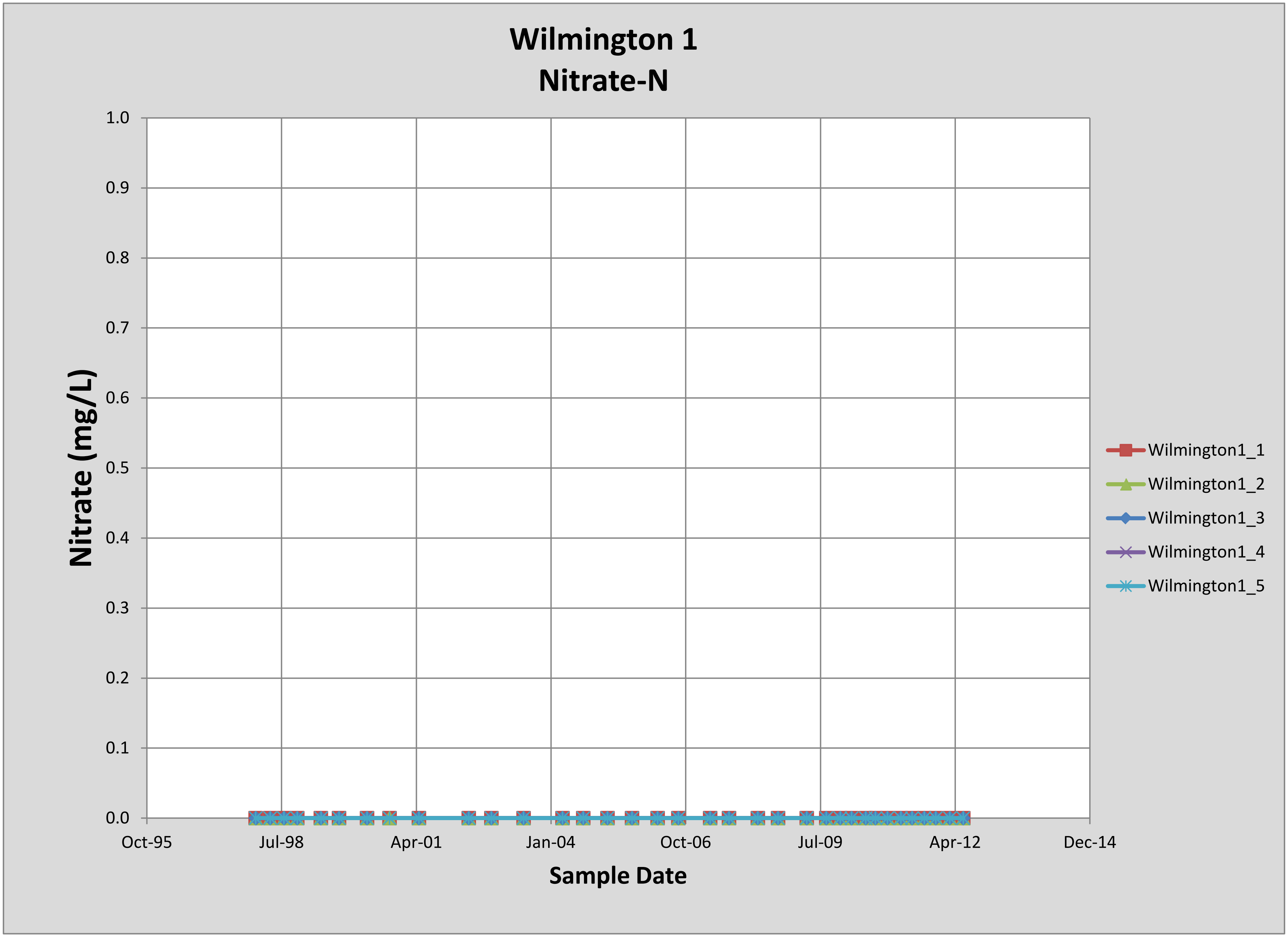

Willowbrook 1
Total Dissolved Solids
TDS (mg/L)
400
350
300
250
200
150
100
50
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Willowbrook1_1
Willowbrook1_2
Willowbrook1_3
Willowbrook1_4

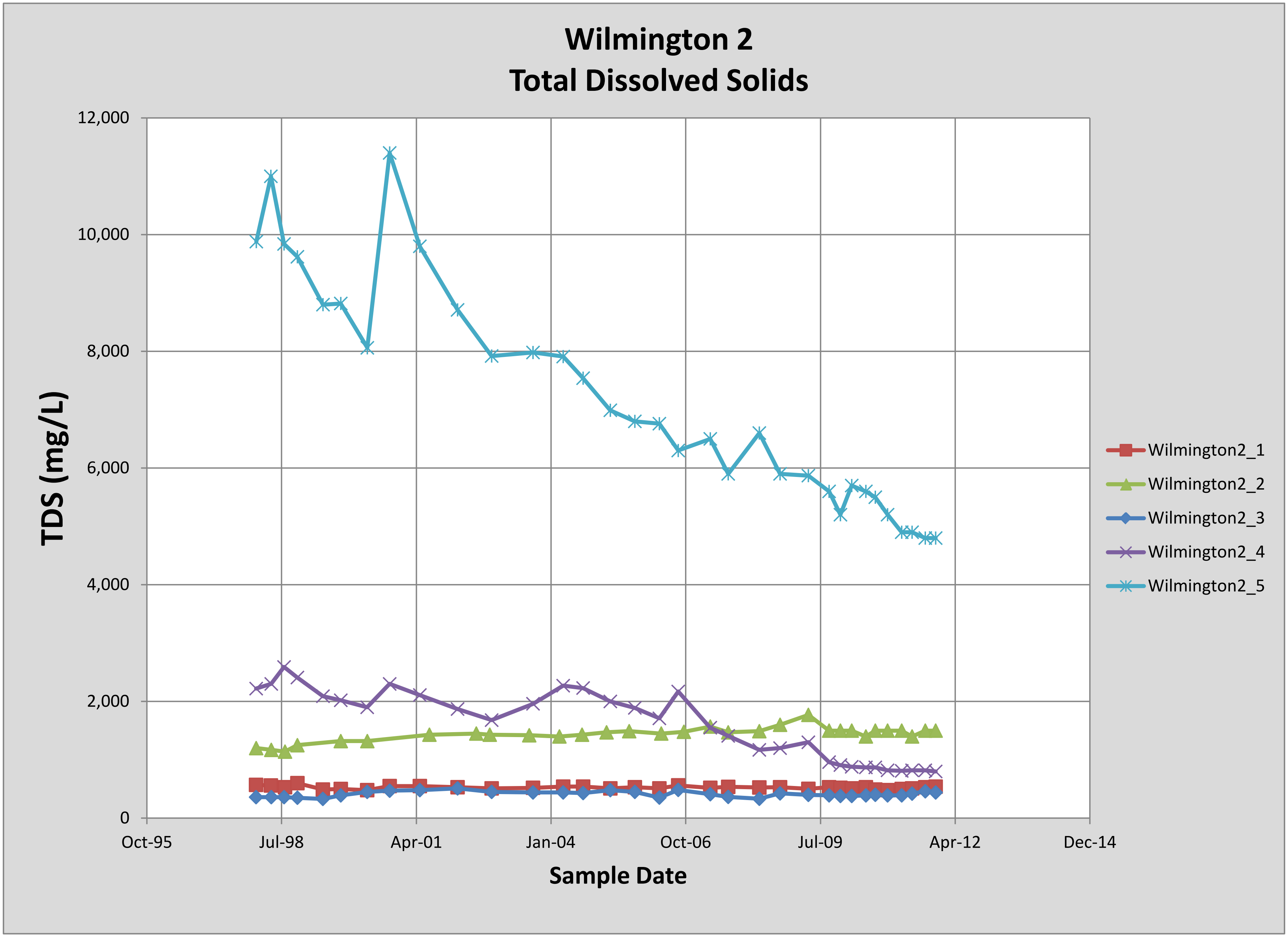

Willowbrook 1
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Willowbrook1_1
Willowbrook1_2
Willowbrook1_3
Willowbrook1_4

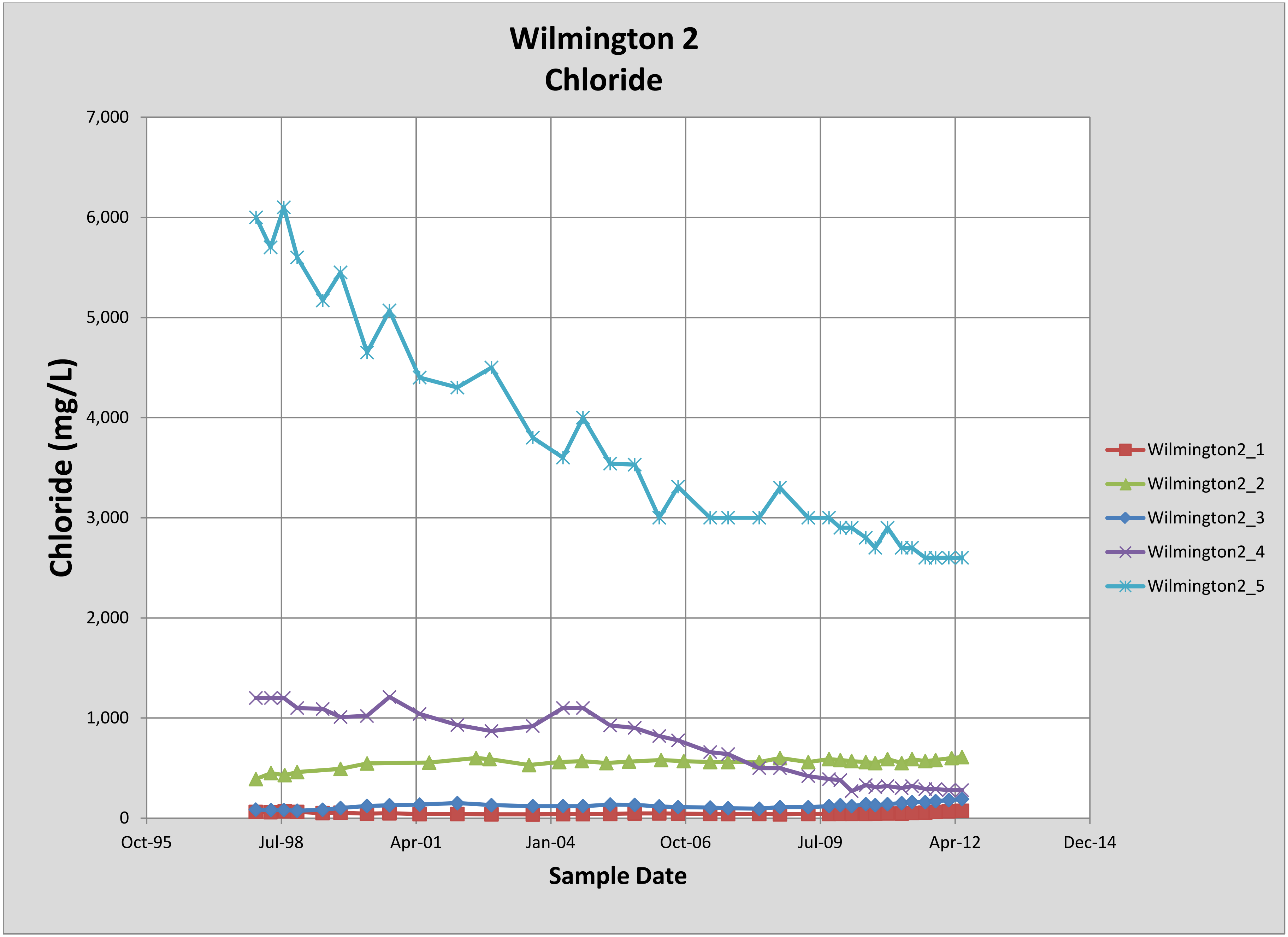

Wilmington 1
Total Dissolved Solids
TDS (mg/L)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Wilmington1_1
Wilmington1_2
Wilmington1_3
Wilmington1_4
Wilmington1_5

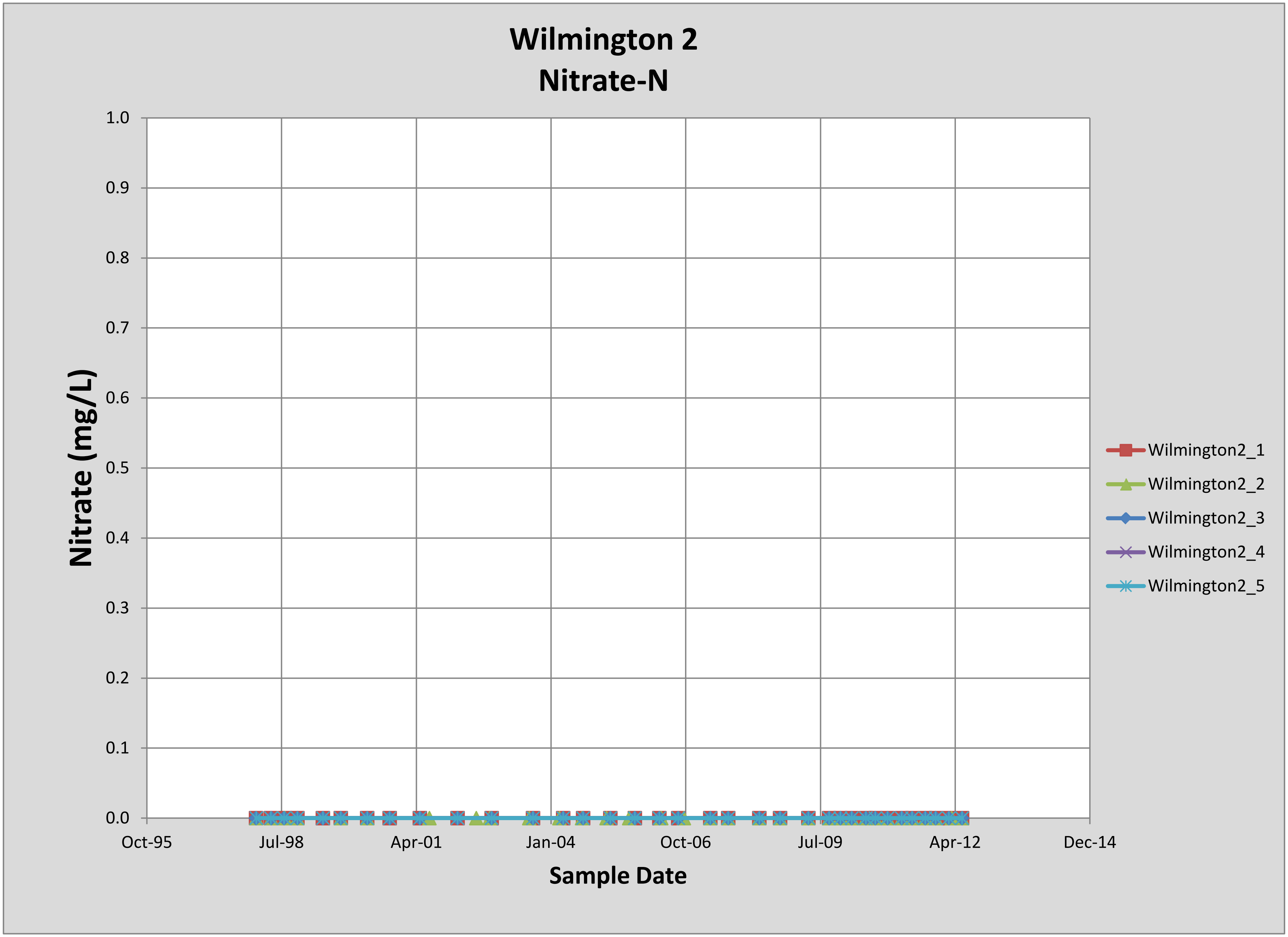


Wilmington 1
Chloride
Chloride (mg/L)
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Wilmington1_1
Wilmington1_2
Wilmington1_3
Wilmington1_4
Wilmington1_5


Wilmington 1
Nitrate-N
Nitrate (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Wilmington1_1
Wilmington1_2
Wilmington1_3
Wilmington1_4
Wilmington1_5


Wilmington 2
Total Dissolved Solids
TDS (mg/L)
12,000
10,000
8,000
6,000
4,000
2,000
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Wilmington2_1
Wilmington2_2
Wilmington2_3
Wilmington2_4
Wilmington2_5


Wilmington 2
Chloride
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Chloride (mg/L)
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Wilmington2_1
Wilmington2_2
Wilmington2_3
Wilmington2_4
Wilmington2_5



Wilmington 2
Nitrate-N
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Nitrate (mg/L)
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sample Date
Wilmington2_1
Wilmington2_2
Wilmington2_3
Wilmington2_4
Wilmington2_5

Attachment I-C

Baseline and Future Salt and Nutrient Balance Tables

List of Tables

Table I-C-1 TDS Balance for Central Basin – Baseline Period

CENTRAL BASIN GROUNDWATER TDS BALANCE											
Water Year	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**Average**
Inflow of TDS Mass to Groundwater (in tons)											
Spreading Grounds	62,304	80,722	69,001	53,213	79,173	88,504	60,568	50,083	44,366	70,873	65,880
Seawater Barrier	2,090	3,333	1,953	2,207	1,804	567	660	3,156	4,093	2,404	2,227
Precipitation Infiltration	5,067	0	5,087	2,620	5,159	3,635	82	5,198	2,983	4,462	3,429
Mountain Front Recharge	3,248	0	3,248	1,331	2,693	4,658	938	2,624	1,639	1,532	2,191
Irrigation Return Flows	29,980	36,283	31,346	32,487	29,401	28,889	30,401	33,996	32,598	31,047	31,643
Subsurface Inflow	26,111	29,934	27,187	30,008	21,632	25,875	30,974	31,433	35,973	35,657	29,478
Total Inflow	128,800	150,271	137,823	121,866	139,863	152,129	123,623	126,490	121,652	145,974	134,849
Outflow of TDS Mass from Groundwater (in tons)											
Groundwater Production	-130,175	-133,676	-126,435	-132,801	-125,559	-126,454	-131,083	-135,824	-129,100	-129,309	-130,042
Subsurface Outflow	-4,862	-4,789	-4,913	-4,003	-3,503	-3,413	-3,359	-2,559	-2,702	-2,107	-3,621
Total Outflow	-135,036	-138,466	-131,348	-136,805	-129,062	-129,867	-134,443	-138,383	-131,802	-131,416	-133,663
Change in TDS Mass in Groundwater (in tons)											
Annual Change in Mass	-6,236	11,806	6,475	-14,939	10,801	22,261	-10,819	-11,893	-10,150	14,558	1,186
Cumulative Change in Mass	-6,236	5,569	12,044	-2,894	7,906	30,168	19,348	7,455	-2,695	11,863	

Negative numbers indicate loss or reduction

Table I-C-2 Chloride Balance for Central Basin – Baseline Period

CENTRAL BASIN GROUNDWATER CHLORIDE BALANCE											
Water Year	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**Average**
Inflow of Chloride Mass to Groundwater (in tons)											
Spreading Grounds	12,496	16,689	14,185	11,602	10,251	17,181	14,137	10,647	9,494	14,571	13,125
Seawater Barrier	491	663	549	572	341	102	128	564	656	400	447
Precipitation Infiltration	676	0	678	349	688	485	11	693	398	595	457
Mountain Front Recharge	505	0	505	133	176	770	217	421	265	153	314
Irrigation Return Flows	4,454	5,152	5,136	5,157	4,219	4,106	4,367	4,825	4,385	4,205	4,601
Subsurface Inflow	3,732	3,731	3,477	3,837	2,618	3,386	4,034	4,927	5,032	5,346	4,012
Total Inflow	22,354	26,235	24,529	21,651	18,292	26,029	22,895	22,077	20,230	25,270	22,956
Outflow of Chloride Mass from Groundwater (in tons)											
Groundwater Production	-16,419	-16,966	-16,141	-16,963	-16,226	-16,433	-17,097	-17,631	-16,890	-17,100	-16,787
Subsurface Outflow	-724	-709	-715	-596	-513	-507	-503	-391	-399	-309	-537
Total Outflow	-17,143	-17,675	-16,857	-17,559	-16,739	-16,940	-17,600	-18,022	-17,289	-17,409	-17,323
Change in Chloride Mass in Groundwater (in tons)											
Annual Change in Mass	5,211	8,560	7,673	4,093	1,553	9,090	5,294	4,055	2,941	7,861	5,633
Cumulative Change in Mass	5,211	13,771	21,444	25,537	27,090	36,179	41,474	45,528	48,470	56,330	

Negative numbers indicate loss or reduction

Table I-C-3 Nitrate Balance for Central Basin – Baseline Period

CENTRAL BASIN GROUNDWATER NITRATE BALANCE											
Water Year	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**Average**
Inflow of Nitrate Mass to Groundwater (in tons)											
Spreading Grounds	307.6	312.6	316.5	292.0	337.8	458.0	237.6	252.2	262.7	299.4	307.6
Seawater Barrier	3.7	3.7	3.9	4.9	3.4	2.4	2.9	6.7	7.6	8.3	4.8
Precipitation Infiltration	6.1	0.0	6.7	2.9	5.6	2.8	0.1	8.1	2.3	3.8	3.8
Mountain Front Recharge	19.8	0.0	19.8	8.5	13.8	36.1	4.2	15.1	12.0	7.1	13.6
Irrigation Return Flows	4.9	5.3	5.1	5.3	4.7	4.8	5.0	4.8	4.4	4.3	4.9
Subsurface Inflow	73.8	87.5	82.2	89.5	51.2	70.7	85.6	91.7	96.9	113.1	84.2
Total Inflow	415.8	409.1	434.2	403.2	416.6	574.8	335.3	378.6	386.0	435.9	419.0
Outflow of Nitrate Mass from Groundwater (in tons)											
Groundwater Production	-104.9	-107.5	-104.7	-107.7	-107.4	-111.0	-114.3	-115.4	-112.6	-117.8	-110.3
Subsurface Outflow	-1.1	-1.2	-1.2	-1.0	-0.9	-0.9	-0.9	-0.7	-0.8	-0.6	-0.9
Total Outflow	-106.0	-108.7	-106.0	-108.7	-108.3	-111.9	-115.2	-116.1	-113.4	-118.4	-111.3
Change in Nitrate Mass in Groundwater (in tons)											
Annual Change in Mass	309.8	300.4	328.2	294.5	308.3	462.9	220.1	262.5	272.6	317.5	307.7
Cumulative Change in Mass	309.8	610.2	938.4	1,232.9	1,541.2	2,004.1	2,224.2	2,486.7	2,759.3	3,076.8	

Negative numbers indicate loss or reduction

Table I-C-4 TDS Balance for West Coast Basin – Baseline Period

WEST COAST BASIN GROUNDWATER TDS BALANCE											
Water Year	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**Average**
Inflow of TDS Mass to Groundwater (in tons)											
Spreading Grounds	124	165	59	35	39	15	0	198	550	89	127
Seawater Barriers	10,106	12,076	8,873	5,541	5,669	5,067	6,519	9,516	12,102	12,833	8,830
Precipitation Infiltration	2,531	0	2,616	1,361	2,620	1,857	51	2,465	1,196	2,195	1,689
Mountain Front Recharge	1,205	0	1,222	490	1,010	1,748	356	931	517	557	804
Irrigation Return Flows	11,707	13,003	11,934	11,392	10,892	10,314	10,457	15,818	16,471	15,172	12,716
Subsurface Inflow	28,992	27,019	28,447	30,588	27,237	23,160	23,672	21,959	27,015	21,148	25,924
Total Inflow	54,665	52,263	53,150	49,407	47,467	42,162	41,055	50,886	57,851	51,995	50,090
Outflow of TDS Mass from Groundwater (in tons)											
Groundwater Production	-70,048	-65,151	-66,727	-61,968	-52,811	-47,729	-49,208	-49,983	-58,897	-56,844	-57,937
Subsurface Outflow	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-70,048	-65,151	-66,727	-61,968	-52,811	-47,729	-49,208	-49,983	-58,897	-56,844	-57,937
Change in TDS Mass in Groundwater (in tons)											
Annual Change in Mass	-15,383	-12,888	-13,577	-12,561	-5,344	-5,567	-8,153	903	-1,046	-4,849	-7,847
Cumulative Change in Mass	-15,383	-28,271	-41,848	-54,409	-59,753	-65,320	-73,473	-72,570	-73,617	-78,466	

Negative numbers indicate loss or reduction

Table I-C-5 Chloride Balance for West Coast Basin – Baseline Period

WEST COAST BASIN GROUNDWATER CHLORIDE BALANCE											
Water Year	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**Average**
Inflow of Chloride Mass to Groundwater (in tons)											
Spreading Grounds	19	18	9	4	4	2	0	25	79	10	17
Seawater Barriers	2,076	2,521	2,370	2,377	1,042	1,175	1,473	1,963	2,062	2,711	1,977
Precipitation Infiltration	337	0	349	181	349	248	7	329	159	293	225
Mountain Front Recharge	187	0	190	49	66	289	82	149	84	56	115
Irrigation Return Flows	3,380	3,217	3,677	3,330	2,698	2,488	2,705	3,506	3,471	3,324	3,179
Subsurface Inflow	15,535	13,977	14,793	16,237	14,234	11,883	12,198	11,475	14,410	11,113	13,586
Total Inflow	21,535	19,733	21,388	22,178	18,393	16,084	16,465	17,446	20,265	17,506	19,099
Outflow of Chloride Mass from Groundwater (in tons)											
Groundwater Production	-35,061	-32,610	-33,399	-31,017	-26,434	-23,890	-24,630	-25,018	-29,480	-28,452	-28,999
Subsurface Outflow	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-35,061	-32,610	-33,399	-31,017	-26,434	-23,890	-24,630	-25,018	-29,480	-28,452	-28,999
Change in Chloride Mass in Groundwater (in tons)											
Annual Change in Mass	-13,526	-12,877	-12,012	-8,839	-8,040	-7,806	-8,165	-7,572	-9,215	-10,946	-9,900
Cumulative Change in Mass	-13,526	-26,403	-38,415	-47,254	-55,294	-63,100	-71,265	-78,837	-88,052	-98,998	

Negative numbers indicate loss or reduction

Table I-C-6 Nitrate Balance for West Coast Basin – Baseline Period

WEST COAST BASIN GROUNDWATER NITRATE BALANCE											
Water Year	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**Average**
Inflow of Nitrate Mass to Groundwater (in tons)											
Spreading Grounds	0.5	0.5	0.6	0.2	0.2	0.1	0.0	1.8	3.9	0.5	0.8
Seawater Barriers	16.9	17.1	15.3	13.2	10.2	13.0	17.0	17.8	13.3	19.0	15.3
Precipitation Infiltration	3.0	0.0	3.4	1.5	2.8	1.4	0.1	3.9	0.9	1.9	1.9
Mountain Front Recharge	7.3	0.0	7.4	3.1	5.2	13.6	1.6	5.3	3.8	2.6	5.0
Irrigation Return Flows	2.4	2.0	2.3	2.3	2.2	2.2	2.3	2.1	2.0	1.9	2.2
Subsurface Inflow	9.9	8.4	11.2	10.8	11.9	11.4	9.7	11.5	11.2	11.5	10.7
Total Inflow	40.1	28.1	40.3	31.2	32.5	41.6	30.6	42.5	35.0	37.3	35.9
Outflow of Nitrate Mass from Groundwater (in tons)											
Groundwater Production	-3.8	-3.8	-4.1	-4.0	-3.5	-3.3	-3.8	-4.0	-4.9	-5.0	-4.0
Subsurface Outflow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Outflow	-3.8	-3.8	-4.1	-4.0	-3.5	-3.3	-3.8	-4.0	-4.9	-5.0	-4.0
Change in Nitrate Mass in Groundwater (in tons)											
Annual Change in Mass	36.2	24.4	36.1	27.2	29.0	38.3	26.9	38.5	30.1	32.3	31.9
Cumulative Change in Mass	36.2	60.6	96.7	123.9	152.9	191.2	218.1	256.5	286.6	318.9	

Negative numbers indicate loss or reduction

Table I-C-7 TDS Balance for Central Basin, No Future Projects (Scenario 1) – Future Planning Period

Water Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
CENTRAL BASIN GROUNDWATER TDS BALANCE																
Inflow of TDS Mass to Groundwater (in tons)																
Spreading Grounds	67,286	67,286	67,286	67,286	67,286	67,286	67,286	67,286	67,286	67,286	67,286	67,286	67,286	67,286	67,286	67,286
Seawater Barrier	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091
Precipitation Infiltration	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429
Mountain Front Recharge	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302
Irrigation Return Flows	31,719	31,719	31,719	31,719	31,719	31,719	31,719	31,719	31,719	31,719	31,719	31,719	31,719	31,719	31,719	31,719
Subsurface Inflow	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359
Total Inflow	135,186	135,186	135,186	135,186	135,186	135,186	135,186	135,186	135,186	135,186	135,186	135,186	135,186	135,186	135,186	135,186
Outflow of TDS Mass from Groundwater (in tons)																
Groundwater Production	-129,943	-130,074	-130,143	-130,172	-130,183	-130,189	-130,200	-130,220	-130,252	-130,295	-130,350	-130,416	-130,490	-130,572	-130,660	-130,277
Subsurface Outflow	-3,670	-3,672	-3,664	-3,654	-3,643	-3,633	-3,625	-3,618	-3,613	-3,609	-3,606	-3,604	-3,603	-3,603	-3,603	-3,628
Total Outflow	-133,614	-133,745	-133,807	-133,826	-133,825	-133,822	-133,825	-133,838	-133,865	-133,905	-133,957	-134,020	-134,093	-134,174	-134,263	-133,905
Change in TDS Mass in Groundwater (in tons)																
Annual Change in Mass	1,573	1,441	1,380	1,361	1,361	1,365	1,362	1,348	1,322	1,282	1,230	1,166	1,093	1,012	924	1,281
Cumulative Change in Mass	1,573	3,014	4,393	5,754	7,115	8,480	9,842	11,190	12,512	13,794	15,023	16,190	17,283	18,295	19,219	
Simulated TDS Groundwater Quality																
Groundwater Quality (mg/L)	528.8	529.1	529.5	529.8	530.1	530.4	530.7	531.0	531.3	531.6	531.9	532.2	532.5	532.8	533.1	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.3	0.6	1.0	1.3	1.6	1.9	2.2	2.5	2.8	3.1	3.4	3.7	4.0	4.3	4.6	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

The annual TDS, chloride, and nitrate loads in No Future Projects Scenario are slightly different than the 10-year baseline average loads because the simple average (not weighted-average) baseline concentration was applied to future volumes; this is reasonable because there is no strong correlation between concentration and flow volume for each factor during the baseline period

Table I-C-8 Chloride Balance for Central Basin, No Future Projects (Scenario 1) – Future Planning Period

Water Year	CENTRAL BASIN GROUNDWATER CHLORIDE BALANCE															
	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	**2023-24**	**2024-25**	**Average**
	Inflow of Chloride Mass to Groundwater (in tons)															
Spreading Grounds	13,807	13,807	13,807	13,807	13,807	13,807	13,807	13,807	13,807	13,807	13,807	13,807	13,807	13,807	13,807	13,807
Seawater Barrier	422	422	422	422	422	422	422	422	422	422	422	422	422	422	422	422
Precipitation Infiltration	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
Mountain Front Recharge	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358
Irrigation Return Flows	4,599	4,599	4,599	4,599	4,599	4,599	4,599	4,599	4,599	4,599	4,599	4,599	4,599	4,599	4,599	4,599
Subsurface Inflow	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813
Total Inflow	23,457	23,457	23,457	23,457	23,457	23,457	23,457	23,457	23,457	23,457	23,457	23,457	23,457	23,457	23,457	23,457
	Outflow of Chloride Mass from Groundwater (in tons)															
Groundwater Production	-16,252	-16,372	-16,502	-16,639	-16,778	-16,918	-17,058	-17,195	-17,330	-17,462	-17,592	-17,718	-17,842	-17,963	-18,081	-17,180
Subsurface Outflow	-545	-541	-540	-539	-539	-540	-541	-542	-543	-544	-545	-546	-547	-549	-550	-543
Total Outflow	-16,797	-16,914	-17,042	-17,178	-17,317	-17,458	-17,598	-17,737	-17,873	-18,006	-18,137	-18,265	-18,389	-18,511	-18,630	-17,724
	Change in Chloride Mass in Groundwater (in tons)															
Annual Change in Mass	6,660	6,543	6,415	6,279	6,140	5,999	5,859	5,720	5,584	5,451	5,320	5,192	5,068	4,946	4,827	5,733
Cumulative Change in Mass	6,660	13,203	19,618	25,898	32,037	38,036	43,895	49,615	55,199	60,650	65,970	71,162	76,230	81,175	86,002	
	Simulated Chloride Groundwater Quality															
Groundwater Quality (mg/L)	67.0	67.4	67.8	68.2	68.5	68.9	69.2	69.6	69.9	70.2	70.5	70.9	71.2	71.5	71.8	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.4	0.8	1.1	1.5	1.9	2.2	2.6	2.9	3.3	3.6	3.9	4.2	4.5	4.8	5.1	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

The annual TDS, chloride, and nitrate loads in No Future Projects Scenario are slightly different than the 10-year baseline average loads because the simple average (not weighted-average) baseline concentration was applied to future volumes; this is reasonable because there is no strong correlation between concentration and flow volume for each factor during the baseline period

Table I-C-9 Nitrate Balance for Central Basin, No Future Projects (Scenario 1) – Future Planning Period

Water Year	CENTRAL BASIN GROUNDWATER NITRATE BALANCE															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	Inflow of Nitrate Mass to Groundwater (in tons)															
Spreading Grounds	318.1	318.1	318.1	318.1	318.1	318.1	318.1	318.1	318.1	318.1	318.1	318.1	318.1	318.1	318.1	318.1
Seawater Barrier	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Precipitation Infiltration	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Mountain Front Recharge	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Irrigation Return Flows	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Subsurface Inflow	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2
Total Inflow	429.7	429.7	429.7	429.7	429.7	429.7	429.7	429.7	429.7	429.7	429.7	429.7	429.7	429.7	429.7	429.7
	Outflow of Nitrate Mass from Groundwater (in tons)															
Groundwater Production	-101.5	-103.8	-106.1	-108.3	-110.4	-112.6	-114.7	-116.8	-118.9	-120.9	-123.0	-125.0	-126.9	-128.9	-130.8	-116.6
Subsurface Outflow	-0.8	-0.9	-0.9	-0.9	-1.0	-1.0	-1.0	-1.0	-1.1	-1.1	-1.1	-1.2	-1.2	-1.2	-1.3	-1.0
Total Outflow	-102.3	-104.7	-107.0	-109.2	-111.4	-113.6	-115.7	-117.9	-120.0	-122.0	-124.1	-126.1	-128.2	-130.1	-132.1	-117.6
	Change in Nitrate Mass in Groundwater (in tons)															
Annual Change in Mass	327.4	325.0	322.8	320.5	318.3	316.1	314.0	311.9	309.7	307.7	305.6	303.6	301.6	299.6	297.6	312.1
Cumulative Change in Mass	327.4	652.4	975.1	1,295.7	1,614.0	1,930.1	2,244.1	2,556.0	2,865.7	3,173.4	3,479.0	3,782.5	4,084.1	4,383.7	4,681.3	
	Simulated Nitrate Groundwater Quality															
Groundwater Quality (mg/L)	0.29	0.29	0.30	0.31	0.32	0.32	0.33	0.34	0.35	0.35	0.36	0.37	0.37	0.38	0.39	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.01	0.02	0.02	0.03	0.04	0.05	0.05	0.06	0.07	0.07	0.08	0.09	0.09	0.10	0.11	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

The annual TDS, chloride, and nitrate loads in No Future Projects Scenario are slightly different than the 10-year baseline average loads because the simple average (not weighted-average) baseline concentration was applied to future volumes; this is reasonable because there is no strong correlation between concentration and flow volume for each factor during the baseline period

Table I-C-10 TDS Balance for West Coast Basin, No Future Projects (Scenario 1) – Future Planning Period

Water Year	WEST COAST BASIN GROUNDWATER TDS BALANCE															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	Inflow of TDS Mass to Groundwater (in tons)															
Spreading Grounds	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139
Seawater Barriers	8,726	8,726	8,726	8,726	8,726	8,726	8,726	8,726	8,726	8,726	8,726	8,726	8,726	8,726	8,726	8,726
Precipitation Infiltration	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689
Mountain Front Recharge	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839
Irrigation Return Flows	12,858	12,858	12,858	12,858	12,858	12,858	12,858	12,858	12,858	12,858	12,858	12,858	12,858	12,858	12,858	12,858
Subsurface Inflow	24,909	25,170	25,355	25,490	25,591	25,669	25,730	25,780	25,821	25,856	25,886	25,912	25,935	25,955	25,973	25,669
Total Inflow	49,161	49,422	49,607	49,742	49,843	49,921	49,982	50,032	50,073	50,108	50,138	50,164	50,187	50,207	50,226	49,921
	Outflow of TDS Mass from Groundwater (in tons)															
Groundwater Production	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937
Subsurface Outflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937	-57,937
	Change in TDS Mass in Groundwater (in tons)															
Annual Change in Mass	-8,776	-8,514	-8,330	-8,195	-8,094	-8,016	-7,954	-7,904	-7,863	-7,829	-7,799	-7,773	-7,750	-7,730	-7,711	-8,016
Cumulative Change in Mass	-8,776	-17,290	-25,619	-33,814	-41,908	-49,924	-57,878	-65,782	-73,646	-81,474	-89,273	-97,046	-104,796	-112,525	-120,236	
Groundwater Quality (mg/L)	888.4	886.8	885.2	883.7	882.1	880.6	879.1	877.6	876.0	874.5	873.0	871.5	870.1	868.6	867.1	
Annual Change in Groundwater Quality from Previous Year (mg/L)	-1.7	-3.3	-4.9	-6.4	-8.0	-9.5	-11.0	-12.5	-14.1	-15.6	-17.1	-18.6	-20.0	-21.5	-23.0	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

The annual TDS, chloride, and nitrate loads in No Future Projects Scenario are slightly different than the 10-year baseline average loads because the simple average (not weighted-average) baseline concentration was applied to future volumes; this is reasonable because there is no strong correlation between concentration and flow volume for each factor during the baseline period

Table I-C-11 Chloride Balance for West Coast Basin, No Future Projects (Scenario 1) – Future Planning Period

Water Year	WEST COAST BASIN GROUNDWATER CHLORIDE BALANCE															
	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	**2023-24**	**2024-25**	**Average**
	Inflow of Chloride Mass to Groundwater (in tons)															
Spreading Grounds	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Seawater Barriers	1,963	1,963	1,963	1,963	1,963	1,963	1,963	1,963	1,963	1,963	1,963	1,963	1,963	1,963	1,963	1,963
Precipitation Infiltration	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225
Mountain Front Recharge	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130
Irrigation Return Flows	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193
Subsurface Inflow	13,235	13,301	13,352	13,392	13,423	13,449	13,470	13,487	13,502	13,516	13,527	13,537	13,547	13,555	13,563	13,457
Total Inflow	18,766	18,832	18,883	18,922	18,954	18,979	19,001	19,018	19,033	19,046	19,058	19,068	19,077	19,086	19,093	18,988
	Outflow of Chloride Mass from Groundwater (in tons)															
Groundwater Production	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999
Subsurface Outflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999	-28,999
	Change in Chloride Mass in Groundwater (in tons)															
Annual Change in Mass	-10,233	-10,167	-10,116	-10,077	-10,045	-10,020	-9,999	-9,981	-9,966	-9,953	-9,941	-9,931	-9,922	-9,913	-9,906	-10,011
Cumulative Change in Mass	-10,233	-20,400	-30,517	-40,593	-50,639	-60,659	-70,657	-80,638	-90,604	-100,557	-110,499	-120,430	-130,352	-140,265	-150,171	
	Simulated Chloride Groundwater Quality															
Groundwater Quality (mg/L)	304.3	302.7	301.1	299.5	297.9	296.3	294.7	293.2	291.6	290.0	288.5	286.9	285.3	283.8	282.2	
Annual Change in Groundwater Quality from Previous Year (mg/L)	-1.6	-3.2	-4.8	-6.4	-8.0	-9.6	-11.2	-12.7	-14.3	-15.9	-17.4	-19.0	-20.5	-22.1	-23.6	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

The annual TDS, chloride, and nitrate loads in No Future Projects Scenario are slightly different than the 10-year baseline average loads because the simple average (not weighted-average) baseline concentration was applied to future volumes; this is reasonable because there is no strong correlation between concentration and flow volume for each factor during the baseline period

Table I-C-12 Nitrate Balance for West Coast Basin, No Future Projects (Scenario 1) – Future Planning Period

Water Year	WEST COAST BASIN GROUNDWATER NITRATE BALANCE															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	Inflow of Nitrate Mass to Groundwater (in tons)															
Spreading Grounds	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Seawater Barriers	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Precipitation Infiltration	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Mountain Front Recharge	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
Irrigation Return Flows	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Subsurface Inflow	10.6	10.6	10.7	10.7	10.7	10.8	10.8	10.8	10.9	10.9	10.9	11.0	11.0	11.0	11.1	10.8
Total Inflow	35.5	35.6	35.6	35.6	35.7	35.7	35.7	35.8	35.8	35.8	35.9	35.9	35.9	36.0	36.0	35.8
	Outflow of Nitrate Mass from Groundwater (in tons)															
Groundwater Production	-3.0	-3.2	-3.5	-3.7	-4.0	-4.2	-4.5	-4.7	-5.0	-5.2	-5.5	-5.7	-6.0	-6.2	-6.5	-4.7
Subsurface Outflow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Outflow	-3.0	-3.2	-3.5	-3.7	-4.0	-4.2	-4.5	-4.7	-5.0	-5.2	-5.5	-5.7	-6.0	-6.2	-6.5	-4.7
	Change in Nitrate Mass in Groundwater (in tons)															
Annual Change in Mass	32.6	32.4	32.1	31.9	31.7	31.5	31.3	31.0	30.8	30.6	30.4	30.2	29.9	29.7	29.5	31.0
Cumulative Change in Mass	32.6	64.9	97.1	129.0	160.7	192.2	223.5	254.5	285.3	315.9	346.3	376.5	406.5	436.2	465.7	
	Simulated Nitrate Groundwater Quality															
Groundwater Quality (mg/L)	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.12	0.12	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.07	0.07	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

The annual TDS, chloride, and nitrate loads in No Future Projects Scenario are slightly different than the 10-year baseline average loads because the simple average (not weighted-average) baseline concentration was applied to future volumes; this is reasonable because there is no strong correlation between concentration and flow volume for each factor during the baseline period

Table I-C-13 TDS Balance for Central Basin, Scenario 8 – Future Planning Period

Water Year	CENTRAL BASIN GROUNDWATER TDS BALANCE															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	Inflow of TDS Mass to Groundwater (in tons)															
Spreading Grounds	68,169	72,306	72,306	72,306	74,494	74,494	74,494	70,521	70,521	70,521	70,521	70,521	70,521	70,521	70,521	71,516
Seawater Barrier	2,168	2,168	2,168	2,168	644	644	644	644	644	644	644	644	644	644	644	1,050
Precipitation Infiltration	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429
Mountain Front Recharge	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302
Irrigation Return Flows	28,719	28,760	28,804	28,849	28,893	28,938	28,982	29,027	29,072	29,117	29,162	29,208	29,253	29,296	28,876	28,997
Subsurface Inflow	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359
Total Inflow	133,147	137,325	137,370	137,414	138,122	138,166	138,211	134,282	134,327	134,372	134,417	134,462	134,508	134,551	134,131	135,654
	Outflow of TDS Mass from Groundwater (in tons)															
Groundwater Production	-129,943	-130,058	-130,109	-130,125	-130,127	-130,113	-130,123	-130,155	-130,190	-130,207	-130,212	-130,214	-130,215	-130,221	-130,231	-130,149
Subsurface Outflow	-3,670	-3,670	-3,659	-3,648	-3,636	-3,624	-3,615	-3,609	-3,605	-3,599	-3,591	-3,585	-3,579	-3,574	-3,571	-3,616
Total Outflow	-133,614	-133,728	-133,768	-133,772	-133,763	-133,736	-133,738	-133,764	-133,796	-133,806	-133,804	-133,798	-133,794	-133,795	-133,801	-133,765
	Change in TDS Mass in Groundwater (in tons)															
Annual Change in Mass	-467	3,597	3,602	3,642	4,359	4,430	4,473	518	531	566	613	664	714	756	329	1,888
Cumulative Change in Mass	-467	3,131	6,732	10,374	14,733	19,162	23,635	24,153	24,684	25,250	25,863	26,527	27,241	27,997	28,326	
	Simulated TDS Groundwater Quality															
Groundwater Quality (mg/L)	528.6	528.8	528.9	529.1	529.2	529.4	529.6	529.5	529.4	529.4	529.4	529.3	529.3	529.2	529.2	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.1	0.3	0.4	0.6	0.7	0.9	1.1	1.0	0.9	0.9	0.9	0.8	0.8	0.7	0.7	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 8

Table I-C-14 Chloride Balance for Central Basin, Scenario 8 – Future Planning Period

Water Year	CENTRAL BASIN GROUNDWATER CHLORIDE BALANCE															
	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	**2023-24**	**2024-25**	**Average**
	Inflow of Chloride Mass to Groundwater (in tons)															
Spreading Grounds	14,095	15,050	15,050	15,050	15,664	15,664	15,664	14,852	14,852	14,852	14,852	14,852	14,852	14,852	14,852	15,003
Seawater Barrier	458	458	458	458	135	135	135	135	135	135	135	135	135	135	135	221
Precipitation Infiltration	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
Mountain Front Recharge	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358
Irrigation Return Flows	4,144	4,156	4,168	4,181	4,193	4,206	4,218	4,231	4,243	4,256	4,268	4,281	4,294	4,305	4,203	4,223
Subsurface Inflow	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813
Total Inflow	23,325	24,291	24,304	24,316	24,621	24,633	24,646	23,846	23,858	23,871	23,883	23,896	23,909	23,920	23,818	24,076
	Outflow of Chloride Mass from Groundwater (in tons)															
Groundwater Production	-16,252	-16,371	-16,501	-16,640	-16,784	-16,929	-17,077	-17,228	-17,375	-17,512	-17,643	-17,767	-17,886	-18,001	-18,112	-17,205
Subsurface Outflow	-545	-541	-539	-539	-539	-540	-541	-543	-545	-546	-547	-548	-549	-549	-550	-544
Total Outflow	-16,797	-16,912	-17,040	-17,179	-17,324	-17,469	-17,619	-17,771	-17,920	-18,059	-18,190	-18,314	-18,434	-18,550	-18,662	-17,749
	Change in Chloride Mass in Groundwater (in tons)															
Annual Change in Mass	6,528	7,379	7,264	7,137	7,297	7,165	7,027	6,075	5,938	5,812	5,694	5,582	5,474	5,370	5,155	6,326
Cumulative Change in Mass	6,528	13,907	21,171	28,308	35,605	42,769	49,796	55,871	61,809	67,621	73,315	78,896	84,371	89,741	94,896	
	Simulated Chloride Groundwater Quality															
Groundwater Quality (mg/L)	67.0	67.4	67.8	68.2	68.6	68.9	69.3	69.6	69.9	70.2	70.5	70.8	71.1	71.4	71.6	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.4	0.8	1.1	1.5	1.9	2.3	2.7	3.0	3.3	3.6	3.9	4.2	4.4	4.7	5.0	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 8

Table I-C-15 Nitrate Balance for Central Basin, Scenario 8 – Future Planning Period

Water Year	CENTRAL BASIN GROUNDWATER NITRATE BALANCE															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	Inflow of Nitrate Mass to Groundwater (in tons)															
Spreading Grounds	331.5	354.0	354.0	354.0	373.7	373.7	373.7	380.5	380.5	380.5	380.5	380.5	380.5	380.5	380.5	370.6
Seawater Barrier	6.3	6.3	6.3	6.3	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	9.8
Precipitation Infiltration	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Mountain Front Recharge	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Irrigation Return Flows	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
Subsurface Inflow	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2
Total Inflow	444.0	466.5	466.5	466.5	491.1	491.1	491.1	497.9	497.9	497.9	497.9	497.9	497.9	497.9	497.9	486.7
	Outflow of Nitrate Mass from Groundwater (in tons)															
Groundwater Production	-101.5	-103.9	-106.3	-108.7	-111.2	-113.7	-116.4	-119.1	-121.8	-124.5	-127.2	-129.8	-132.4	-135.0	-137.4	-119.3
Subsurface Outflow	-0.8	-0.9	-0.9	-0.9	-0.9	-1.0	-1.0	-1.1	-1.1	-1.1	-1.2	-1.2	-1.3	-1.3	-1.3	-1.1
Total Outflow	-102.3	-104.7	-107.1	-109.6	-112.1	-114.7	-117.4	-120.2	-122.9	-125.7	-128.4	-131.1	-133.7	-136.3	-138.8	-120.3
	Change in Nitrate Mass in Groundwater (in tons)															
Annual Change in Mass	341.7	361.8	359.4	356.9	378.9	376.3	373.6	377.7	375.0	372.2	369.5	366.8	364.2	361.6	359.1	366.3
Cumulative Change in Mass	341.7	703.5	1,062.8	1,419.7	1,798.6	2,175.0	2,548.6	2,926.4	3,301.4	3,673.6	4,043.1	4,410.0	4,774.2	5,135.8	5,494.9	
	Simulated Nitrate Groundwater Quality															
Groundwater Quality (mg/L)	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.36	0.37	0.37	0.38	0.39	0.40	0.41	0.42	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.09	0.10	0.11	0.12	0.13	0.14	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 8

Table I-C-16 TDS Balance for West Coast Basin, Scenario 8 – Future Planning Period

Water Year	WEST COAST BASIN GROUNDWATER TDS BALANCE															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	Inflow of TDS Mass to Groundwater (in tons)															
Spreading Grounds	184	184	184	184	184	184	184	425	425	425	425	425	425	425	425	313
Seawater Barriers	6,443	7,256	4,765	3,240	3,240	3,240	3,240	3,240	2,487	2,487	2,487	2,487	2,487	2,487	2,487	3,471
Precipitation Infiltration	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689
Mountain Front Recharge	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839
Irrigation Return Flows	11,676	11,684	11,732	11,847	11,962	12,077	12,191	12,306	12,421	12,535	12,650	12,765	12,879	12,994	13,222	12,329
Subsurface Inflow	24,909	25,184	25,357	25,478	25,616	25,715	25,792	25,853	25,917	25,970	26,010	26,042	26,068	26,090	26,109	25,740
Total Inflow	45,739	46,836	44,566	43,277	43,529	43,743	43,935	44,352	43,778	43,946	44,100	44,247	44,388	44,524	44,772	44,382
	Outflow of TDS Mass from Groundwater (in tons)															
Groundwater Production	-63,269	-62,623	-61,462	-61,462	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-67,911
Subsurface Outflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-63,269	-62,623	-61,462	-61,462	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-67,911
	Change in TDS Mass in Groundwater (in tons)															
Annual Change in Mass	-17,530	-15,787	-16,896	-18,185	-26,458	-26,244	-26,052	-25,635	-26,209	-26,041	-25,886	-25,740	-25,599	-25,462	-25,215	-23,529
Cumulative Change in Mass	-17,530	-33,317	-50,212	-68,397	-94,855	-121,099	-147,152	-172,786	-198,995	-225,036	-250,923	-276,663	-302,262	-327,724	-352,940	
Groundwater Quality (mg/L)	887.3	884.6	881.8	878.3	874.2	870.1	866.1	861.9	857.7	853.5	849.3	845.1	841.0	836.8	832.7	
Annual Change in Groundwater Quality from Previous Year (mg/L)	-2.8	-5.5	-8.3	-11.8	-15.9	-20.0	-24.0	-28.2	-32.4	-36.6	-40.8	-45.0	-49.2	-53.3	-57.4	

mg/L - milligrams per liter
Negative numbers indicate loss or reduction
See Table I-1 for a description of Scenario 8

AWT - advanced water treatment
GRIP - Groundwater Reliability Improvement Project

Table I-C-17 Chloride Balance for West Coast Basin, Scenario 8 – Future Planning Period

Water Year	WEST COAST BASIN GROUNDWATER CHLORIDE BALANCE															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	Inflow of Chloride Mass to Groundwater (in tons)															
Spreading Grounds	24	24	24	24	24	24	24	56	56	56	56	56	56	56	56	41
Seawater Barriers	1,360	1,525	950	696	696	696	696	696	588	588	588	588	588	588	588	762
Precipitation Infiltration	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225
Mountain Front Recharge	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130
Irrigation Return Flows	3,096	3,092	3,091	3,114	3,137	3,161	3,184	3,208	3,231	3,255	3,278	3,301	3,325	3,348	3,457	3,219
Subsurface Inflow	13,235	13,304	13,353	13,390	13,429	13,460	13,484	13,505	13,526	13,543	13,558	13,570	13,580	13,589	13,597	13,475
Total Inflow	18,070	18,301	17,773	17,579	17,642	17,696	17,744	17,820	17,757	17,798	17,835	17,871	17,904	17,937	18,054	17,852
	Outflow of Chloride Mass from Groundwater (in tons)															
Groundwater Production	-31,511	-31,128	-30,550	-30,550	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-32,857
Subsurface Outflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-31,511	-31,128	-30,550	-30,550	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-32,857
	Change in Chloride Mass in Groundwater (in tons)															
Annual Change in Mass	-13,440	-12,827	-12,777	-12,971	-15,914	-15,860	-15,812	-15,736	-15,799	-15,758	-15,721	-15,685	-15,652	-15,619	-15,502	-15,005
Cumulative Change in Mass	-13,440	-26,268	-39,044	-52,015	-67,929	-83,789	-99,600	-115,336	-131,136	-146,894	-162,615	-178,300	-193,952	-209,571	-225,073	
	Simulated Chloride Groundwater Quality															
Groundwater Quality (mg/L)	303.8	301.8	299.9	297.7	295.3	292.9	290.5	288.1	285.7	283.2	280.8	278.4	276.0	273.6	271.2	
Annual Change in Groundwater Quality from Previous Year (mg/L)	-2.0	-4.1	-6.0	-8.2	-10.6	-13.0	-15.4	-17.8	-20.2	-22.7	-25.1	-27.5	-29.9	-32.3	-34.7	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 8

Table I-C-18 Nitrate Balance for West Coast Basin, Scenario 8 – Future Planning Period

Water Year	WEST COAST BASIN GROUNDWATER NITRATE BALANCE															
	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	**2023-24**	**2024-25**	**Average**
	Inflow of Nitrate Mass to Groundwater (in tons)															
Spreading Grounds	1.1	1.1	1.1	1.1	1.1	1.1	1.1	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	1.8
Seawater Barriers	13.7	14.5	11.4	13.3	13.3	13.3	13.3	13.3	14.0	14.0	14.0	14.0	14.0	14.0	14.0	13.6
Precipitation Infiltration	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Mountain Front Recharge	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
Irrigation Return Flows	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.3	2.3	2.3	2.1
Subsurface Inflow	10.6	10.6	10.7	10.7	10.7	10.8	10.8	10.9	10.9	10.9	11.0	11.0	11.1	11.1	11.1	10.9
Total Inflow	34.4	35.2	32.1	34.1	34.2	34.2	34.3	35.8	36.5	36.6	36.7	36.7	36.8	36.9	36.9	35.4
	Outflow of Nitrate Mass from Groundwater (in tons)															
Groundwater Production	-3.0	-3.3	-3.5	-3.7	-4.3	-4.5	-4.8	-5.0	-5.3	-5.5	-5.8	-6.0	-6.3	-6.5	-6.8	-4.9
Subsurface Outflow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Outflow	-3.0	-3.3	-3.5	-3.7	-4.3	-4.5	-4.8	-5.0	-5.3	-5.5	-5.8	-6.0	-6.3	-6.5	-6.8	-4.9
	Change in Nitrate Mass in Groundwater (in tons)															
Annual Change in Mass	31.4	31.9	28.6	30.4	29.9	29.7	29.5	30.8	31.3	31.1	30.9	30.7	30.5	30.3	30.1	30.5
Cumulative Change in Mass	31.4	63.3	91.9	122.3	152.3	182.0	211.5	242.3	273.6	304.7	335.6	366.3	396.8	427.1	457.3	
	Simulated Nitrate Groundwater Quality															
Groundwater Quality (mg/L)	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.12	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 8

Table I-C-19 TDS Balance for Central Basin, Scenario 9 – Future Planning Period

Water Year	CENTRAL BASIN GROUNDWATER TDS BALANCE															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	Inflow of TDS Mass to Groundwater (in tons)															
Spreading Grounds	68,169	72,306	72,306	72,306	78,141	78,141	78,141	78,141	78,141	78,141	78,141	78,141	78,141	78,141	78,141	76,309
Seawater Barriers	2,168	2,168	2,168	2,168	644	644	644	644	644	644	644	644	644	644	644	1,050
Precipitation Infiltration	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429
Mountain Front Recharge	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302
Irrigation Return Flows	28,719	28,760	28,804	28,849	28,893	28,938	28,982	29,027	29,072	29,117	29,162	29,208	29,253	29,296	28,876	28,997
Subsurface Inflow	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359
Total Inflow	133,147	137,325	137,370	137,414	141,768	141,813	141,858	141,902	141,947	141,992	142,037	142,083	142,128	142,171	141,751	140,447
	Outflow of TDS Mass from Groundwater (in tons)															
Groundwater Production	-129,943	-130,058	-130,109	-130,125	-130,127	-130,126	-130,180	-130,276	-130,402	-130,546	-130,702	-130,865	-131,032	-131,201	-131,370	-130,471
Subsurface Outflow	-3,670	-3,670	-3,659	-3,648	-3,636	-3,624	-3,619	-3,618	-3,620	-3,622	-3,625	-3,628	-3,632	-3,635	-3,638	-3,636
Total Outflow	-133,614	-133,728	-133,768	-133,772	-133,763	-133,749	-133,799	-133,895	-134,021	-134,168	-134,327	-134,494	-134,664	-134,836	-135,008	-134,107
	Change in TDS Mass in Groundwater (in tons)															
Annual Change in Mass	-467	3,597	3,602	3,642	8,006	8,063	8,058	8,008	7,926	7,824	7,710	7,589	7,464	7,335	6,743	6,340
Cumulative Change in Mass	-467	3,131	6,732	10,374	18,379	26,443	34,501	42,509	50,435	58,259	65,969	73,558	81,022	88,357	95,100	
	Simulated TDS Groundwater Quality															
Groundwater Quality (mg/L)	528.6	528.8	528.9	529.1	529.4	529.8	530.1	530.5	530.8	531.2	531.5	531.8	532.2	532.5	532.8	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.1	0.3	0.4	0.6	0.9	1.3	1.6	2.0	2.3	2.7	3.0	3.3	3.7	4.0	4.3	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 9

Table I-C-20 Chloride Balance for Central Basin, Scenario 9 – Future Planning Period

Water Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	CENTRAL BASIN GROUNDWATER CHLORIDE BALANCE															
	Inflow of Chloride Mass to Groundwater (in tons)															
Spreading Grounds	14,095	15,050	15,050	15,050	16,689	16,689	16,689	16,689	16,689	16,689	16,689	16,689	16,689	16,689	16,689	16,188
Seawater Barriers	458	458	458	458	135	135	135	135	135	135	135	135	135	135	135	221
Precipitation Infiltration	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
Mountain Front Recharge	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358
Irrigation Return Flows	4,144	4,156	4,168	4,181	4,193	4,206	4,218	4,231	4,243	4,256	4,268	4,281	4,294	4,305	4,203	4,223
Subsurface Inflow	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813
Total Inflow	23,325	24,291	24,304	24,316	25,645	25,658	25,670	25,683	25,695	25,708	25,720	25,733	25,746	25,757	25,655	25,260
	Outflow of Chloride Mass from Groundwater (in tons)															
Groundwater Production	-16,252	-16,371	-16,501	-16,640	-16,784	-16,932	-17,094	-17,262	-17,433	-17,603	-17,770	-17,934	-18,092	-18,246	-18,396	-17,287
Subsurface Outflow	-545	-541	-539	-539	-539	-540	-542	-546	-549	-553	-556	-559	-562	-564	-567	-549
Total Outflow	-16,797	-16,912	-17,040	-17,179	-17,324	-17,472	-17,636	-17,808	-17,982	-18,156	-18,326	-18,492	-18,654	-18,811	-18,963	-17,837
	Change in Chloride Mass in Groundwater (in tons)															
Annual Change in Mass	6,528	7,379	7,264	7,137	8,321	8,185	8,034	7,875	7,713	7,552	7,394	7,240	7,091	6,946	6,692	7,424
Cumulative Change in Mass	6,528	13,907	21,171	28,308	36,629	44,815	52,849	60,724	68,437	75,989	83,383	90,623	97,715	104,661	111,353	
	Simulated Chloride Groundwater Quality															
Groundwater Quality (mg/L)	67.0	67.4	67.8	68.2	68.6	69.0	69.5	69.9	70.3	70.7	71.1	71.4	71.8	72.2	72.5	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.4	0.8	1.1	1.5	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.2	5.5	5.9	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 9

Table I-C-21 Nitrate Balance for Central Basin, Scenario 9 – Future Planning Period

Water Year	CENTRAL BASIN GROUNDWATER NITRATE BALANCE															
	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	**2023-24**	**2024-25**	**Average**
	Inflow of Nitrate Mass to Groundwater (in tons)															
Spreading Grounds	331.5	354.0	354.0	354.0	406.5	406.5	406.5	406.5	406.5	406.5	406.5	406.5	406.5	406.5	406.5	391.0
Seawater Barriers	6.3	6.3	6.3	6.3	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	9.8
Precipitation Infiltration	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Mountain Front Recharge	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Irrigation Return Flows	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
Subsurface Inflow	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2
Total Inflow	444.0	466.5	466.5	466.5	523.9	523.9	523.9	523.9	523.9	523.9	523.9	523.9	523.9	523.9	523.9	507.1
	Outflow of Nitrate Mass from Groundwater (in tons)															
Groundwater Production	-101.5	-103.9	-106.3	-108.7	-111.2	-113.8	-116.9	-120.1	-123.2	-126.4	-129.4	-132.4	-135.4	-138.2	-141.0	-120.6
Subsurface Outflow	-0.8	-0.9	-0.9	-0.9	-0.9	-1.0	-1.0	-1.1	-1.1	-1.2	-1.2	-1.2	-1.3	-1.3	-1.4	-1.1
Total Outflow	-102.3	-104.7	-107.1	-109.6	-112.1	-114.8	-117.9	-121.1	-124.4	-127.5	-130.6	-133.7	-136.6	-139.5	-142.3	-121.6
	Change in Nitrate Mass in Groundwater (in tons)															
Annual Change in Mass	341.7	361.8	359.4	356.9	411.8	409.1	406.0	402.8	399.5	396.4	393.3	390.2	387.3	384.4	381.5	385.5
Cumulative Change in Mass	341.7	703.5	1,062.8	1,419.7	1,831.5	2,240.5	2,646.5	3,049.3	3,448.8	3,845.2	4,238.5	4,628.7	5,016.0	5,400.3	5,781.9	
	Simulated Nitrate Groundwater Quality															
Groundwater Quality (mg/L)	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.40	0.41	0.42	0.43	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.15	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 9

Table I-C-22 TDS Balance for West Coast Basin, Scenario 9 – Future Planning Period

Water Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	WEST COAST BASIN GROUNDWATER TDS BALANCE															
	Inflow of TDS Mass to Groundwater (in tons)															
Spreading Grounds	184	184	184	184	184	184	184	425	425	425	425	425	425	425	425	313
Seawater Barriers	6,443	7,256	4,765	3,240	3,240	3,240	3,240	3,240	2,487	2,487	2,487	2,487	2,487	2,487	2,487	3,471
Precipitation Infiltration	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689
Mountain Front Recharge	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839
Irrigation Return Flows	11,676	11,684	11,732	11,847	11,962	12,077	12,191	12,306	12,421	12,535	12,650	12,765	12,879	12,994	13,222	12,329
Subsurface Inflow	24,909	25,184	25,357	25,478	25,616	25,715	25,796	25,862	25,931	25,992	26,043	26,084	26,118	26,148	26,173	25,760
Total Inflow	45,739	46,836	44,566	43,277	43,529	43,743	43,938	44,361	43,792	43,968	44,133	44,289	44,439	44,583	44,836	44,402
	Outflow of TDS Mass from Groundwater (in tons)															
Groundwater Production	-63,269	-62,623	-61,462	-61,462	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-67,911
Subsurface Outflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-63,269	-62,623	-61,462	-61,462	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-67,911
	Change in TDS Mass in Groundwater (in tons)															
Annual Change in Mass	-17,530	-15,787	-16,896	-18,185	-26,458	-26,244	-26,049	-25,626	-26,195	-26,018	-25,854	-25,698	-25,548	-25,404	-25,150	-23,509
Cumulative Change in Mass	-17,530	-33,317	-50,212	-68,397	-94,855	-121,099	-147,148	-172,774	-198,969	-224,987	-250,841	-276,538	-302,087	-327,491	-352,641	
Groundwater Quality (mg/L)	887.3	884.6	881.8	878.3	874.2	870.1	866.1	861.9	857.7	853.5	849.3	845.1	841.0	836.8	832.8	
Annual Change in Groundwater Quality from Previous Year (mg/L)	-2.8	-5.5	-8.3	-11.8	-15.9	-20.0	-24.0	-28.2	-32.4	-36.6	-40.8	-45.0	-49.1	-53.3	-57.3	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 9

Table I-C-23 Chloride Balance for West Coast Basin, Scenario 9 – Future Planning Period

Water Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	CENTRAL BASIN GROUNDWATER CHLORIDE BALANCE															
	Inflow of Chloride Mass to Groundwater (in tons)															
Spreading Grounds	14,095	15,050	15,050	15,050	16,689	16,689	16,689	16,689	16,689	16,689	16,689	16,689	16,689	16,689	16,689	16,188
Seawater Barriers	458	458	458	458	135	135	135	135	135	135	135	135	135	135	135	221
Precipitation Infiltration	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
Mountain Front Recharge	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358
Irrigation Return Flows	4,144	4,156	4,168	4,181	4,193	4,206	4,218	4,231	4,243	4,256	4,268	4,281	4,294	4,305	4,203	4,223
Subsurface Inflow	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813
Total Inflow	23,325	24,291	24,304	24,316	25,645	25,658	25,670	25,683	25,695	25,708	25,720	25,733	25,746	25,757	25,655	25,260
	Outflow of Chloride Mass from Groundwater (in tons)															
Groundwater Production	-16,252	-16,371	-16,501	-16,640	-16,784	-16,932	-17,094	-17,262	-17,433	-17,603	-17,770	-17,934	-18,092	-18,246	-18,396	-17,287
Subsurface Outflow	-545	-541	-539	-539	-539	-540	-542	-546	-549	-553	-556	-559	-562	-564	-567	-549
Total Outflow	-16,797	-16,912	-17,040	-17,179	-17,324	-17,472	-17,636	-17,808	-17,982	-18,156	-18,326	-18,492	-18,654	-18,811	-18,963	-17,837
	Change in Chloride Mass in Groundwater (in tons)															
Annual Change in Mass	6,528	7,379	7,264	7,137	8,321	8,185	8,034	7,875	7,713	7,552	7,394	7,240	7,091	6,946	6,692	7,424
Cumulative Change in Mass	6,528	13,907	21,171	28,308	36,629	44,815	52,849	60,724	68,437	75,989	83,383	90,623	97,715	104,661	111,353	
	Simulated Chloride Groundwater Quality															
Groundwater Quality (mg/L)	67.0	67.4	67.8	68.2	68.6	69.0	69.5	69.9	70.3	70.7	71.1	71.4	71.8	72.2	72.5	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.4	0.8	1.1	1.5	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.2	5.5	5.9	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 9

Table I-C-24 Nitrate Balance for West Coast Basin, Scenario 9 – Future Planning Period

Water Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	CENTRAL BASIN GROUNDWATER NITRATE BALANCE															
	Inflow of Nitrate Mass to Groundwater (in tons)															
Spreading Grounds	331.5	354.0	354.0	354.0	406.5	406.5	406.5	406.5	406.5	406.5	406.5	406.5	406.5	406.5	406.5	391.0
Seawater Barriers	6.3	6.3	6.3	6.3	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	9.8
Precipitation Infiltration	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Mountain Front Recharge	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Irrigation Return Flows	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
Subsurface Inflow	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2
Total Inflow	444.0	466.5	466.5	466.5	523.9	523.9	523.9	523.9	523.9	523.9	523.9	523.9	523.9	523.9	523.9	507.1
	Outflow of Nitrate Mass from Groundwater (in tons)															
Groundwater Production	-101.5	-103.9	-106.3	-108.7	-111.2	-113.8	-116.9	-120.1	-123.2	-126.4	-129.4	-132.4	-135.4	-138.2	-141.0	-120.6
Subsurface Outflow	-0.8	-0.9	-0.9	-0.9	-0.9	-1.0	-1.0	-1.1	-1.1	-1.2	-1.2	-1.2	-1.3	-1.3	-1.4	-1.1
Total Outflow	-102.3	-104.7	-107.1	-109.6	-112.1	-114.8	-117.9	-121.1	-124.4	-127.5	-130.6	-133.7	-136.6	-139.5	-142.3	-121.6
	Change in Nitrate Mass in Groundwater (in tons)															
Annual Change in Mass	341.7	361.8	359.4	356.9	411.8	409.1	406.0	402.8	399.5	396.4	393.3	390.2	387.3	384.4	381.5	385.5
Cumulative Change in Mass	341.7	703.5	1,062.8	1,419.7	1,831.5	2,240.5	2,646.5	3,049.3	3,448.8	3,845.2	4,238.5	4,628.7	5,016.0	5,400.3	5,781.9	
	Simulated Nitrate Groundwater Quality															
Groundwater Quality (mg/L)	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.40	0.41	0.42	0.43	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.15	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 9

Table I-C-25 TDS Balance for Central Basin, Scenario 10 – Future Planning Period

Water Year	CENTRAL BASIN GROUNDWATER TDS BALANCE															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	Inflow of TDS Mass to Groundwater (in tons)															
Spreading Grounds	68,169	72,306	72,306	72,306	74,494	74,494	74,494	70,521	70,521	70,521	70,521	70,521	70,521	70,521	70,521	71,516
Seawater Barrier	2,168	2,168	2,168	2,168	644	644	644	644	644	644	644	644	644	644	644	1,050
Precipitation Infiltration	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429
Mountain Front Recharge	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302
Irrigation Return Flows	29,117	29,192	29,270	29,348	29,426	29,505	29,583	29,662	29,741	29,820	29,900	29,979	30,059	30,134	29,476	29,614
Subsurface Inflow	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359
Total Inflow	133,545	137,757	137,835	137,913	138,655	138,733	138,812	134,917	134,996	135,075	135,155	135,234	135,314	135,388	134,730	136,271
	Outflow of TDS Mass from Groundwater (in tons)															
Groundwater Production	-129,943	-130,060	-130,113	-130,132	-130,137	-130,127	-130,142	-130,178	-130,219	-130,240	-130,251	-130,258	-130,266	-130,278	-130,295	-130,176
Subsurface Outflow	-3,670	-3,671	-3,662	-3,651	-3,641	-3,629	-3,622	-3,617	-3,615	-3,609	-3,603	-3,597	-3,592	-3,588	-3,586	-3,624
Total Outflow	-133,614	-133,731	-133,775	-133,783	-133,778	-133,757	-133,764	-133,796	-133,833	-133,849	-133,854	-133,855	-133,858	-133,866	-133,881	-133,800
	Change in TDS Mass in Groundwater (in tons)															
Annual Change in Mass	-68	4,026	4,060	4,130	4,876	4,976	5,048	1,121	1,163	1,226	1,301	1,379	1,456	1,522	850	2,471
Cumulative Change in Mass	-68	3,958	8,018	12,148	17,024	22,001	27,049	28,170	29,333	30,558	31,859	33,238	34,694	36,216	37,066	
	Simulated TDS Groundwater Quality															
Groundwater Quality (mg/L)	528.7	528.8	529.0	529.2	529.4	529.5	529.7	529.7	529.7	529.7	529.7	529.7	529.7	529.7	529.6	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.2	0.3	0.5	0.7	0.9	1.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 10

Table I-C-26 Chloride Balance for Central Basin, Scenario 10 – Future Planning Period

Water Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	CENTRAL BASIN GROUNDWATER CHLORIDE BALANCE															
	Inflow of Chloride Mass to Groundwater (in tons)															
Spreading Grounds	14,095	15,050	15,050	15,050	15,664	15,664	15,664	14,852	14,852	14,852	14,852	14,852	14,852	14,852	14,852	15,003
Seawater Barrier	458	458	458	458	135	135	135	135	135	135	135	135	135	135	135	221
Precipitation Infiltration	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
Mountain Front Recharge	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358
Irrigation Return Flows	4,638	4,691	4,745	4,799	4,854	4,908	4,963	5,017	5,072	5,127	5,182	5,237	5,292	5,343	4,945	4,988
Subsurface Inflow	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813
Total Inflow	23,818	24,826	24,880	24,934	25,281	25,335	25,390	24,632	24,687	24,742	24,797	24,852	24,907	24,958	24,560	24,840
	Outflow of Chloride Mass from Groundwater (in tons)															
Groundwater Production	-16,252	-16,373	-16,506	-16,649	-16,798	-16,947	-17,101	-17,257	-17,410	-17,554	-17,691	-17,822	-17,948	-18,071	-18,191	-17,238
Subsurface Outflow	-545	-542	-542	-543	-545	-547	-550	-553	-556	-559	-561	-563	-565	-567	-569	-554
Total Outflow	-16,797	-16,916	-17,048	-17,193	-17,343	-17,494	-17,651	-17,810	-17,966	-18,113	-18,252	-18,385	-18,513	-18,638	-18,760	-17,792
	Change in Chloride Mass in Groundwater (in tons)															
Annual Change in Mass	7,021	7,910	7,832	7,742	7,938	7,841	7,739	6,822	6,721	6,629	6,545	6,467	6,394	6,320	5,800	7,048
Cumulative Change in Mass	7,021	14,932	22,764	30,506	38,443	46,285	54,024	60,846	67,567	74,196	80,741	87,208	93,601	99,921	105,721	
	Simulated Chloride Groundwater Quality															
Groundwater Quality (mg/L)	67.0	67.5	67.9	68.3	68.7	69.1	69.5	69.9	70.2	70.6	70.9	71.3	71.6	71.9	72.2	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.4	0.8	1.2	1.6	2.1	2.5	2.9	3.2	3.6	3.9	4.3	4.6	4.9	5.3	5.6	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 10

Table I-C-27 Nitrate Balance for Central Basin, Scenario 10 – Future Planning Period

Water Year	CENTRAL BASIN GROUNDWATER NITRATE BALANCE															
	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	**2023-24**	**2024-25**	**Average**
	Inflow of Nitrate Mass to Groundwater (in tons)															
Spreading Grounds	331.5	354.0	354.0	354.0	373.7	373.7	373.7	380.5	380.5	380.5	380.5	380.5	380.5	380.5	380.5	370.6
Seawater Barrier	6.3	6.3	6.3	6.3	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	9.8
Precipitation Infiltration	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Mountain Front Recharge	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Irrigation Return Flows	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.5	4.5	4.5	4.5	4.5	4.4	4.4
Subsurface Inflow	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2
Total Inflow	444.1	466.6	466.6	466.6	491.2	491.2	491.2	498.0	498.0	498.0	498.0	498.1	498.1	498.1	498.0	486.8
	Outflow of Nitrate Mass from Groundwater (in tons)															
Groundwater Production	-101.5	-103.9	-106.3	-108.7	-111.2	-113.7	-116.4	-119.1	-121.8	-124.5	-127.2	-129.8	-132.4	-135.0	-137.5	-119.3
Subsurface Outflow	-0.8	-0.9	-0.9	-0.9	-0.9	-1.0	-1.0	-1.1	-1.1	-1.1	-1.2	-1.2	-1.3	-1.3	-1.3	-1.1
Total Outflow	-102.3	-104.7	-107.1	-109.6	-112.1	-114.7	-117.4	-120.2	-122.9	-125.7	-128.4	-131.1	-133.7	-136.3	-138.8	-120.3
	Change in Nitrate Mass in Groundwater (in tons)															
Annual Change in Mass	341.8	361.9	359.4	357.0	379.0	376.5	373.8	377.9	375.1	372.4	369.7	367.0	364.4	361.8	359.2	366.4
Cumulative Change in Mass	341.8	703.6	1,063.1	1,420.1	1,799.1	2,175.5	2,549.3	2,927.1	3,302.3	3,674.6	4,044.3	4,411.3	4,775.6	5,137.4	5,496.6	
	Simulated Nitrate Groundwater Quality															
Groundwater Quality (mg/L)	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.36	0.37	0.37	0.38	0.39	0.40	0.41	0.42	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.10	0.11	0.12	0.13	0.14	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 10

Table I-C-28 TDS Balance for West Coast Basin, Scenario 10 – Future Planning Period

Water Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	WEST COAST BASIN GROUNDWATER TDS BALANCE															
	Inflow of TDS Mass to Groundwater (in tons)															
Spreading Grounds	184	184	184	184	184	184	184	425	425	425	425	425	425	425	425	313
Seawater Barriers	6,443	7,256	4,765	3,240	3,240	3,240	3,240	3,240	2,487	2,487	2,487	2,487	2,487	2,487	2,487	3,471
Precipitation Infiltration	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689
Mountain Front Recharge	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839
Irrigation Return Flows	11,933	11,943	11,996	12,115	12,234	12,353	12,473	12,592	12,711	12,830	12,949	13,068	13,188	13,307	13,527	12,615
Subsurface Inflow	24,909	25,182	25,355	25,476	25,613	25,712	25,790	25,851	25,916	25,969	26,010	26,042	26,069	26,092	26,111	25,740
Total Inflow	45,996	47,094	44,827	43,542	43,799	44,017	44,214	44,636	44,067	44,240	44,400	44,551	44,697	44,839	45,079	44,666
	Outflow of TDS Mass from Groundwater (in tons)															
Groundwater Production	-63,269	-62,623	-61,462	-61,462	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-67,911
Subsurface Outflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-63,269	-62,623	-61,462	-61,462	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-67,911
	Change in TDS Mass in Groundwater (in tons)															
Annual Change in Mass	-17,273	-15,529	-16,634	-17,920	-26,188	-25,970	-25,773	-25,351	-25,920	-25,747	-25,587	-25,436	-25,290	-25,148	-24,908	-23,245
Cumulative Change in Mass	-17,273	-32,802	-49,436	-67,356	-93,544	-119,514	-145,287	-170,638	-196,558	-222,305	-247,892	-273,328	-298,617	-323,765	-348,674	
Groundwater Quality (mg/L)	887.3	884.6	881.9	878.5	874.4	870.4	866.4	862.2	858.0	853.9	849.7	845.6	841.5	837.4	833.3	
Annual Change in Groundwater Quality from Previous Year (mg/L)	-2.8	-5.5	-8.2	-11.6	-15.7	-19.7	-23.7	-27.9	-32.1	-36.2	-40.4	-44.5	-48.6	-52.7	-56.8	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 10

Table I-C-29 Chloride Balance for West Coast Basin, Scenario 10 – Future Planning Period

Water Year	WEST COAST BASIN GROUNDWATER CHLORIDE BALANCE															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	Inflow of Chloride Mass to Groundwater (in tons)															
Spreading Grounds	24	24	24	24	24	24	24	56	56	56	56	56	56	56	56	41
Seawater Barriers	1,360	1,525	950	696	696	696	696	696	588	588	588	588	588	588	588	762
Precipitation Infiltration	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225
Mountain Front Recharge	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130
Irrigation Return Flows	3,347	3,345	3,348	3,376	3,404	3,432	3,459	3,487	3,515	3,543	3,571	3,599	3,626	3,654	3,755	3,497
Subsurface Inflow	13,235	13,303	13,351	13,388	13,428	13,459	13,484	13,505	13,527	13,545	13,560	13,573	13,584	13,594	13,604	13,476
Total Inflow	18,322	18,553	18,029	17,840	17,907	17,966	18,019	18,100	18,042	18,088	18,131	18,171	18,210	18,248	18,358	18,132
	Outflow of Chloride Mass from Groundwater (in tons)															
Groundwater Production	-31,511	-31,128	-30,550	-30,550	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-32,857
Subsurface Outflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-31,511	-31,128	-30,550	-30,550	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-32,857
	Change in Chloride Mass in Groundwater (in tons)															
Annual Change in Mass	-13,189	-12,575	-12,521	-12,710	-15,649	-15,590	-15,537	-15,456	-15,514	-15,468	-15,425	-15,385	-15,346	-15,308	-15,198	-14,725
Cumulative Change in Mass	-13,189	-25,764	-38,284	-50,995	-66,643	-82,233	-97,770	-113,227	-128,741	-144,209	-159,634	-175,019	-190,364	-205,672	-220,870	
	Simulated Chloride Groundwater Quality															
Groundwater Quality (mg/L)	303.9	301.9	300.0	297.8	295.5	293.1	290.8	288.4	286.0	283.6	281.2	278.9	276.5	274.1	271.8	
Annual Change in Groundwater Quality from Previous Year (mg/L)	-2.0	-4.0	-5.9	-8.0	-10.4	-12.7	-15.1	-17.5	-19.9	-22.3	-24.6	-27.0	-29.4	-31.8	-34.1	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 10

Table I-C-30 Nitrate Balance for West Coast Basin, Scenario 10 – Future Planning Period

Water Year	WEST COAST BASIN GROUNDWATER NITRATE BALANCE															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	Inflow of Nitrate Mass to Groundwater (in tons)															
Spreading Grounds	1.1	1.1	1.1	1.1	1.1	1.1	1.1	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	1.8
Seawater Barriers	13.7	14.5	11.4	13.3	13.3	13.3	13.3	13.3	14.0	14.0	14.0	14.0	14.0	14.0	14.0	13.6
Precipitation Infiltration	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Mountain Front Recharge	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
Irrigation Return Flows	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.3	2.3	2.3	2.3	2.4	2.4	2.4	2.2
Subsurface Inflow	10.6	10.6	10.7	10.7	10.7	10.8	10.8	10.9	10.9	10.9	11.0	11.0	11.1	11.1	11.1	10.9
Total Inflow	34.5	35.3	32.2	34.2	34.3	34.3	34.4	35.9	36.6	36.7	36.8	36.8	36.9	37.0	37.0	35.5
	Outflow of Nitrate Mass from Groundwater (in tons)															
Groundwater Production	-3.0	-3.3	-3.5	-3.7	-4.3	-4.5	-4.8	-5.0	-5.3	-5.5	-5.8	-6.0	-6.3	-6.5	-6.8	-5.0
Subsurface Outflow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Outflow	-3.0	-3.3	-3.5	-3.7	-4.3	-4.5	-4.8	-5.0	-5.3	-5.5	-5.8	-6.0	-6.3	-6.5	-6.8	-5.0
	Change in Nitrate Mass in Groundwater (in tons)															
Annual Change in Mass	31.5	32.0	28.7	30.5	30.0	29.8	29.6	30.9	31.4	31.2	31.0	30.8	30.6	30.4	30.2	30.6
Cumulative Change in Mass	31.5	63.5	92.2	122.7	152.7	182.5	212.2	243.0	274.4	305.6	336.6	367.4	398.0	428.5	458.7	
	Simulated Nitrate Groundwater Quality															
Groundwater Quality (mg/L)	0.06	0.06	0.06	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.11	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.06	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 10

Table I-C-31 TDS Balance for Central Basin, Scenario 11 – Future Planning Period

Water Year	CENTRAL BASIN GROUNDWATER TDS BALANCE															
	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	**2023-24**	**2024-25**	**Average**
	Inflow of TDS Mass to Groundwater (in tons)															
Spreading Grounds	68,169	72,306	72,306	72,306	78,141	78,141	78,141	78,141	78,141	78,141	78,141	78,141	78,141	78,141	78,141	76,309
Seawater Barrier	2,168	2,168	2,168	2,168	644	644	644	644	644	644	644	644	644	644	644	1,050
Precipitation Infiltration	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429	3,429
Mountain Front Recharge	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302	2,302
Irrigation Return Flows	29,117	29,192	29,270	29,348	29,426	29,505	29,583	29,662	29,741	29,820	29,900	29,979	30,059	30,134	29,476	29,614
Subsurface Inflow	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359	28,359
Total Inflow	133,545	137,757	137,835	137,913	142,301	142,380	142,458	142,537	142,616	142,696	142,775	142,855	142,934	143,009	142,351	141,064
	Outflow of TDS Mass from Groundwater (in tons)															
Groundwater Production	-129,943	-130,060	-130,113	-130,132	-130,137	-130,141	-130,199	-130,300	-130,430	-130,579	-130,741	-130,910	-131,083	-131,258	-131,434	-130,497
Subsurface Outflow	-3,670	-3,671	-3,662	-3,651	-3,641	-3,629	-3,626	-3,626	-3,629	-3,632	-3,636	-3,641	-3,645	-3,649	-3,654	-3,644
Total Outflow	-133,614	-133,731	-133,775	-133,783	-133,778	-133,770	-133,825	-133,926	-134,059	-134,212	-134,377	-134,551	-134,728	-134,907	-135,087	-134,142
	Change in TDS Mass in Groundwater (in tons)															
Annual Change in Mass	-68	4,026	4,060	4,130	8,523	8,610	8,634	8,611	8,558	8,484	8,398	8,304	8,206	8,101	7,263	6,923
Cumulative Change in Mass	-68	3,958	8,018	12,148	20,671	29,281	37,914	46,526	55,083	63,567	71,965	80,269	88,475	96,576	103,840	
	Simulated TDS Groundwater Quality															
Groundwater Quality (mg/L)	528.7	528.8	529.0	529.2	529.6	529.9	530.3	530.7	531.1	531.5	531.8	532.2	532.6	532.9	533.2	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.2	0.3	0.5	0.7	1.1	1.4	1.8	2.2	2.6	3.0	3.3	3.7	4.1	4.4	4.7	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 11

Table I-C-32 Chloride Balance for Central Basin, Scenario 11 – Future Planning Period

Water Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	CENTRAL BASIN GROUNDWATER CHLORIDE BALANCE															
	Inflow of Chloride Mass to Groundwater (in tons)															
Spreading Grounds	14,095	15,050	15,050	15,050	16,689	16,689	16,689	16,689	16,689	16,689	16,689	16,689	16,689	16,689	16,689	16,188
Seawater Barrier	458	458	458	458	135	135	135	135	135	135	135	135	135	135	135	221
Precipitation Infiltration	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
Mountain Front Recharge	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358
Irrigation Return Flows	4,638	4,691	4,745	4,799	4,854	4,908	4,963	5,017	5,072	5,127	5,182	5,237	5,292	5,343	4,945	4,988
Subsurface Inflow	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813	3,813
Total Inflow	23,818	24,826	24,880	24,934	26,305	26,360	26,414	26,469	26,524	26,579	26,634	26,689	26,744	26,795	26,397	26,025
	Outflow of Chloride Mass from Groundwater (in tons)															
Groundwater Production	-16,252	-16,373	-16,506	-16,649	-16,798	-16,951	-17,117	-17,291	-17,468	-17,644	-17,818	-17,989	-18,155	-18,317	-18,475	-17,320
Subsurface Outflow	-545	-542	-542	-543	-545	-547	-551	-556	-560	-565	-570	-574	-578	-582	-586	-559
Total Outflow	-16,797	-16,916	-17,048	-17,193	-17,343	-17,498	-17,668	-17,847	-18,028	-18,210	-18,388	-18,563	-18,733	-18,899	-19,061	-17,879
	Change in Chloride Mass in Groundwater (in tons)															
Annual Change in Mass	7,021	7,910	7,832	7,742	8,962	8,862	8,746	8,622	8,495	8,369	8,246	8,126	8,011	7,896	7,337	8,145
Cumulative Change in Mass	7,021	14,932	22,764	30,506	39,468	48,330	57,076	65,699	74,194	82,563	90,809	98,935	106,946	114,841	122,178	
	Simulated Chloride Groundwater Quality															
Groundwater Quality (mg/L)	67.0	67.5	67.9	68.3	68.8	69.2	69.7	70.1	70.6	71.0	71.5	71.9	72.3	72.7	73.1	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.4	0.8	1.2	1.6	2.1	2.6	3.0	3.5	3.9	4.4	4.8	5.2	5.7	6.1	6.5	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 11

Table I-C-33 Nitrate Balance for Central Basin, Scenario 11 – Future Planning Period

Water Year	CENTRAL BASIN GROUNDWATER NITRATE BALANCE															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	Inflow of Nitrate Mass to Groundwater (in tons)															
Spreading Grounds	331.5	354.0	354.0	354.0	406.5	406.5	406.5	406.5	406.5	406.5	406.5	406.5	406.5	406.5	406.5	391.0
Seawater Barrier	6.3	6.3	6.3	6.3	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	9.8
Precipitation Infiltration	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Mountain Front Recharge	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Irrigation Return Flows	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.5	4.5	4.5	4.5	4.5	4.4	4.4
Subsurface Inflow	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2
Total Inflow	444.1	466.6	466.6	466.6	524.0	524.0	524.0	524.0	524.0	524.0	524.0	524.1	524.1	524.1	524.0	507.2
	Outflow of Nitrate Mass from Groundwater (in tons)															
Groundwater Production	-101.5	-103.9	-106.3	-108.7	-111.2	-113.8	-116.9	-120.1	-123.2	-126.4	-129.5	-132.5	-135.4	-138.2	-141.0	-120.6
Subsurface Outflow	-0.8	-0.9	-0.9	-0.9	-0.9	-1.0	-1.0	-1.1	-1.1	-1.2	-1.2	-1.2	-1.3	-1.3	-1.4	-1.1
Total Outflow	-102.3	-104.7	-107.1	-109.6	-112.1	-114.8	-117.9	-121.1	-124.4	-127.5	-130.7	-133.7	-136.7	-139.5	-142.3	-121.6
	Change in Nitrate Mass in Groundwater (in tons)															
Annual Change in Mass	341.8	361.9	359.4	357.0	411.9	409.2	406.1	402.9	399.7	396.5	393.4	390.4	387.4	384.5	381.6	385.6
Cumulative Change in Mass	341.8	703.6	1,063.1	1,420.1	1,831.9	2,241.1	2,647.2	3,050.1	3,449.7	3,846.2	4,239.6	4,630.0	5,017.4	5,401.9	5,783.6	
	Simulated Nitrate Groundwater Quality															
Groundwater Quality (mg/L)	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.40	0.41	0.42	0.43	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.15	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 11

Table I-C-34 TDS Balance for West Coast Basin, Scenario 11 – Future Planning Period

Water Year	WEST COAST BASIN GROUNDWATER TDS BALANCE															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	Inflow of TDS Mass to Groundwater (in tons)															
Spreading Grounds	184	184	184	184	184	184	184	425	425	425	425	425	425	425	425	313
Seawater Barriers	6,443	7,256	4,765	3,240	3,240	3,240	3,240	3,240	2,487	2,487	2,487	2,487	2,487	2,487	2,487	3,471
Precipitation Infiltration	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689	1,689
Mountain Front Recharge	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839
Irrigation Return Flows	11,933	11,943	11,996	12,115	12,234	12,353	12,473	12,592	12,711	12,830	12,949	13,068	13,188	13,307	13,527	12,615
Subsurface Inflow	24,909	25,182	25,355	25,476	25,613	25,712	25,793	25,860	25,930	25,992	26,043	26,084	26,120	26,150	26,176	25,760
Total Inflow	45,996	47,094	44,827	43,542	43,799	44,017	44,217	44,645	44,081	44,263	44,432	44,594	44,748	44,897	45,143	44,686
	Outflow of TDS Mass from Groundwater (in tons)															
Groundwater Production	-63,269	-62,623	-61,462	-61,462	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-67,911
Subsurface Outflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-63,269	-62,623	-61,462	-61,462	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-69,987	-67,911
	Change in TDS Mass in Groundwater (in tons)															
Annual Change in Mass	-17,273	-15,529	-16,634	-17,920	-26,188	-25,970	-25,769	-25,342	-25,906	-25,724	-25,554	-25,393	-25,239	-25,089	-24,844	-23,225
Cumulative Change in Mass	-17,273	-32,802	-49,436	-67,356	-93,544	-119,514	-145,283	-170,625	-196,531	-222,256	-247,810	-273,203	-298,442	-323,532	-348,375	
Groundwater Quality (mg/L)	887.3	884.6	881.9	878.5	874.4	870.4	866.4	862.3	858.1	853.9	849.7	845.6	841.5	837.4	833.4	
Annual Change in Groundwater Quality from Previous Year (mg/L)	-2.8	-5.5	-8.2	-11.6	-15.7	-19.7	-23.7	-27.8	-32.0	-36.2	-40.4	-44.5	-48.6	-52.7	-56.7	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 11

Table I-C-35 Chloride Balance for West Coast Basin, Scenario 11 – Future Planning Period

Water Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
WEST COAST BASIN GROUNDWATER CHLORIDE BALANCE																
Inflow of Chloride Mass to Groundwater (in tons)																
Spreading Grounds	24	24	24	24	24	24	24	56	56	56	56	56	56	56	56	41
Seawater Barriers	1,360	1,525	950	696	696	696	696	696	588	588	588	588	588	588	588	762
Precipitation Infiltration	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225
Mountain Front Recharge	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130
Irrigation Return Flows	3,347	3,345	3,348	3,376	3,404	3,432	3,459	3,487	3,515	3,543	3,571	3,599	3,626	3,654	3,755	3,497
Subsurface Inflow	13,235	13,303	13,351	13,388	13,428	13,459	13,485	13,508	13,531	13,551	13,569	13,584	13,597	13,609	13,619	13,481
Total Inflow	18,322	18,553	18,029	17,840	17,907	17,966	18,020	18,102	18,046	18,094	18,139	18,182	18,223	18,263	18,374	18,137
Outflow of Chloride Mass from Groundwater (in tons)																
Groundwater Production	-31,511	-31,128	-30,550	-30,550	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-32,857
Subsurface Outflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-31,511	-31,128	-30,550	-30,550	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-33,556	-32,857
Change in Chloride Mass in Groundwater (in tons)																
Annual Change in Mass	-13,189	-12,575	-12,521	-12,710	-15,649	-15,590	-15,536	-15,454	-15,510	-15,462	-15,417	-15,374	-15,333	-15,293	-15,182	-14,720
Cumulative Change in Mass	-13,189	-25,764	-38,284	-50,995	-66,643	-82,233	-97,769	-113,223	-128,733	-144,195	-159,612	-174,986	-190,319	-205,612	-220,794	
Simulated Chloride Groundwater Quality																
Groundwater Quality (mg/L)	303.9	301.9	300.0	297.8	295.5	293.1	290.8	288.4	286.0	283.6	281.2	278.9	276.5	274.1	271.8	
Annual Change in Groundwater Quality from Previous Year (mg/L)	-2.0	-4.0	-5.9	-8.0	-10.4	-12.7	-15.1	-17.5	-19.9	-22.3	-24.6	-27.0	-29.4	-31.7	-34.1	

mg/L - milligrams per liter

Negative numbers indicate loss or reduction

See Table I-1 for a description of Scenario 11

Table I-C-36 Nitrate Balance for West Coast Basin, Scenario 11 – Future Planning Period

Water Year	WEST COAST BASIN GROUNDWATER NITRATE BALANCE															
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	Average
	Inflow of Nitrate Mass to Groundwater (in tons)															
Spreading Grounds	1.1	1.1	1.1	1.1	1.1	1.1	1.1	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	1.8
Seawater Barriers	13.7	14.5	11.4	13.3	13.3	13.3	13.3	13.3	14.0	14.0	14.0	14.0	14.0	14.0	14.0	13.6
Precipitation Infiltration	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Mountain Front Recharge	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
Irrigation Return Flows	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.3	2.3	2.3	2.3	2.4	2.4	2.4	2.2
Subsurface Inflow	10.6	10.6	10.7	10.7	10.7	10.8	10.8	10.9	10.9	11.0	11.0	11.0	11.1	11.1	11.2	10.9
Total Inflow	34.5	35.3	32.2	34.2	34.3	34.3	34.4	35.9	36.7	36.7	36.8	36.9	36.9	37.0	37.0	35.5
	Outflow of Nitrate Mass from Groundwater (in tons)															
Groundwater Production	-3.0	-3.3	-3.5	-3.7	-4.3	-4.5	-4.8	-5.0	-5.3	-5.5	-5.8	-6.0	-6.3	-6.5	-6.8	-5.0
Subsurface Outflow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Outflow	-3.0	-3.3	-3.5	-3.7	-4.3	-4.5	-4.8	-5.0	-5.3	-5.5	-5.8	-6.0	-6.3	-6.5	-6.8	-5.0
	Change in Nitrate Mass in Groundwater (in tons)															
Annual Change in Mass	31.5	32.0	28.7	30.5	30.0	29.8	29.6	30.9	31.4	31.2	31.0	30.8	30.6	30.4	30.2	30.6
Cumulative Change in Mass	31.5	63.5	92.2	122.7	152.7	182.5	212.2	243.0	274.4	305.6	336.7	367.5	398.1	428.6	458.8	
	Simulated Nitrate Groundwater Quality															
Groundwater Quality (mg/L)	0.06	0.06	0.06	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.11	
Annual Change in Groundwater Quality from Previous Year (mg/L)	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.06	

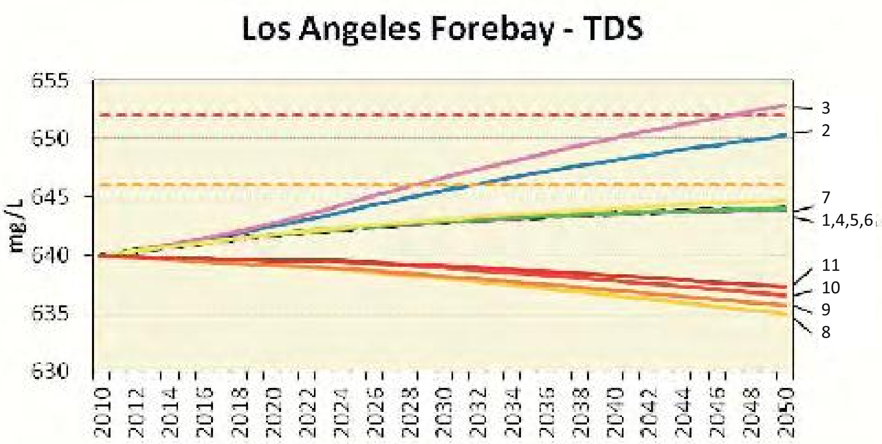
mg/L - milligrams per liter

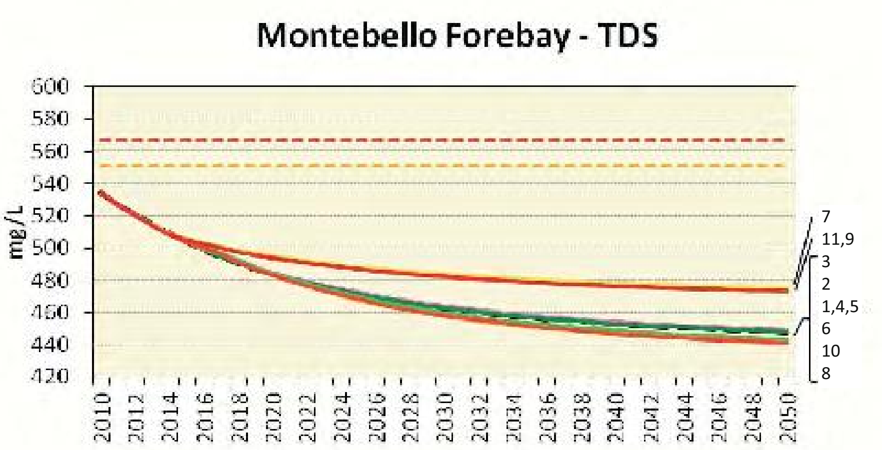
Negative numbers indicate loss or reduction

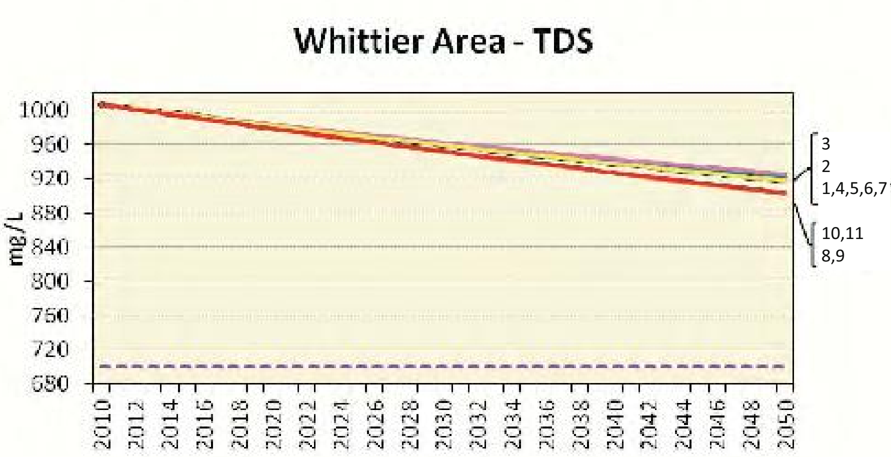
See Table I-1 for a description of Scenario 11

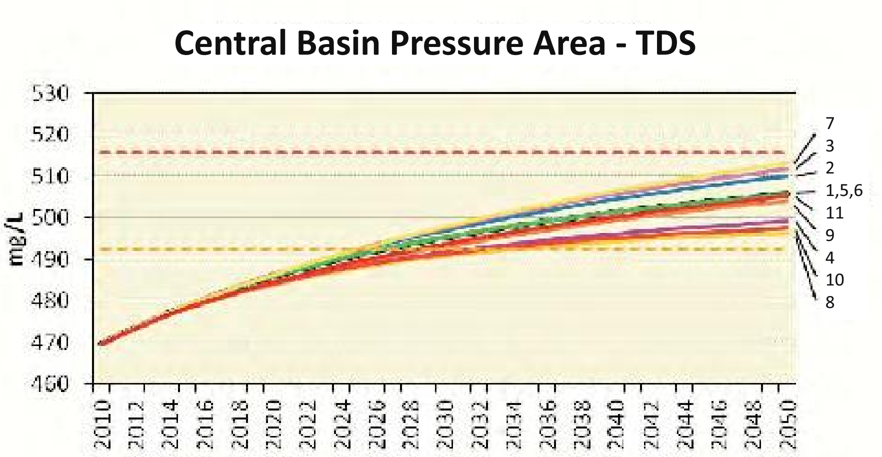
Attachment I-D

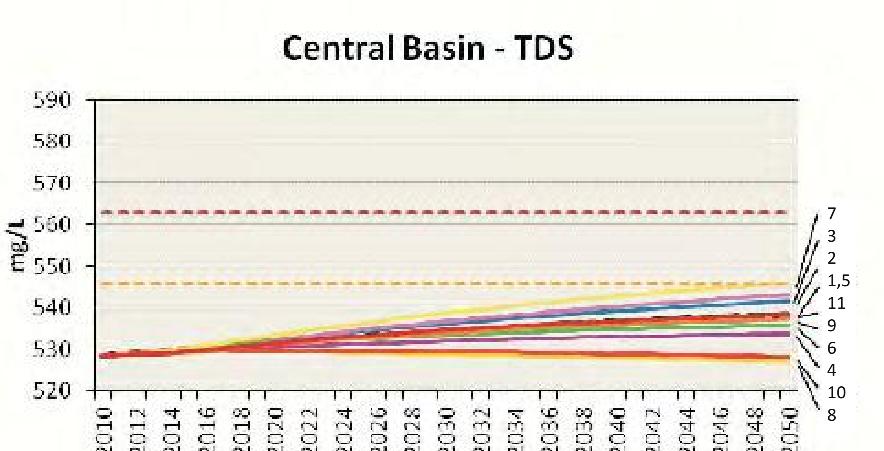
Future Projections through Water Year 2049-50

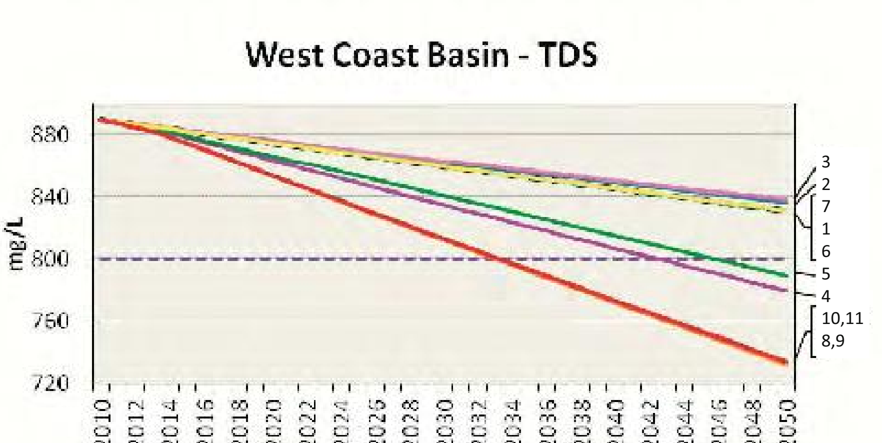












Legend

- BPO/BSBPO
- 20% Assimilative Capacity Threshold
- 10% Assimilative Capacity Threshold
- 1. No Future Projects
- 2. Increased Recycled Water Irrigation (baseline average)
- 3. Increased Recycled Water Irrigation (MCL or SMCL)
- 4. Seawater Barriers (Increased Injection Volume & AWT RW)
- 5. Increased Desalter Well Pumping and Treatment
- 6. GRIP A (10,000 AFY AWT and 11,000 AFY Tertiary-treated RW)
- 7. GRIP B (21,000 AFY [100%] Tertiary-treated RW)
- 8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)
- 9. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)
- 10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)
- 11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)

Notes:

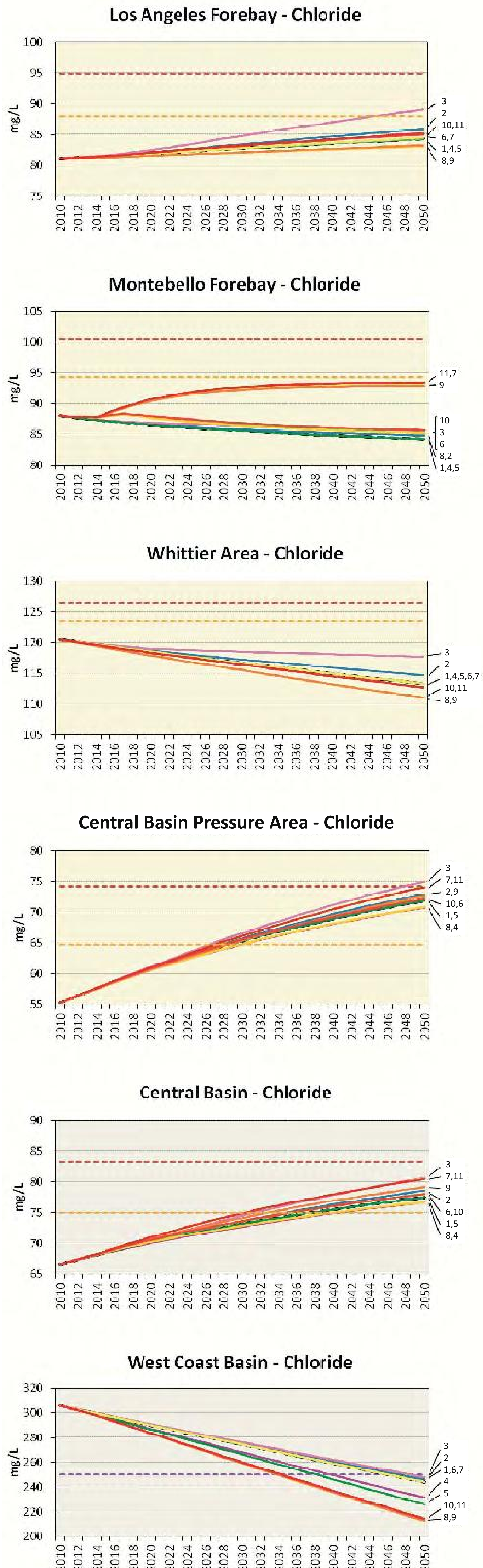
In the West Coast Basin, where there is no available assimilative capacity for TDS and chloride due to historical seawater intrusion, the BPO/BSBPO is shown rather than the 10% and 20% assimilative capacity threshold.

Minor Future Changes included in Scenarios 8 through 11 include projected background changes including increased spreading at Dominguez Gap Spreading Grounds, reduced imported water for municipal supply in Central Basin, and increased imported water for supply in West Coast Basin

RW - Recycled Water
MCL - Maximum Contaminant Level
SMCL - Secondary MCL
GRIP - Groundwater Reliability Improvement Project
TDS - total dissolved solids
mg/L - milligrams per liter
AFY - acre-feet per year
AWT - advanced water treatment
BPO/BSBPO - Basin Plan Objective/Basin-Specific Basin Plan Objective

Figure I-D-1
Simulated Calibrated TDS Groundwater Concentrations All Projects Through WY 2050

TODD GROUNDWATER



Legend

- BPO/BSBPO
- 20% Assimilative Capacity Threshold
- 10% Assimilative Capacity Threshold
- 1. No Future Projects
- 2. Increased Recycled Water Irrigation (baseline average)
- 3. Increased Recycled Water Irrigation (MCL or SMCL)
- 4. Seawater Barriers (Increased Injection Volume & AWT RW)
- 5. Increased Desalter Well Pumping and Treatment
- 6. GRIP A (10,000 AFY AWT and 11,000 AFY Tertiary-treated RW)
- 7. GRIP B (21,000 AFY [100%] Tertiary-treated RW)
- 8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)
- 9. Combined Scenarios (2 + 4 + 5 + 7 + Minor Future Changes)
- 10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)
- 11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)

Notes:

In the West Coast Basin, where there is no available assimilative capacity for TDS and chloride due to historical seawater intrusion, the BPO/BSBPO is shown rather than the 10% and 20% assimilative capacity threshold.

Minor Future Changes included in Scenarios 8 through 11 include projected background changes including increased spreading at Dominguez Gap Spreading Grounds, reduced imported water for municipal supply in Central Basin, and increased imported water for supply in West Coast Basin

RW - Recycled Water

MCL - Maximum Contaminant Level

SMCL - Secondary MCL

GRIP - Groundwater Reliability Improvement Project

mg/L - milligrams per liter

AFY - acre-feet per year

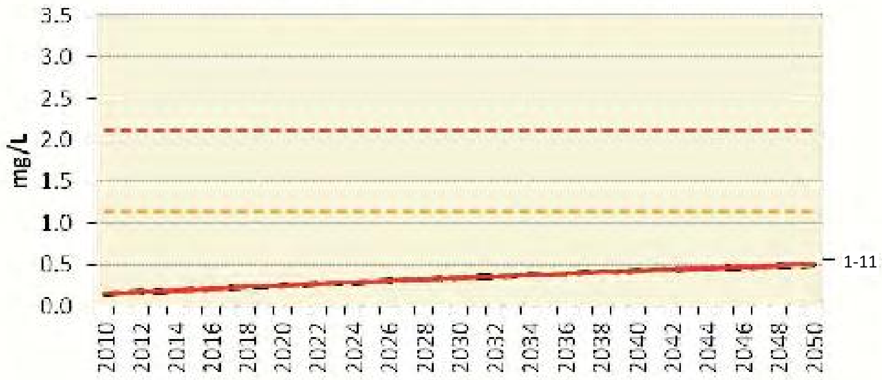
AWT - advanced water treatment

BPO/BSBPO - Basin Plan Objective/Basin-Specific Basin Plan Objective

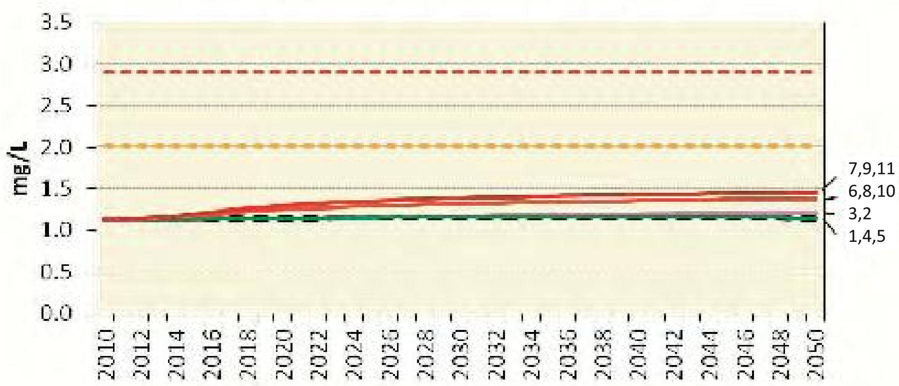
Figure I-D-2
Simulated Calibrated Chloride Groundwater Concentrations All Projects Through WY 2050

TODD GROUNDWATER

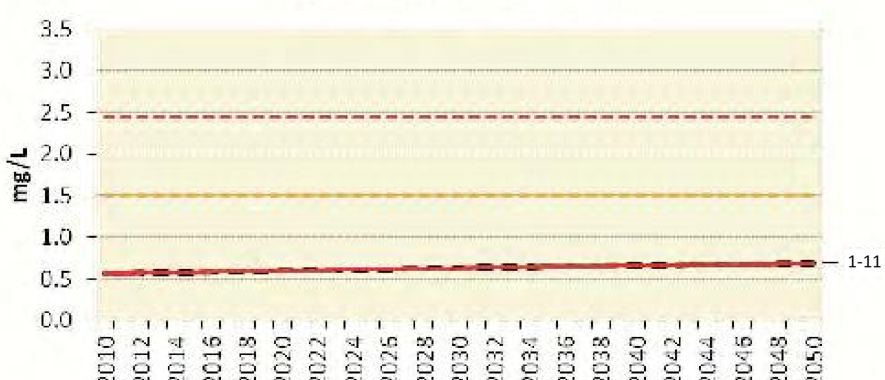
Los Angeles Forebay - NO_3-N



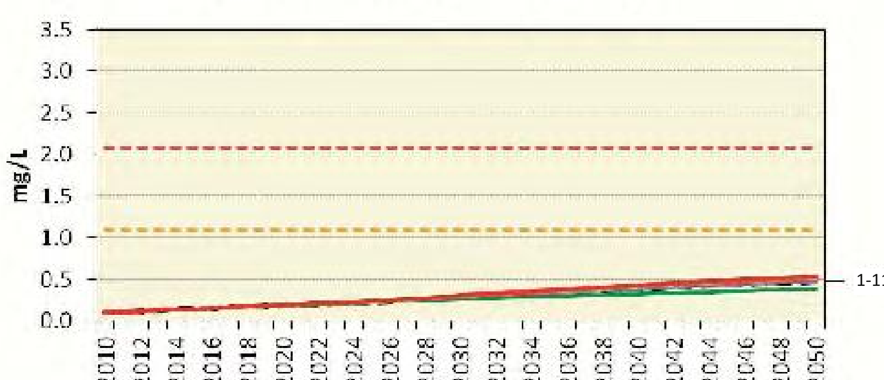
Montebello Forebay - NO_3-N



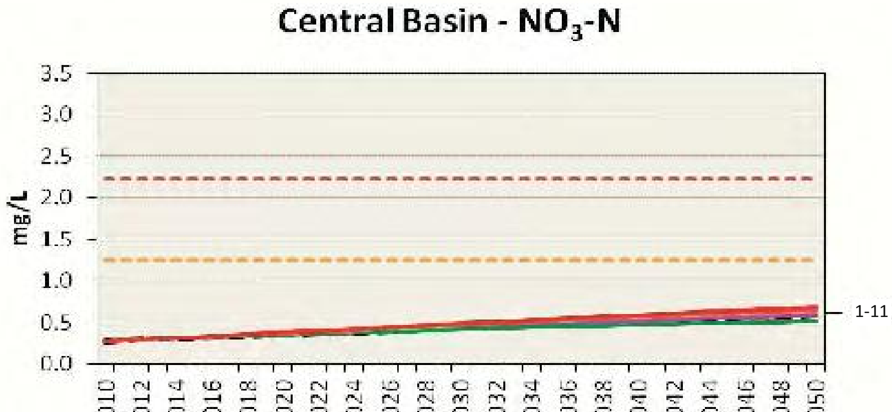
Whittier Area - NO_3-N



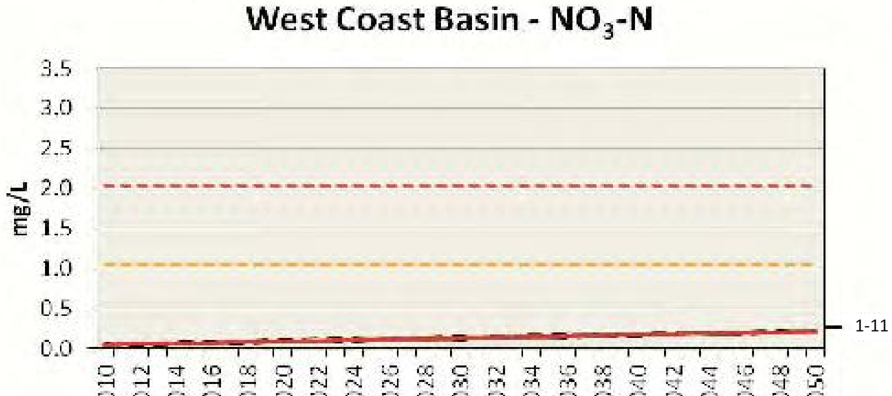
Central Basin Pressure Area - NO_3-N



Central Basin - NO_3-N



West Coast Basin - NO_3-N



Legend

- BPO/BSBPO
- 20% Assimilative Capacity Threshold
- 10% Assimilative Capacity Threshold
- 1. No Future Projects
- 2. Increased Recycled Water Irrigation (baseline average)
- 3. Increased Recycled Water Irrigation (MCL or SMCL)
- 4. Seawater Barriers (Increased Injection Volume & AWT RW)
- 5. Increased Desalter Well Pumping and Treatment
- 6. GRIP A (10,000 AFY AWT and 11,000 AFY Tertiary-treated RW)
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- 8. Combined Scenarios (2 + 4 + 5 + 6 + Minor Future Changes)
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- 10. Combined Scenarios (3 + 4 + 5 + 6 + Minor Future Changes)
- 11. Combined Scenarios (3 + 4 + 5 + 7 + Minor Future Changes)

Notes:

In the West Coast Basin, where there is no available assimilative capacity for TDS and chloride due to historical seawater intrusion, the BPO/BSBPO is shown rather than the 10% and 20% assimilative capacity threshold.

Minor Future Changes included in Scenarios 8 through 11 include projected background changes including increased spreading at Dominguez Gap Spreading Grounds, reduced imported water for municipal supply in Central Basin, and increased imported water for supply in West Coast Basin

RW - Recycled Water

MCL - Maximum Contaminant Level

SMCL - Secondary MCL

GRIP - Groundwater Reliability Improvement Project

NO_3-N - Nitrate

mg/L - milligrams per liter

AFY - acre-feet per year

AWT - advanced water treatment

BPO/BSBPO - Basin Plan Objective/Basin-Specific Basin Plan Objective

Figure I-D-3
Simulated Calibrated Nitrate Groundwater Concentrations All Projects Through WY 2050

TODD GROUNDWATER

Appendix J

Implementation Plan

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1 Introduction

This Appendix J describes the *Implementation Plan* that was developed by the stakeholders of the Central Basin and West Coast Basin (CBWCB or Study Area) to manage salt and nutrient (S/N) loading on a sustainable basis and ensure reliable water supplies by promoting the use of recycled water. Key components of this appendix include:

- A historical perspective on CBWCB groundwater quality,
- A description of changing conditions that could affect future groundwater quality and supply and how these factors were addressed by the CBWCB stakeholders,
- A summary of average existing and future simulated S/N groundwater quality,
- A description of existing, planned, and conceptual implementation measures, and
- A description of proposed major recycled water projects.

Section 2 presents a historical perspective on groundwater quality in the CBWCB. Section 3 describes changing conditions that could affect future groundwater quality and supply and how these factors were addressed by the CBWCB stakeholders. Section 4 summarizes average existing groundwater quality and simulated future groundwater quality for the future planning period through 2035. Section 5 assesses the need for implementation measures, which are strategies, projects, or programs established to control, reduce, or manage (mitigate) S/N loading on a sustainable basis. Section 6 presents existing, planned, and conceptual implementation measures. Section 7 describes the major recycled water projects proposed for implementation in the CBWCB. Section 8 describes the challenges that could impact achievement of recycled water and stormwater goals and objectives, as well as proposed recycled water projects and implementation measures.

References cited in this appendix and other appendices are provided at the end of the Salt and Nutrient Management Plan (SNMP). As discussed in Section 5.1 in the SNMP, total dissolved solids (TDS), chloride, and nitrate were selected as the appropriate indicator constituents of S/Ns in the Study Area.

2 Historical Perspective

In the early 1900s to late 1950s, over-pumping in the CBWCB depressed groundwater levels and caused seawater intrusion, which induced inland saline plumes containing high total dissolved solids (TDS) and chloride. In 1961 and 1965, the West Coast Basin and the Central Basin, respectively, were adjudicated and allowable pumping allocations and pumping rights were established for each of the basins. The Water Replenishment District of Southern California (WRD) was formed in 1959 to function as the basin manager to facilitate groundwater replenishment.

In the CBWCB, there are significant engineering solutions currently in place to replenish the groundwater basins and manage the seawater intrusion and other sources of S/N loading. In the Central Basin, surface spreading of imported water, stormwater, and tertiary-treated recycled water at the Montebello Forebay Spreading Grounds (MFSG) and historical spreading of stormwater at the Dominguez Gap Spreading Grounds (DGSG) replenish the groundwater basin along with other stormwater capture projects. Injection of imported water and advanced treated recycled water at the Alamitos Gap Seawater Intrusion Barrier (AGB) also prevents seawater intrusion and replenishes the groundwater basin.

In the West Coast Basin, groundwater is currently replenished by stormwater capture projects, including the DGSG. Injection of imported water and advanced treated recycled water at the Dominguez Gap Seawater Intrusion Barrier (DGB) and West Coast Basin Seawater Intrusion Barrier (WCBB) prevents seawater intrusion and replenishes the groundwater basin. Along with these replenishment projects, the Robert W. Goldsworthy (Goldsworthy) Desalter and C. Marvin Brewer (Brewer) Desalter also help to remediate brackish groundwater in the West Coast Basin, thereby reducing high TDS and chloride levels in groundwater.

3 Changing Conditions

This section describes changing conditions, including population growth, climate change, and drought, that could affect future groundwater quality and supply and how these factors were addressed by the CBWCB stakeholders as part of the SNMP.

3.1 Population Growth

According to the California Department of Finance, the State's population as a whole is projected to increase by more than 35% while Los Angeles County's population is projected to increase by approximately 18% by 2050 (USBOR, LACFCD, LACDPW, 2013). Although the population in the CBWCB is predicted to increase, use of potable supplies (imported water and groundwater) is projected to remain near 2010 levels through the end of the SNMP future planning period, i.e., 2025 (see Appendix H *Baseline and Future Water Balances* for further details). This is due to the increased use of recycled water (replacing and supplementing imported water) and overall reduced water demand due to conservation. The Study Area is mostly urbanized and essentially fully developed, so much of the predicted county-wide increase in population will likely occur through development outside the CBWCB.

3.2 Climate Change

The effects of climate change in California present many water supply challenges and unknowns. The sustainability of water supply sources will likely be impacted by warmer winter storms, reduced precipitation, winter snowpack, and surface water flows, significant dips in groundwater levels, more intense winter and spring runoff (due to precipitation occurring as rain instead of snow), and more extreme hydrologic variability between drier drought periods and wetter winter periods. Rainfall patterns locally are also likely to change with heavier rainfall periods (but reduced events) that potentially could overwhelm the flood control system, leading to less conserved stormwater, more property damage, and greater maintenance and operational demands (USBOR, LACFCD, and LACDPW, 2013). In addition, sea level along the Southern California Coast is projected to rise 5 to 25 inches above 2000 levels by 2025 due to global climate change (NRCC, 2012). Rising sea water levels have the potential to increase seawater intrusion along the coastal areas of the CBWCB.

It is noted that 7 of the last 10 seasonal years (July 1 to June 30) (2003-04, 2005-06, 2006-07, 2007-08, 2008-09, 2011-12, 2012-13) have seen below normal rainfall in Los Angeles, resulting in a lower than expected stormwater capture for recharge at the MFSG. This has led the LARWQCB to approve a longer, from 5 years to 10 years, averaging period for calculation of the relative contribution of recycled water for recharge at the MFSG (LARWQCB, 2013). Additionally, the LARWQCB increased the permitted maximum quantity of recycled water recharged at the MFSG from 35% to 45% of the total inflow from all sources (i.e., imported water, recycled water, and stormwater) in any 10-year period (LARWQCB, 2014).

In recognition of the water supply implications of greenhouse gas emissions, climate change, drought, and uncertainties and increasing costs associated with imported water supplies, the CBWCB stakeholders have been planning and implementing projects to maximize the use of recycled water and stormwater, encourage conservation, and address seawater level rise. Thus, consideration of climate change was a key factor in the development of projects and implementation measures (see Section 10) to reduce reliance on expensive, energy-intensive (due to pumping, distribution, and other costs), and increasingly unreliable imported water supplies by replacing these supplies with drought-proof, reliable, safe, and sustainable recycled water at the MFSG, seawater intrusion barriers, and for irrigation. Various measures and studies to increase stormwater capture have also been implemented and planned, including low impact development (LID) projects, new retention basins, rubber dams along the San Gabriel River, increasing the height of water storage behind the Whittier Narrows Dam, and the MFSG interconnection pipeline, among others. It is anticipated that projects and programs associated with the MS4 Permit will also result in increased stormwater capture.

As recognized in the Department of Water Resources (DWR) Public Review Draft of the Water Plan Update 2013 (DWR, 2013), conservation is a fundamental component of the South Coast region's water management planning. The South Coast Region includes all of Orange County and portions of Ventura, Los Angeles (including the CBWCB), San Bernardino, Riverside, and Sana Diego counties. Water agencies in the South Coast have been aggressively implementing water conservation since the 1990s. The GLAC IRWMP (GLAC IRWMP Leadership Committee, 2014) has been developed to define a clear vision and direction for the sustainable management of water resources in the GLAC Region for the next 20 years.

The Water Conservation Act of 2009 (Senate Bill [SB] x7-7) requires each urban retail agency to establish in its Urban Water Management Plan (UWMP) a reduction goal to help California achieve a 20% statewide reduction in daily per capita water use by 2020. The UWMPs indicate the South Coast Hydrologic Region had a population-weighted baseline average water use of 188 gallons per capita per day with an average population-weighted 2020 target of 159 gallons per capita per day. In addition, although the population in the CBWCB is predicted to increase, conservation programs are helping to maintain the use of potable supplies (imported water and groundwater) near 2010 levels through the end of the SNMP future planning period, i.e., 2025.

3.3 Drought

Historically, California has experienced frequent periods of prolonged drought. Based on scientific projections, drought is expected to occur more frequently and for longer intervals due to climate change. With significant below-normal rainfall since 2012, the current drought is being described as the driest period in the State's recorded history. There was less rain in 2013 than in any year since California became a state in 1850. Locally, there has been approximately 5.6 inches of rain since October 1, 2013 (when the "water year" starts from a record-keeping standpoint), approximately 37% of the normal precipitation for this period. A Sierra Mountain snow survey conducted by the DWR at the end of February and March 2014 found the snowpack's statewide water content at about 25% of average. According to the United States Drought Monitor, a majority of the State is designated in either Exceptional Drought (including the CBWCB) or Extreme Drought (http://droughtmonitor.unl.edu/Home/StateDroughtMonitor.aspx?CA).

The current drought, as a result of the lack of precipitation, has impacted the following areas, which has affected imported water and groundwater supplies in the CBWCB:

- San Gabriel Mountains and Valley which feed runoff to rivers leading to recharge at the Montebello Forebay Spreading Grounds;
- Sierra Nevada Mountains which feed the Owens River, the Los Angeles Aqueduct, Northern California, the Sacramento-San Joaquin River Delta, and the California Aqueduct;
- Western United States and the Rocky Mountains which feed the Colorado River; and
- Groundwater – In the Montebello Forebay, which supplies many production wells and also serves as the conduit to supply groundwater to "downstream" areas of the Central Basin and West Coast Basin, groundwater levels have fallen over 50 feet since 2011 due to the extended drought. Water levels have dropped to their lowest levels in over 35 years, causing some production wells to have lowered pumps to keep up with the decline.

Due to seriously diminished water supplies in the State, on January 17, 2014, Governor Jerry Brown declared a State of Emergency (Proclamation No. 1-17-2014, http://www.gov.ca.gov/news.php?id=18368). As part of his proclamation, the Governor directed State officials to take all necessary actions to prepare for drought conditions. On April 25, 2014, Governor Brown issued an Executive Order (Proclamation No. 4-25-2014, http://gov.ca.gov/news.php?id=18496) declaring a continued state of emergency due to severe drought conditions, with an emphasis on statewide conservation and included directives to strengthen the State's ability to manage water effectively under drought conditions. Directive No. 10 in the Executive Order states, "The Water Board [SWRCB] will adopt statewide general waste discharge requirements to facilitate the use of treated wastewater that meets standards set by the Department of Public Health, in order to reduce demand on potable water supplies." (Office of California Governor Edmund G. Brown, Jr., 2014b).

In direct response to the Governor's April 2014 Executive Order, the SWRCB adopted *General Waste Discharge Requirements for Recycled Water Use* (General Order No. WQ 2014-0090-DWQ; http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2014/wqo2014_0090_dwq_revised.pdf) on June 3, 2014 to streamline permitting for recycled water use (i.e., relieve producers, distributors, and users of recycled water from the lengthy permit approval process) throughout the State. This General Order is intended to increase local water supplies by promoting the non-potable use of recycled water in communities grappling with drought conditions. Additionally, the General Order is consistent with the Recycled Water Policy that was adopted by the SWRCB in 2009 and amended in 2013, which required the development of SNMPs for all groundwater basins in California. Thus, all uses of recycled water allowed by the General Order must be consistent with the SNMPs that will be approved by the Regional Water Quality Control Boards. Importantly, the General Order did not modify existing permitted recycled water quality limits established for irrigation. If this was the case, this would have significantly limited the sustainable and cost effective use of recycled water to offset demand for raw and potable water supplies in the CBWCB.

Currently, permitted recycled water quality limits established for non-potable reuse (irrigation, industrial and recreational activities) are generally more conservative than the SMCLs established for TDS and chloride. As part of the SNMP, the CBWCB stakeholders, in close consultation with the LARWQCB, modeled the impacts on groundwater quality from the increased use of recycled water for irrigation at the SMCLs/MCL for S/Ns. As discussed further in Section 7.4.1, the modeling results showed that there were minimal potential impacts to the basins when utilizing recycled water for irrigation at these generally higher concentrations, even at increased volumes. Therefore, the CBWCB stakeholders believe that modification of existing permit levels for recycled water for non-potable reuse are warranted to further reduce dependency on potable water supplies, meet the goals set forth in the Recycled Water Policy to increase the use of recycled water (as discussed in Section 1.2), and more fully embrace the spirit of the Governor's drought proclamations.

In addition to the modification of existing permit levels for recycled water for non-potable reuse, the CBWCB stakeholders have proposed other recycled water projects (refer to Section 10.1 and Appendix J) for implementation in the basins. As discussed further in Section 7 and Appendix I, impacts to groundwater quality from the proposed recycled water projects were estimated using the mixing model that was developed as part of the SNMP. The SNMP modeling results clearly demonstrate that future recycled water projects that may increase S/N loading are more than offset by projects that reduce S/N loading and thus, groundwater quality overall in the CBWCB is either improving or remaining well below BPOs, for S/Ns. Since some of the proposed recycled water projects in the CBWCB actually reduce S/N loading or improve groundwater quality, they were also identified as implementation measures, as discussed further in Section 10.2 and Appendix J. Thus, the proposed recycled water projects and implementation measures developed by the CBWCB stakeholders directly address the impacts of drought, while improving or maintaining high-quality groundwater in the basins.

Recognizing the implications of changing climatic conditions, WRD and SNMP stakeholders have developed a number of plans and programs to reduce reliance on imported water by increasing use of stormwater and recycled water. WRD has developed the Water Independence Now (WIN) program, which is a series of projects that will fully utilize stormwater and recycled water sources to restore and protect the groundwater resources. WIN seeks to completely eliminate dependence on imported water to ensure the future security of the CBWCB by developing local resources to create a locally sustainable groundwater supply.

To complement the WIN program, WRD and CBWCB stakeholders have developed the GBMP (CH2MHILL, 2012b) to identify and assess impacts of potential projects and programs to enhance basin replenishment, increase the reliability of groundwater resources, improve and protect groundwater quality, and ensure that the groundwater supplies are suitable for beneficial uses. This GBMP identifies opportunities to develop supplemental replenishment water supplies to further utilize the CBWCB. The key objective for creating additional replenishment water supply is to significantly reduce imported water use by providing for increased pumping from the CBWCB. Various scenarios and alternatives were developed and evaluated with the updated USGS MODFLOW groundwater flow model with the goal of maximizing the development of groundwater supplies.

3.4 Greenhouse Gas Emissions

Greenhouse gases, measured and evaluated in terms of carbon dioxide, are generated from the combustion of carbon-based fuels, principally wood, coal, oil, and natural gas. Greenhouse gas emissions are known to cause climate change at various scales, including local and regional. The amount of energy associated with various water sources depends on many factors, including the quality of the source water, the energy required for water treatment, the efficiency of conveyance and distribution systems, and the distance to approved end uses. In the CBWCB, recycled water and groundwater require significantly less distance for transport to approved end uses compared with imported supplies, and thus results in substantial overall energy savings, mainly due to delivery.

From an energy standpoint, greater reliance on water conservation, recycled water, and stormwater provides significant energy benefits compared with imported water. These energy benefits provide significant reductions in greenhouse gas emissions in direct relation to their energy savings.

The CBWCB stakeholders have recognized the importance of reducing greenhouse gas emissions. For over 50 years, recycled water and stormwater have been used in the Montebello Forebay for groundwater recharge, thus reducing reliance on more energy-intensive imported water supplies. Water conservation programs are currently in place (thus, conservation was identified as an implementation measure; see Appendix J), which not only conserve energy but may also result in reduced S/N loading, thus improving groundwater quality. To further meet the goals of the Recycled Water Policy and the Governor's drought proclamation, multiple projects have been proposed by the CBWCB stakeholders to increase the use of recycled water (replacing and supplementing more energy-intensive imported water supplies), as further discussed in Section 10.2. The use of recycled water in the CBWCB has been proven to be an energy-efficient, safe, and reliable resource and has played a vital role in increasing the sustainability of the overall water supply. Impacts to air quality, including greenhouse gas emissions, will be evaluated as part of the CEQA process for the individual projects in the basins and was also assessed for the program alternatives presented in the SED.

4 Summary of Groundwater Quality Assessment and Results

Average existing water quality and assimilative capacity results and the methodology for determining the average groundwater quality are presented in Appendix G *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality.* Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality* presents simulated baseline (Water Year [WY] 2000-01 to 2009-10) and future (WY 2010-11 to 2024-25) groundwater quality and assimilative capacity and the methods used to predict water quality. Results are summarized here for context.

Comparison of average existing and estimated future groundwater quality with the BPO for nitrate and Basin-Specific Basin Plan Objectives (BSBPOs)[1] for TDS and chloride and assessment of water quality trends informs the need for, or lack of need for implementation measures. This section summarizes existing groundwater quality and available assimilative capacity and estimated future groundwater quality and assimilative capacity at the end of the SNMP future planning period in 2025. Water quality trends are also discussed.

4.1 Existing Groundwater Quality and Assimilative Capacity

The CBWCB, Central Basin subareas, and adjacent basins are shown in Figure 2[2]. Groundwater quality was assessed with and without inclusion of the coastal areas shown in Figure 2 for the following reasons: 1) high salinity of the coastal areas are associated with historical seawater intrusion, 2) the location of these areas near the coast and in some areas seaward of the seawater intrusion barriers, and 3) the likelihood that these areas will not be used for potable supply[3]. The West Coast Basin water quality was further assessed with and without the large trapped WCBB-inland saline plume, shown in green in Figure 2.

Table J-1 and Figure 40 present the average existing TDS, chloride, and nitrate as nitrogen (nitrate-N) concentrations for each Central Basin subarea and for the basins as a whole and each constituent's BPO/BSBPOs. The calculated available existing assimilative capacity for each area is also presented in Table J-1.

The analysis indicates that average TDS, chloride, and nitrate concentrations in the Central Basin are below BPO/BSBPOs and assimilative capacity is available. The elevated average TDS

[1] The Central Basin and West Coast Basin have different BSBPOs for TDS and chloride. The have the same BPO for nitrate.

[2] The subareas shown on Figure 2 represent model subareas. Due to gridding of the model domain, the subarea boundaries have a stepped rather than a smooth appearance.

[3] Based on groundwater quality, large portions of the coastal areas are not suitable for potable supply in accordance with SWRCB Sources of Drinking Water Policy (Resolution No. 88-63 as revised by Resolution No. 2006-0008).

Table J-1 Summary of Existing Average Groundwater Quality and Available Assimilative Capacity

	GROUNDWATER QUALITY IN SUBAREAS AND IN THE CBWCB (all concentrations in mg/L)																																
	Los Angeles Forebay			Montebello Forebay			Whittier Area			Central Basin Pressure Area (including coastal area)			Central Basin Pressure Area (no coastal area)			Central Basin (including coastal area)			Central Basin (no coastal area)			West Coast Basin (including coastal areas)			West Coast Basin (no coastal areas)			West Coast Basin (no coastal areas & no saline plume)			Coastal Areas [a] (seaward of seawater barriers)		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS [b]	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
Existing Average Concentration	640	81	0.15	534	88	1.13	1,007	121	0.57	485	65	0.10	470	55	0.10	538	73	0.28	529	67	0.28	1,424	660	0.04	890	306	0.05	747	224	0.05	2,464	1,343	0.01
BPO/BSBPO	700	150	10.00	700	150	10.00	700	150	10.00	700	150	10.00	700	150	10.00	700	150	10.00	700	150	10.00	800	250	10.00	800	250	10.00	800	250	10.00	700/ 800	150/ 250	10.00
Assimilative Capacity	60	69	9.85	166	62	8.87	-307	29	9.43	215	85	9.90	230	95	9.90	162	77	9.72	171	83	9.72	-624	-410	9.96	-90	-56	9.95	53	26	9.95	-1,764/ -1,664	-1,193/ -1,093	9.99

TDS - total dissolved solids
Cl - chloride
NO_3-N - nitrate as nitrogen
NA - not applicable; no Model Layer 1 in these areas
Averages based on groundwater concentration contour maps; average of all layers is a weighted average based on area and aquifer thickness
Negative numbers indicate there is no available assimilative capacity
BPO/BSBPO - Basin Plan Objective or Basin Specific Basin Plan Objective
- Average concentration indicated exceeds BPO
- Model Layer 1 not included; typically unsaturated within the Los Angeles Forebay and of very limited extent Whittier Area (see explanation in Appendix G *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality* Section 2.6.3)

a - Includes both Central Basin and West Coast Basin

b - Elevated TDS and chloride concentrations in the Whittier Area are likely naturally occurring as discussed in Appendix G *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality* Section 3.5.3

concentration in the Whittier Area (see Table J-1) is due to naturally-occurring conditions, specifically dissolution of formation materials high in silts and clays and/or of marine origin.

Due to historical seawater intrusion in the West Coast Basin, average TDS and chloride concentrations exceed BPO/BSBPOs when the WCBB-inland saline plume is included and, as a result, there is no available assimilative capacity for TDS and chloride in this basin. However, average nitrate concentrations in the West Coast Basin are well below the BPO and assimilative capacity is available for nitrate. As shown in Figure 40 and Table J-1, when the WCBB-inland saline plume[4] is removed from the basin average calculations, the West Coast Basin does have available assimilative capacity for TDS, chloride, and nitrate.

It is important to note that, despite the existing elevated TDS and chloride groundwater concentrations in the West Coast Basin, TDS and chloride concentrations are declining due to existing and proposed implementation measures. Existing implementation measures include the basin adjudication and associated limits on pumping, the seawater intrusion barriers, and the desalters. TDS and chloride concentrations will continue to decline and the decline will accelerate with the proposed increased use of recycled water that has received advanced water treatment (AWT) at the seawater barriers (completely replacing imported water) combined with the proposed increased pump and treat by the desalters (including expansion of the Goldsworthy Desalter).

4.2 Future Groundwater Quality and Assimilative Capacity

Future groundwater quality was simulated for each of the basins and basin subareas/model layers assuming implementation of planned projects through the future planning period (WY 2010-11 to 2024-25). Future projects and simulated water quality results are presented in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater*. Major future projects or "scenarios" simulated by the SNMP mixing model and discussed in Appendix I are summarized in **Table J-2**.

Table J-3 lists the change in groundwater quality calculated for the Central Basin and West Coast Basin for each of the future project scenarios described above.

In the Central Basin for all projects, TDS, chloride, and nitrate concentrations increase slightly in groundwater, but eventually level out as 2025 is approached. The increase in nitrate levels in groundwater is very small and nitrate is not considered a water quality concern because concentrations remain well below the BPO. TDS, chloride, and nitrate do not exceed BPO/BSBPOs by 2025 in the Central Basin. The implementation of either Groundwater Reliability Improvement Program (GRIP) Recycled Water Project A (GRIP A) or Recycled Water Project B (GRIP B) (Scenarios 6 and 7, respectively) would result in TDS and chloride concentrations in groundwater to remain below BPO/BSBPOs. The GRIP B Scenario (all tertiary-

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[4] The saline plume that is inland of the West Coast Basin Barrier was able to be removed when calculating existing salt and nutrient concentrations overall in the basin, but it was not possible to remove the plume area for future (planning period through 2025) groundwater quality simulations due to difficulties in extracting water balances for this subarea from the groundwater model.

Table J-2 List of Scenarios Simulated by the SNMP Mixing Model

Scenario No.	Description
1	**No Future Projects** – Average of baseline period conditions (i.e. continuation of only existing projects and no implementation of proposed projects) reproduced for each year of the future planning period (Water Year [WY] 2010-11 through 2024-25).
2	**Increased Recycled Water for Irrigation (Baseline Period Average Water Quality)** – This is a proposed project in the Central Basin and West Coast Basin (CBWCB) that would increase the use of recycled water for irrigation (replacing imported water and groundwater). Recycled water used for irrigation is anticipated to increase from the 10-year baseline period (WY 2000-01 through 2024-25) average of about 10,600 acre-feet per year (AFY) to about 23,100 AFY by WY 2024-25. For this scenario, recycled water quality for salt and nutrients (S/Ns) is equivalent to the baseline period average (see Table I-9 in Appendix I). For the CBWCB Salt and Nutrient Management Plan (SNMP), S/Ns specifically refers to nitrate as nitrogen (nitrate-N), total dissolved solids (TDS), and chloride.
3	**Increased Recycled Water for Irrigation (Water Quality Equivalent to MCL/SMCLs)** – This is a proposed project in the CBWCB that would increase the use of recycled water for irrigation (replacing imported water and groundwater). Recycled water used for irrigation is anticipated to increase from a baseline period average of about 10,600 AFY to about 23,100 AFY by WY 2024-25. For this scenario, recycled water quality is equivalent to: • Nitrate as nitrogen (nitrate-N) – Primary Maximum Contaminant Level (MCL) of 10 milligrams per liter (mg/L), • TDS – Secondary Maximum Contaminant Level (SMCL) of 1,000 mg/L, and • Chloride – SMCL of 500 mg/L. These recycled water concentrations are higher than the baseline period averages (Scenario 2). Currently, permitted recycled water quality limits established for non-potable reuse (irrigation, industrial and recreational activities) are generally more conservative than the SMCLs established for TDS and chloride.
4	**Seawater Intrusion Barriers** – This scenario consists of planned projects that would increase injection volumes and increase the use of recycled water that has undergone advanced water treatment (AWT) to completely replace imported water at the West Coast Basin Seawater Intrusion Barrier (WCBB), Alamitos Gap Seawater Intrusion Barrier (AGB), and Dominguez Gap Seawater Intrusion Barrier (DGB). Total AWT recycled water used for injection at the barriers is anticipated to increase from a baseline period average of about 9,500 AFY to about 31,700 AFY by WY 2018-19. The switch to AWT recycled water from imported water significantly reduces TDS and chloride in the recharge water (changes in nitrate concentrations are not significant). As a result, these planned seawater barrier projects were designated as an implementation measure, as further discussed in Section 6.2.2 of this appendix.

Scenario No.	Description
5	**Increased Groundwater Pump and Treat by the Desalters in the West Coast Basin** – This scenario consists of planned projects that would increase the amount of groundwater pumped and treated by the two existing desalter facilities in the West Coast Basin. The Robert W. Goldsworthy Desalter will be expanded and the associated groundwater pumping will increase from a baseline period average of about 1,900 AFY to about 5,500 AFY by WY 2014-15. Groundwater pumping for treatment by the C. Marvin Brewer Desalter is also expected to increase from a baseline period average of about 500 AFY to an average of about 900 AFY in the future planning period. Since these planned desalter projects are expected to improve groundwater quality, they were designated as an implementation measure, as further discussed in Section 6.2.2 of this appendix.
6	**Groundwater Reliability Improvement Program, Recycled Water Project A (GRIP A)** – This is a planned project in the Central Basin that would increase the use of recycled water, specifically a combination of AWT recycled water (10,000 acre-feet per year [AFY]) and tertiary-treated recycled water (11,000 AFY) to completely replace imported water for recharge at the Montebello Forebay Spreading Grounds (MFSG) beginning WY 2017-18.
7	**GRIP Recycled Water Project B (GRIP B)** – This is a proposed project in the Central Basin that would increase the use of tertiary-treated recycled water (21,000 AFY) to completely replace imported water for recharge at the MFSG beginning WY 2014-15.
8	**Combined Projects/Scenarios** – A combination of Scenarios 2 (increased recycled water for irrigation at baseline period average S/N concentrations), 4, 5, 6 (GRIP A), and minor future changes (includes increased and decreased imported water for supply in the West Coast Basin and Central Basin, respectively, and increased stormwater capture).
9	**Combined Projects/Scenarios** – A combination of Scenarios 2 (increased recycled water for irrigation at baseline period average S/N concentrations), 4, 5, 7 (GRIP B), and minor future changes (includes increased and decreased imported water for supply in the West Coast Basin and Central Basin, respectively, and increased stormwater capture).
10	**Combined Projects/Scenarios** – A combination of Scenarios 3 (increased recycled water for irrigation at SMCLs/MCL), 4, 5, 6 (GRIP A), and minor future changes (includes increased and decreased imported water for supply in the West Coast Basin and Central Basin, respectively, and increased stormwater capture).
11	**Combined Projects/Scenarios** – A combination of Scenarios 3 (increased recycled water for irrigation at SMCLs/MCL), 4, 5, 7 (GRIP B), and minor future changes (includes increased and decreased imported water for supply in the West Coast Basin and Central Basin, respectively, and increased stormwater capture).

SNMP – Salt and Nutrient Management Plan
S/N – salt and nutrient
MCL – Maximum Contaminant Level
SMCL – Secondary Maximum Contaminant Level
Nitrate-N – nitrate as nitrogen
TDS – total dissolved solids
mg/L – milligrams per liter
CBWCB – Central Basin and West Coast Basin
AFY – acre-feet per year
WY – Water Year
GRIP – Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A
GRIP B – GRIP Recycled Water Project B
MFSG – Montebello Forebay Spreading Grounds

Table J-3 Future Groundwater Projects – Groundwater Quality Impacts and Use of Available Assimilative Capacity

FUTURE PROJECTS - CHANGE IN GROUNDWATER QUALITY AND USE OF AVAILABLE ASSIMILATIVE CAPACITY

Scenario	1. No Future Projects			2. Increased Recycled Water Irrigation (Baseline period average RW quality)						3. Increased Recycled Water Irrigation (RW quality at MCL/SMCLs)					
Basin				Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
CENTRAL BASIN [e]															
Change (2010 to 2025) (mg/L)	4.6	5.1	0.11	5.8	5.4	0.11	1.2	0.3	0.00	6.2	5.9	0.11	1.6	0.8	0.00
A.C. Used (2010 to 2025) (%)	2.7%	6.1%	1.1%	3.4%	6.4%	1.1%	0.7%	0.3%	0.0%	3.6%	7.1%	1.1%	0.9%	1.0%	0.0%
WEST COAST BASIN [e]															
Change (2010 to 2025) (mg/L)	-23.0	-23.6	0.07	-21.3	-23.0	0.07	1.7	0.6	0.00	-20.6	-22.4	0.07	2.4	1.3	0.00
A.C. Used (2010 to 2025) (%)	NC	NC	0.7%	NC	NC	0.7%	NC	NC	0.0%	NC	NC	0.7%	NC	NC	0.0%

Scenario	4. Seawater Barriers						5. Desalters						6. GRIP A (Tertiary and AWT RW)					
Basin	Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
CENTRAL BASIN [e]																		
Change (2010 to 2025) (mg/L)	2.8	4.8	0.11	-1.8	-0.3	0.00	4.6	5.1	0.11	0.0	0.0	0.00	4.1	5.5	0.14	-0.5	0.4	0.03
A.C. Used (2010 to 2025) (%)	1.6%	5.8%	1.1%	-1.1%	-0.3%	0.0%	2.7%	6.1%	1.1%	0.0%	0.0%	0.0%	2.4%	6.6%	1.4%	-0.3%	0.5%	0.3%
WEST COAST BASIN [e]																		
Change (2010 to 2025) (mg/L)	-41.0	-28.3	0.06	-18.0	-4.7	0.00	-36.6	-29.4	0.07	-13.6	-5.8	0.00	-23.0	-23.6	0.07	0.0	0.0	0.00
A.C. Used (2010 to 2025) (%)	NC	NC	0.6%	NC	NC	0.0%	NC	NC	0.7%	NC	NC	0.0%	NC	NC	0.7%	NC	NC	0.0%

Scenario	1. No Future Projects			7. GRIP B (Tertiary RW)						8. Combined Projects/Scenarios (2 + 4 + 5 + 6 + Minor Future Changes) [d]					
Basin				Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
CENTRAL BASIN [e]															
Change (2010 to 2025) (mg/L)	4.6	5.1	0.11	7.7	6.4	0.15	3.1	1.3	0.04	0.7	5.0	0.14	-4.0	-0.1	0.03
A.C. Used (2010 to 2025) (%)	2.7%	6.1%	1.1%	4.5%	7.7%	1.5%	1.8%	1.5%	0.4%	0.4%	6.0%	1.4%	-2.3%	-0.1%	0.3%
WEST COAST BASIN [e]															
Change (2010 to 2025) (mg/L)	-23.0	-23.6	0.07	-23.0	-23.6	0.07	0.1	0.0	0.00	-57.4	-34.7	0.06	-34.4	-11.1	0.00
A.C. Used (2010 to 2025) (%)	NC	NC	0.7%	NC	NC	0.7%	NC	NC	0.0%	NC	NC	0.6%	NC	NC	0.0%

Scenario	9. Combined Project/Scenarios (2 + 4 + 5 + 7 + Minor Future Changes) [d]						10. Combined Projects/Scenarios (3 + 4 + 5 + 6 + Minor Future Changes) [d]						11. Combined Projects/Scenarios (3 + 4 + 5 + 7 + Minor Future Changes) [d]					
Basin	Overall Scenario [a]			Scenario minus Baseline Conditions [b]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]			Overall Scenario [a,c]			Scenario minus Baseline Conditions [b,c]		
	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N	TDS	Cl	NO_3-N
CENTRAL BASIN [e]																		
Change (2010 to 2025) (mg/L)	4.2	5.9	0.15	-0.4	0.8	0.04	1.1	5.6	0.14	-3.5	0.5	0.03	4.7	6.5	0.15	0.1	1.3	0.04
A.C. Used (2010 to 2025) (%)	2.5%	7.1%	1.5%	-0.2%	0.9%	0.4%	0.7%	6.7%	1.4%	-2.0%	0.6%	0.3%	2.8%	7.8%	1.5%	0.1%	1.6%	0.4%
WEST COAST BASIN [e]																		
Change (2010 to 2025) (mg/L)	-57.3	-34.7	0.06	-34.3	-11.1	0.00	-56.8	-34.1	0.06	-33.8	-10.5	0.00	-56.7	-34.1	0.06	-33.7	-10.4	0.00
A.C. Used (2010 to 2025) (%)	NC	NC	0.6%	NC	NC	0.0%	NC	NC	0.6%	NC	NC	0.0%	NC	NC	0.6%	NC	NC	0.0%

TDS - total dissolved solids
AWT - advanced water treatment
MCL - maximum contaminant level
Cl - chloride
SMCL - secondary MCL
NO_3-N - nitrate as nitrogen
mg/L - milligrams per liter
NC - No assimilative capacity available
A.C. - assimilative capacity
GRIP - Groundwater Reliability Improvement Program
GRIP A – GRIP Recycled Water Project A
GRIP B - GRIP Recycled Water Project B
RW - recycled water
Baseline - The period of time from water year 2000-01 to 2009-10 used for assessment of salt and nutrient inflows and outflows

a - "Overall Scenario" quantifies the impacts of the indicated future project/scenario in combination with existing projects in the CBWCB, i.e. including average baseline conditions (No Future Projects Scenario) continued through the future planning period

b - "Scenario minus Baseline Conditions" quantifies the impacts of the indicated future project/scenario solely, without existing projects in the CBWCB, i.e. excluding average baseline conditions (No Future Projects Scenario) or background loading

c - Positive value indicates the scenario is increasing concentrations or using additional available assimilative capacity; negative value indicates the scenario is improving groundwater quality or increasing available assimilative capacity

d -Minor Future Changes, as referenced for all combined scenarios (8, 9, 10, and 11), include decreased imported water use for supply in the Central Basin, slightly increased imported water for supply in the West Coast Basin, and increased stormwater capture at the DGSG and other facilities

e - 2010 year values used to calculate changes in concentrations and use of assimilative capacity are the average existing groundwater quality and available assimilative capacity treated recycled water) would increase TDS, chloride, and nitrate concentrations relative to baseline conditions (i.e. Scenario 1, No Future Projects) and the GRIP A Scenario (blend of tertiary-treated and AWT recycled water) results are similar to the No Future Projects Scenario.

In the West Coast Basin for all projects, TDS and chloride concentrations are decreasing, and nitrate concentrations are very slightly increasing in groundwater. As with findings in the Central Basin, the increase in nitrate concentrations in the West Coast Basin is minimal and thus, nitrate is not considered a water quality concern because concentrations remain significantly below the BPO. Existing average TDS and chloride concentrations are above BSBPOs due to historical seawater intrusion. Existing implementation measures such as basin adjudication, injection at the seawater intrusion barriers, and operation of the desalters will continue to improve TDS and chloride groundwater quality over time. Planned implementation measures will further improve groundwater quality over time. Average TDS and chloride concentrations are expected to decline in the West Coast Basin through 2025 and are estimated to achieve BSBPOs by about 2035.

Nitrate concentrations in groundwater in the CBWCB are well below the BPO with very minor increasing trends. Accordingly, nitrate is not currently or predicted to be a groundwater quality concern in the future in the CBWCB and thus, nitrate did not drive implementation measures development. The increased recycled water irrigation scenarios (Scenarios 2 and 3) both slightly increase TDS and chloride loading, with greater loading from Scenario 3 due to concentrations at SMCLs/MCL, which are higher than the baseline period averages. Nonetheless, S/N concentrations in groundwater remain below the BPO/BSBPOs in the Central Basin. When Scenarios 2 and 3 are combined with existing and proposed implementation measures (see Section 6.2), S/N concentrations decline over time in the West Coast Basin.

Because the negative water quality impacts of increased recycled water use for irrigation have been demonstrated in the SNMP to be minor and more than offset by implementation measures and projects that improve groundwater quality, the SNMP may be used to modify currently permitted recycled water quality limits established for non-potable reuse (irrigation, industrial and recreational activities) and provide a basis for streamlining the permitting process for future recycled water projects, per the Recycled Water Policy and the Governor's recent drought proclamations (refer to Section 3.3). In particular, irrigation with recycled water has very minor impacts on groundwater quality and thus, permits for individual irrigation sites do not appear warranted. As a result, TDS, chloride, and nitrate limits for recycled water used for irrigation and other non-potable reuse applications can be set equivalent to SMCLs/MCL, while still protecting groundwater quality and preserving beneficial uses.

5 Assessment of Need for Implementation Measures

The Recycled Water Policy states that within one year of the receipt of a proposed SNMP, the Regional Water Quality Control Board shall consider for adoption revised implementation plans, consistent with Water Code section 13242, for those groundwater basins where Water Quality Objectives (WQOs) or BPOs for S/Ns are being, or are threatening to be exceeded. Accordingly, the need for, or lack of need for implementation measures was determined by comparing existing and projected future groundwater quality with respect to BPO/BSBPOs.

Nitrate does not exceed or threaten to exceed its BPO in either the Central Basin or West Coast Basin. TDS and chloride do not exceed or threaten to exceed their BSBPOs in the Central Basin. In the West Coast Basin, average TDS and chloride concentrations in groundwater currently exceed BSBPOs due to historical seawater intrusion, but are declining and expected to reach BSBPOs in the future (approximately 2035) as a result of existing and planned implementation measures. Thus, in accordance with the Recycled Water Policy, implementation measures are warranted for the West Coast Basin. While not strictly required by the Recycled Water Policy, implementation measures have also been developed for the Central Basin. All implementation measures developed by the stakeholders for the CBWCB are described in Section 6.

Elevated average TDS and chloride concentrations in groundwater in the West Coast Basin are the result of seawater intrusion in areas along the coast caused by significant historical groundwater over-pumping and associated drawdown. A large plume of saline groundwater became trapped inland after operation of the WCBB. This WCBB-inland saline plume causes overall average TDS and chloride concentrations to exceed BSBPOs in the West Coast Basin. This is due to the significant size of the WCBB-inland saline plume and the high TDS and chloride concentrations within the plume. WRD has estimated the volume of the WCBB-inland saline plume to be greater than 600,000 acre-feet (AF) (Johnson, 2013).

Significant implementation measures have been undertaken and are planned to protect groundwater quality in the CBWCB and to restore West Coast Basin groundwater quality to below BSBPOs. In order to address over-pumping, the Central Basin and West Coast Basin were adjudicated in 1965 and 1961, respectively, to limit groundwater pumping and WRD was formed in 1959 to manage the basins and facilitate groundwater recharge. WRD and other stakeholders have addressed the seawater intrusion by optimizing operation of the WCBB, DGB, and AGB; using high quality water for injection in the barriers, which replenishes the basins and dilutes the saline groundwater; operating the Brewer Desalter and Goldsworthy Desalter to extract brackish groundwater from the leading edge of the WCBB-inland saline plume and in the future from targeted spots within the plume; surface spreading of stormwater to dilute groundwater salt concentrations; and operating the MFSG to replenish the Central Basin. Expansion of the Goldsworthy Desalter and increased recharge at the WCBB, DGB, AGB, DGSG, and MFSG are currently planned to further mitigate the effects of basin overdraft, including seawater intrusion. Over the past 20 years, WRD has evaluated other alternatives to remediate the saline groundwater. These projects are hindered by legal, technical, economic, and institutional obstacles such as:

- Adjudicated pumping rights that limit groundwater extraction to 64,468 AFY in the West Coast Basin and 217,367 AFY in the Central Basin;
- Impacts of increased desalter well pumping on the seawater intrusion barriers that necessitate additional barrier injection wells and replenishment water;
- Capital and operation costs for extraction and injection wells, membrane treatment for saline groundwater, brine disposal systems, piping systems, etc.; and

- Lack of open space for new wells, treatment systems, and pipelines.

The analysis presented in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality* of the SNMP demonstrate that for the West Coast Basin, the existing and planned implementation measures are improving groundwater quality. Specifically, average TDS and chloride concentrations are expected to decline in the West Coast Basin through 2025 and are estimated to achieve BSBPOs in about 2035.

Based on the SNMP analysis, no additional implementation measures beyond what has been implemented and are planned through 2025 are warranted. Nonetheless, the S/N management process in the CBWCB is active and ongoing. S/N groundwater quality will continue to be monitored through the future to determine if water quality improvement objectives are met and the need for additional implementation measures will be reassessed when the SNMP is updated in 10 years or when deemed necessary based on the results of the SNMP Monitoring Program.

6 Implementation Measures

6.1 Types of Impacts – Loading Versus Concentration

Implementation measures are projects or programs established to control, reduce, or manage (mitigate) S/N loading on a sustainable basis. Implementation measures can impact the groundwater basins in two ways: 1) they can decrease the S/N loading, and/or 2) they can decrease the concentration of S/Ns in groundwater. This distinction is important in understanding the different types of benefits of implementation measures in the context of S/N management. The impacts are differentiated by the source water quality and whether one source water replaces another of different water quality. Some of the proposed major recycled water projects discussed in Section 7 do not decrease S/N loading or decrease S/N concentrations in groundwater and hence, they were not designated as implementation measures.

Table J-4 shows the range in average TDS, chloride, and nitrate-N concentrations in different water sources recharged in the CBWCB. The different water sources are listed from top to bottom, from lowest to highest relative TDS concentrations. The current average groundwater concentrations in the Central Basin and the West Coast Basin are also included in the table.

The average water quality values shown in Table J-4 may be used to generally illustrate the loading and concentration impacts on a groundwater basin from the different source waters. Depending on the concentration of a constituent in a source water, and whether or not this source water is replacing another source water, a project can increase or decrease the S/N loading into a basin while also decreasing the S/N concentration in groundwater. Figure 63 shows a schematic diagram representing how several types of projects impact the basins differently in terms of TDS loading and average TDS concentrations in groundwater.

Table J-4 Average TDS, Chloride and Nitrate Source Water Concentrations

Type of Water	TDS [a] (mg/L)	Chloride [a] (mg/L)	NO_3–N [a] (mg/L)
AWT RW [b]	65 - 98	9 - 37	0.26 - 1.13
Stormwater [c]	25 9- 297	40 - 46	1.16 - 1.58
Treated Imported Water [d]	218 - 481	25 - 84	0.09 - 0.61
MFSG [e]	286 - 492	37 - 107	1.45 - 3.07
Untreated Imported Water [f]	251 - 624	68 - 88	0.21 - 0.67
Central Basin Groundwater [i]	**529**	**67**	**0.28**
Tertiary RW Spreading Grounds [g]	533 - 626	105 - 149	3.41 - 6.31
Tertiary RW Irrigation [h]	533 - 825	109 - 211	1.01 - 5.63
West Coast Basin Groundwater [i]	**890**	**306**	**0.05**

TDS – total dissolved solids
mg/L – milligrams per liter
NO_3-N – nitrate as nitrogen
AWT – advanced water treatment
RW – recycled water
TM – Technical Memorandum
WTP – Water Treatment Plant
WRF – Water Recycling Facility
WRP – Water Reclamation Plant
AWTF – Advanced Water Treatment Facility
WY – water year
TIWRP – Terminal Island Water Reclamation Plant/Advanced Water Purification Facility
WRD – Water Replenishment District of Southern California
MFSG – Montebello Forebay Spreading Grounds
MWD – Metropolitan Water District of Southern California
WBMWD – West Basin Municipal Water District
SDLAC – Sanitation Districts of Los Angeles County

a – Water quality information is presented in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality;* concentrations are expressed as ranges of averages from different source waters over the 10-year baseline period from WY 2000-01 to 2009-10 (e.g., the “AWT RW” ranges are made up of the 10-year averages for constituents from the three different AWT facilities)

b – AWT RW from WBMWD’s Edward C. Little WRF, WRD’s Leo J. Vander Lans AWTF, and City of Los Angeles’ TIWRP

c – Montebello Forebay Spreading Grounds intake during storm events and Los Angeles County’s stormwater monitoring station S10 near the Dominguez Gap Spreading Grounds

d – Based on MWD’s Jensen WTP, Diemer WTP, Weymouth WTP, and City of Los Angeles’ WTPs

e – Combination of imported water, stormwater, and recycled water

f – Untreated water from the Colorado River and the State Water Project

g – Tertiary-treated RW from SDLAC’s Pomona, San Jose Creek, and Whittier Narrows WRPs

h – Tertiary-treated RW from SDLAC’s San Jose Creek, Los Coyotes, and Long Beach WRPs, and WBMWD’s Edward C. Little WRF

i – Averages excluding coastal areas

For example, the first two arrows on the left in Figure 63 could represent the Scenario 4 (see Section 4.2), which replaces imported water (higher TDS concentration) with AWT recycled water (lower TDS concentration) at the three seawater intrusion barriers. In this case, both the TDS loading and average TDS concentration in groundwater decrease. However, if a source water containing a lower TDS concentration than those in ambient groundwater is added to the basin without replacing another source water (e.g., new stormwater capture project or a new AWT recycled water injection well), the TDS loading would increase while the basin concentration would decrease. This is represented by the third arrow from the left in Figure 63. Another example is the desalter wells. These wells extract impacted groundwater within the WCBB-inland saline plume for treatment, resulting in increased outflow of TDS (decreased loading) and decreased TDS concentrations in groundwater, illustrated by the second arrow from the right in Figure 63. The two types of impacts (S/N loading and concentration) were assessed for various implementation measures and proposed major recycled water projects in the CBWCB.

Examples of project impacts depicted in Figure 63 are summarized in **Table J-5**.

6.2 Existing, Planned, and Conceptual Implementation Measures

Implementation measures are projects, programs, or strategies for stakeholders to manage S/Ns on a sustainable basis. "Sustainable" in this context means using a resource such that the resource is not depleted or permanently damaged. The SNMP planning horizon is 2025 for the implementation measures that were developed by the CBWCB stakeholders and summarized in this section. The implementation measures were classified into three categories: existing, planned, and conceptual.

Table J-6 lists the existing, planned and conceptual implementation measures, as well their impacts to groundwater in terms of S/N loading and concentration. Existing implementation measures are projects/programs that are currently in place. For existing implementation measures, the impacts to S/N loading and concentrations in groundwater are determined in relation to conditions before they were implemented (e.g., existing seawater intrusion barriers currently recharged with AWT recycled water and imported water are compared to seawater intrusion barriers prior to the injection of AWT recycled water, when only imported water was injected). Implementation measures are classified as planned if they are scheduled to be in operation prior to 2025, notwithstanding exigencies that are outside the control of the project sponsors. Available costs are shown for planned implementation measures. The conceptual implementation measures are projects that have been hypothetically identified, so they may or may not be implemented before or after 2025, if ever.

Some of the implementation measures listed in Table J-6, specifically major existing and proposed projects in the basins, were quantitatively assessed for their S/N groundwater quality impacts using the SNMP mixing model, as discussed further in Section 4.2. The remaining implementation measures were not modeled because these projects were smaller in size and complexity (thus, their impacts to overall groundwater quality were insignificant) and/or lacked details that were required to perform modeling (e.g. conceptual implementation measures).

Table J-5 Examples of Projects Affecting Salt and Nutrient Loading and Concentrations in Groundwater

Description	Impact to S/N Loading to Groundwater	Impact to S/N Concentrations in Groundwater	Example Project
Replace current water with lower TDS water	Decrease	Decrease	Seawater intrusion barriers replacing imported water with AWT recycled water
Add lower TDS water	Increase	Decrease	New stormwater capture project; new AWT recycled water injection wells [a]
Replace current water with higher TDS water	Increase	Increase	Existing irrigation that replaces imported water with tertiary-treated recycled water
Add higher TDS water	Increase	Increase	New irrigation with tertiary treated recycled water
Increase saline plume pumping	Decrease	Decrease	Desalters
Increase well pumping	Decrease	None	Typical groundwater production

TDS – total dissolved solids AWT – advanced water treatment S/N – salt and nutrient

a – New injection of AWT recycled water via wells (not replacing an existing water source) is currently a conceptual implementation measure

Table J-6 CBWCB Implementation Measures

Timeframe	Category	Implementation Measure (IM) No.	Description of Existing S/N Management Strategy	Basin	Cost [a]	Implementation Date	Impact to S/N Loading to Groundwater	Impact to S/N Concentrations in Groundwater
Existing	Seawater intrusion control	1	Three seawater intrusion barriers (WCBB, DGB, and AGB), existing operations with imported water and AWT recycled water	CBWCB	N/A	Existing	Decrease	Decrease
		2	Two desalters (Brewer Desalter and Goldsworthy Desalter)	WCB	N/A	Existing	Decrease	Decrease
	Groundwater recharge	3	Dominguez Gap Spreading Grounds existing operations	WCB	N/A	Existing	Increase	Decrease
		4	Montebello Forebay Spreading Grounds existing operations	CB	N/A	Existing	Increase	Decrease
		5	Montebello Forebay Spreading Grounds interconnection pipeline	CB	N/A	Existing	Increase	Decrease
		6	Rio Hondo Spreading Grounds Basin 6E to 8E connection	CB	N/A	Existing	Increase	Decrease
		7	San Gabriel River rubber dams	CB	N/A	Existing	Increase	Decrease
		8	Whittier Narrows Dam Conservation Pool Project	CB	N/A	Existing	Increase	Decrease
	Institutional	9	CBWCB adjudication and Central Basin judgment amendment (December 2013)	CBWCB	N/A	Existing	Decrease	Decrease
		10	Groundwater management agency (WRD)	CBWCB	N/A	Existing	Decrease	Decrease
	Source water salinity control	11	LACDPW stormwater "First Flush" policy	CBWCB	N/A	Existing	Decrease	Decrease
		12	MWD Salinity Source Water Control Program	CBWCB	N/A	Existing	Decrease	Decrease
	Stormwater capture/runoff management	13	City of Torrance stormwater retention basins	WCB	N/A	Existing	Increase	Decrease
		14	LID and stormwater BMPs	CBWCB	N/A	Existing	Decrease	Decrease
		15	MS4 NPDES permits issued by LARWQCB	CBWCB	N/A	Existing	Decrease	Decrease
	Wastewater salinity/ nutrient source control	16	Industrial wastewater source control programs	CBWCB	N/A	Existing	Decrease	Decrease
		17	Wastewater and recycled water nitrogen treatment	CBWCB	N/A	Existing	Decrease	Decrease
		18	Residential automatic water softener educational outreach	CBWCB	N/A	Existing	Decrease	Decrease
	Public education	19	Council for Watershed Health (http://watershedhealth.org/Default.aspx)	CBWCB	N/A	Existing	Potential non-measureable decrease	Potential non-measureable decrease
		20	CBWCB SNMP (http://www.wrd.saltnutrient.com/)	CBWCB	N/A	Existing	Potential non-measureable decrease	Potential non-measureable decrease
		21	Water Replenishment District of Southern California (WRD) (http://www.wrd.org/index.php)	CBWCB	N/A	Existing	Potential non-measureable decrease	Potential non-measureable decrease
		22	Southern California Salinity Coalition (http://www.socalsalinity.org/)	CBWCB	N/A	Existing	Potential non-measureable decrease	Potential non-measureable decrease
		23	WateReuse Association (http://www.watereuse.org/) and WateReuse Research Foundation (http://www.watereuse.org/foundation)	CBWCB	N/A	Existing	Potential non-measureable decrease	Potential non-measureable decrease
	Conservation	24	Senate Bill x7-7 (20% by 2020) and Other Activities	CBWCB	N/A	Existing	Potential non-measureable decrease	Potential non-measureable decrease
	Regulatory/ non-regulatory	25	Wastewater, recycled water, surface water/stormwater, imported water and groundwater monitoring	CBWCB	N/A	Existing	Potential non-measureable decrease	Potential non-measureable decrease
		26	State regulations for groundwater replenishment using recycled water	CBWCB	N/A	Existing	Potential non-measureable decrease	Potential non-measureable decrease
		27	LARWQCB permits for groundwater recharge	CBWCB	N/A	Existing	Potential non-measureable decrease	Potential non-measureable decrease
		28	Recycled water non-potable reuse regulations, guidelines, and permits	CBWCB	N/A	Existing	Potential non-measureable decrease	Potential non-measureable decrease
	Land use regulation	29	Model Water Efficient Landscape Ordinance	CBWCB	N/A	Existing	Decrease	Decrease

Table J-6 CBWCB Implementation Measures (continued)

Timeframe	Category	Implementation Measure (IM) No.	Description of Proposed S/N Management Strategy	Basin	Cost [a]	Estimated Implementation Date	Impact to S/N Loading to Groundwater	Impact to S/N Concentrations in Groundwater
Planned	Seawater intrusion control	30	Increase AWT recycled water supply (completely replacing imported water) for all three seawater intrusion barriers (WCBB, AGB, and DGB)	CBWCB	$206M	2017	Decrease	Decrease
		31	Increase groundwater pump and treat by the desalters and expansion of Goldsworthy Desalter	WCB	$60M	2015	Decrease	Decrease
	Groundwater recharge	32	Dominguez Gap Spreading Grounds West Basin Percolation Enhancement	WCB	$4M	2015	Increase	Decrease
		33	Montebello Forebay Spreading Grounds new turnout structures	CB	$60M	2015	Increase	Decrease
		34	Rio Hondo Spreading Grounds sediment removal	CB	$10M	2016/17	Increase	Decrease
	Institutional	35	West Coast Basin judgment amendment	WCB	N/A	Before 2025	Potential non-measureable decrease	Potential non-measureable decrease
	Stormwater capture/runoff management	36	Additional LID projects and stormwater BMPs	CBWCB	N/A	Ongoing	Decrease	Decrease
		37	MS4 permits issued by LARWQCB	CBWCB	N/A	Ongoing	Decrease	Decrease
		38	Los Angeles Basin Stormwater Conservation Study	CBWCB	$140,000	2014	Increase	Decrease
		39	Broadway Neighborhood Stormwater Greenway Project	CBWCB	$3.7M	2015	Increase	Decrease
		40	Improvement to Entradero storm drain channel for stormwater infiltration (GLAC IRWMP)	WCB	$2M	2015	Increase	Decrease
		41	Vermont Avenue stormwater capture	WCB	$2M	2017	Increase	Decrease
	Total Maximum Daily Loads (TMDLs)	42	TMDLs	CBWCB	N/A	Ongoing	Decrease	Decrease
	Conservation	43	Senate Bill x7-7 (20% by 2020) and Other Activities	CBWCB	N/A	2020	Potential non-measureable decrease	Potential non-measureable decrease
	Regulatory/ non-regulatory	44	SNMP Monitoring Program	CBWCB	$30K	2015	Potential non-measureable decrease	Potential non-measureable decrease

Table J-6 CBWCB Implementation Measures (continued)

Timeframe	Category	Implementation Measure (IM) No.	Description of Potential S/N Management Strategy	Basin	Cost [a]	Estimated Implementation Date	Impact to S/N Loading to Groundwater	Impact to S/N Concentrations in Groundwater
Conceptual	Seawater intrusion control	45	Additional desalters	WCB	N/A	Not available	Decrease	Decrease
	Groundwater recharge	46	Additional tertiary-treated/AWT recycled water recharge in the Montebello Forebay	CB	N/A	Not available	Increase	Decrease
		47	Los Angeles River Aquifer Stormwater Recharge and Recovery Facility	CB	N/A	Not available	Increase	Decrease
		48	Montebello Forebay New Extraction and Intrabasin Transfer	CB	N/A	Not available	No change	Decrease
		49	New Los Angeles Forebay AWT recycled water recharge and recovery	CB	N/A	Not available	Increase	Decrease
		50	Whittier Narrows Dam Conservation Pool Project	CB	N/A	Not available	Increase	Decrease
	Stormwater capture/runoff management	51	Additional LID projects and stormwater BMPs	CBWCB	N/A	Not available	Decrease	Decrease
	Wastewater salinity/nutrient source control	52	Residential automatic water softener control (bans and/or rebates)	CBWCB	N/A	Not available	Decrease	Decrease
		53	San Jose Creek East WRP process optimization	CB	$86M	Not available	Increase	Decrease
	Conservation	54	Xeriscape policy	CBWCB	N/A	Not available	Decrease	Decrease
		55	Senate Bill x7-7 (20% by 2020) and Other Activities	CBWCB	N/A	Not available	Potential non-measureable decrease	Potential non-measureable decrease

CBWCB – Central Basin and West Coast Basin; CB – Central Basin; WCB – West Coast Basin; S/N – salt and nutrient; SNMP – Salt and Nutrient Management Plan
SW – stormwater; BMPs – best management practices; WRP – Water Reclamation Plant; LID – low impact development; TMDL – total maximum daily load
DGB – Dominguez Gap Seawater Intrusion Barrier; AGB – Alamitos Gap Seawater Intrusion Barrier; WCBB – West Coast Basin Seawater Intrusion Barrier; N/A – Not available
AWT – advanced water treatment; NPDES – National Pollutant Discharge Elimination System; MS4 – Municipal Separate Storm Sewer System
LARWQCB – Los Angeles Regional Water Quality Control Board; MWD – Metropolitan Water District of Southern California; WRD – Water Replenishment District of Southern California
LACDPW – Los Angeles County Department of Public Works; CDPH – California Department of Public Health; GLAC IRWMP – Greater Los Angeles County Integrated Regional Water Management Plan
MFSG – Montebello Forebay Spreading Grounds, which include the Rio Hondo Spreading Grounds, San Gabriel River Spreading Grounds, and the unlined portion of the San Gabriel River in the Montebello Forebay
Existing – Implementation measures or projects/programs/strategies that are currently in place
Planned – Implementation measures that are anticipated to be in operation before 2025, notwithstanding exigencies that are outside the control of the project sponsors
Conceptual – Implementation measures that have been hypothetically identified, but may or may not begin by 2025
a – Costs were obtained from Greater Los Angeles County IRWMP, 2013; online Project Tracking and Integration [http://irwm.rmcwater.com/la]; CH2MHILL, 2012a; costs are estimated totals for completion of the project including planning, design, construction, and permits; personal communication from Phuong Ly of WRD, March 19, 2014 regarding estimated costs for SNMP monitoring program

Although impacts from some implementation measures could not be quantitatively assessed, it is clear that each implementation measure, based on the details of the project/strategy, will reduce S/N loading and/or improve groundwater quality, as indicated in Table J-6.

As shown in Table J-6, the implementation measures are grouped into the following categories: seawater intrusion control, groundwater recharge, institutional, stormwater capture/runoff management, source water salinity control, wastewater salinity/nutrient source control, total maximum daily loads (TMDLs), conservation, public education, regulatory/non-regulatory, and land use regulation. Generally, projects that improve stormwater, wastewater, and recycled water quality, increase stormwater recharge, increase AWT recycled water recharge, and reduce sources of S/N loading provide for improved groundwater quality are considered implementation measures.

Individual implementation measures listed in Table J-6 are described in detail below, organized by the existing, planned, and conceptual categories and implementation measure (IM) numbers correspond to the numbers shown in the third column from the left in Table J-6.

6.2.1 Existing Implementation Measures

The existing implementation measures are listed as IM 1 through IM 29 in Table J-6 and described in detail below. Since these implementation measures are projects/programs that have already been put into place, they are considered part of the baseline conditions.

SEAWATER INTRUSION CONTROL

<u>IM 1. Seawater Intrusion Barriers (WCBB, DGB, and AGB)</u> – The seawater intrusion barriers are existing implementation measures, which manage the saline intrusion as well as provide groundwater recharge in the CBWCB. Historically, both imported water and advanced treated recycled water were delivered to the seawater barriers for injection. As discussed further in Section 6.2.2 (Implementation Measure No. IM 30), AWT recycled water is expected to be replace imported water at all three seawater barriers during the future planning period.

The AGB began operating in the early 1960s along the southern border of the Central Basin. Historically, the AGB received only treated imported water for injection, but began also utilizing AWT recycled water in 2005. The AWT recycled water is produced by WRD's Leo J. Vander Lans Advanced Water Treatment Facility (Vander Lans AWTF) and the treated imported water is provided by the Metropolitan Water District of Southern California (MWD). Advanced treatment processes at the Vander Lans AWTF currently include microfiltration (MF), reverse osmosis (RO), ultraviolet irradiation (UV), and advanced oxidation (AOP) through the addition of peroxide.

The WCBB began operating in the mid-1950s along the western coast of the West Coast Basin. Historically, the WCBB received only treated imported water for injection, but began also utilizing AWT recycled water in 1995. The AWT recycled water is produced by West Basin Municipal Water District's (WBMWD's) Edward C. Little Water Recycling Facility (Edward C.

Little WRF) and the treated imported water is provided by MWD. Treatment processes at the Edward C. Little WRF include MF, RO, AOP, ozonation (O_3), and chemical stabilization.

The DGB began operating in the early 1970s in southern portion of the West Coast Basin. Currently, AWT recycled water produced by the City of Los Angeles' Terminal Island Water Reclamation Plant/Advanced Water Treatment Facilities (TIWRP) and treated imported water from MWD are delivered to the DGB for injection. The TIWRP treatment train currently includes MF, RO, and chlorination. Historically, the DGB received only treated imported water, but began also utilizing AWT recycled water in 2006.

As shown in Table J-4, AWT recycled water is significantly lower in TDS and chloride compared with imported water, but nitrate levels are very low and comparable in both water sources. As such, the partial replacement of imported water with AWT recycled water at the barriers continues to significantly reduce TDS and chloride loading and concentrations in groundwater in the CBWCB.

IM 2. Desalters – The C. Marvin Brewer Desalter (Brewer Desalter) and Robert W. Goldsworthy Desalter (Goldsworthy Desalter) are existing facilities that treat brackish groundwater pumped from wells located in areas impacted by seawater intrusion in the West Coast Basin, thereby increasing the outflow of S/Ns from the basin and reducing S/N concentrations in groundwater.

The desalters are operating in the City of Torrance. The Brewer Desalter has a design capacity of 1,200 AFY and is owned by WBMWD and operated by California Water Service Company, who distributes the treated water as part of its potable supply.

The Goldsworthy Desalter has a design capacity of 2,800 AFY and currently operates at about 2,200 AFY. It is owned by WRD and is operated and maintained by the City of Torrance, who delivers the treated water to their drinking water system.

GROUNDWATER RECHARGE

IM 3. Dominguez Gap Spreading Grounds (DGSG) Existing Operations – Stormwater is currently captured at the DGSG and recharges the West Coast Basin. Historically, the DGSG recharged both the Central Basin and West Coast Basin. Recharge of stormwater adds S/N load but decreases concentrations because stormwater has lower S/N concentrations compared with ambient groundwater.

IM 4. Montebello Forebay Spreading Grounds Existing (MFSG) Operations – Currently, the MFSG uses tertiary-treated recycled water, untreated imported water, and stormwater for groundwater recharge. Although current recharge operations at the MFSG increase S/N loading, future water quality projections as determined from the SNMP analysis indicate that the current blend of recharge water results in declining S/N concentrations in groundwater in the Montebello Forebay.

IM 5. MFSG Interconnection Pipeline – The interconnection pipeline between the Rio Hondo Spreading Grounds and San Gabriel River Spreading Grounds, completed in 2011, allows greater operational flexibility and increases stormwater capture by about 1,300 AFY (CH2MHILL, 2012b), thereby increasing S/N loading, but reducing S/N concentrations in groundwater.

IM 6. Rio Hondo Spreading Grounds (RHSG) Basin 6E to 8E Connection – Construction of a connection from RHSG Basin 6E to 8E is an existing project that allows for increased flexibility and the capture of an additional 1,200 AFY of replenishment water, thereby increasing S/N loading, but reducing S/N concentrations in groundwater.

IM 7. San Gabriel River Rubber Dams – Additional rubber dams recently installed in the San Gabriel River above the Whittier Narrows Dam increase the amount of stormwater capture by about 3,600 AFY (Johnson, 2011; CH2MHILL, 2012b), thus increasing S/N loading, but reducing S/N concentrations in groundwater.

IM 8. Whittier Narrows Dam Conservation Pool Project – Operational enhancements are being implemented to increase the conservation pool elevation behind the dam from 195 to 205 feet above mean sea level (ft-msl). The project is being implemented in phases. In 2004, the conservation pool elevation behind the dam was raised to 201.6 ft-msl, resulting in an estimated additional capture of about 3,000 AFY of stormwater (Weeks, 2013), thereby increasing S/N loading, but reducing S/N concentrations in groundwater.

INSTITUTIONAL

IM 9 and IM 10. CBWCB Adjudication, Central Basin Judgment Amendment, and Groundwater Management Agency (WRD) – As described in Section 2, the following are existing institutional implementation measures currently in place:

- CBWCB judgments that adjudicated the basins and established other provisions,
- Central Basin judgment amendment issued in December 2013,
- Establishment of a groundwater management agency (WRD), and
- Multiple WRD programs, including the Safe Drinking Water Program, Groundwater Contamination Prevention Program, Regional Groundwater Monitoring Program, Hydrogeology Program, In-Lieu Program, and Water Independence Now (WIN) Program.

Due to significant overdraft in the CBWCB by the mid-1900s, the courts adjudicated the two basins to put a limit on pumping. The West Coast Basin judgment adjudicated the basin in 1961 and limited groundwater extractions to 64,468 AFY. The Central Basin judgment adjudicated the basin in 1965 and limited groundwater extractions to 217,367 AFY. While reduced pumping reduces S/N outflow from the basins, the net effect is reduced loading and improved groundwater quality due to reduced seawater intrusion.

To more efficiently manage the CBWCB and allow flexibility for basin pumpers, the judgments established provisions for carryover of unused annual pumping rights in any given year and an exchange pool wherein water rights not used by one party can be made available to another. A provision in the Central Basin judgment further allows additional carryover of pumping rights during a period that is declared by the WRD as a Water Emergency. The intent of this "drought carryover" provision is to prevent degradation of the groundwater basins by helping to restore groundwater levels and improving the water supply in the aquifers and provide an incentive to groundwater producers in the Central Basin to reduce pumping for a particular period of time under drought conditions.

On December 18, 2013, an amendment to the judgment for the Central Basin was issued by the courts. The amendment enables large-scale changes in the management practices within the basin, which are expected to enhance opportunities to develop recycled water for recharge and improve the capability to utilize the basin's storage for conjunctive use. As a result of the judgment amendment, the Watermaster in the Central Basin is now comprised of three entities: 1) Administrative Body, 2) Water Rights Panel, and 3) Storage Panel. WRD was designated as the Administrative Body and is responsible for preparing the annual *Watermaster Service* reports and submitting them to the Water Rights Panel. The Water Rights Panel is ultimately responsible for submitting the final *Watermaster Service* reports to the Superior Court of the State of California for filing.

WRD was established in 1959 for the purpose of protecting and preserving groundwater in the CBWCB. Accordingly, WRD is enabled under the California Water Code to provide the needed supplemental replenishment water to make up the difference between the adjudicated amounts and the natural safe yield. The process of supplementing natural groundwater recharge with additional recharge is known as artificial replenishment or managed aquifer recharge. In addition to facilitating groundwater recharge, WRD monitors and reports on groundwater quality and cooperates with various regulatory agencies to protect groundwater quality. Increased recharge increases S/N loading, but improves groundwater quality.

In order to ensure that the use of recycled water for groundwater recharge remains a safe and reliable practice, WRD participates in various research and monitoring activities, proactively contributes to the regulatory and legislative development processes, and engages in information exchange and dialogue with regulatory agencies and other recycled water users. WRD continues to closely coordinate with the SDLAC, which produces the recycled water used for surface spreading in the Montebello Forebay, on permit compliance activities, including groundwater monitoring, assessment, and reporting. Many monitoring and production wells are sampled frequently by WRD staff, and the results are reported to the regulatory agencies.

In addition to compliance monitoring and sampling associated with the spreading grounds, WRD is partnering with others to more fully investigate the effectiveness of soil aquifer treatment during groundwater recharge. Research is underway to more fully characterize the percolation process and to quantify the filtering and purifying properties of the underlying soil with respect to constituents of concern, such as nitrogen, total organic carbon, and chemicals of emerging concern (CECs). WRD continues to be vigilant in monitoring research on the occurrence, significance, attenuation, and removal of CECs, including pharmaceuticals, endocrine disruptors, and personal care products.

Three separate groundwater tracer studies were performed in 2003-2005, 2005-2006, and 2010-2011 for the purpose of tracking and verifying the movement of recycled water from the spreading grounds by testing the monitoring wells and the production wells. Results showed that the depth rather than the horizontal distance from the recharge ponds is the key factor influencing arrival times of recycled water to wells. Travel time to deeper wells is greater than to shallower wells, even if the deeper wells are very near the spreading grounds. In some cases, WRD made modifications to wells to seal off their shallow perforations so that the wells would only produce from the deeper aquifers. Tracer tests subsequent to well modification demonstrated an increased travel time compared to earlier results. These efforts, in addition to periodic studies assessing health effects and toxicological issues, are necessary to provide continued assurances that the use of recycled water for groundwater recharge remains safe and compliant with all regulatory standards.

The Safe Drinking Water Program was implemented by WRD in 1991 to promote the cleanup of groundwater resources at specific well locations. As part of this program, WRD provides grants and loans to pumpers in the CBWCB to install wellhead treatment facilities at active production wells that have been impacted by naturally-occurring constituents and man-made chemicals. A total of 16 wellhead treatment systems have been constructed. This program not only helps to remediate groundwater contamination plumes, but also helps to maintain a sustainable water supply by reducing reliance on imported water for potable supply.

In an effort to minimize or eliminate threats to groundwater supplies, WRD established the Groundwater Contamination Prevention Program. As part of this program, WRD created and administers the CBWCB Groundwater Contamination Forum, a data-sharing and discussion forum with key stakeholders that include the United States Environmental Protection Agency (USEPA), California Department of Toxic Substances Control (DTSC), LARWQCB, CDPH (now the SWRCB Division of Drinking Water), United States Geological Survey (USGS), and various cities and drinking water purveyors. In 2005, these stakeholders drafted and signed a Memorandum of Understanding, agreeing to meet regularly and share data on groundwater contaminated sites within the CBWCB. As a key stakeholder, WRD has been tracking and working in close consultation with the regulatory agencies to provide data and technical support to expedite investigations and cleanups at priority groundwater contaminated sites within the CBWCB.

WRD has been monitoring groundwater quality (including S/Ns) and water levels in the CBWCB for over 50 years. The Regional Groundwater Monitoring Program provides for the collection of basic information used for groundwater basin management including groundwater level data and water quality data. It currently consists of a network of over 300 WRD and USGS-installed monitoring wells at over 50 locations throughout the CBWCB, supplemented by the existing groundwater production wells operated by the water purveyors. Annually, WRD collects nearly 600 groundwater samples from its nested monitoring well network and analyzes them for over 100 constituents to produce nearly 60,000 individual data points to help track groundwater quality. The information generated by this program is compiled and evaluated in WRD's annual Regional Groundwater Monitoring Report, which are available for downloading from the WRD website (http://www.wrd.org/engineering/groundwater-engineering-reports.php). The Regional Groundwater Monitoring Report provides water quality summary tables (including data for TDS, chloride, nitrate) for each of the nested monitoring wells, water quality maps for the nested wells and drinking water wells, and maps and hydrographs depicting groundwater level data.

WRD is also the designated groundwater monitoring entity for the CBWCB under the State of California's California Statewide Groundwater Elevation Monitoring (CASGEM) program. WRD collects water level data from 28 of its nested monitoring wells and uploads it to the State's CASGEM website on a regular basis for seasonal and long-term water level trend tracking. Public access to the CASGEM website is at: www.water.ca.gov/groundwater/casgem.

Work performed under WRD's Hydrogeology Program includes the preparation of an annual Engineering Survey and Report, which incorporates the calculation and determination of annual overdraft, accumulated overdraft, changes in storage, pumping amounts, and replenishment water availability to help assess groundwater replenishment needs and costs in the ensuing year. Maps are created to show water levels in the basins and groundwater production patterns and amounts. Much of this information is published in Technical Bulletins, which are two-page documents that summarize groundwater issues of importance in the CBWCB. WRD continuously works with the USGS to better characterize the hydrogeologic conditions in the basins by compiling and interpreting the extensive amounts of data generated during drilling and logging of the WRD/USGS monitoring wells and collected from historical information for production wells and oil wells within the CBWCB. The final conceptual model will significantly improve the understanding of the aquifer depths, extents and thicknesses throughout the basins, and will assist pumpers and other basin stakeholders with planning for groundwater resource projects such as new well drilling, storage opportunities, or modeling.

WRD's In-Lieu Program plays an important role in the conjunctive use of the CBWCB, utilizing surplus imported water to lower the annual overdraft and reduce artificial replenishment needs. The In-Lieu Program helps provide an alternate means of replenishing the groundwater supply by encouraging basin pumpers to purchase surplus imported water when available instead of pumping groundwater, which lowers the annual overdraft and reduces artificial replenishment needs. The goal of the In-Lieu Program is to replenish in those areas which are not easily recharged through surface spreading due to their distance from the MFSG and/or location in deep confined aquifers. When wells are turned off, groundwater levels rise and water remains in storage that would have otherwise been pumped out.

WRD established the WIN Program to develop local and sustainable sources of water for use in groundwater replenishment activities. This has become increasingly important in light of persistent drought conditions in the State and environmental and regulatory issues that limit delivery of imported water to the Los Angeles area. As part of the WIN Program, the Groundwater Reliability Improvement Program (GRIP) was established to offset the current use of imported water by providing up to 21,000 AFY of alternative supply sources (e.g., recycled water, stormwater) for replenishment at the MFSG. The primary goals of GRIP are to:

- Provide a sustainable and reliable supply for replenishing the basins;
- Protect groundwater quality;
- Minimize the environmental/energy footprint of any option or options selected;
- Comply with pertinent regulatory requirements employing an institutionally feasible approach;
- Minimize cost to agencies using ground water; and
- Engage stakeholders in the decision making process.

Two recycled project alternatives were proposed as part of GRIP, GRIP Recycled Water Project A (GRIP A) and GRIP Recycled Water Project B (GRIP B), as further discussed in Section 7.2.

SOURCE WATER SALINITY CONTROL

IM 11. LACDPW Stormwater "First Flush" Policy – As described in WRD's Replenishment Operations Manual (September 2007), typically at least the first several hours of flow (e.g., the "first flush") of the first season's stormwater event is bypassed around the MFSG and DGSG and wasted to the ocean because it is too high in turbidity and contains trash. This first flush is also believed to contain higher concentrations of pollutants, and thus conducting first flush potentially lowers S/N loading and improves groundwater quality.

IM 12. MWD Salinity Source Water Control Program – The MWD imports supplemental water supplies to the Southern California region, which includes the CBWCB. These supplies are imported from the Colorado River (CR) via the Colorado River Aqueduct and the Sacramento-San Joaquin Bay Delta (Delta) via the State Water Project (SWP). The salinity of these imported supplies is managed through source control measures, collaborative actions with other agencies, distribution system salinity management, and participation with local agencies to protect groundwater and recycled water supplies. Source control measures are critical for reducing salinity in imported water supplies and protecting groundwater supplies from additional salinity[5]. Salinity control programs and studies are described below.

- Colorado River Basin Salinity Control Program – The program provides Federal appropriations for salinity reduction projects. These projects include irrigation improvement practices, rangeland management, and deep well brine injection which aid in meeting the program's salinity numerical objectives for the Colorado River Basin.
- California Department of Water Resources Municipal Water Quality Investigations Program – The program, funded through the SWP Contractors, provides routine and real-time monitoring and forecasting of salinity levels in the Delta and SWP.
- Future SWP Activities – The proposed Bay Delta Conservation Plan could significantly reduce TDS levels of exported SWP supplies. If the plan is implemented, the Sacramento River would bypass the Sacramento -San Joaquin Delta and feed directly into the SWP, reducing TDS levels in the SWP supply.
- Update of the 1999 Salinity Management Study – The 1999 Study is being updated through a partnership between MWD, the United States Bureau of Reclamation, and the Southern California Salinity Coalition. The Update will seek to effectively quantify and set goals for managing the effects of salinity on water resources in Southern California.

Collaborative actions with other agencies allow MWD to exchange water supplies, thereby providing its service area with lower salinity water as described below.

- MWD exchanges CR supplies for lower salinity SWP supplies with the Desert Water Agency and the Coachella Valley Water District. These water agencies contract for SWP supplies, but are unable to take direct delivery of these supplies.

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[5] Information provided by Kathy Kunysz, Metropolitan Water District, July 31, 2012

- As opportunities arise, MWD also exchanges some of its SWP supplies for higher quality runoff from the Sierra Nevada mountain range as part of its storage and recovery operations with San Joaquin Valley irrigation districts.

MWD delivers a blend of CR water and SWP supplies to the CBWCB and this imported water is treated by three of MWD's drinking water treatment plants: two blended water plants (Weymouth and Diemer WTPs) and one SWP plant (Jensen treatment WTP).

- 1999 Salinity Management Policy – MWD continues to support long-term salinity control by considering the 500 mg/L annual TDS goal in its operations by blending water from the SWP and CR. The anticipated Update of the 1999 Salinity Management Study will assess MWD's future operational capability to deliver low salinity water supplies through 2020.

MWD works with local agencies to manage salinity to protect the quality of groundwater resources and enhance the quality of recycled water.

- Multiple-Agency Collaboration – The Southern California Salinity Coalition, formed in 2002, focuses on coordinating salinity management strategies and programs, including research projects, with water and wastewater agencies throughout Southern California. Refer to Project No. 20 for a further description of the Southern California Salinity Coalition.
- In addition, the Multi-State Salinity Coalition was formed in 2001 to advance the development of local and regional projects and programs associated with desalination and salinity management technologies, practices, funding, and implementation.
- Local Salinity Management Projects – Various Southern California agencies are undertaking salinity management studies and projects related to brine concentrate disposal, water softener management, and desalination projects.
- Local Resources Program – MWD encourages the recovery and cleanup of saline groundwater through its Local Resources Program. This program provides financial payments of up to $250 per acre-foot of water supply yield created through desalters.

STORMWATER CAPTURE/RUNOFF MANAGEMENT

IM 13. City of Torrance Retention Basins – Based on the Greater Los Angeles County Integrated Regional Water Management Plan (GLAC IRWMP) Online Project Tracking and Integration (OPTI) website, there are several projects that are considered implementation measures for the CBWCB. Currently, the City of Torrance operates a number of stormwater retention basins, some of which (the Bishop Montgomery, Del Amo, and Ocean basins) allow for recharge and groundwater replenishment. This project increases stormwater capture, which increases S/N loading but reduces S/N concentrations in groundwater due to the relatively low S/N concentrations in surface water/stormwater compared with ambient groundwater.

IM 14. Low Impact Development (LID) and Stormwater Best Management Practices (BMPs) – LID includes design techniques that infiltrate, filter, store, evaporate, and detain surface water runoff close to its source. BMPs address the increased volume and rate of runoff from impervious surfaces and the concentration of pollutants in the runoff. BMPs can include structural systems such as infiltration devices, ponds, filters and constructed wetlands. BMPs can also include non-structural BMPs such as LID practices to preserve/recreate natural landscape features or minimize effective imperviousness and management measures such as maintenance practices, street sweeping, public education, and outreach programs. The main goals of LID and stormwater BMPs are to increase groundwater recharge and improve stormwater quality. There are multiple existing and planned LID and stormwater BMPs in the CBWCB. These projects/practices decrease S/N loading and concentrations in groundwater.

IM 15. LARWQCB Municipal Separate Storm Sewer System (MS4) Permit for Los Angeles County – In 2001, the LARWQCB issued the National Pollutant Discharge Elimination System (NPDES) permit (2001 MS4 Permit; Order No. 01-182, NPDES No. CAS004001) for MS4 discharges for 84 cities and a majority portion of the unincorporated areas of Los Angeles County. Some cities within the CBWCB, such as the City of Long Beach, have a separate MS4 NPDES permit. The 2001 MS4 Permit regulated the discharge of runoff from MS4s or storm drains, prohibited non-stormwater discharges into the storm drain system, and limited any discharges to receiving waters that would cause or contribute to a violation of water quality standards. The 2001 MS4 Permit required implementation of a Stormwater Quality Management Plan that included the use of BMPs to reduce the amount of pollutants in stormwater and dry-weather runoff.

In December 2012, the LARWQCB adopted a new MS4 Permit (Order No. R4-2012-0175; http://www.waterboards.ca.gov/rwqcb4/water_issues/programs/stormwater/municipal/index.shtml) that replaced the 2001 MS4 Permit. The 2012 MS4 Permit differs significantly from the 2001 MS4 Permit in several respects, including new requirements for hydromodification[6] and LID that apply to existing development or redevelopment projects that have been constructed or for which grading or land disturbance permits have been submitted and are deemed complete prior to the adoption date of the 2012 MS4 Permit. Significantly, permittees are encouraged to infiltrate stormwater as a fundamental aspect of permit implementation. Additional details regarding the MS4 permits in Los Angeles County can be found in the SNMP *Monitoring Plan* (Appendix K of the SNMP). Overall, MS4 permits in the CBWCB decrease S/N loading and concentrations in groundwater.

WASTEWATER SALINITY/NUTRIENT SOURCE CONTROL

IM 16. Industrial Wastewater Source Control Programs – Within the CBWCB, SDLAC and the City of Los Angeles Bureau of Sanitation (LABOS) operate pretreatment programs that regulate industrial and commercial discharges into the agencies' wastewater management systems.

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[6] Hydromodification can be any activity that increases the velocity and volume (flow rate), and often the timing, of runoff. Such activities include: construction and maintenance of channels, levees, dams, and other water conveyance structures and/or impoundments for purposes of flood control, water storage, water conveyance, and navigation; dredging and/or filling or other alterations to natural land contours for the purposes of new development (including transportation and other infrastructure) or navigation; development of impervious surfaces (asphalt, concrete, most buildings, etc.); and deforestation or removal of vegetation.

These activities are conducted in accordance with ordinances adopted by SDLAC and LABOS, Federal pretreatment regulations pursuant to Code of Federal Regulations, Title 40, Part 403, and the Clean Water Act. The source control programs permit, inspect, monitor, develop source control and pollution prevention requirements, and take enforcement actions for permit and ordinance violations. The overall objectives of the programs are to:

- Protect water treatment plants (WTPs) and water reclamation plants (WRPs) from interference with process operations and pass through of harmful pollutants to the environment;
- Protect the life, health, and safety of operating and maintenance personnel;
- Ensure the health, safety, and welfare of the public;
- Provide the opportunity for beneficial reuse of biosolids; and
- Provide the opportunity for water reclamation.

Each agency's ordinance allows for the development of industrial and commercial discharge requirements to protect the quality of recycled water and meet Waste Discharge Requirements/Water Recycling Requirements (WDR/WRR) and NPDES limits, including S/Ns. This can be accomplished by establishing industry-specific or industrial category-specific discharge limits, requiring industries to bypass discharges around WRPs, prohibiting the use of self-regenerating water softeners (SRWS), requiring implementation of pollution prevention BMPs, and conducting public outreach. Thus, these programs help to reduce S/N loading and concentrations in groundwater.

IM 17. Wastewater and Recycled Water Nitrogen Treatment – Within the Los Angeles Region, wastewater treatment plants that discharge to inland surface waters have implemented nitrification-denitrification (NdN) as part of their secondary biological treatment processes to reduce nitrogen concentrations. The biological conversion of ammonia in sewage to nitrate-nitrogen is called nitrification. The biological reduction of nitrate to nitrogen gas by facultative heterotrophic bacteria is called denitrification. By 2003, SDLAC converted its WRPs to include NdN to meet NPDES discharge limits for ammonia, nitrate, and nitrite that are based on BPOs. The NdN modifications have achieved meaningful reductions in total nitrogen and therefore, help to reduce nutrient (nitrate) loading and concentrations in groundwater. As one example, the pre-NdN (1993 to mid-2003) average total nitrogen concentration in the San Jose Creek East WRP effluent was approximately 14 mg/L compared to the post-NdN (mid-2003 to 2011) average total nitrogen concentration of approximately 6.5 mg/L, a reduction of 53%. SDLAC documents NdN reductions for all of its WRPs.

IM 18. Residential Automatic Water Softeners Educational Outreach – Because self-regenerating water softeners (SRWS) rely on salt for water softening, which ultimately gets discharged to the sewer and wastewater treatment plants, they add significant salt loading to the tertiary-treated recycled water that recharges the CBWCB. The SDLAC and Santa Clarita Valley Sanitation District have done extensive outreach and education regarding SRWS in the Santa Clarita Valley in order to comply with the State's legal limit for chloride discharged to the Santa Clara River. The SDLAC's website provides information on SRWS, their groundwater quality impacts, and salt-free alternatives to SRWS (http://www.lacsd.org/wastewater/automatic_water_softeners/alternatives.asp). This program helps to reduce salt (TDS and chloride) loading and concentrations in groundwater. There currently are no plans within the CBWCB for mandated replacement of residential SRWS or to implement voluntary rebate programs.

PUBLIC EDUCATION

IM 19. Council for Watershed Health (CWH) – The CWH is an organization established in 1996 to facilitate a stakeholder-driven consensus process to enhance the economic, social, and ecological health of the region's watersheds through education, research, and planning. One of the goals of the CWH is to achieve regional sustainability through integrated natural resources management, including water resources management. CWH conducts active technical and outreach programs directed at professionals, the media, agencies, elected officials, and the public. This organization and its outreach efforts have the potential to decrease S/N loading and concentrations in groundwater.

IM 20. CBWCB SNMP – To promote the development of the CBWCB SNMP, an informational website was created (http://www.wrd.saltnutrient.com/). The website disseminates information regarding the SNMP, including a calendar of events and meetings, meeting agendas and minutes, meeting presentations, project schedules, contact information, deliverables, data, and weblinks to other reference materials. Once the CBWCB SNMP is finalized and the Basin Plan Amendment is adopted, S/N management measures, including the implementation measures, will be carried out. As a result, these efforts will reduce S/N concentrations in groundwater or maintain groundwater quality in accordance with Basin Plan objectives.

IM 21. Water Replenishment District of Southern California (WRD) – WRD has a website (http://www.wrd.org/index.php) that provides useful information on various recharge and water quality monitoring and protection programs. WRD also conducts numerous public meetings and events throughout the year to discuss the uses and benefits of recycled water, groundwater replenishment, and preserving groundwater quality. This agency and its outreach efforts have the potential to decrease S/N loading and concentrations in groundwater.

IM 22. Southern California Salinity Coalition (SCSC) – SCSC was formed in 2002 to address the critical need to remove salt from water supplies and to preserve water resources in California. SCSC is administrated by the National Water Research Institute (NWRI; http://nwri-usa.org/) and is a coalition of water and wastewater agencies in Southern California (including SDLAC and MWD) dedicated to managing salinity in the water supply. SCSC has partnered with MWD and United States Department of the Interior, Bureau of Reclamation (USBOR) to update the 1999 Salinity Management Study. As part of the effort, SCSC will be producing outreach and education materials on understanding Southern California salinity conditions and practices and identifying opportunities to promote effective regional salinity management. SCSC is working to update the regional salt balance by considering local and imported salinity sources and identifying trends (e.g., groundwater basin accumulation considering salt imports and exports); develop a tool to determine annual salinity indicators to assess the status of regional salinity management; identify regulatory approaches that affect salinity management and water resource development (e.g., SWRCB/RWQCB criteria for brine discharges, implementation of

SNMPs, water quality objectives for TDS, etc.); and assess the regional salinity impacts of compliance with SB X7-7 (refer to IM 24), including impacts to wastewater and receiving groundwater. This organization and its outreach efforts have the potential to decrease salt (TDS and chloride) loading and concentrations in groundwater.

SCSC maintains websites for outreach on salinity information (www.socalsalinity.org) and assessing impacts of salinity from irrigation (www.salinitymanagement.org). The SCSC website (www.socalsalinity.org) describes upcoming and past events hosted by SCSC and provides salinity-related publications such as fact sheets, research project reports, workshop summaries, and SCSC-funded projects.

IM 23. WateReuse Association and WateReuse Research Foundation – The WateReuse Association (http://www.watereuse.org/) is a nonprofit organization whose mission is to advance the beneficial and efficient uses of high-quality, locally produced, sustainable water sources for the betterment of society and the environment through advocacy, education and outreach, research, and membership. The WateReuse Research Foundation (http://www.watereuse.org/foundation) is an educational, nonprofit corporation that was established to conduct applied research on behalf of the water and wastewater community for the purpose of advancing the science of water reuse, recycling, reclamation, and desalination. The Foundation's research covers a broad spectrum of issues, including chemical contaminants, microbiological agents, treatment technologies, salinity management, public perception, economics, and marketing. The Foundation's research supports communities across the United States and abroad in their efforts to create new sources of high quality water while protecting public health and the environment. As an example, a recent WateReuse research project, supported by SDLAC, assessed no-salt alternatives to self-regenerating water softeners, which contribute a significant salt load to the wastewater system. The research identified commercially available, cost competitive, and effective alternatives. These organizations and their efforts help to reduce S/N loading and concentrations in groundwater.

CONSERVATION

IM 24. Senate Bill x7-7 and Other Activities – As recognized in the Department of Water Resources (DWR) Public Review Draft of the Water Plan Update 2013 (DWR, 2013), conservation is a fundamental component of the South Coast region’s water management planning. The South Coast Region includes all of Orange County and portions of Ventura, Los Angeles (including the CBWCB), San Bernardino, Riverside, and Sana Diego counties. Water agencies in the South Coast have been aggressively implementing water conservation since the 1990s. Many local water agencies are signatories to the California Urban Water Conservation Council (CUWCC) memorandum of agreement for urban water conservation and also have adopted Urban Water Management Plans (UWMPs) to ensure water supply reliability during normal, dry, and multiple dry years. These agencies implement best management practices (BMPs) and demand management measures contained in those documents. The backbone of MWD’s conservation program is the Conservation Credits Program (CCP), initiated in 1988, that contributes $195 per AF of water conserved to assist member agencies in pursuing urban BMPs and other demand management opportunities. All of the region’s water suppliers have water conservation programs for their customers which feature residential and commercial water saving tips, rebates for water efficient purchases (e.g., low - flow toilets, high - efficiency clothes washers, weather - based irrigation controllers), and tools for implementing landscape/garden improvements.

Local agencies are also developing water conservation master plans and conservation rate structures as well as working closely through integrated regional water management (IRWM) planning efforts to develop coordinated water efficiency programs. To these ends, the GLAC IRWMP (GLAC IRWMP Leadership Committee, 2014) has been developed to define a clear vision and direction for the sustainable management of water resources in the GLAC Region for the next 20 years, to present the basic information regarding possible solutions and the costs and benefits of those solutions, and to inspire the Region and potential funding partners outside this Region.

The Water Conservation Act of 2009 (Senate Bill [SB] x7-7) requires each urban retail agency to establish in its UWMP a reduction goal to help California achieve a 20% statewide reduction in daily per capita water use by 2020. SB x7-7 requires urban water suppliers to calculate baseline water use and set an interim 2015 (half the 2020 target) and 2020 water use targets. One hundred fifty - seven South Coast urban water suppliers have submitted 2010 urban water management plans to DWR. SB x7-7 provides options to meet these targets including shifting to more recycled water use. The UWMPs indicate the South Coast Hydrologic Region had a population-weighted baseline average water use of 188 gallons per capita per day with an average population-weighted 2020 target of 159 gallons per capita per day.

The GLAC IRWMP provides estimates of water conservation target volumes (water use efficiency excluding water recycling) for the CBWCB in 2035. These target volumes are believed to be a conservative estimate that would also be in effect in 2025 based on compliance with SB x7-7. The estimated water conservation target volumes in 2025 are shown in **Table J-7**.

Water conservation helps to ensure reliable water supplies by avoiding or efficiently using water, but can have mixed impacts on S/N loading. It has the potential to increase the TDS, chloride, and nitrate concentrations in wastewater discharged to the sewer due to reduced in-home water use. This is because the same amount of salt are added through use, but the total volume of water used is less. On the other hand, to the extent that conservation reduces irrigation and associated irrigation return flows, it will decrease S/N loading. Overall, SB x7-7 has the potential to reduce S/N loading and concentrations in groundwater, and is accordingly included as an implementation measure.

SDLAC evaluated its WRPs in the CBWCB in terms of flow reductions and changes in TDS and chloride[7] concentrations. While wastewater flows have declined starting in 1998, the TDS concentrations have remained steady and do not appear to be impacted by water conservation. However, chloride trends are a bit different. For the six facilities that make up SDLAC's Joint Outfall System (including the WRPs that provide recycled water in Central Basin), chloride has increased at the Joint Water Pollution Control Plant, La Cañada WRP, and Whittier Narrows

[7] Personal communication from Ann Heil, SDLAC, July 27, 2012.

Table J-7 2025 Estimated Water Conservation Target Volumes for Central Basin and West Coast Basin

2025 Estimated Water Conservation Target Volumes AFY	
Central Basin	West Coast Basin
2,300[a]	9,600[d]
5,700[b]	4,100[e]
6,500[c]	21,400[f]
Total = 14,500	**Total = 35,100**

AFY – acre-feet per year UWMP – Urban Water Management Plan

a. City of Los Angeles 2010 UWMP (broken down based on area within the Central Basin)
b. Long Beach Water Department 2010 UWMP
c. Central Basin Municipal Water District 2010 UWMP
d. West Basin Municipal Water District 2010 UWMP
e. Torrance 2010 UWMP
f. City of Los Angeles 2010 UWMP (broken down based on area of City of Los Angeles within the West Coast Basin)

WRP. SDLAC has observed a slight increase at the Pomona WRP and San Jose Creek East WRP, but since chloride concentrations appear to be cyclical at these plants, this trend is not definitive. Chloride levels are staying steady or dropping at the Long Beach, Los Coyotes, and San Jose Creek West WRPs, although this trend may be influenced by chloride industrial dischargers shutting down or being rerouted to other plants.

Assessment of the WBMWD's Edward C. Little WRF tertiary-treated recycled water quality (see Table I-9 in Appendix I) shows a significant increase in both TDS and chloride beginning in WY 2005-06, indicating that an increasing trend in salt due to conservation may be occurring. Based on these findings, the increased use of tertiary-treated recycled water for irrigation was simulated as part of the SNMP analysis for both the average of the baseline period (WY 2000-01 through 2009-10) and at higher concentrations through the future planning period (WY 2010-11 through 2024-25), as further discussed in Appendix I. Refer to Section 7 (Recycled Water Project Nos. RW 3 and RW 4) for a discussion of the results of the SNMP analysis.

REGULATORY/NON REGULATORY

IM 25. Wastewater, Recycled Water, Surface Water/Stormwater, Imported Water and Groundwater Monitoring – There are multiple recycled water, wastewater, imported water, surface water/stormwater, and groundwater monitoring programs within and upstream of the CBWCB. Details regarding these monitoring programs are provided in the SNMP *Monitoring Plan* (Appendix K of the SNMP). These monitoring programs provide a comprehensive and continuing assessment on all the types of water within and entering the CBWCB. Thus, the monitoring programs assist in the overall efforts to decrease S/N loading and concentrations in groundwater.

Under the various existing monitoring programs, groundwater has been and continues to be monitored near recycled water recharge sites, in production wells used for water supply, and in a large network of multiple completion monitoring wells for multiple decades. Groundwater from more than 1,500 wells[8] is sampled on a daily to annual basis. Hundreds of chemicals/analytical parameters are tested each year.

WRD's Regional Groundwater Monitoring Program is an existing voluntary monitoring program that currently includes of a network of over 300 nested groundwater monitoring wells installed at over 55 locations throughout the CBWCB. Annually, WRD collects nearly 600 groundwater samples from its monitoring well network and analyzes them for over 100 constituents to produce nearly 60,000 individual data points to help track groundwater quality. Each year, WRD publishes a Regional Groundwater Monitoring Report that provides water quality summary tables (including data for TDS, chloride, nitrate) for each of the nested monitoring wells, water quality maps for the nested wells and production wells, and maps and hydrographs depicting groundwater level data.

In addition to groundwater monitoring, the CBWCB and tributary areas have numerous, robust, and accessible monitoring programs for recycled water, wastewater, imported water, and surface water/stormwater for the three S/N indicators. In addition, hundreds of chemicals/analytical parameters, including constituents of emerging concern (CECs), are tested each year for multiple source waters. These existing monitoring programs are managed by multiple stakeholder agencies/organizations. Some programs, such as surface water/stormwater and wastewater monitoring, are part of the NPDES permits' Monitoring and Reporting Programs (MRPs), including regional watershed monitoring programs. Drinking water permits mandate imported water and groundwater monitoring. Non-potable reuse monitoring programs and groundwater recharge reuse monitoring programs for the Montebello Forebay Groundwater Recharge Project and the seawater intrusion barriers (WCBB, DGB, and AGB) are part of MRPs in each project's recycled water/reuse permit.

IM 26 and IM 27. State Regulations for Groundwater Replenishment using Recycled Water and LARWQCB Permits for Groundwater Recharge Projects – Regulations regarding groundwater replenishment (both surface and subsurface applications) using recycled municipal wastewater are specified in California Code of Regulations, Title 22, Division 4, Chapter 3, Articles 5.1 and 5.2. These regulations include a number of measures to ensure the protection of groundwater quality, including:

- An industrial pretreatment and pollutant source control program for the wastewater,
- Pathogenic microorganism control,

[8] The total number of wells that are sampled in the CBWCB on a regular basis far exceeds 1,500 because this estimated quantity only includes nested groundwater monitoring wells owned and sampled by WRD, existing production wells, and permit compliance monitoring wells associated with ongoing large recycled water projects in the basins, such as the Montebello Forebay Spreading Grounds and the three seawater intrusion barriers. This quantity does not include the numerous groundwater monitoring wells associated with existing environmental release sites in the CBWCB.

- Nitrogen compounds control,
- Regulated contaminants and physical characteristics control,
- Diluent water requirements,
- CEC monitoring,
- Demonstration that recycled water is retained underground for a period of time necessary to allow a response time sufficient to identify failure and implement actions necessary for the protection of human health,
- Calculation of the running monthly average recycled water contribution (RWC) based on the total volume of recycled water and credited diluent water that is recharged during the preceding 120 months,
- Chemical monitoring requirements for the recycled water and groundwater,
- Preparation of an Operation Optimization Plan that identifies and describes the operations, maintenance, analytical methods, and monitoring necessary to meet all groundwater recharge regulations,
- Groundwater monitoring well requirements, and
- Reporting to the SWRCB Division of Drinking Water (formerly CDPH) and LARWQCB.

Due to the potential for confusion and duplication of effort between CDPH and the RWQCBs, CDPH and the SWRCB signed a Memorandum of Agreement (MOA) in 1996. The MOA delineates responsibilities of each agency in review and approval of recycled water projects. As of July 1, 2014, under the direction of California Governor Jerry Brown, the administration of the Drinking Water Program was transferred from CDPH to the SWRCB to consolidate all major water quality programs within a single department, which will allow the State to better manage and protect water resources and ensure safe drinking water for all Californians. Thus, the State's drinking water and recycled water programs are now regulated under the SWRCB Division of Drinking Water. While the SWRCB Division of Drinking Water regulates public water systems and sets standards for wastewater reuse to protect public health (*Water Recycling Criteria* in Title 22 of the California Code of Regulations), the RWQCB has the permitting and ongoing oversight authority of groundwater recharge projects. SWRCB Division of Drinking Water requirements for permit approval are to be incorporated in the final permit that will be issued by the RWQCB.

IM 28. Recycled Water Non-Potable Reuse Regulations, Guidelines, and Permits – In January 1977 the SWRCB approved Resolution No. 77-1 which states, "*the California legislature has declared that the State shall undertake all possible steps to encourage the development of water reclamation facilities so that reclaimed water may be made available to help meet the growing water requirements of the State.*" The resolution also recognizes the need to protect public health from the environmental problems associated with reclamation projects. To this end, the SWRCB included in its July 1997 strategic plan a goal to meet this objective.

Recycled water has been used in California since the late 1800s. Public health restrictions have been in effect since the early part of this century. The regulations covering recycled water irrigation in California are found in California Health and Safety Code (CH&SC) Division 104, Part 12; California Water Code (CWC), Division 7; California Code of Regulations (CCR), Title 22, Division 4; and CCR, Title 17, Division 1, Chapter 5, Group 4. These documents can be found on the LARWQCB website (http://www.swrcb.ca.gov/losangeles/laws_regulations/).

Recycled water is an important resource for the State of California, and its use for non-potable applications is, in many cases, mandated by State law. Manuals have been developed to ensure protection of public health and compliance with regulations. Two manuals have been prepared for local recycled water users, as described below.

- The 2005 Los Angeles County Recycled Water User's Manual was compiled by the local chapter of WateReuse and includes the water and regulatory agencies involved with recycled water. The manual provides the recycled water "User" and "Site Supervisor" a resource for the day-to-day operation and control of that system. The manual outlines the process of converting to recycled water use in order to protect the health and welfare of the personnel involved with its use and the general public and to protect the quality of local water resources.
- The 2008 SDLAC Recycled Water Users Handbook provides information on the general rules, regulations, and guidelines regarding the safe use of tertiary-treated recycled water produced by SDLAC. The Handbook includes:
    - General information about SDLAC's water reuse program;
    - State and local standards, regulations, and guidelines for the use of recycled water;
    - Information on the duties and responsibilities of water purveyors and recycled water users;
    - Information on operational requirements at reuse sites; and
    - Information on notification and reporting.

Overall, recycled water non-potable reuse regulations, guidelines, and permits have the potential to reduce S/N loading and concentrations in groundwater in the CBWCB.

LAND USE REGULATION

IM 29. Model Water Efficient Landscape Ordinance – The Water Conservation in Landscaping Act of 2006 requires cities, counties, charter cities, and charter counties, to adopt landscape water conservation ordinances by January 1, 2010. Pursuant to this law, the Department of Water Resources (DWR) prepared a Model Water Efficient Landscape Ordinance (Model Ordinance) for use by local agencies. The Model Ordinance became effective on September 10, 2009.

All local agencies were required to adopt a water efficient landscape ordinance by January 1, 2010. The local agencies either adopted the State Model Ordinance, or crafted an ordinance to fit local conditions. In addition, local agencies could have collaborated to craft a region-wide ordinance. In any case, the adopted ordinance had to be as effective as the Model Ordinance in regard to water conservation.

The objectives of DWR's Model Water Efficient Landscape Ordinance are to:

- Promote the values and benefits of landscapes while recognizing the need to invest water and other resources as efficiently as possible;
- Establish a structure for planning, designing, installing, maintaining, and managing water efficient landscapes in new and rehabilitated projects;
- Establish provisions for water management practices and water waste prevention for established landscapes; and
- Use water efficiently without waste by setting a Maximum Applied Water Allowance as an upper limit for water use and reduce water use to the lowest practical amount.

Reduced irrigation, as stipulated by the Model Ordinance, reduces S/N loading and improves groundwater quality.

6.2.2 Planned Implementation Measures

The planned implementation measures are numbered IM 30 through IM 44 in Table J-6 and described in detail below. These projects/programs are expected to be implemented by the 2025 planning horizon of the CBWCB SNMP.

SEAWATER INTRUSION CONTROL

IM 30. Increase AWT Recycled Water Supply to Seawater Barriers (AGB, WCBB and DGB) – As described for Implementation Measure No. IM 1 in Section 6.2.1, the seawater intrusion barriers manage the saline intrusion as well as provide groundwater recharge in the CBWCB. Historically, both imported water and AWT recycled water were injected at each of the barriers. By or before the SNMP 2025 planning horizon, projects will be implemented at each of the barriers to allow for AWT recycled water to completely replace imported water for injection. This will require upgrades and expansion of source water treatment plants, along with potential construction of associated conveyance equipment such as pipelines and pump stations to convey the additional AWT recycled water to the three seawater barriers.

During WY 2014-15 when the Vander Lans AWTF was expanded to produce from 3,360 AFY to 8,960 AFY of AWT recycled water, the treatment train was modified to also include advanced oxidation (AOP) through the addition of peroxide. As planned, the expanded Vander Lans AWTF will produce 100% AWT recycled water (total of 7,200 AFY) for injection at the AGB, thus completely replacing the use of imported water. However, minor volumes of treated imported water, supplied by MWD, may be utilized as necessary through the future due to temporary operational and maintenance issues that may be encountered at the Vander Lans AWTF or at the AGB.

In WY 2013-14, the Edward C. Little WRF was expanded to produce from 14,000 AFY to 19,600 AFY of recycled water and the treatment train now includes ozonation (O_3). It was anticipated that AWT recycled water (total injection volume of 17,000 AFY) would fully replace imported water at the WCBB beginning in WY 2013-14. However, minor volumes of treated imported water, supplied by MWD, may be utilized as necessary through the future due to temporary operational and maintenance issues that may be encountered at the Edward C. Little WRF or at the WCBB.

The TIWRP is currently undergoing expansion activities to increase production of AWT recycled water. Once expansion of the TIWRP is complete in WY 2018-19, injection of 7,500 AFY into the DGB is planned to be 100% AWT recycled water, thus completely replacing imported water.

The SNMP mixing model was used to estimate the impacts of these seawater barrier projects on future groundwater quality. AWT recycled water is significantly lower in TDS and chloride compared with imported water, but nitrate levels are very low and comparable in both water sources. As such, the complete replacement of imported water with AWT recycled water at the seawater barriers will significantly reduce TDS and chloride loading and concentrations in groundwater. Groundwater quality in the CBWCB will continue to improve or remain well below WQOs.

IM 31. Increase Pump and Treat by the Desalters and Expansion of Goldsworthy Desalter – As described for Implementation Measure No. IM 2 in Section 6.2.1, the Goldsworthy Desalter is an existing facility that treats brackish groundwater extracted from an area inland of the WCBB that is impacted by historical seawater intrusion. The Goldsworthy Desalter has a design capacity of 2,800 AFY and currently operates at about 2,200 AFY. In 2015, the total plant capacity will be expanded to 5,500 AFY[9], which will allow increased groundwater pump and treat. In addition, average groundwater pumping for the Brewer Desalter is projected to increase in the future planning period compared with current pumping.

GROUNDWATER RECHARGE

IM 32. DGSG West Basin Percolation Enhancement – This planned project, described in the GLAC IRWMP, which will increase capture and percolation of stormwater at the DGSG in Long Beach in order to increase groundwater replenishment in the West Coast Basin.

The SNMP mixing model was used to estimate the impacts of this project in combination with other proposed projects in the CBWCB on future groundwater quality. Recharge of stormwater adds S/N load, but decreases concentrations in groundwater because stormwater has lower S/N concentrations compared with ambient groundwater. Modeling results show that groundwater quality in the CBWCB will continue to improve in the West Coast Basin and WQOs will be achieved in the future.

IM 33. MFSG New Turnout Structures – This planned project consists of the construction of two new turnout structures along the San Gabriel River in 2015 that will allow for more flexibility for the spreading of recycled water. The existing system restricts recycled water distribution to the San Gabriel River Spreading Grounds when stormwater is available for replenishment. Although recharge operations at the MFSG increase S/N loading, future water

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[9] Personal communication from Ted Johnson, November 14, 2012.

quality projections as determined from the SNMP analysis indicate that groundwater quality in the Central Basin will remain well below WQOs.

IM 34. RHSG Sediment Removal – This planned project will restore percolation and storage capacity at the spreading grounds. The RHSG basins have approximately 450,000 cubic yards of sediment accumulated in them, which not only reduces the water storage capacity, but also the percolation capacity from 400 cubic feet per second to 200 cubic feet per second. The spreading basins are thus filled to capacity sooner, which results in reduced operational flexibility and having to bypass storm flows which reduces recharge of stormwater. This project would restore percolation and storage capacity, potentially yielding approximately 1,000 AFY of replenishment water by removing approximately 450,000 cubic yards of sediment accumulated in the spreading basins. The greater capacity will increase operational flexibility, thereby better accommodating the increasingly dynamic delivery schedules of imported water, recycled water, and stormwater. The estimated implementation date for the sediment removal is WY 2016-17.

Although recharge operations at the MFSG increase S/N loading, future water quality projections as determined from the SNMP analysis indicate that groundwater quality in the Central Basin will remain well below WQOs.

INSTITUTIONAL

IM 35. West Coast Basin Judgment Amendment – The adjudication decree for the West Coast Basin is in the process of being amended and anticipated to be completed by the SNMP 2025 planning horizon. The proposed amendments would enable large-scale changes in the management practices within the West Coast Basin. They will further enhance opportunities to develop recycled water for recharge and improve the capability to utilize the basin's storage for conjunctive use. There is a potential for this implementation measure to decrease S/N loading and concentrations in groundwater, depending on the final management strategies that are enacted as part of the judgment amendment.

STORMWATER CAPTURE/RUNOFF MANAGEMENT

IM 36 and IM 37. Additional LID Projects, Stormwater BMPs, and LARWQCB MS4 Permits – As described for Implementation Measure Nos. IM 14 and IM 15 in Section 6.2.1, there are multiple existing and planned LID projects and stormwater BMPs. Recent MS4 permits issued by the LARWQCB include new requirements for stormwater infiltration and reuse, hydromodification, and LID that apply to existing development or redevelopment projects that have been constructed or for which grading or land disturbance permits have been submitted and are deemed complete prior to the adoption date of the MS4 permit. It is anticipated that the MS4 permits and permit-related LID/BMP projects overall would decrease S/N loading and concentrations in groundwater in the CBWCB.

In the 2012 MS4 permit that was issued by LARWQCB for the 84 cities and a majority portion of the unincorporated areas of Los Angeles County, Enhanced Watershed Management Programs (EWMP) and Watershed Management Programs were required for development to increase stormwater and non-stormwater surface water capture, as well as improve surface water quality. Recharge of higher quality surface water will result in improved groundwater quality once these programs are implemented.

<u>IM 38. Los Angeles Basin Stormwater Conservation Study</u> – In recognition that imported water supplies to Los Angeles County are uncertain due to periodic droughts in Northern California and the Colorado River Basin, court decisions related to endangered species in the Bay Delta, potential allocations of Colorado River water, changing demographics, climate variability, and the competing interests for available water, the USBOR, Los Angeles County Flood Control District (LACFCD), and several local agencies have begun a study (2013) of the long-term flood control and water conservation impacts from projected population and climate conditions in the Los Angeles Basin. According to the California Department of Finance, the State's population as a whole is projected to increase by more than 35% while Los Angeles County's is projected to increase by approximately 18% by 2050. Projected larger population growth rates outside of Los Angeles County portends enormous pressure and competition for imported sources of water and the need for increased development of local water supply sources. The study to be completed in 2015 will recommend potential changes to the operation of stormwater capture systems, modifications to existing facilities, and development of new facilities that could help resolve future flood control and water supply issues. It is assumed that some of the study recommendations will increase stormwater capture and will be implemented before 2025.

<u>IM 39. Broadway Neighborhood Stormwater Greenway Project</u> – This planned project in the City of Los Angeles will improve surface water and groundwater quality by reducing pollutant discharges through a number of BMPs including subsurface infiltration basins, rain gardens, dry wells, and green streets. The project incorporates LID practices on residential parcels and streets that will infiltrate and retain dry and wet weather runoff. These practices will result in a variety of benefits, including: 1) reducing the rate and volume of stormwater runoff; 2) providing filtration for water quality improvement; and 3) providing on-site storage and infiltration of stormwater into the underlying aquifers of the CBWCB. The LID measures will also reduce pollutant loading into the Los Angeles River by infiltrating and retaining contaminated stormwater runoff at its source: from roof tops, alleys, and neighboring streets of a 32-acre tributary area. This project is expected to begin operation in 2015. Recharge of stormwater adds S/N load, but decreases concentrations in groundwater because stormwater has lower S/N concentrations compared with ambient groundwater.

<u>IM 40. Improvements to Entradero Storm Drain Channel for Stormwater Infiltration</u> – This planned project in the City of Torrance will modify the Entradero Storm Drain Channel to improve stormwater infiltration for bacteria TMDL compliance. The channel currently has an asphalt bottom and dirt slopes. The project would replace the asphalt bottom and natural sides of the channel with a continuous pervious material to improve infiltration of stormwater while maintaining vegetation on the slopes to improve slope stability. This project is expected to begin operation in 2015. Recharge of stormwater adds S/N load, but decreases concentrations in groundwater because stormwater has lower S/N concentrations compared with ambient groundwater.

IM 41. Vermont Avenue Stormwater Capture – The Vermont Median Stormwater Park project is a planned project in the City of Gardena that consists of construction of a median park on Vermont Avenue over a planned recycled water line. The new park/dedicated open space accommodates multiuse pathways (pedestrian and bike lanes), open space areas, native habitats, biofiltration systems, and other stormwater features. This project is expected to begin operation in 2017. Recharge of stormwater adds S/N load, but decreases concentrations in groundwater because stormwater has lower S/N concentrations compared with ambient groundwater.

TOTAL MAXIMUM DAILY LOADS (TMDLS)

IM 42. TMDLs – Section 303(d) of the Clean Water Act requires States and Territories of the United States to identify water bodies that do not meet water quality standards (e.g., the 303(d) list of impaired water bodies) and then to establish TMDLs for each water body for each pollutant of concern. The TMDL is a calculation of the maximum amount of a pollutant from point sources and nonpoint sources that a water body can receive and still meet water quality standards, within a margin of safety and considering seasonal variation. When a TMDL is approved, controls on pollutants are expected to be implemented for point sources through limits in NPDES permits and for nonpoint sources through other means, such as BMPs. TMDLs may help to reduce S/N loading and concentrations in groundwater.

CONSERVATION

IM 43. Senate Bill x7-7 and Other Activities – As described for Implementation Measure No. IM 24, conservation is a fundamental component of the GLAC water management planning, which has included aggressively implementing water conservation since the 1990s. Many local water agencies are signatories to the CUWCC memorandum of agreement for urban water conservation and also have UWMPs to ensure water supply reliability during normal, dry, and multiple dry years. The backbone of MWD's conservation program is the CCP, initiated in 1988, that contributes $195 per AF of water conserved to assist member agencies in pursuing urban BMPs and other demand management opportunities. All of the region's water suppliers have water conservation programs for their customers.

Local agencies are also developing water conservation master plans and conservation rate structures as well as working closely through IRWM planning efforts to develop coordinated water efficiency programs. To these ends, the GLAC IRWMP (GLAC IRWMP Leadership Committee, 2014) has been developed for the greater Los Angeles County area.

SB x7-7, enacted in 2009, requires each urban retail agency to establish in its UWMP a reduction goal to help California achieve a 20% statewide reduction in daily per capita water use by 2020. SB x7-7 requires urban water suppliers to calculate baseline water use and set an interim 2015 (half the 2020 target) and 2020 water use targets. One hundred fifty - seven South Coast urban water suppliers have submitted 2010 urban water management plans to DWR. SB x7-7 provides options to meet these targets including shifting to more recycled water use.

The GLAC IRWMP provides estimates of water conservation target volumes (water use efficiency excluding water recycling) for the CBWCB in 2035. Accordingly, existing water conservation efforts are planned to continue through the SNMP future planning period and beyond. Overall, SB x7-7 has the potential to reduce S/N loading and concentrations in groundwater, and is accordingly included as an implementation measure.

REGULATORY/NON REGULATORY

IM 44. SNMP Monitoring Program – The Recycled Water Policy requires development of a SNMP Monitoring Plan for each groundwater basin in California. The SNMP *Monitoring Plan*, provided as Appendix K in the SNMP, includes a detailed description of the SNMP Monitoring Program. The intent of the SNMP *Monitoring Plan* is to evaluate concentrations of S/Ns in groundwater with respect to applicable WQOs.

The SNMP Monitoring Program was developed based on WRD's Regional Groundwater Monitoring Program. Seventy (70) WRD nested groundwater monitoring wells (referred to as the SNMP monitoring wells) at 13 locations throughout the CBWCB were designated for S/N sampling and reporting to SWRCB's online GeoTracker database. Each nested well is screened in a specific aquifer, which allows the assessment of S/Ns in all the major aquifers of the CBWCB. In accordance to the Recycled Water Policy, these wells were selected based on their location in the most critical areas of the basins, particularly their proximity to water supply wells and groundwater recharge projects that utilize recycled water, including the seawater intrusion barriers and the MFSG.

WRD's annual Regional Groundwater Monitoring Report provides maps depicting chloride, TDS, and nitrate concentrations in the all the WRD nested groundwater monitoring wells and active purveyors' production wells, chloride and TDS trend graphs for the SNMP monitoring wells, and a discussion of S/N concentrations/trends in groundwater with respect to WQOs to assess overall groundwater quality in the CBWCB. These analyses provide the performance measures and evaluation of the effectiveness of the CBWCB SNMP implementation measures. Both WRD's Regional Groundwater Monitoring Program and the SNMP Monitoring Program provide the means for comprehensive assessment and reporting of S/N levels in groundwater in the CBWCB.

Once the LARWQCB has approved the SNMP and established a GeoTracker weblink for the SNMP Monitoring Program for the CBWCB, WRD will implement the SNMP Monitoring Program by collecting TDS, chloride, and nitrate data from the 70 SNMP monitoring wells on a semi-annual basis and uploading this water quality data to the GeoTracker database. It is anticipated that the SNMP *Monitoring Plan* will be implemented in 2015. The SNMP *Monitoring Plan* will be reviewed and updated as necessary as part of the SNMP update every ten years.

The SNMP Monitoring Program will assist in the overall efforts to decrease S/N loading and concentrations in groundwater in the CBWCB.

6.2.3 Conceptual Implementation Measures

The conceptual implementation measures are numbered IM 45 through IM 55 in Table J-6. These projects/programs/strategies are those that have been hypothetically identified, but may or may not begin after the SNMP 2025 planning horizon.

SEAWATER INTRUSION CONTROL

IM 45. Additional Desalters – Additional desalters and associated extraction wells were described as one of many potential CBWCB management alternatives in the Draft Groundwater Basins Master Plan (GBMP) (CH2MHILL, 2012b). This alternative would include seven additional desalter wells with a total capacity of 15,000 AFY. Since management alternatives developed and assessed in the GBMP are conceptual in nature and may or may not ultimately be implemented, the additional desalters and associated extraction wells are included as a conceptual implementation measure. Any additional desalters will increase the outflow of S/Ns from the basins, thereby reducing S/N concentrations in groundwater.

GROUNDWATER RECHARGE

IM 46. Additional Tertiary-Treated/AWT Recycled Water Recharge in the Montebello Forebay – As discussed in Section 7.2, GRIP recycled water projects are planned in the Montebello Forebay to recharge additional tertiary-treated recycled water and/or AWT recycled water at the MFSG. Other recycled water projects in the Montebello Forebay were described and assessed in the Draft GBMP (CH2MHILL, 2012b) to fully utilize SDLAC's San Jose Creek WRP and Los Coyotes WRP to provide up to an additional 45,800 AFY of tertiary-treated/AWT recycled water for spreading and injection. These potential future expansions were projected to occur beyond the SNMP 2025 planning horizon. Since management alternatives developed and assessed in the GBMP are conceptual in nature and may or may not ultimately be implemented, this alternative is included as a conceptual implementation measure. Depending on the type and amount of recycled water (tertiary-treated versus AWT) recharged, S/N loading could increase in the Central Basin, but S/N concentrations in groundwater could decrease since AWT recycled water has lower S/N concentrations than ambient groundwater quality. Potential impacts of any proposed groundwater recharge projects will be assessed in detail in the future and will be required to comply with all applicable State and Local regulations.

IM 47. Los Angeles River Aquifer Stormwater Recharge and Recovery Facility – In the Draft GBMP (CH2MHILL, 2012b), the Los Angeles River Aquifer Recharge and Recovery Facility (ARRF) Project is proposed as a CBWCB management alternative that would capture approximately 5,000 AFY of stormwater for recharge. Stormwater flows would be diverted to an infiltration basin along the Interstate 710 Freeway where it would percolate into the upper, shallow aquifer above the confining aquitard. The treated water would then be recovered (pumped) for subsequent injection through a vadose zone infiltration conduit into the Central Basin as a source of supplemental replenishment supply. This alternative would provide natural filtration to remove nitrate, pathogenic microorganisms, and constituents of emerging concern. Since management alternatives developed and assessed in the GBMP are conceptual in nature and may or may not ultimately be implemented, this alternative is included as a conceptual implementation measure. Recharge of stormwater adds S/N load, but decreases concentrations in groundwater because stormwater has lower S/N concentrations compared with ambient groundwater.

IM 48. Montebello Forebay Extraction and Intrabasin Transfer Project – This conceptual project is a CBWCB management alternative assessed in the Draft GBMP (CH2MHILL, 2012b).

For this project, 25,000 AFY of groundwater would be extracted in the Montebello Forebay to reduce groundwater levels, which would provide additional storage capacity and allow for 17,000 AFY of additional stormwater recharge. A pipeline would be constructed to deliver the extracted water from the Montebello Forebay to participating water purveyors as far south as the City of Long Beach. Since management alternatives developed and assessed in the GBMP are conceptual in nature and may or may not ultimately be implemented, this alternative is included as a conceptual implementation measure. This project is not anticipated to have an impact on S/N loading, but the extraction of groundwater could decrease S/N concentrations in groundwater.

IM 49. New Los Angeles Forebay AWT Recycled Water Recharge and Recovery – The Draft GBMP (CH2MHILL, 2012b) assessed the potential for a new replenishment supply in the Los Angeles Forebay produced by a new AWT recycled water facility. The facility, identified in the City of Los Angeles Recycled Water Master Planning, Groundwater Replenishment Master Planning Report (RMC, 2012a), would skim and treat wastewater from the major sewer trunk line otherwise destined for the Hyperion WTP. The facility could produce 45,480 AFY of AWT recycled water for groundwater recharge. This is a conceptual project that may or may not be implemented. Recharge of AWT recycled water in the Los Angeles Forebay will increase S/N loading, but will decrease S/N concentrations in groundwater since AWT recycled water would have lower S/N concentrations than ambient groundwater quality.

IM 50. Whittier Narrows Conservation Pool Project – As described for Implementation Measure No. IM 8 in Section 6.2.1, this next phase of the Whittier Narrows Conservation Pool Project will increase the conservation pool elevation behind the Whittier Narrows Dam from 201.6 to 205 ft-msl resulting in an estimated additional capture of 1,100 AFY of stormwater. This project is not expected to be implemented within the SNMP 2025 planning horizon. Recharge of stormwater adds S/N load, but decreases concentrations in groundwater because stormwater has lower S/N concentrations compared with ambient groundwater.

STORMWATER/RUNOFF MANAGEMENT

IM 51. Additional LID Projects and Stormwater BMPs – Additional LID projects and stormwater BMPs may be implemented in the CBWCB through the SNMP future planning period (refer to Implementation Measure Nos. IM 36 and IM 37 in Section 6.2.2). These projects are only conceptual at this time. Overall, LID/BMP projects potentially could decrease S/N loading and concentrations in groundwater.

WASTEWATER SALINITY/NUTRIENT SOURCE CONTROL

IM 52. Residential Self-Regenerating Water Softeners (SRWS) Control – There are currently no plans within the CBWCB for SDLAC or the City of Los Angeles to control residential SRWS or implement voluntary rebate programs. Thus, this project is only conceptual. While SRWS can add significant salt loading to the wastewater system, regulation of residential SRWS has historically been a very contentious issue and there are significant hurdles facing local agencies that wish to enact controls. Any efforts to control or reduce the use of SRWS would help to reduce salt (TDS and chloride) loading and concentrations in groundwater.

The State Health and Safety Code (California Code of Regulations, Section 116786) authorizes a local agency to prospectively limit the availability, or prohibit the installation, of residential water softening or conditioning appliances that discharge to the sewer system through adoption of an ordinance if the following findings are made, substantiated by an independent study, and included in the ordinance:

- Limiting the availability, or prohibiting the installation, of the appliance is a necessary means of achieving compliance with waste discharge requirements.
- The local agency has adopted and is enforcing regulatory requirements that limit the volumes and concentrations of saline discharges from nonresidential sources in the community waste disposal system to the extent technologically and economically feasible.

In 2009, Assembly Bill 1366 added Section 13148 to the California Water Code that provides other mechanisms to control residential SRWS. It only applies to specific hydrologic regions identified in the California Water Plan: the Central Coast, South Coast, San Joaquin River, Tulare Lake regions, and the Counties of Butte, Glenn, Placer, Sacramento, Solano, Sutter, and Yolo.[10] An agency is allowed to adopt an ordinance controlling residential SRWS if the applicable RWQCB makes a finding at a public hearing that the control of residential salinity input will contribute to the achievement of water quality objectives based on:

- A TMDL that addresses salinity-related pollutants in a water segment;
- A SNMP for a groundwater basin or subbasin;
- WDR, WRR, or master reclamation permit for a supplier or distributor of recycled water; or
- A cease and desist order directed to a local agency.

An adopted ordinance can among, many options, require the removal of previously-installed residential SRWS and/or prospectively prohibit the installation of residential SRWS. If the agency includes in its ordinance removal or replacement of previously installed softeners, it must develop a program to compensate the owner for the "reasonable value" of the removed residential SRWS.

If a regional wastewater management agency (such as SDLAC) were to adopt an ordinance, it has no legal authority to enter residences and enforce the ban. Consequently, each city or local government within the agency's regional service area would have to adopt its own ordinance to implement and enforce the prospective ban.

The SNMP analysis indicates that existing and planned implementation measures are adequate to manage S/N sources for the sustainable protection of groundwater quality. However, future updates to the SNMP may consider SRWS control measures if water quality changes in the future.

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[10] See http://www.water.ca.gov/groundwater/bulletin118/gwbasin_maps_descriptions.cfm and http://www.water.ca.gov/groundwater/bulletin118/maps/statewide_basin_map_V3_subbas.pdf

IM 53. San Jose Creek East WRP Process Optimization – This conceptual project would provide flow equalization and treatment process upgrades, which would enable SDLAC's San Jose Creek East WRP to accept more wastewater and thereby produce more recycled water, either tertiary-treated or AWT. Further, flow equalization would make more recycled water available to water purveyors overnight when their demand is highest, thus facilitating increased recycled water use. This project is not expected to be implemented within the SNMP 2025 planning horizon and is therefore placed in the conceptual category. Depending on the type and amount of recycled water (tertiary-treated versus AWT) recharged or used for irrigation, S/N loading could increase in the Central Basin, but S/N concentrations in groundwater could decrease since AWT recycled water has lower S/N concentrations than ambient groundwater quality.

CONSERVATION

IM 54. Xeriscape Policy – Some water agencies in the CBWCB provide rebates for weather-based irrigation controls and turf removal programs for residential and commercial customers. Additional information is available on the MWD SoCal Water$mart website: http://socalwatersmart.com. These projects have the potential to reduce S/N loading and concentrations in groundwater in the CBWCB.

IM 55. Senate Bill x7-7 and Other Activities – As described for Implementation Measure Nos. IM 24 and 43, conservation is a fundamental component of the GLAC water management planning, which has included aggressively implementing water conservation since the 1990s. Many local water agencies are signatories to the CUWCC memorandum of agreement for urban water conservation and also have UWMPs to ensure water supply reliability during normal, dry, and multiple dry years. The backbone of MWD's conservation program is the CCP, initiated in 1988, that contributes $195 per AF of water conserved to assist member agencies in pursuing urban BMPs and other demand management opportunities. All of the region's water suppliers have water conservation programs for their customers.

Local agencies are also developing water conservation master plans and conservation rate structures as well as working closely through IRWM planning efforts to develop coordinated water efficiency programs. To these ends, the GLAC IRWMP (GLAC IRWMP Leadership Committee, 2014) has been developed for the greater Los Angeles County area.

SB x7-7, enacted in 2009, requires each urban retail agency to establish in its UWMP a reduction goal to help California achieve a 20% statewide reduction in daily per capita water use by 2020. SB x7-7 requires urban water suppliers to calculate baseline water use and set an interim 2015 (half the 2020 target) and 2020 water use targets. One hundred fifty - seven South Coast urban water suppliers have submitted 2010 urban water management plans to DWR. SB x7-7 provides options to meet these targets including shifting to more recycled water use.

The GLAC IRWMP provides estimates of water conservation target volumes (water use efficiency excluding water recycling) for the CBWCB in 2035. Accordingly, existing water conservation efforts are planned to continue through the SNMP future planning period and beyond. Overall, SB x7-7 has the potential to reduce S/N loading and concentrations in groundwater, and is accordingly included as an implementation measure.

7 Proposed Major Recycled Water Projects

Recognizing the potential negative impacts of climate change and drought, the use of recycled water by stakeholders in the CBWCB has played a vital role in increasing the reliability and sustainability of the overall water supply. Because one of the goals of the Recycled Water Policy is increased use of recycled water to reduce dependency on expensive, energy-intensive (due to pumping, distribution, and other costs), and increasingly unreliable imported water supplies, the CBWCB stakeholders are proposing some major recycled water projects for implementation while still protecting groundwater quality and beneficial uses.

Table J-8 describes the proposed major recycled water projects in the CBWCB, their estimated implementation dates, and their potential impacts to groundwater quality and S/N loading. The projects listed in Table J-8 are described in detail below and recycled water project (RW) numbers correspond to the numbers shown in the second column from the left in Table J-8. These projects are expected to be implemented by or before the SNMP 2025 planning horizon. Table J-8 is not inclusive of all recycled projects that may be implemented in the future in the CBWCB. As other recycled water projects are proposed throughout the SNMP future planning period, it is expected that each project will be implemented in accordance with all applicable regulations, including the California Environmental Quality Act (CEQA). The SNMP will be reviewed every 10 years, and Table J-8 will be updated accordingly.

Some of the proposed recycled water projects listed in Table J-8 (specifically Recycled Water Project No. RW 1), are also identified as implementation measures, since they are expected to reduce S/N loading and improve groundwater quality. Other recycled water projects listed in Table J-8 may add S/N load and increase S/N concentrations in groundwater. All the recycled water projects listed in Table J-8 were quantitatively assessed for their S/N groundwater quality impacts and use of assimilative capacity using the SNMP mixing model, as discussed further in Section 4.2.

The SNMP analysis demonstrated that projects that degrade groundwater quality are more than offset by projects (implementation measures) that improve groundwater quality. Further, an implementation plan that includes any of the combinations of projects described in Section 4.2, even including those that slightly degrade groundwater quality, is protective of groundwater quality and beneficial uses. None of the identified major recycled water projects use more than 10% of the available assimilative capacity of the Central Basin and in the West Coast Basin, where there is no available assimilative capacity, the combined projects improve groundwater quality with respect to TDS and chloride and have essentially no impact on nitrate in groundwater. Overall, the SNMP analysis demonstrated that implementation of the proposed major recycled water projects will result in groundwater quality remaining below BPO/BSBPOs in the Central Basin and BSBPOs for chloride and TDS being achieved in the future in the West Coast Basin. Nitrate in groundwater in both basins remains significantly below the BPO through the future.

Because the negative groundwater quality impacts of the proposed major recycled water projects have been demonstrated in the SNMP to be minimal and more than offset by implementation measures that improve groundwater quality, the SNMP may be used to

Table J-8 Proposed Major Recycled Water Projects in the CBWCB

Category	Recycled Water Project (RW) No.	Project Description	Basin	Cost [a]	Estimated Implementation Date	Impact to S/N Loading to Groundwater	Impact to S/N Concentrations in Groundwater
Seawater intrusion control	1	Increase AWT recycled water supply to all seawater intrusion barriers (WCBB, AGB, and DGB)	CBWCB	$206M	2017	Decrease	Decrease
Groundwater recharge	2A	GRIP A (AWT & tertiary-treated recycled water to replace imported water at MFSG)	CB	$490M	2017/18	No Change	No Change
	2B	GRIP B (tertiary-treated recycled water to replace imported water at MFSG)	CB	$183M	2014/15	Increase	Increase
Non-potable recycled water reuse	3	Increased non-potable reuse of recycled water for irrigation	CBWCB	N/A	Ongoing	Increase	Increase
	4	Recycled water quality limits at SMCLs for TDS and chloride and MCL for nitrate	CBWCB	N/A	Upon approval of the SNMP by LARWQCB	Increase	Increase

CBWCB – Central Basin and West Coast Basin
MFSG – Montebello Forebay Spreading Grounds
WCBB – West Coast Basin Seawater Intrusion Barrier
LARWQCB – Los Angeles Regional Water Quality Control Board
GRIP – Groundwater Reliability Improvement Program
CB – Central Basin
AGB – Alamitos Gap Seawater Intrusion Barrier
DGB – Dominguez Gap Seawater Intrusion Barrier
SNMP – Salt and Nutrient Management Plan
RW – Recycled Water Project
WCB – West Coast Basin
S/N – salt and nutrient
TDS – total dissolved solids
AWT – advanced water treatment
N/A – Not available

GRIP A – GRIP Recycled Water Project A, which utilizes a blend of tertiary-treated recycled water (11,000 acre-feet per year) and advanced treated (10,000 acre feet per year) recycled water to completely replace imported water for recharge at the Montebello Forebay Spreading Grounds

GRIP B – GRIP Recycled Water Project B, which utilizes 100% tertiary-treated recycled water to completely replace imported water for recharge at the Montebello Forebay Spreading Grounds

a – Costs were obtained from Greater Los Angeles County Integrated Regional Water Management Plan, 2013; online Project Tracking and Integration [http://irwm.rmcwater.com/la]; CH2MHILL, 2012a; costs are estimated totals for completion of the project including planning, design, construction, and permits.

provide a basis for streamlining of the permitting process for recycled water projects in the future in the CBWCB, per the Recycled Water Policy.

A program-level environmental analysis of the proposed major recycled water projects, as well as the implementation measures presented in Section 6, was conducted in accordance to California Environmental Quality Act (CEQA) requirements and results are presented in the Substitute Environmental Document (SED), which was prepared in conjunction with the SNMP and has been submitted to LARWQCB under a separate cover for review. The proposed projects will undergo their own individual CEQA analysis and will comply with all applicable rules and regulations before they can be implemented.

7.1 Seawater Intrusion Control Projects

RW 1. Increase AWT Recycled Water Supply to All Seawater Intrusion Barriers (AGB, WCBB and DGB) – Refer to description for Implementation Measure No. IM 30 in Section 6.2.2.

7.2 Groundwater Recharge Projects

As discussed in Section 6.2.1 (Implementation Measure No. IM 10 in Section 6.2.1), two GRIP recycled water project alternatives, GRIP A and GRIP B, were proposed by WRD to completely replace imported water (up to 21,000 AFY) with a reliable alternative supply source (i.e. recycled water) for recharge at the MFSG. Both GRIP A and GRIP B, are currently being considered for implementation and are described below as Recycled Water Project Nos. RW 2A and RW 2B, respectively.

The GRIP A and GRIP B alternatives are the end result of many studies conducted over a number of years to assess multiple potential projects to improve water supply reliability in the face of imported water supply uncertainties and increasing costs. These studies evaluated a wide spectrum of projects, including consideration of different levels of recycled water treatment and blending, modifications to existing wastewater treatment facilities, continued imported water deliveries, alternative imported water supplies, desalination, and increased stormwater capture (MWH, 2009a through 2009l; RMC, 2011b; SDLAC, 2012; and CH2MHILL, 2012c). GRIP A and GRIP B were determined to be the best alternatives for implementation and thus, potential water quality impacts for both scenarios were simulated by the SNMP mixing model (refer to Section 7 in the SNMP).

At this time, the GRIP A and GRIP B alternatives are being further evaluated by WRD in terms of feasibility and cost and a Draft Environmental Impact Report (EIR) was issued for public review in March 2014. The Draft EIR (AECOM, 2014) was used as a reference in the preparation of the SED and is available online from the following website: http://www.wrd.org/business/water-replenishment-grip.php. In the Draft EIR, GRIP A was identified as the "proposed project," while GRIP B was identified as an "alternative" to the "proposed project." As a result, it is anticipated that GRIP A likely would be the project to be implemented by WRD. However, this is subject to change until the Final EIR is prepared and certified by WRD.

RW 2A. GRIP Recycled Water Project A (GRIP A) – This planned recycled water project will completely replace imported water used for recharge at the MFSG with a combination of 11,000 AFY of tertiary-treated recycled water produced by SDLAC's San Jose Creek WRP and

10,000 AFY of AWT recycled water produced by a new treatment plant to be constructed by WRD (AECOM, 2014). The tertiary-treated recycled water would be conveyed to the MFSG via an existing underground outfall pipeline. Based on the proposed location of the proposed treatment plant, an underground pipeline is anticipated to be constructed by WRD to convey the AWT recycled water from the proposed treatment plant to the MFSG.

The AWT plant is proposed for construction at either undeveloped areas of SDLAC's San Jose Creek WRP property or on adjacent parcels owned by LADWP and the United States Army Corps of Engineers. If the proposed AWT plant location is revised in the future, the GRIP Draft EIR (AECOM, 2014) will be revised and certified accordingly by WRD. Source water for the proposed AWT plant will consist of tertiary-treated recycled water produced by SDLAC's San Jose Creek WRP. The new AWT plant will include the following treatment processes: microfiltration/ultrafiltration (MF/UF), reverse osmosis (RO), and ultraviolet advanced oxidation process (UV-AOP).

The estimated implementation date for GRIP A is WY 2017-18. Based on the results of the future S/N loading analysis conducted for the SNMP (see Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality*), implementation of GRIP A will result in similar S/N groundwater quality as from the continued operations of current recharge at the MFSG with the blend of imported water, stormwater, and recycled water.

In the GRIP Draft EIR (AECOM, 2014), GRIP A is identified as the "proposed project," while GRIP B is identified as an "alternative" to the "proposed project." As a result, it is anticipated that GRIP A likely would be the project to be implemented by WRD. However, this is subject to change until the Final EIR is prepared and certified by WRD.

RW 2B. GRIP Recycled Water Project B (GRIP B) – As an alternative to GRIP A, GRIP B would completely replace imported water used for recharge at the MFSG with 21,000 AFY of tertiary-treated recycled water produced by SDLAC's San Jose Creek WRP. Unlike GRIP A, no physical changes to the environment would be required to implement GRIP B since the tertiary-treated recycled water will be conveyed to the MFSG via an existing outfall pipeline. For the SNMP analysis, GRIP B was modeled to begin in WY 2014-15.

Based on the results of the future S/N loading analysis conducted for the SNMP (see Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality*), implementation of GRIP B will result in slightly higher S/N concentrations in groundwater as compared with the continued operations of current recharge with a blend of imported water, stormwater, and recycled water. However, the SNMP mixing model results indicate that potential impacts from implementation of GRIP B are more than offset by projects that reduce S/N loading in the Central Basin. Thus, average S/N concentrations will not exceed or threaten to exceed their respective BPOs in the Central Basin in the future.

In the GRIP Draft EIR (AECOM, 2014), GRIP B was identified as an "alternative" to GRIP A and thus, was rejected from consideration after the CEQA evaluation (AECOM, 2014). As a result, it is anticipated that GRIP A likely would be the project to be implemented by WRD. However, this is subject to change until the Final EIR is prepared and certified by WRD.

7.3 Non-Potable Recycled Water Reuse Projects

RW 3. Increased Recycled Water Reuse for Irrigation – The Recycled Water Policy encourages the increased use of recycled water as a reliable, drought proof, local, safe source of water supply. Recycled water is utilized for a variety of non-potable reuse (NPR) applications in the CBWCB, including irrigation and industrial operations. For the purposes of the SNMP, irrigation is the primary consideration since it can contribute to S/N loading to the groundwater basins. While recycled water use for irrigation results in increased S/N loading and does not meet the definition of implementation measures, which are projects or programs to control, reduce, or manage (mitigate) S/N loading on a sustainable basis, increased recycled water use is proposed by the CBWCB stakeholders because it is a critical component of the CBWCB water supply sustainability portfolio, meets supports the goals of the Recycled Water Policy, and supports the Governor's recent drought proclamations (see Section 3.3).

As described in Appendix H *Baseline and Future Water Balances*, NPR of recycled water is projected to increase during the SNMP future planning period. Total NPR in the Central Basin is projected to increase from about 9,700 AFY in WY 2009-10 to 22,100 AFY in WY 2014-25. Of this total, recycled water used for irrigation in the Central Basin is projected to increase from about 7,600 AFY in WY 2009-10 to 17,200 AFY in WY 2024-25. In the West Coast Basin, NPR of recycled water is projected to increase from about 21,100 AFY in WY 2009-10 to 44,000 AFY in WY 2024-25. Of this total, recycled water used for irrigation in the West Coast Basin is projected to increase from about 3,900 AFY in WY 2009-10 to 5,800 AFY in WY 2024-25.

As part of the SNMP, the CBWCB stakeholders, in close consultation with the LARWQCB, modeled the impacts on groundwater quality from the increased use of recycled water for irrigation at the average S/N concentrations in the effluent from applicable WRPs during the baseline period (WY 2000-01 through 2009-10). Modeling results show that increased recycled water use for irrigation increases TDS and chloride concentrations in groundwater a very small amount and uses a very small amount of the available assimilative capacity (significantly less than 10%). There was no impact to nutrient (nitrate) loading. Overall, increased recycled water use for irrigation has minimal impacts on groundwater quality and these minor impacts are more than offset by implementation measures and other projects that reduce S/N loading. Groundwater quality in the CBWCB will either continue to improve or remain well below WQOs.

In direct response to California Governor Jerry Brown's April 2014 Executive Order proclaiming a continued state of emergency due to severe drought conditions, the SWRCB adopted *General Waste Discharge Requirements for Recycled Water Use* (General Order No. WQ 2014-0090-DWQ; http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2014/wqo2014_0090_dwq_revised.pdf) on June 3, 2014 to streamline permitting for recycled water use (i.e. relieve producers, distributors, and users of recycled water from the lengthy permit approval process) throughout the State. This General Order is intended to increase local water supplies by promoting the non-potable use of recycled water in communities grappling with drought conditions. Additionally, the General Order is consistent with the Recycled Water Policy that was adopted by the SWRCB in 2009 and amended in 2013, which required the development of

SNMPs for all groundwater basins in California. Thus, all uses of recycled water allowed by the General Order must be consistent with the SNMPs that will be approved by the Regional Water Quality Control Boards. Importantly, the General Order did not modify existing permitted recycled water quality limits established for irrigation. If this was the case, this would have significantly limited the sustainable and cost effective use of recycled water to offset demand for raw and potable water supplies in the CBWCB.

RW 4. Recycled Water Quality Limits at SMCLs for TDS and Chloride and MCL for Nitrate – Currently, permitted recycled water quality limits established for non-potable reuse (irrigation, industrial and recreational activities) are generally more conservative than the SMCLs established for TDS and chloride. As part of the SNMP, the CBWCB stakeholders, in close consultation with the LARWQCB, modeled the impacts on groundwater quality from the increased use of recycled water for irrigation at the SMCLs for TDS and chloride and at the MCL for nitrate. As discussed further in Section 7.4.1 in the SNMP, the modeling results showed that there were minimal impacts to the basins when utilizing recycled water for irrigation at these concentrations, even at increased volumes. Overall, increased recycled water use for irrigation at the SMCLs for TDS and chloride and MCL for nitrate has minimal impacts on groundwater quality and these minor impacts are more than offset by implementation measures and other projects that reduce S/N loading. Groundwater quality in the CBWCB will either continue to improve or remain well below WQOs. Therefore, the CBWCB stakeholders believe that modification of existing permit levels for recycled water for non-potable reuse are warranted to allow for increased use of recycled water to further reduce dependency on potable water supplies, meet the goals set forth in the Recycled Water Policy to increase the use of recycled water, and more fully embrace the spirit of the Governor's recent drought proclamations, as discussed in Section 3.3.

8 Implementation Plan Challenges

The purpose of this section is to acknowledge the possible technical, institutional, economic, and regulatory challenges that could impact achievement of recycled water and stormwater, goals and objectives, as well as proposed recycled water projects and implementation measures. Accordingly, the implementation plan that will be adopted by the LARWQCB needs to provide flexibility in the event that the implementation schedules for key recycled water projects and implementation measures need to be adjusted to accommodate these challenges. Potential challenges are listed below.

Technical Challenges

- Treatment costs
- Space for treatment facilities
- Space for infrastructure
- Recycled water availability
- Imported water availability
- Stormwater availability

- Seawater barrier injection capacities
- Spreading grounds capacities

Regulatory Challenges

- California Department of Public Health requirements
- LARWQCB requirements
- SWRCB requirements
- United States Environmental Protection Agency requirements
- California Water Code Section 1211 for changes in point or volume of wastewater discharge
- Local requirements and other requirements

Institutional Challenges

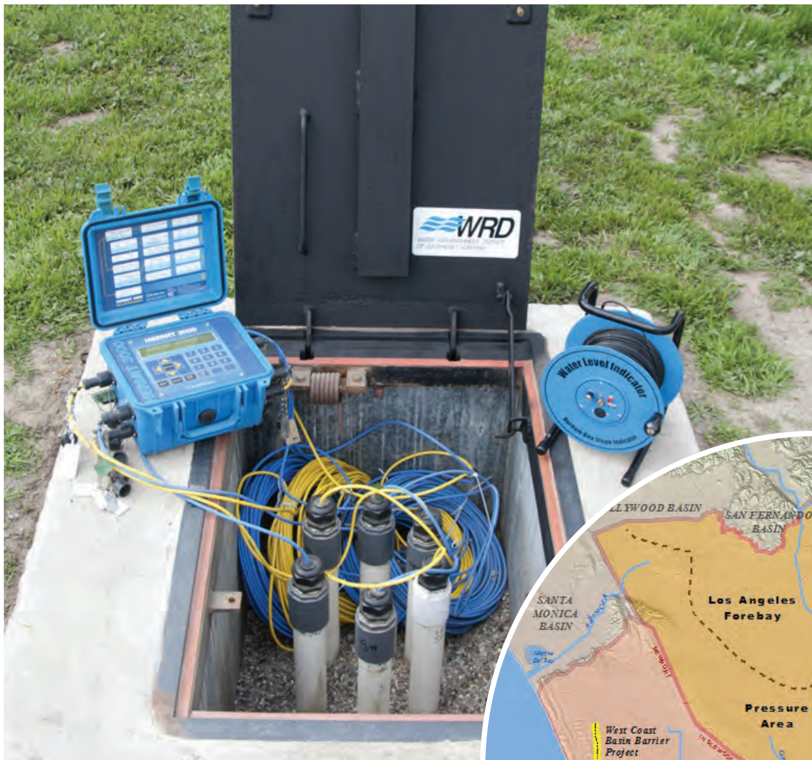
- Public acceptance
- Working relationships between water agencies, flood control agencies, groundwater agencies, wastewater management agencies, and municipalities
- Recycled water pricing

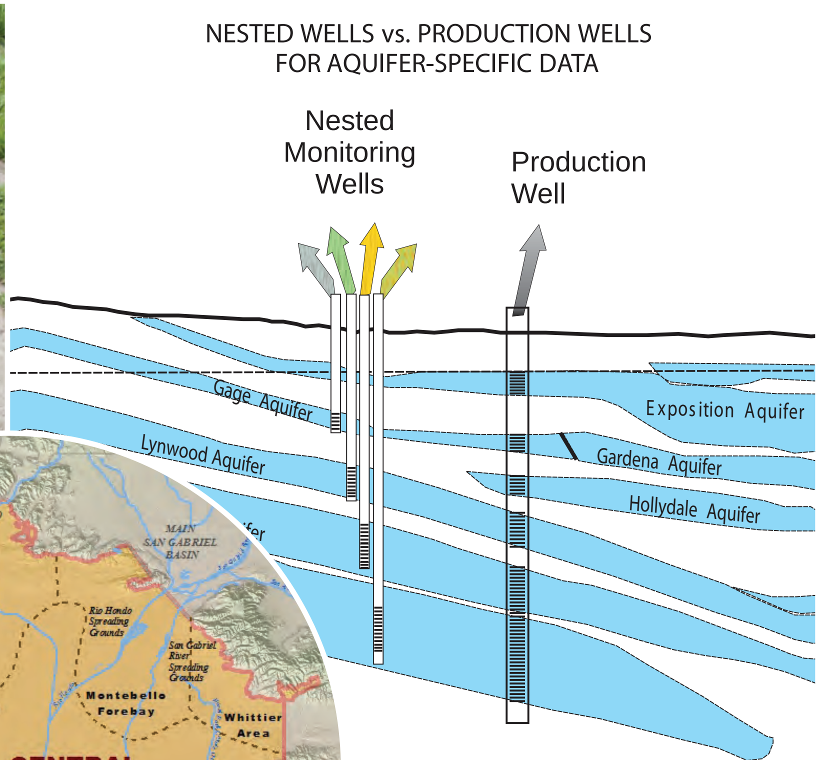
Economic Challenges

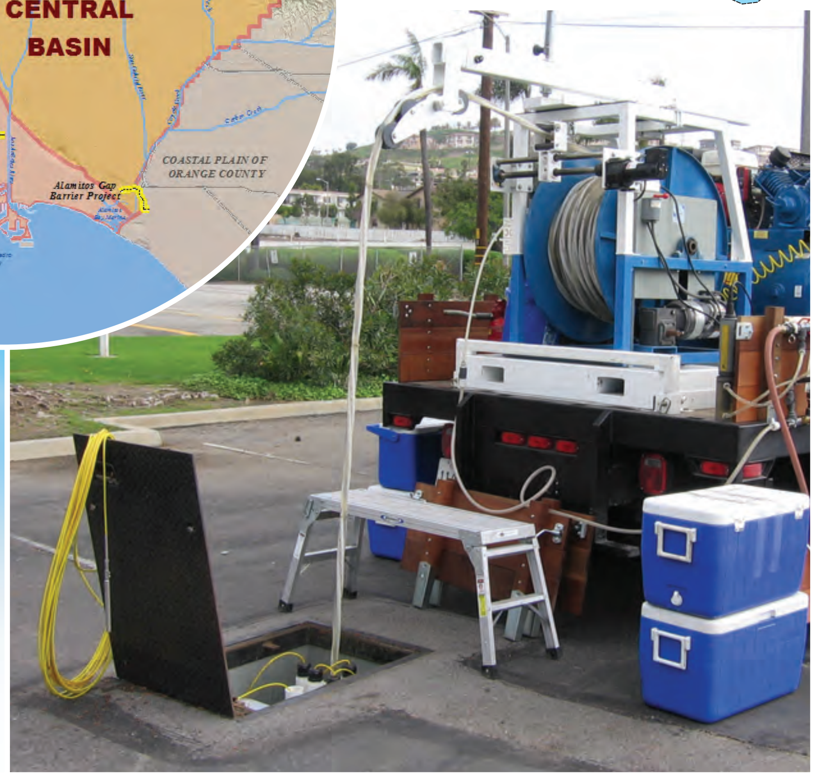
- Cost of recycled water treatment, conveyance, and brine disposal
- Availability of funding

Appendix K

SNMP Monitoring Plan







MONITORING PLAN
SALT AND NUTRIENT MANAGEMENT PLAN

CENTRAL BASIN AND WEST COAST BASIN
Southern Los Angeles County, California

WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA

February 2015

SANITATION DISTRICTS OF LOS ANGELES COUNTY

COVER

Center: Map of the Central Basin and West Coast Basin (CBWCB)
Upper Left: Photo of a nested groundwater monitoring well location in the CBWCB
Lower Left: Indicator constituents for salt and nutrients in the CBWCB
Upper Right: Diagram comparing nested groundwater monitoring wells to a production well
Lower Right: Photo of sampling of a nested groundwater monitoring well in the CBWCB

ACKNOWLEDGMENTS

Many agencies/organizations collaborated to develop the Salt and Nutrient Management Plan (SNMP) and this associated Monitoring Plan for the Central Basin and West Coast Basin (CBWCB). The CBWCB stakeholders would like to recognize and thank everyone who contributed to this tremendous endeavor.

The CBWCB SNMP was made possible by the generous financial support from the Water Replenishment District of Southern California (WRD), Los Angeles County Department of Public Works, West Basin Municipal Water District, Los Angeles Department of Water and Power, and County Sanitation Districts of Los Angeles County. With WRD managing and facilitating the process, these agencies played a key role in every stage of the SNMP development.

Multiple agencies/organizations generously dedicated their time to review and comment on project documents, participate in the stakeholder meetings, and provide vital data for the salt and nutrient analysis. We are especially grateful to the Metropolitan Water District of Southern California, Council for Watershed Health, and City of Los Angeles Bureau of Sanitation for their input and contributions.

We would like to express our gratitude to the Los Angeles Regional Water Quality Control Board and Egoscue Law Group for providing invaluable advice and guidance throughout the entire project.

We are truly thankful to the consultant team indicated below who worked tirelessly to facilitate and prepare the SNMP. We greatly appreciated their expertise and patience.

TODD GROUNDWATER

Todd Groundwater
2490 Mariner Square Loop, Suite 215
Alameda, CA 94501
510/747-6920
www.toddgroundwater.com

In cooperation with:

RMC Water and Environment

RMC
Water and Environment
2400 Broadway, Suite 300
Santa Monica, CA 90404
310/566-6460
www.rmcwater.com

Nellor Environmental Associates, Inc.

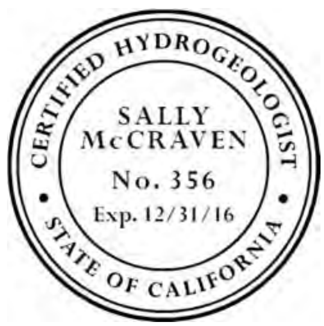
Nellor
Environmental Associates
4024 Walnut Clay Drive
Austin, TX 78731
512/374-9330

ESA

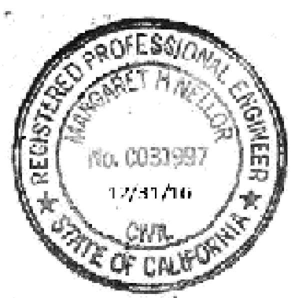
Environmental Science Associates
626 Wilshire Blvd., Suite1100
Los Angeles, CA 90017
213/599-4300
www.esassoc.com

PROFESSIONAL CERTIFICATION

This Monitoring Plan for the Salt and Nutrient Management Plan for the Central Basin and West Coast Basin was prepared under the direct supervision and with the support of the California Professional Geologist and Professional Engineer whose stamps and signatures appear below. The information contained in this plan has been prepared in accordance with the generally accepted principles and practices of their professions.



Sally McCraven, PG 5427, CHg 356, CEG 1744
Principal Hydrogeologist, Todd Groundwater



Margaret H. Nellor, PE 31997
President, Nellor Environmental Associates

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List of Acronyms

ADI	Acceptable Daily Intake
AF	Acre-feet
AFY	Acre-feet per year
AGB	Alamitos Gap Seawater Intrusion Barrier
AOP	Advanced oxidation process
APA	Allowed Pumping Allocation
ARRF	Aquifer Recharge and Recovery Facility
ASR	Aquifer Storage and Recovery
AWT	Advanced water treatment
AWTF	Advanced Wastewater Treatment Facility
BMPs	Best Management Practices
BOD	Biochemical Oxygen Demand
BPO	Basin Plan Objective
BSBPO	Basin Specific Basin Plan Objective
CASGEM	California Statewide Groundwater Elevation Monitoring Program
CASTNET	Clean Air Status and Trends Network
CCR	California Code of Regulations
CBWCB	Central Basin and West Coast Basin
CBWA	Central Basin Water Association
CDPH	California Department of Public Health (now the SWRCB Division of Drinking Water)
CEQA	California Environmental Quality Act
CECs	Constituents of Emerging Concern
CIMIS	California Irrigation Management Information System
CIMP	Coordinated Integrated Monitoring Program
COCs	Constituents of Concern
COD	Chemical Oxygen Demand
CR	Colorado River
CREST	Cleaner Rivers through Effective Stakeholder-Led TMDLs
CTAS	Cetyltrimethylammonium Bromide
CWA	Clean Water Act
CWH	Council for Watershed Health
DEET	N,N-Diethyl-meta-toluamide
DGB	Dominguez Gap Seawater Intrusion Barrier
DGSG	Dominquez Gap Spreading Grounds
DME	Designated Monitoring Entity for CASGEM
DTSC	California Department of Toxic Substances Control
DWEL	Drinking Water Equivalent Level
DWR	California Department of Water Resources
EC	Electrical conductivity
EDC	Endocrine Disrupting Compound
EIR	Environmental Impact Report

ESR	Engineering Survey and Report
ET	Evapotranspiration
EWMP	Enhanced Watershed Management Plan
ft/d	feet per day
ft^2/d	cubic feet per day
ft^3/d	cubic feet per day
GAMA	Groundwater Ambient Monitoring and Assessment Program
GBMP	Groundwater Basins Master Plan
GIS	Geographic Information System
GLAC	Greater Los Angeles County
GRIP	Groundwater Reliability Improvement Program
GRIP A	Groundwater Reliability Improvement Program, Recycled Water Project A
GRIP B	Groundwater Reliability Improvement Program, Recycled Water Project B
GSWC	Golden State Water Company
HSU	Hydrostratigraphic Unit
IMP	Integrated Monitoring Program
IRWMP	Integrated Regional Water Management Plan
LABOS	City of Los Angeles Bureau of Sanitation
LACDPW	Los Angeles County Department of Public Works
LADWP	Los Angeles Department of Water and Power
LARWMP	Los Angeles River Watershed Monitoring Program
LARWQCB	Los Angeles Regional Water Quality Control Board
LID	Low Impact Development
LUST	Leaking Underground Storage Tank
MBAS	Methylene Blue Active Substances
MCL	Maximum Contaminant Level
MF	Microfiltration
MFGWR	Montebello Forebay Groundwater Recharge
MFSG	Montebello Forebay Spreading Grounds
mg/L	milligrams per liter
MSGBW	Main San Gabriel Basin Watermaster
msl	mean sea level
MS4	Municipal Separate Storm Sewer System
MTBE	Methyl tertiary butyl ether
MWD	Metropolitan Water District of Southern California
N	Nitrogen
ND	Not Detected
NDMA	n-Nitrosodimethylamine
NdN	Nitrification/denitrification
ng/L	nanograms per liter
nitrate-N	nitrate as nitrogen
NL	Notification Level
NO_3	Nitrate
NOP	Notice of Preparation

NPDES	National Pollutant Discharge Elimination System
NPR	Nonpotable reuse
OCWD	Orange County Water District
OEHHA	California Office of Environmental Health Hazard Assessment
O_3	Ozonation
PBDE	Polybrominated diphenyl ethers
PCE	Tetrachloroethylene
PEIR	Programmatic Environmental Impact Report
PFOS	Perfluorooctane sulfonate
PHG	Public Health Goal
POTWs	Publicly Owned Treatment Works
PPCP	Pharmaceuticals and Personal Care Products
QA/QC	Quality Assurance/Quality Control
RGWMP	Regional Groundwater Monitoring Program
RGWMR	Regional Groundwater Monitoring Report
RHSG	Rio Hondo Spreading Grounds
RO	Reverse Osmosis
RW	Recycled Water
RWQCB	Regional Water Quality Control Board
SAT	Soil Aquifer Treatment
SCCWRP	Southern California Coastal Water Research Project
SDLAC	Sanitation Districts of Los Angeles County
SED	Substitute Environmental Document
SGRSG	San Gabriel River Spreading Grounds
SGRRMP	San Gabriel River Regional Monitoring Program
SMC	Stormwater Monitoring Coalition
SMCL	Secondary Maximum Contaminant Level
S/Ns	Salts and Nutrients
SNMP	Salt Nutrient Management Plan
SRWS	Self regenerating water softeners
SSC	Suspended-Sediment Concentration
SWAMP	Surface Water Ambient Monitoring Program
SWP	State Water Project
SWRCB	State Water Resources Control Board
1,1,1-TCA	1,1,1-Trichlorooethane
TCE	Trichloroethylene
TCEP	Tris (2-chloroethyl) phosphate
TCPP	Tris (1-chloro-2-propyl) phosphate
TDCP	Tris (2-chloroethyl) phosphate
TDI	Tolerable Daily Intake
TDS	Total Dissolved Solids
TIE	Toxicity Identification Evaluation
TIWRP	Terminal Island Water Reclamation Plant/Advanced Water Purification Facility
TMDL	Total Maximum Daily Load

TOC	Total Organic Carbon
TON	Threshold Odor Number
TSS	Total Suspended Solids
UC Davis	University of California at Davis
µg/L	micrograms per liter
USBOR	United States Bureau of Reclamation
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UV	Ultraviolent Irradiation
UWMP	Urban Water Management Plans
WBMWD	West Basin Municipal Water District
WBWA	West Basin Water Association
WCBB	West Coast Basin Seawater Intrusion Barrier
WDR	Waste Discharge Requirements
WEMAP	Western Environmental Monitoring and Assessment Program
WIN	Water Independence Now Strategy
WLA	Wasteload Allocation
WMA	Watershed Management Area
WMP	Watershed Management Plan
WQO	Water Quality Objective
WRD	Water Replenishment District of Southern California
WRF	Water Recycling Facility
WRP	Water Reclamation Plant
WRR	Water Recycling Requirements
WRRF	WateReuse Research Foundation
WTF	Water Treatment Facility
WTP	Water Treatment Plant
WY	Water Year

Executive Summary

Two of the most heavily utilized groundwater basins in Southern California are the Central Basin and the West Coast Basin (CBWCB or Study Area), which are located in the southern portion of Los Angeles County. Groundwater in the CBWCB meets approximately a third of the overall water supply needs of nearly 4 million residents and businesses in the 43 cities overlying the basins.

In February 2009, the State Water Resources Control Board (SWRCB) adopted Resolution No. 2009-0011, which established a statewide Recycled Water Policy. The purpose of the Recycled Water Policy is to establish uniform requirements for recycled water use and to develop sustainable water supplies throughout the State, thus encouraging the increased use of recycled water and local stormwater. It also requires development of a Salt and Nutrient Management Plan (SNMP), which should include a Monitoring Plan, for each groundwater basin in California. The SNMP process should be led by local stakeholders, including water and wastewater entities, together with local salt/nutrient contributing stakeholders. For the CBWCB, both the SNMP and the associated *Monitoring Plan* has been submitted to the Los Angeles Regional Water Quality Control Board (LARWQCB) for approval and a Basin Plan Amendment will be prepared by the LARWQCB and subsequently adopted by the LARWQCB Board.

In accordance with the Recycled Water Policy, this *Monitoring Plan* (Plan) for the SNMP was developed through a collaborative process by the CBWCB stakeholders as a means to evaluate concentrations of salt and nutrients (S/Ns) in groundwater with respect to applicable water quality objectives (WQOs). Specifically, this Plan describes the groundwater monitoring program (SNMP Monitoring Program) that was developed to assess total dissolved solids (TDS), chloride, and nitrate, which were determined in the SNMP to be the indicator compounds for S/Ns in the CBWCB. This Plan also summarizes other existing monitoring programs in the CBWCB, as well as special studies that have been conducted or are in progress.

Groundwater in the CBWCB has been and continues to be monitored near recycled water recharge sites, in drinking water wells, and through a large network of multiple completion monitoring wells for many decades. Groundwater from more than 1,500 wells[1] is sampled on a daily to annual basis and hundreds of chemicals/analytical parameters are tested each year. Currently, in significant excess of $1 million is expended annually for just groundwater monitoring and compliance in the CBWCB.

All of the existing groundwater monitoring programs are under direct oversight of regulatory agencies, except for voluntary programs such as the Water Replenishment District of Southern

[1] The total number of wells that are sampled in the CBWCB on a regular basis far exceeds 1,500 because this estimated quantity only includes nested groundwater monitoring wells owned and sampled by WRD, existing production wells, and permit compliance monitoring wells associated with ongoing large recycled water projects in the basins, such as the Montebello Forebay Spreading Grounds and the three seawater intrusion barriers. This quantity does not include the numerous groundwater monitoring wells associated with existing environmental release sites in the CBWCB.

California's (WRD's) Regional Groundwater Monitoring Program (RGWMP). The existing monitoring programs provide a comprehensive and continuing assessment of the overall health of the basins and allow for proper management of S/N loading on a sustainable basis.

Currently, WRD's RGWMP consists of a network of over 300 nested groundwater monitoring wells installed at over 55 locations throughout the CBWCB. Annually, WRD collects nearly 600 groundwater samples from its monitoring well network and analyzes them for over 100 constituents to produce nearly 60,000 individual data points to help track groundwater quality. Because each well is screened in a specific aquifer, constituents including S/Ns are more accurately monitored and can be effectively managed. Each year, WRD publishes a Regional Groundwater Monitoring Report (RGWMR) that provides water quality summary tables (including data for TDS, chloride, and nitrate) for each of the nested wells, water quality maps for the nested wells and production wells, and maps and hydrographs depicting groundwater level data.

The SNMP Monitoring Program was developed based on WRD's RGWMP. Seventy (70) WRD nested groundwater monitoring wells (referred to as the SNMP monitoring wells) at 13 locations throughout the CBWCB have been designated for S/N sampling and reporting as part of the SNMP Monitoring Program. Each well is screened in a specific aquifer, which allows the assessment of S/Ns in all the major aquifers of the CBWCB. These wells were selected based on their location in the most critical areas of the basins, particularly their proximity to water supply wells and groundwater recharge projects that utilize recycled water, including the seawater intrusion barriers (Alamitos Gap Barrier, Dominguez Gap Barrier, and West Coast Basin Barrier) and the Montebello Forebay Spreading Grounds. WRD is the designated entity responsible for collecting TDS, chloride, and nitrate samples (on a semi-annual basis) from the SNMP monitoring wells and submitting this data to the LARWQCB via the SWRCB online GeoTracker database. In addition, WRD's annual RGWMR provides maps depicting chloride, TDS, and nitrate concentrations in the all the nested wells and active drinking water wells, chloride and TDS trend graphs for the SNMP monitoring wells, and a discussion of S/N concentrations/trends in groundwater with respect to WQOs to assess overall groundwater quality in the CBWCB. Thus, both WRD's RGWMP and the SNMP Monitoring Program provide the means for comprehensive assessment and reporting of S/N levels in groundwater in the CBWCB.

In addition to groundwater monitoring, the CBWCB and tributary areas have numerous and extensive monitoring programs for recycled water, wastewater, imported water, and surface water/stormwater, including sampling for chloride, TDS, and nitrate, that are being managed by multiple stakeholder agencies/organizations. The existing and planned augmentation of these monitoring programs, as described in this Plan, are robust and therefore, fully comply with the Recycled Water Policy requirements. The data being collected and reported allow complete characterization of groundwater quality and potential impacts from recycled water projects (e.g. irrigation and groundwater recharge). Further, given the large number of wells monitored, many with depth discrete completions, additional site-specific monitoring at recycled water irrigation sites were not found to be warranted in the CBWCB.

Monitoring for constituents of emerging concern (CECs) in the Study Area is being conducted for groundwater recharge projects that utilize recycled water, wastewater treatment plants that discharge to surface water, and for special studies. There are also ongoing leading edge research efforts to further develop analytical methods and understand the health implications of low level CEC detections. As such, no additional CEC monitoring was found to be warranted in the CBWCB and thus, not proposed as part of the SNMP Monitoring Program.

Based on results from the SNMP Monitoring Program, the SNMP *Monitoring Plan* will be updated as necessary. Additionally, the SNMP *Monitoring Plan* will be reviewed and updated as necessary as part of the SNMP review every 10 years.

1 Introduction

In accordance with the Recycled Water Policy that was issued by the State Water Resources Control Board (SWRCB), this Appendix K describes the *Monitoring Plan* (Plan) that was prepared by Nellor Environmental Associates, Inc. and Todd Groundwater and developed by the stakeholders of the Central Basin and West Coast Basin (CBWCB or Study Area) for the Salt and Nutrient Management Plan (SNMP). These CBWCB stakeholders include the Water Replenishment District of Southern California (WRD), Los Angeles County Department of Public Works (LACDPW), West Basin Municipal Water District (WBMWD), Los Angeles Department of Water and Power (LADWP), County Sanitation Districts of Los Angeles County (SDLAC), Metropolitan Water District of Southern California (MWD), Council for Watershed Health, City of Los Angeles Bureau of Sanitation, and other interested parties. The CBWCB stakeholders also worked collaboratively with the Los Angeles Regional Water Quality Control Board (LARWQCB) to develop the SNMP and this associated *Monitoring Plan*. WRD has been the lead agency managing and facilitating development of the CBWCB SNMP and all associated documents.

Key components of this appendix include a description of the SNMP Monitoring Program and other existing monitoring programs in the CBWCB related to recycled water, wastewater, imported water, surface water/stormwater, and groundwater, including the program origin, responsible agency, monitoring locations, parameters monitored, monitoring frequency, reporting and data location, and quality control/quality assurance information. This Plan also presents information on monitoring and studies related to constituents of emerging concerns (CECs). Attachment K-A consists of a list of definitions related to the SNMP. Attachments K-B through K-P provide more detailed informaton on the different monitoring programs in the CBWCB.

1.1 Regulatory Framework

In February 2009, the SWRCB adopted Resolution No. 2009-0011, *Policy for Water Quality Control for Recycled Water* (Recycled Water Policy). The statewide Recycled Water Policy was revised, specifically the monitoring requirements for priority pollutants and constituents of emerging concern, by an Amendment (Resolution No. 2013-0003) that was adopted by the SWRCB on January 22, 2013 and became effective on April 25, 2013. The Recycled Water Policy and its Amendment (http://www.swrcb.ca.gov/water_issues/programs/water_recycling_policy/docs/rwp_revtoc.pdf) are provided as Appendix A in the SNMP.

The purpose of the Recycled Water Policy is to establish uniform requirements for recycled water used for groundwater recharge and landscape irrigation and to develop sustainable water supplies throughout the State, thus encouraging the increased use of recycled water and local stormwater. It also requires development of a SNMP (which should include a Monitoring Plan) for each groundwater basin in California. The SNMP process should be led by local stakeholders, including water and wastewater entities, together with local salt/nutrient contributing stakeholders. To provide further guidance, on June 28, 2012, the Los Angeles Regional Water Quality Control Board (LARWQCB) issued the *Regional Water Board Assistance* *in Guiding Salt and Nutrient Management Plan Development in the Los Angeles Region* (SNMP Assistance Document), which provides guidance for preparation of SNMPs within the Los Angeles region.

Both the SNMP and this associated *Monitoring Plan* have been submitted to the LARWQCB for approval and subsequently, a Basin Plan Amendment will be prepared by the LARWQCB and adopted by the LARWQCB Board.

1.2 Description of the CBWCB SNMP

The objective of the SNMP is to facilitate basin-wide management of S/Ns from all sources in a manner that optimizes recycled water use while ensuring protection of the groundwater supply and beneficial uses, agricultural beneficial uses, and human health. The SNMP that was developed for the CBWCB identifies total dissolved solids (TDS), chloride, and nitrate to be the indicator compounds for S/Ns. Major elements of the SNMP include the following:

- Goals and Objectives for Stormwater and Recycled Water Use[2]
- Characterization of Hydrogeologic Conceptual Model/Water Quality
- Estimation of Current and Future Salt and Nutrient Loading and Unloading
- A Monitoring Plan
- Estimation of Basin Salt and Nutrient Assimilative Capacity (relative to Water Quality Objectives)
- An Anti-degradation Analysis
- Development of Implementation Measures to Reduce Salt and Nutrient Loading
- California Environmental Quality Act (CEQA) Analysis of the SNMP

After the Recycled Water Policy was issued in 2009, the Water Replenishment District of Southern California (WRD) began coordinating the development of the SNMP for the CBWCB. A stakeholder group was formed, consisting of the WRD (lead agency), LACDPW, WBMWD, LADWP, SDLAC, and MWD. For over 50 years, these agencies as well as other local agencies and numerous cities have been collaborating and implementing critical measures, such as water reclamation and reuse, water conservation, improved maintenance of supply and delivery infrastructure, and the capture and use of stormwater, to prevent overdraft and replenish the CBWCB aquifer system. The use of recycled water in the CWCB has played a vital role in increasing the reliability and sustainability of the overall water supply.

In 2011, the CBWCB stakeholders prepared the *Workplan of the Salt/Nutrient Management Plan, Central Basin and West Coast Basin* (SNMP Workplan) and submitted this document to the LARWQCB for review. The purpose of the SNMP Workplan was to provide an outline of the SNMP and discuss the major elements to be included in the SNMP. On December 13, 2011, LARWQCB issued an approval letter for the SNMP Workplan. This SNMP was prepared in general accordance with the approved SNMP Workplan. Both the SNMP Workplan and the associated LARWQCB approval letter are provided as Appendix D of the SNMP and can be

[2] In addition to goals and objectives for recycled water and stormwater use, all other planned changes impacting salt and nutrient loading and unloading during the future planning period through 2025 in the CBWCB were identified.

downloaded from the LARWQCB website:
http://www.swrcb.ca.gov/rwqcb4/water_issues/programs/salt_and_nutrient_management/Stakeholder_Outreach/Workgroups/central_and_west_coast_Basin.shtml.

At the request of the CBWCB stakeholders, the LARWQCB issued an approval letter to extend the deadline for submittal of the Draft CBWCB SNMP (including this *Monitoring Plan*) and the associated Draft Substitute Environmental Document to LARWQCB for review by August 31, 2014. Based on the SNMP, a Basin Plan Amendment will be subsequently prepared the LARWQCB and adopted by the LARWQCB.

The SNMP is intended to be a living document, and the S/N management program, including the goals, existing basin conditions, implementation measures, SNMP Monitoring Program, etc., will be reviewed every 10 years by the CBWCB stakeholders with revisions made as necessary. However, based on results from the SNMP Monitoring Program, interim updates to the SNMP may be conducted when deemed necessary.

1.3 Background of the Central Basin and West Coast Basin

Two of the most heavily utilized groundwater basins in Southern California are the Central Basin and the West Coast Basin, which are located in the southern portion of Los Angeles County (**Figure K-1**). Groundwater in the CBWCB meets approximately a third of the overall water supply needs of nearly 4 million residents and businesses in the 43 cities overlying the basins.

1.3.1 Physiographic Description

The CBWCB are located in the Coastal Plain of Los Angeles County, California. The Coastal Plain is a northwest-trending structural basin underlain by up to 20,000 feet of sedimentary deposits comprised of gravel, sand, silt, and clay. The major land forms of the Coastal Plain consist of bordering highlands and foothills, older plains and hills, younger alluvial plains, the rivers which drain the area, and the offshore topography. The CBWCB are characterized by a layered aquifer/aquitard system.

The Central Basin covers approximately 280 square miles and extends over most of the Coastal Plain northeast of the Newport-Inglewood Uplift, a series of discontinuous faults and folds that form a prominent line of northwest-trending hills including the Baldwin Hills, Dominguez Hills, and Signal Hill (Figure K-1). It is bounded on the north by the Hollywood Basin, on the northeast by a series of low hills, on the southwest by the Newport-Inglewood Uplift, and on the southeast by the Los Angeles-Orange County line and the Coastal Plain of Orange County.

The Central Basin is geologically divided into four areas: the Los Angeles Forebay, Montebello Forebay, Whittier Area, and Pressure Area (California Department of Water Resources [DWR], 1961). The forebays are areas where confining layers are thin or absent and infiltration of precipitation and surface water can recharge deeper potable production aquifers. The Whittier Area was historically considered a separate basin based on the low lying hills that bound the area to the south, but is now treated as part of the Central Basin. The Central Basin Pressure Area, largest of the four divisions, is characterized by aquifers that are confined by relatively impermeable clay layers over most of the area. The groundwater basin is generally unconfined in the forebays and confined in the pressure area.

The West Coast Basin covers approximately 140 square miles and is bounded by the Newport-Inglewood Uplift on the northeast, by the Santa Monica Basin on the north, and by the Pacific Ocean, Palos Verdes Hills, and the Los Angeles-Orange County line on the southwest and south. Aquifers are generally confined in the West Coast Basin and receive the majority of their natural replenishment from adjacent groundwater basins or from the Pacific Ocean (seawater intrusion). Groundwater flows between the Central Basin and the West Coast Basin based on the groundwater elevations on either side of the Newport-Inglewood Uplift. Most of the groundwater in the CBWCB remains at elevations below sea level, so the importance of maintaining the seawater barrier wells (see Section 1.3.2) to keep out the intruding saltwater is of vital importance.

1.3.2 Groundwater Quality and Replenishment

Between 1900 and the 1950s, groundwater was an important factor in accelerating the urbanization of the CBWCB, which led to increasing demand for groundwater that far exceeded natural freshwater recharge. Over-pumping during this period caused the potentiometric surface[3] to drop to about 100 feet below sea level resulting in seawater intrusion that contaminated coastal aquifers and threatened the future usability of the basins. To remedy the groundwater problems related to supply and quality, multiple salinity and nutrient management measures, which involve the use of recycled water and stormwater, were implemented beginning in the 1950s and continue today.

To reduce the demand on groundwater (thereby reducing drawdown and minimizing the rate of seawater intrusion) and to supplement the water supply, surface water was imported to the region from northern California and the Colorado River via aqueducts. The basins were adjudicated in the 1960s, which limited pumping. Managed aquifer recharge utilizing captured stormwater has been conducted in the northeastern region of the Central Basin since 1938, when the Rio Hondo and San Gabriel River spreading grounds were established by the Los Angeles County Flood Control District (LACFCD). In addition to stormwater, imported water (since 1953) and recycled water (since 1962) are also sources of recharge water at the spreading grounds and there are current plans to potentially deliver advanced treated recycled water (i.e. treatment by reverse osmosis) to the spreading grounds in the near future.

To directly halt seawater intrusion, three barriers (West Coast Basin Seawater Intrusion Barrier, Alamitos Gap Seawater Intrusion Barrier, and Dominguez Gap Seawater Intrusion Barrier) consisting of an extensive network of injection and observation wells were constructed along the coast by the LACFCD between the 1950s and 1970s. Currently, imported water and advanced treated recycled water are utilized for injection at all three barriers. To remediate the saline plume that had been trapped inland due to operation of the West Coast Basin Seawater Intrusion Barrier, two reverse osmosis treatment plants (i.e., desalter facilities) began operating in 1993 and 2002 to pump and treat brackish groundwater for potable supply.

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[3] A hypothetical surface representing the level to which groundwater would rise if not trapped in a confined aquifer (an aquifer in which the water is under pressure because of an impermeable layer above it that keeps it from seeking its level). The potentiometric surface is equivalent to the water table in an unconfined aquifer.

Groundwater recharge to the CBWCB can occur through underflow from adjacent groundwater basins (such as the Main San Gabriel Basin and the Santa Monica Basin), the Montebello Forebay Spreading Grounds, the seawater intrusion barriers along the coast, precipitation infiltration, return flow of irrigation water that penetrates below the root zone, percolation through unlined river channels, and minor continued seawater intrusion in certain areas. There are currently over 400 active production wells in the basins and groundwater leaves the CBWCB mainly through groundwater extraction. Due to continued pumping depressions, very little groundwater leaves the SBWCB as subsurface outflow.

Groundwater quality in the CBWCB also reflects current and historic land uses. There are localized areas of marginal to poor groundwater quality that are not used for water supply due to shallow depths or that may require treatment prior to use. Historic agricultural activities may have impacted groundwater quality locally and, as a highly urban region, commercial and industrial activities (e.g., leaking aboveground and underground storage tanks, leaking sewer and oil pipelines, and illegal discharges) have contaminated groundwater with localized plumes of petroleum fuels, solvents, and other hazardous substances. In general, these plumes are limited to shallow groundwater. However, as the aquifers and confining layers in these alluvial basins are typically interfingered, the quality of groundwater in the deeper production aquifers can be threatened by the migration of pollutants from the upper aquifers. Overall, the groundwater in the CBWCB continues to be of high quality, suitable for potable and non-potable uses, and continues to meet regulatory requirements.

2 SNMP Monitoring Program

2.1 Recycled Water Policy Requirements

The SWRCB Recycled Water Policy states that the SNMP should include a monitoring program that consists of a network of groundwater monitoring locations *". . . adequate to provide a reasonable, cost-effective means of determining whether the concentrations of salts, nutrients, and other constituents of concern as identified in the salt and nutrient plans are consistent with applicable water quality objectives.*" Additionally, the SNMP monitoring program *". . . must focus on basin water quality near water supply wells and areas proximate to large water recycling projects, particularly groundwater recharge projects. Also, monitoring locations shall, where appropriate, target groundwater and surface waters where groundwater has connectivity with the adjacent surface waters.*" The preferred approach is to *". . . collect samples from existing wells if feasible as long as the existing wells are located appropriately to determine water quality throughout the most critical areas of the basin."* (SWRCB, 2009).

"The SNMP Monitoring Plan shall identify those stakeholders responsible for conducting, sampling, and reporting the monitoring data. The data shall be reported to the Regional Water Quality Control Board at least every three years." With regards to constituents of emerging concern (CECs), the Recycled Water Policy requires that the SNMP include *". . . a provision for annual monitoring of Emerging Constituents/Chemicals of Emerging Concern (e.g., endocrine disruptors, personal care products or pharmaceuticals) consistent with recommendations by CDPH* [now the SWRCB Division of Drinking Water] *and consistent with any actions by the State Water Board* [SWRCB] . . . ." (SWRCB, 2009).

In accordance with the Recycled Water Policy, an SNMP Monitoring Program that was developed for the CBWCB is presented in Section 2.2 below. Section 4 of this Plan addresses CEC monitoring in the CBWCB, including the identification of the CECs monitored and performance measures for salt and nutrient management.

2.2 Description of the SNMP Monitoring Program

As the groundwater manager of the CBWCB, WRD has been monitoring the aquifers in these two basins for over 50 years. Through its Regional Groundwater Monitoring Program (RGWMP), WRD has installed nested groundwater monitoring wells and conducts well sampling, groundwater level monitoring, modeling, and data evaluation continuously to ensure the long-term viability of groundwater in the CBWCB. Currently, the RGWMP consists of a network of over 300 nested groundwater monitoring wells installed at over 55 locations throughout the CBWCB. Each year, WRD publishes a Regional Groundwater Monitoring Report (RGWMR) that provides water quality summary tables (including data for TDS, chloride, and nitrate) for each of the nested wells, water quality maps for the nested wells and production wells, and maps and hydrographs depicting groundwater level data. Further details regarding the RGWMP are provided in Section 3.6.1.

The SNMP Monitoring Program was developed based on WRD's RGWMP. Seventy (70) WRD nested groundwater monitoring wells (now referred to as SNMP monitoring wells) at 13 key locations throughout the CBWCB have been designated for S/N sampling and reporting as part of the SNMP Monitoring Program. Each well is screened in a specific aquifer, which allows the assessment of S/Ns in all the major aquifers of the CBWCB. These wells were selected based on their location in the most critical areas of the basins, particularly their proximity to water supply wells and groundwater recharge projects that utilize recycled water, including the seawater intrusion barriers and the Montebello Forebay Spreading Grounds.

As previously mentioned, TDS, chloride and nitrate were identified in the SNMP as the indicator constituents for S/Ns. Data for these specific constituents that are collected from the SNMP monitoring wells will be uploaded at least annually by WRD to SWRCB's online GeoTracker database. The SNMP Monitoring Program is summarized in **Table K-1** and construction details and the rationale for the locations of the SNMP groundwater monitoring wells are provided in **Table K-2**. All the SNMP nested groundwater monitoring wells are shown in **Figure K-2**.

Table K-1 SNMP Monitoring Program

<table>
<tr><td>Program Origin</td><td>Water Replenishment District of Southern California's Regional Groundwater Monitoring Program Plan (RGWMP; see Section 3.6.1 and Attachment K-N for further details)</td></tr>
<tr><td>Responsible Agency</td><td>Water Replenishment District of Southern California (WRD)</td></tr>
<tr><td>Number of Monitoring Points</td><td>70 nested groundwater monitoring wells (referred to as Salt and Nutrient Management Plan [SNMP] monitoring wells) at 13 locations throughout the Central Basin and West Coast Basin (CBWCB); each nested well is screened in a specific aquifer (see Table K-2 for well construction details)</td></tr>
<tr><td>Monitoring Locations</td><td>13 locations at the most critical areas of the CBWCB, particularly in proximity to water supply wells and groundwater recharge projects that utilize recycled water, including the seawater intrusion barriers and the Montebello Forebay Spreading Grounds (see Figure K-2)</td></tr>
<tr><td>Constituents and Frequency</td><td>
<table>
<tr><th>Parameter</th><th>Monitoring Frequency</th></tr>
<tr><td>Nitrate</td><td rowspan="3">Semi-Annually</td></tr>
<tr><td>Chloride[a]</td></tr>
<tr><td>Total Dissolved Solids[a]</td></tr>
</table>
a. Trend graphs for the 70 SNMP monitoring wells are presented in WRD's annual Regional Groundwater Monitoring Report
</td></tr>
<tr><td>Other Media Monitored/ Monitoring Locations</td><td>Refer to Section 3 for other monitoring programs in the CBWCB related to groundwater, recycled water, wastewater, imported water, and surface water/stormwater</td></tr>
<tr><td>Reporting / Databases</td><td>• At least annually, WRD will upload TDS, chloride, and nitrate data collected from the SNMP monitoring wells to the SWRCB online GeoTracker database: http://geotracker.waterboards.ca.gov/</td></tr>
</table>

	• WRD's annual Regional Groundwater Monitoring Report (RGWMR), which provides maps depicting chloride, TDS, and nitrate concentrations in all the RGWMP wells and active drinking water wells, chloride and TDS trend graphs for the SNMP monitoring wells, and a discussion of S/N concentrations/trends in groundwater with respect to Water Quality Objectives (WQOs) established in the Basin Plan to assess overall groundwater quality in the CBWCB. The RGWMR is sent to the CBWCB water purveyors and can be downloaded from the WRD website: http://www.wrd.org/engineering/groundwater-engineering-reports.php • WRD's online Geographical Information System (GIS) database provides groundwater quality data, well locations, well construction, and water levels for active production wells and all the RGWMP wells: http://gis.wrd.org/wrdmap/login.asp
Quality Assurance / Quality Control (QA/QC) Program	• Certified laboratories • Field blanks and blind duplicates; unusual analytical results are noted and compared to historical values/trends and if the result appears to be an outlier or anomaly, the result is flagged in the WRD database • Laboratory method blanks, control standards, matrix spike/matrix spike duplicates, and surrogate spikes • Eurofins Eaton Analytical, Inc. and other commercial laboratories: Comprehensive, written QA/QC program (see Attachment K-N)
Compliance Oversight	TDS, chloride, and nitrate data collected from the SNMP monitoring wells will be reviewed by WRD and LARWQCB

Table K-2 Well Construction Details and Location Rationale for SNMP Monitoring Wells

WRD Nested Groundwater Monitoring Well Name	Explanation for Selection of this Well Location for Salt and Nutrient Monitoring	Zone [a]	WRD ID Number	Depth of Well (feet bgs)	Top of Perforation (feet bgs)	Bottom of Perforation (feet bgs)	Aquifer Designation	Model Layer
Carson #1	Located at the southern portion of the West Coast Basin in the vicinity of active production wells.	1	100030	1010	990	1010	Sunnyside	4
		2	100031	760	740	760	Silverado	3
		3	100032	480	460	480	Lynwood	3
		4	100033	270	250	270	Gage	3
Huntington Park #1	Located within the Los Angeles Forebay (northern portion of the Central Basin) in the vicinity of active production wells.	1	100005	910	890	910	Silverado	3
		2	100006	710	690	710	Jefferson	3
		3	100007	440	420	440	Gage	3
		4	100008	295	275	295	Exposition	2
		5	100009	134	114	134	Gaspur	1/2
Long Beach #6	Located at the southern portion of the Central Basin (within the Pressure Area) in the vicinity of production wells.	1	101792	1530	1490	1510	Pico Formation	Below 4
		2	101793	950	930	950	Sunnyside	3
		3	101794	760	740	760	Sunnyside	3
		4	101795	500	480	500	Silverado	3
		5	101796	400	380	400	Lynwood	3
		6	101797	240	220	240	Gage	3
Manhattan Beach #1	Located adjacent to the West Coast Basin Seawater Intrusion Barrier, where advanced treated recycled water and imported water are currently injected to halt seawater intrusion and replenish the groundwater basin.	1	102081	1990	1950	1990	Pico Formation	Below 4
		2	102082	1590	1570	1590	Pico Formation	Below 4
		3	102083	1270	1250	1270	Sunnyside	Below 4
		4	102084	885	865	885	Silverado	Below 4
		5	102085	660	640	660	Silverado	4
		6	102086	340	320	340	Lynwood	3
		7	102087	200	180	200	Gage	2

Table K-2 (continued) Well Construction Details and Location Rationale for SNMP Monitoring Wells

WRD Nested Groundwater Monitoring Well Name	Explanation for Selection of this Well Location for Salt and Nutrient Monitoring	Zone [a]	WRD ID Number	Depth of Well (feet bgs)	Top of Perforation (feet bgs)	Bottom of Perforation (feet bgs)	Aquifer Designation	Model Layer
Norwalk #2	Located at the east-northeast portion of the Central Basin (southern end of the Montebello Forebay) downgradient of the Montebello Forebay Spreading Grounds and in the vicinity of active production wells.	1	101942	1480	1460	1480	Sunnyside	Below 4
		2	101943	1280	1260	1280	Sunnyside	4
		3	101944	980	960	980	Silverado	3
		4	101945	820	800	820	Lynwood	3
		5	101946	500	480	500	Gardena	3
		6	101947	256	236	256	Exposition	2
Pico #2	Located in the Montebello Forebay (northeastern portion of the Central Basin), adjacent to the San Gabriel River Spreading Grounds, where tertiary-treated recycled water, imported water, and stormwater are currently recharged.	1	100085	1200	1180	1200	Sunnyside	Below 4
		2	100086	850	830	850	Sunnyside	4
		3	100087	580	560	580	Sunnyside	3
		4	100088	340	320	340	Silverado	3
		5	100089	255	235	255	Lynwood	2/3
		6	100090	120	100	120	Gaspur	1
PM-4 Mariner	Located in the central portion of the West Coast Basin, in the vicinity of production wells and within the saline plume inland of the West Coast Basin Barrier.	1	100038	720	670	710	Sunnyside	3/4
		2	100039	550	500	540	Silverado	3
		3	100040	390	340	380	Lynwood	3
		4	100041	250	200	240	Lynwood	2/3
Rio Hondo #1	Located in the Montebello Forebay (northeastern portion of the Central Basin), adjacent to the Rio Hondo Spreading Grounds, where tertiary-treated recycled water, imported water, and stormwater are currently recharged.	1	100064	1150	1110	1130	Sunnyside	Below 4
		2	100065	930	910	930	Sunnyside	4
		3	100066	730	710	730	Sunnyside	3
		4	100067	450	430	450	Silverado	3
		5	100068	300	280	300	Lynwood	2/3
		6	100069	160	140	160	Gardena	1/2

Table K-2 (continued) Well Construction Details and Location Rationale for SNMP Monitoring Wells

WRD Nested Groundwater Monitoring Well Name	Explanation for Selection of this Well Location for Salt and Nutrient Monitoring	Zone [a]	WRD ID Number	Depth of Well (feet bgs)	Top of Perforation (feet bgs)	Bottom of Perforation (feet bgs)	Aquifer Designation	Model Layer
Seal Beach #1	Located at the southern end of the Central Basin (within the Pressure Area), adjacent to the Alamitos Gap Seawater Intrusion Barrier where advanced treated recycled water and imported water are currently injected to halt seawater intrusion and replenish the groundwater basin.	1	102062	1485	1345	1365	Sunnyside	Below 4
		2	102063	1180	1160	1180	Sunnyside	Below 4
		3	102064	1040	1020	1040	Sunnyside	Below 4
		4	102065	795	775	795	Silverado	4
		5	102066	625	605	625	Lynwood	3/4
		6	102067	235	215	235	Gage	2
		7	102068	70	60	70	Gaspur	1
South Gate #1	Located in the central area of the Central Basin (within the northern portion of the Pressure Area), adjacent to the Los Angeles River and in the vicinity of active production wells.	1	100893	1460	1440	1460	Pico Formation	Below 4
		2	100894	1340	1320	1340	Sunnyside	4
		3	100895	930	910	930	Silverado	3
		4	100896	585	565	585	Lynwood	3
		5	100897	250	220	240	Exposition	2
Whittier #1	Located within the northeastern portion of the Central Basin, within the Whittier Area where very few production wells exist.	1	101735	1298	1180	1200	Sunnyside	Below 4
		2	101736	940	920	940	Sunnyside	4
		3	101737	620	600	620	Silverado	3
		4	101738	470	450	470	Lynwood	3
		5	101739	220	200	220	Gage	2/3
Willowbrook #1	Located in the western area of the Central Basin (within the western portion of the Pressure Area), near the Newport-Inglewood Uplift that separates the Central Basin from the West Coast Basin and in the vicinity of active production wells.	1	100016	905	885	905	Sunnyside	4
		2	100017	520	500	520	Silverado	3
		3	100018	380	360	380	Lynwood	3
		4	100019	220	200	220	Gage	2

Table K-2 (continued) Well Construction Details and Location Rationale for SNMP Monitoring Wells

WRD Nested Groundwater Monitoring Well Name	Explanation for Selection of this Well Location for Salt and Nutrient Monitoring	Zone [a]	WRD ID Number	Depth of Well (feet bgs)	Top of Perforation (feet bgs)	Bottom of Perforation (feet bgs)	Aquifer Designation	Model Layer
Wilmington #2	Located at the southern portion of the West Coast Basin, adjacent to the Dominguez Gap Seawater Intrusion Barrier (DGB) where advanced treated recycled water and imported water are currently injected to halt seawater intrusion and replenish the groundwater basin; the recycled water connection point is located at western end of the DGB.	1	100075	1030	950	970	Sunnyside	4
		2	100076	775	755	775	Silverado	4
		3	100077	560	540	560	Lynwood	3
		4	100078	410	390	410	Lynwood	2/3
		5	100079	140	120	140	Gage	2

WRD – Water Replenishment District of Southern California
ID – identification
bgs – below ground surface
a – WRD depth designation

To further assess S/Ns in groundwater, WRD's annual RGWMR provides maps depicting chloride, TDS, and nitrate concentrations in the all the nested wells and active production wells, chloride and TDS trend graphs for the SNMP monitoring wells, and a discussion of S/N concentrations/trends in groundwater with respect to Water Quality Objectives (WQOs) established in the Basin Plan to assess overall groundwater quality in the CBWCB. Thus, both WRD's RGWMP and the SNMP Monitoring Program provide the means for the assessment and reporting of S/N levels in groundwater in the CBWCB.

In addition to groundwater monitoring, the CBWCB and tributary areas have numerous and extensive monitoring programs for recycled water, wastewater, imported water, and surface water/stormwater, including sampling for the three S/N indicators, as discussed further in Section 3. In addition, hundreds of chemicals/analytical parameters, including CECs, are tested each year for multiple source waters. Monitoring for CECs in the Study Area is being conducted for the groundwater recharge projects that utilize recycled water, wastewater treatment plants that discharge to surface water, and for special studies, as discussed further in Section 4.

2.3 Implementation of the SNMP Monitoring Program

Once the LARWQCB has approved the SNMP *Monitoring Plan* and established a GeoTracker weblink for the SNMP Monitoring Program for the CBWCB, WRD will implement the SNMP Monitoring Program by collecting TDS, chloride, and nitrate data from the 70 SNMP monitoring wells on a semi-annual basis and uploading this water quality data to the GeoTracker database.

As discussed earlier, WRD will continue to monitor for salt, nutrients, and other constituents in groundwater as part of its RGWMP and these monitoring results will be presented and evaluated in the annual RGWMR that is issued by WRD. Refer to Section 3.6.1 for a further description of the RGWMP.

2.4 Model Layers and the SNMP Mixing Model

In 2003, the United States Geological Survey (USGS) developed a regional groundwater flow (MODFLOW) model of the CBWCB based on review of geophysical logs along with ancillary information. As part of this groundwater model, the USGS simplified the DWR-defined aquifers into four aquifer systems for modeling purposes. The aquifers were grouped into the Recent (Model Layer 1), Lakewood (Model Layer 2), Upper San Pedro (Model Layer 3), and Lower San Pedro (Model Layer 4). These model layers are used throughout the SNMP to describe the movement and quality of groundwater. The USGS-designated aquifer systems and model layers as they relate to the DWR-designated aquifers are described further in Appendix G *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality* of the SNMP.

Figure K-3 and Table K-2 indicate the Model Layer that each SNMP monitoring well is screened within. As shown in Figure K-3, Model Layer 1, comprised of the Semi-Perched Aquifer and Gaspur Aquifer, does not exist in all areas of the CBWCB. In the Los Angeles Forebay, the Gaspur Aquifer is typically unsaturated. As a result, there are no monitoring or production wells screened in Model Layer 1 in the Los Angeles Forebay. Model Layer 1 extends to a very small extent into the Whittier Area. As in the Los Angeles Forebay, there are no monitoring or production wells screened in Model Layer 1 in the Whittier Area. Because of its limited extent in the Whittier Area, unsaturated condition in the Los Angeles Forebay, and lack of monitoring data in both areas, Model Layer 1 was not considered as part of the hydrogeologic conceptual model for the Los Angeles Forebay and Whittier Area for the SNMP water quality analysis. This assumption had almost no effect on the estimation of average groundwater quality because Model Layer 1 is very thin and contains a very small volume of water relative to the other model layers. Similarly, Model Layer 1 does not exist in other portions of the Central Basin Pressure Area and West Coast Basin as shown in Figure K-3. In areas where Model Layer 1 does not exist, is unsaturated, or is of very limited extent, S/N loading was assumed to be directly into Model Layer 2.

An SNMP mixing model was developed to simulate/estimate future planning period groundwater quality and evaluate the effects of planned future projects on overall groundwater quality and use of assimilative capacity in the CBWCB through Water Year (WY) 2024-25. The mixing model was developed in Microsoft Excel™ and is effectively a set of linked spreadsheets used to represent "continuously-stirred" mixing volumes (basin/subarea/layer). The mixing model was designed to: 1) account for the current groundwater volume and S/N mass in storage within the CBWCB, and 2) track the loading/unloading of S/Ns through major groundwater sources and sinks under current (baseline period) and future land use/water use conditions (various scenarios for the future planning period).

SNMP mixing model results were calibrated to baseline period (WY 2000-01 through 2009-10) to address the uncertainty in estimating S/N loading for each individual S/N source, identify S/N loading factors with the highest level of significance, and of those factors, modify the ones with the highest level of uncertainty to provide a reasonable match between observed and simulated concentrations. As further described in Appendix I of the SNMP, the following adjustments to key S/N loading estimates were incorporated into the final calibrated mixing model:

- Loading factor for TDS and chloride in irrigation return flows,
- Attenuation factor for nitrate in irrigation return flows throughout the CBWCB,
- Attenuation factor for nitrate for groundwater recharge within the Montebello Forebay, and
- Assumed TDS and chloride concentrations for precipitation return flows.

The SNMP mixing model, as well as model calibration and modeling assumptions, are further described in Appendix I *Simulated Baseline and Future Salt and Nutrient Groundwater Quality* of the SNMP.

3 Existing Monitoring Programs in the CBWCB

Monitoring Program Objectives

- Provide a comprehensive overview of all existing water quality monitoring programs in the Study Area
- Identify any data gaps
- Characterize the CEC monitoring programs

Numerous monitoring programs already exist in the CBWCB and tributary areas. These programs are managed by multiple stakeholder agencies and routinely monitor groundwater, untreated and treated imported water, stormwater/surface water, recycled water, and wastewater. Some programs, such as stormwater/surface water and wastewater monitoring, are part of National Pollutant Discharge Elimination System (NPDES) permits, including regional watershed monitoring programs. Permits issued by the SWRCB Division of Drinking Water (formerly California Department of Public Health) to community water systems mandate monitoring of imported water and production wells. Recycled water monitoring is required as part of permits issued for non-potable reuse projects, as well as groundwater recharge projects that utilize recycled water. Groundwater monitoring for the Montebello Forebay Groundwater Recharge Project and the seawater intrusion barriers (Alamitos Gap Barrier, Dominguez Gap Barrier, and West Coast Basin Barrier) is required as part of each project's waste discharge/water recycling/water reclamation permit. Multiple monitoring wells are utilized to monitor groundwater near the major groundwater recharge projects.

Through its RGWMP, WRD monitors groundwater regionally through a network of nested monitoring wells. WRD reports on groundwater quality and groundwater level trends in annual reports (RGWMR) and is the designated groundwater monitoring entity for the CBWCB under the California Statewide Groundwater Elevation Monitoring (CASGEM) program. Many constituents of concern associated with groundwater contaminated sites are monitored under the oversight of the LARWQCB, the California Department of Toxic Substances Control (DTSC), and the United States Environmental Protection Agency (USEPA). Agencies have also conducted special studies or research that collect various water quality data, including CECs.

Table K-3 summarizes the existing water quality monitoring programs in the CBWCB. The following subsections describe these existing water quality monitoring programs, including responsible agencies, media monitored, monitoring points and locations, constituents monitored, monitoring frequency, quality assurance/quality control (QA/QC) programs, and reporting/data locations. Particular attention is directed at monitoring for the three indicators of salt and nutrients (TDS, chloride, and nitrate) in the CBWCB and CECs (see Section 4). Additional information on water sources and water quality is presented in the SNMP.

3.1 Recycled Water Monitoring for Groundwater Recharge Projects

Recycled water monitoring is conducted for four groundwater recharge reuse projects in the Study Area:

- Montebello Forebay Groundwater Recharge (MFGWR) Project;
- Alamitos Gap Seawater Intrusion Barrier Project (AGB);

Table K-3 Summary of Existing Water Quality Monitoring Programs in the CBWCB

Project	Groundwater Basin	Monitoring Locations	Constituents Monitored	Frequency	Responsible Agency	Reporting
RECYCLED WATER						
Montebello Forebay Groundwater Recharge Project	Central Basin	3 Water reclamation plants (WRPs): Pomona WRP, San Jose Creek WRP, and Whittier Narrows WRP	Salt and nutrients (S/Ns, i.e. total dissolved solids [TDS], chloride, nitrate), general minerals, inorganics, radioactivity, general physical, organic chemicals, etc.	Daily to quarterly	County Sanitation Districts of Los Angeles County (SDLAC)	Monthly and annual reports submitted to the Los Angeles Regional Water Quality Control Board (LARWQCB) and State Water Resources Control Board (SWRCB), Division of Drinking Water (formerly California Department of Public Health[CDPH]) and posted on the SWRCB online GeoTracker database: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001790
Alamitos Gap Barrier Seawater Intrusion Barrier	Central Basin and Orange County Basin	1 Advanced water recycling facility: Leo J. Vander Lans Advanced Water Treatment Facility	S/Ns (TDS, chloride, nitrate), Constituents of Emerging Concern (CECs), general minerals, inorganics, radioactivity, general physical, organic chemicals, etc.	Daily to annually	Water Replenishment District of Southern California (WRD)	Quarterly and annual reports submitted to LARWQCB and the SWRCB Division of Drinking Water (formerly CDPH) and posted on the SWRCB GeoTracker online database: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100006793

Project	Groundwater Basin	Monitoring Locations	Constituents Monitored	Frequency	Responsible Agency	Reporting
RECYCLED WATER						
Dominguez Gap Seawater Intrusion Barrier	West Coast Basin	1 Advanced water recycling facility: Terminal Island Water Reclamation Plant/Advanced Water Purification Facility (TIWRP)	S/Ns (TDS, chloride, nitrate), CECs, general minerals, inorganics, radioactivity, general physical, organic chemicals, etc.	Daily to annually	City of Los Angeles	Quarterly and annual reports submitted to LARWQCB and the SWRCB Division of Drinking Water (formerly CDPH) and posted on the SWRCB GeoTracker online database: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100000534
West Coast Basin Seawater Intrusion Barrier	West Coast Basin	1 Advanced water recycling facility: Edward C. Little Water Recycling Facility	S/Ns (TDS, chloride, nitrate), CECs, general minerals, inorganics, radioactivity, general physical, organic chemicals, etc.	Daily to annually	West Basin Municipal Water District (WBMWD)	Quarterly and annual reports submitted to LARWQCB and the SWRCB Division of Drinking Water (formerly CDPH) and posted on the SWRCB GeoTracker online database: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100000047
City of Los Angeles Non-Potable Reuse Program	West Coast Basin	1 Water recycling facility: Terminal Island Water Reclamation Plant/Advanced Water Purification Facility (TIWRP)	S/Ns (TDS, chloride, nitrate), general minerals, inorganics, radioactivity, general physical, organic chemicals, etc.	Daily to annually	City of Los Angeles	Quarterly and annual reports submitted to LARWQCB and the SWRCB Division of Drinking Water (formerly CDPH) and posted on the SWRCB GeoTracker online database: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001170

Project	Groundwater Basin	Monitoring Locations	Constituents Monitored	Frequency	Responsible Agency	Reporting
RECYCLED WATER						
WBMWD Nonpotable Reuse Program	West Coast Basin	1 Water recycling facility: Edward C. Little Water Recycling Facility	S/Ns (TDS, chloride, nitrate), general minerals, inorganics, radioactivity, general physical, organic chemicals, etc.	Daily to annually	West Basin Municipal Water District (WBMWD	Quarterly and annual reports submitted to LARWQCB and the SWRCB Division of Drinking Water (formerly CDPH)

Project	Groundwater Basin	Monitoring Locations	Constituents Monitored	Frequency	Responsible Agency	Reporting
RECYCLED WATER						
SDLAC Nonpotable Reuse Program	Throughout Central Basin and West Coast Basin (CBWCB)	5 Water reclamation plants (WRPs): Pomona WRP, San Jose Creek WRP, Los Coyotes WRP, Long Beach WRP, and Whittier Narrows WRP	S/Ns (TDS, chloride, nitrate), general minerals, inorganics, radioactivity, general physical, organic chemicals, etc.	Daily to semi-annually	County Sanitation Districts of Los Angeles County (SDLAC)	Quarterly and annual reports submitted to LARWQCB and the SWRCB Division of Drinking Water (formerly CDPH) and posted on the SWRCB GeoTracker online database: • Pomona Water Reclamation Plant (WRP): http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001746 • San Jose Creek WRP: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001083 • Los Coyotes WRP: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001745 • Long Beach WRP: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001744 • Whittier Narrows WRP: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001741

Project	Groundwater Basin	Monitoring Locations	Constituents Monitored	Frequency	Responsible Agency	Reporting
WASTEWATER						
SDLAC National Pollutant Discharge Elimination System (NPDES) Permits	Throughout Central Basin	5 Water reclamation plants (WRPs): Pomona WRP, San Jose Creek WRP, Los Coyotes WRP, Long Beach WRP, and Whittier Narrows WRP	S/Ns (TDS, chloride, nitrate), CECs, general minerals, inorganics, radioactivity, general physical, organic chemicals, etc.	Daily to biennially	County Sanitation Districts of Los Angeles County (SDLAC)	Monthly and annual reports submitted to LARWQCB and posted on the SWRCB online California Integrated Water Quality System (CIWQS) database: http://ciwqs.waterboards.ca.gov/ciwqs/readOnly/PublicReportEsmrAtGlanceServlet?inCommand=reset
IMPORTED WATER						
Untreated Water Imported from Colorado River and State Water Project	Throughout Central Basin and West Coast Basin (CBWCB)	Untreated water delivered to 2 reservoirs: Lake Mathews and Silverwood Lake	S/Ns (TDS, chloride, nitrate), general minerals, inorganics, radioactivity, general physical, organic chemicals, etc.	Monthly to annually	Metropolitan Water District of Southern California (MWD)	Laboratory data reported to the SWRCB Division of Drinking Water (formerly CDPH) and can be downloaded from their website: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/EDTlibrary.aspx Annual water quality tables distributed to water purveyors and posted on the MWD website: http://www.mwdh2o.com/mwdh2o/pages/yourwater/wq-report/index.html

Project	Groundwater Basin	Monitoring Locations	Constituents Monitored	Frequency	Responsible Agency	Reporting
IMPORTED WATER						
Treated Water from Colorado River water and State Water Project	Throughout Central Basin and West Coast Basin (CBWCB)	Treated water produced by 3 water treatment plants (WTP): Weymouth WTP, Diemer WTP, and Jensen WTP	S/Ns (TDS, chloride, nitrate), general minerals, inorganics, radioactivity, general physical, organic chemicals, etc.	Daily to annually	Metropolitan Water District of Southern California (MWD)	Laboratory data is reported to the SWRCB Division of Drinking Water (formerly CDPH) and can be downloaded from their website: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/EDTlibrary.aspx Annual water quality tables distributed to water purveyors and posted on the MWD website: http://www.mwdh2o.com/mwdh2o/pages/yourwater/wq-report/index.html
Treated Los Angeles Aqueduct Water	West Coast Basin	Treated water produced by the Los Angeles Aqueduct Filtration Plant	S/Ns (TDS, chloride, nitrate), general minerals, inorganics, radioactivity, general physical, organic chemicals, etc.	Daily to annually	Los Angeles Department of Water and Power (LADWP)	Laboratory data is reported to the SWRCB Division of Drinking Water (formerly CDPH) and can be downloaded from their website: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/EDTlibrary.aspx The annual water quality report is posted on the LADWP website: https://www.ladwp.com/ladwp/faces/wcnav_externalId/a-w-anual-wqualty-rprt?_adf.ctrl-state=y63elm854_4&_afrLoop=1047980407298000

Project	Groundwater Basin	Monitoring Locations	Constituents Monitored	Frequency	Responsible Agency	Reporting
SURFACE WATER						
Los Angeles River Watershed Monitoring Program	Central Basin and West Coast Basin (CBWCB)	Multiple surface water monitoring locations within the Los Angeles River Watershed	S/Ns (salinity, chloride, nitrate), general minerals, inorganics, radioactivity, general physical, organic chemicals, etc.	Monthly to annually depending on monitoring location	Council for Watershed Health and other stakeholders	Annual Reports posted on the Council for Watershed Health website: http://watershedhealth.org/dataandreference/Document.aspx
San Gabriel River Regional Monitoring Program	Central Basin and West Coast Basin (CBWCB)	Multiple surface water monitoring locations within the San Gabriel River Watershed	S/Ns (salinity, chloride, nitrate), general minerals, inorganics, radioactivity, general physical, organic chemicals, etc.	Monthly to annually depending on monitoring location	Council for Watershed Health and other stakeholders	Annual Reports and State of the River Reports posted on the Council for Watershed Health website: http://watershedhealth.org/dataandreference/Document.aspx
Montebello Forebay Groundwater Recharge Project	Central Basin	2 Intakes to the Rio Hondo and San Gabriel River Spreading Grounds	S/Ns (TDS, chloride, nitrate), general minerals, inorganics, radioactivity, general physical, organic chemicals, etc.	Quarterly	Sampling conducted by WRD; reporting by County Sanitation Districts of Los Angeles County (SDLAC)	Monthly and annual reports submitted to LARWQCB and the SWRCB Division of Drinking Water (formerly CDPH) and posted on the SWRCB online GeoTracker database: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001790

Project	Groundwater Basin	Monitoring Locations	Constituents Monitored	Frequency	Responsible Agency	Reporting
SURFACE WATER						
SDLAC NPDES Permits	Central Basin and West Coast Basin (CBWCB)	30 Surface water receiving stations	S/Ns (TDS, chloride, nitrate), general minerals, inorganics, toxicity/pollutants, general physical, organic chemicals, etc.	Monthly to annually	County Sanitation Districts of Los Angeles County (SDLAC)	Monthly and annual reports submitted to LARWQCB and posted on the SWRCB online CIWQS database: http://ciwqs.waterboards.ca.gov/ciwqs/readOnly/PublicReportEsmrAtGlanceServlet?inCommand=reset
Los Angeles County Stormwater Monitoring Program	Central Basin and West Coast Basin (CBWCB)	4 Mass Emission Stations, 6 Tributary Stations, Total Maximum Daily Load Compliance Stations, Stormwater Outfalls, Non-Stormwater Outfalls	S/Ns (TDS, chloride, nitrate), general minerals, inorganics, microbiological parameters, general physical, organic chemicals, etc.	Varies from one time sampling to quarterly depending on sampling location, applicable Total Maximum Daily Load, sampling results	Los Angeles County Flood Control District, the County of Los Angeles, and 84 incorporated cities within the coastal watersheds of Los Angeles County, with the exception of the City of Long Beach	Annual reports posted on Los Angeles County Department of Public Works (LACDPW) website: http://ladpw.org/wmd/npdes/report_directory.cfm Laboratory data posted on LACDPW website: http://ladpw.org/wmd/npdes/wq_data.cfm Annual reports and data submitted to LARWQCB and posted on the LARWQCB website: http://www.swrcb.ca.gov/losangeles/water_issues/programs/stormwater/municipal/los_angeles_ms4/lams4annualreport.shtml

Project	Groundwater Basin	Monitoring Locations	Constituents Monitored	Frequency	Responsible Agency	Reporting
GROUNDWATER						
Regional Groundwater Monitoring Program	Throughout Central Basin and West Coast Basin (CBWCB)	>300 nested monitoring wells at more than 55 locations	S/Ns (TDS, chloride, nitrate), general minerals, inorganics, radioactivity, general physical, organic chemicals, etc.	Semi-annually	Water Replenishment District of Southern California (WRD)	Annual Regional Groundwater Monitoring Reports distributed to water purveyors and LARWQCB and posted on WRD website: http://www.wrd.org/engineering/groundwater-engineering-reports.php
CDPH Title 22 Drinking Water Well Monitoring Program	Throughout Central Basin and West Coast Basin (CBWCB)	>400 production wells	S/Ns (TDS, chloride, nitrate), general minerals, inorganics, radioactivity, bacteriological parameters, general physical, organic chemicals, etc.	Daily to annually	Well owners	Laboratory data reported to the SWRCB Division of Drinking Water (formerly CDPH) and can be downloaded from their website: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/EDTlibrary.aspx Annual Consumer Confidence Reports issued by the water system to their drinking water customers and to the SWRCB Division of Drinking Water (formerly CDPH)
LACDPW Seawater Intrusion Barriers Chloride Groundwater Monitoring Program	Central Basin and West Coast Basin (CBWCB)	Groundwater monitoring wells adjacent to seawater intrusion barriers: Alamitos Gap Barrier – 194 wells; Dominguez Gap Barrier – 243 wells; West Coast Basin Barrier - 355 wells	Salt (chloride)	Semi-annually to annually	Los Angeles County Department of Public Works (LACDPW)	Annual Alamitos Gap Seawater Intrusion Barrier Reports posted on the LACDPW website: http://ladpw.org/wrd/barriers/ Chloride data from other barriers are available upon request from the Water Resources Division of LACDPW: http://dpw.lacounty.gov/contact/

Project	Groundwater Basin	Monitoring Locations	Constituents Monitored	Frequency	Responsible Agency	Reporting
GROUNDWATER						
Montebello Forebay Groundwater Recharge Project	Central Basin	6 monitoring wells; 19 production wells	S/Ns (TDS, chloride, nitrate), general minerals, inorganics, radioactivity, general physical, organic chemicals, etc.	Bimonthly to semi-annually	Sampling conducted by WRD; reporting by SDLAC	Monthly and annual reports submitted to LARWQCB and the SWRCB Division of Drinking Water (formerly CDPH) and posted on the SWRCB online GeoTracker database: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001790
Alamitos Gap Seawater Intrusion Barrier	West Coast Basin and Orange County Basin	10 groundwater monitoring wells	S/Ns (TDS, chloride, nitrate), general minerals, inorganics, radioactivity, general physical, organic chemicals, total coliform, etc.	Quarterly to annually	Water Replenishment District of Southern California (WRD)	Quarterly, annual, and 5-year engineering reports submitted to LARWQCB and the SWRCB Division of Drinking Water (formerly CDPH) and posted on the SWRCB online GeoTracker database: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100006793
Dominguez Gap Seawater Intrusion Barrier	West Coast Basin	16 groundwater monitoring wells	S/Ns (TDS, chloride, nitrate), general minerals, inorganics, radioactivity, general physical, organic chemicals, total coliform, etc.	Quarterly to annually	Water Replenishment District of Southern California (WRD)	Quarterly, annual, and 5-year engineering reports submitted to LARWQCB and the SWRCB Division of Drinking Water (formerly CDPH) and posted on the SWRCB online GeoTracker database: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100000534

Project	Groundwater Basin	Monitoring Locations	Constituents Monitored	Frequency	Responsible Agency	Reporting
GROUNDWATER						
West Coast Basin Seawater Intrusion Barrier	West Coast Basin	9 groundwater monitoring wells	S/Ns (TDS, chloride, nitrate), general minerals, inorganics, radioactivity, general physical, organic chemicals, total coliform, etc.	Quarterly to annually	Water Replenishment District of Southern California (WRD)	Quarterly, annual, and 5-year engineering reports submitted to LARWQCB and the SWRCB Division of Drinking Water (formerly CDPH) and posted on the SWRCB online GeoTracker database: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100000047
Environmental Release sites	Throughout Central Basin and West Coast Basin (CBWCB)	Monitoring wells located at multiple sites	Organic chemicals, metals, hydrocarbons, perchlorate, etc., depending on chemicals of concern at each specific environmental release site	Varies by environmental release site	Multiple entities (private and public) under the oversight of the LARWQCB, California Department of Toxic Substances Control (DTSC), or United States Environmental Protection Agency (USEPA)	Reports, laboratory, and well data submitted to LARWQCB and posted on the SWRCB online GeoTracker database: http://geotracker.waterboards.ca Reports submitted to DTSC and posted on the DTSC online EnviroStor database: http://www.envirostor.dtsc.ca.gov/public/ Reports submitted to USEPA and posted on the USEPA Superfund Site website: http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/WSOState!OpenView&Start=1&Count=1000&Expand=2.14#2.14

Project	Groundwater Basin	Monitoring Locations	Constituents Monitored	Frequency	Responsible Agency	Reporting
GROUNDWATER						
California Groundwater Ambient Monitoring and Assessment Program (GAMA)	Throughout Central Basin and West Coast Basin (CBWCB)	69 groundwater monitoring wells	S/Ns (TDS, chloride, nitrate)	Varies	State Water Resources Control Board (SWRCB) and United States Geological Survey (USGS)	Data available on the SWRCB online GeoTracker GAMA database: http://www.waterboards.ca.gov/gama/

GAMA – California Groundwater Ambient Monitoring and Assessment Program
CIWQS – California Integrated Water Quality System
LACDPW – Los Angeles County Department of Public Works
LARWQCB – California Regional Water Quality Control Board, Los Angeles Region
NPDES – National Pollutant Discharge Elimination System
S/N – Salt and nutrients
TDS – Total dissolved solids
USGS – United States Geological Survey
WRD – Water Replenishment District of Southern California
CDPH – California Department of Public Health (now the SWRCB Division of Drinking Water)
CBWCB – Central Basin and West Coast Basin
DTSC – California Department of Toxic Substance Control
LADWP – Los Angeles Department of Water and Power
MWD – Metropolitan Water District of Southern California
SDLAC – Sanitation Districts of Los Angeles County
SWRCB – State Water Resources Control Board
USEPA – United States Environmental Protection Agency
WBMWD – West Basin Municipal Water District
WRP – Water Reclamation Plant

- West Coast Basin Seawater Intrusion Barrier (WCBB); and
- Dominquez Gap Seawater Intrusion Barrier (DGB).

The three indicators of salts and nutrients (i.e., TDS, chloride, and nitrate) and other related parameters are highlighted in yellow in the following tables for each project.

3.1.1 Montebello Forebay Groundwater Recharge Project

The Montebello Forebay Spreading Grounds (MFSG), which consist of the Rio Hondo Spreading Grounds and the San Gabriel River Spreading Grounds, are located in the northeastern portion of the Central Basin. The MFSG are owned and operated by the Los Angeles County Department of Public Works (LACDPW). The Sanitation Districts of Los Angeles County (SDLAC) provide tertiary-treated recycled water for surface spreading at the MFSG. This water is produced by three water reclamation plants including the Whittier Narrows Water Reclamation Plant (WRP), San Jose Creek WRP, and Pomona WRP. The WRPs provide primary treatment, nitrification / denitrification (NdN) activated sludge biological treatment, granular media filtration, disinfection, and dechlorination. The San Jose Creek WRP and Pomona WRP use sequential chlorination for disinfection; the Whittier Narrows WRP uses ultraviolet irradiation (UV). Information on recycled water (i.e., WRP effluent) monitoring for the MFGWR Project is presented in **Table K-4.** The locations of the San Jose Creek WRP, Whittier Narrows WRP, and Pomona WRP are shown in **Figure K-4**. Additional details on the recycled water monitoring program are presented in **Attachment K-B**.

Table K-4 MFGWR Project Recycled Water Quality Monitoring

Program Origin	1991 Permit – Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. R4-91-100 Water Recycling Requirements and Monitoring and Reporting Program: http://63.199.216.6/larwqcb_new/permits/docs/5728_91-100_WRR.pdf 2009 Permit Amendment – Permit amended by LARWQCB Order No. R4-2009-0048: http://63.199.216.6/larwqcb_new/permits/docs/5728_R4-2009-0048_WDR_amd.pdf 2012 Permit Amendment – Monitoring and Reporting Program amended by LARWQCB letter dated August 30, 2012 http://63.199.216.6/larwqcb_new/permits/docs/5728_91-100_MRP_amd.pdf 2013 Permit Amendment – LARWQCB letter dated June 4, 2013 approving an increase in the compliance averaging period for recycled water contribution: http://geotracker.waterboards.ca.gov/esi/uploads/geo_report/3643924772/WDR100001790.PDF 2014 Permit Amendment – Permit amended by LARWQCB Order No. R4-2009-0048-A-01, increasing the permitted maximum quantity of recycled water from 35% to 45% of total inflow in any 10-year period: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001790
Responsible Agency	Sanitation Districts of Los Angeles County (SDLAC)

<table>
<tr><td>Number of Monitoring Points</td><td>3 – Tertiary treated recycled water</td></tr>
<tr><td>Monitoring Locations</td><td>Effluent (i.e., tertiary treated recycled water) from SDLAC's water reclamation plants (see Figure K-4):
• Pomona Water Reclamation Plant (WRP)
• San Jose Creek WRP
• Whittier Narrows Water WRP</td></tr>
<tr><td>Constituents and Frequency</td><td>
<table>
<tr><th>Parameter[a]</th><th>Monitoring Frequency</th></tr>
<tr><td>Total Dissolved Solids</td><td>Monthly</td></tr>
<tr><td>Chloride</td><td>Bimonthly</td></tr>
<tr><td>Other Major Minerals</td><td>Bimonthly</td></tr>
<tr><td>Nitrate</td><td>Monthly</td></tr>
<tr><td>Other Nitrogen Compounds</td><td>Monthly</td></tr>
<tr><td>Oxidants and Reductants</td><td>Weekly - Monthly</td></tr>
<tr><td>Base/Neutral Extractable Organics</td><td>Bimonthly</td></tr>
<tr><td>Acid Extractable Organics</td><td>Bimonthly</td></tr>
<tr><td>Pesticides</td><td>Bimonthly</td></tr>
<tr><td>Purgeable Organics</td><td>Bimonthly</td></tr>
<tr><td>Miscellaneous Organics</td><td>Bimonthly</td></tr>
<tr><td>Physical Properties</td><td>Daily - Monthly</td></tr>
<tr><td>Iron and Manganese</td><td>Quarterly</td></tr>
<tr><td>Trace Constituents</td><td>Quarterly</td></tr>
<tr><td>Radioactivity</td><td>Quarterly</td></tr>
<tr><td>Total Coliform</td><td>Daily</td></tr>
<tr><td>Virus</td><td>Quarterly</td></tr>
<tr><td>N-nitrosodimethylamine</td><td>Monthly[b]</td></tr>
</table>
a. A more comprehensive list of parameters and their associated monitoring frequency is presented in Attachment K-B
b. Not currently required by the permit</td></tr>
<tr><td>CECs Monitored</td><td>CEC monitoring is currently not required by the permit; however, when the permit is amended in the future, it is anticipated to include CEC monitoring in accordance with the Recycled Water Policy and State regulations for groundwater replenishment using recycled water (also see CEC research studies and SDLAC CEC monitoring in Section 4)</td></tr>
<tr><td>Other Media Monitored/ Monitoring Locations</td><td>• Surface water for each point of intake to the Rio Hondo Spreading Grounds and San Gabriel River Spreading Grounds (see Section 3.5.4)
• Groundwater monitoring of permit-required monitoring wells and production wells (see Section 3.6.3.1) located in proximity of the spreading grounds</td></tr>
<tr><td>Reporting/ Databases</td><td>• Monthly and annual reports submitted to LARWQCB and the State Water Resources Control Board (SWRCB), Division of Drinking Water (formerly California Department of Public Health)
• Data and reports submitted to the State Water Resources Control Board online GeoTracker database, including groundwater monitoring data in Electronic Data</td></tr>
</table>

	Format, well locational data (latitude and longitude), and monitoring reports in Adobe Acrobat™ format: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001790
Quality Assurance / Quality Control (QA/QC) Program	• Certified laboratories • SDLAC laboratories: Blanks, laboratory control standards, duplicate samples, and fortified samples; calibration standards as required by the analytical methods; trip blanks for the analysis of volatile organic analytes; surrogate standards are added to every sample to monitor the overall performance of the procedure with recoveries compared to established acceptance limits; control limits have been established for both precision and accuracy of the laboratory analyses with specified corrective actions when data are outside the control limits • Commercial laboratories: Must have a written comprehensive QA/QC program • Data are checked for completeness as part of the reporting process
Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by SDLAC, SWRCB Division of Drinking Water, and LARWQCB

3.1.2 Alamitos Gap Seawater Intrusion Barrier

The AGB is located at the southern end of the Central Basin, specifically at the Los Angeles-Orange County border about two miles inland from the mouth of the San Gabriel River. The AGB is jointly owned by LACDPW and Orange County Water District and is operated/maintained by LACDPW. The AGB, consisting of a series of injection wells, was established in the early 1960s to prevent seawater intrusion and replenish groundwater in both the Central Basin and adjacent Orange County Basin. Historically, the AGB received only treated imported water (supplied by MWD), but began also utilizing AWT recycled water in 2005.

The Leo J. Vander Lans Advanced Water Treatment Facility (Vander Lans AWTF), which is owned by WRD and operated by the Long Beach Water Department, performs advanced water treatment (AWT) of tertiary recycled water supplied by SDLAC's Long Beach WRP. Treatment processes at the Vander Lans AWTF historically consisted of microfiltration (MF), reverse osmosis (RO), and UV. During WY 2014-15, when the Vander Lans AWTF was expanded to produce from 3,360 acre-feet per year (AFY) to 8,960 AFY of AWT recycled water, the treatment train was modified to also include advanced oxidation (AOP) through the addition of UV/peroxide. Thus, AWT recycled water is expected to fully replace imported water for injection at the AGB, with flow projected to increase to 7,200 AFY beginning WY 2014-15. However, minor volumes of treated imported water, supplied by MWD, may be utilized as necessary through the future due to temporary operational and maintenance issues that may be encountered at the Vander Lans AWTF or at the AGB.

Information regarding the monitoring of AWT recycled water (i.e., plant product water from Vander Lans AWTF) is summarized in **Table K-5**. The blended water is monitored for multiple constituents, including TDS, chloride, and total nitrogen, on a weekly basis. The location of the Vander Lans AWTF is provided in Figure K-4. More details on the recycled water monitoring program are presented in **Attachment K-C**.

Table K-5 Alamitos Gap Seawater Intrusion Barrier AWT Recycled Water Quality Monitoring

Program Origin	2005 Permit – Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. R4-2005-0061: http://63.199.216.6/larwqcb_new/permits/permit_display.php?order_no=R4-2005-0061&ci_no=8956&program_id=152914 2006 Permit Amendment – Permit amended by State Water Resources Control Board (SWRCB) Water Quality Order No. 2006-0001: http://www.swrcb.ca.gov/board_decisions/adopted_orders/water_quality/2006/wqo/wqo2006_0001.pdf 2007 Permit Amendment – Monitoring and Reporting Program amended per the California Department of Public Health (CDPH) letter dated March 23, 2007 2012 Permit Amendment – Monitoring and Reporting Program amended by LARWQCB letter dated July 20, 2012 http://geotracker.waterboards.ca.gov/regulators/deliverable_documents/5311355412/Alamitos%20Barrier%20Recycled%20Water%20Proj_Amend%20to%20MRP%2C%20CI%208956_2012-07-20.pdf 2014 Permit Amendment – Permit amended per LARWQCB Order No. 2005-0061-A01: http://63.199.216.6/permits/docs/8956_R4-2005-0061_WDR_amd.pdf 2014 Permit (supersedes all previous permits and amendments) – LARWQCB Order No. R4-2014-0111 issued due to the expansion of WRD's expanded Leo J. Vander Lans Advanced Water Treatment Facility (Vander Lans AWTF): http://63.199.216.6/permits/docs/8956_R4-2014-0111_WDR_PKG.pdf
Responsible Agency	Water Replenishment District of Southern California (WRD)
Number of Monitoring Points	1 – Advanced treated recycled water
Monitoring Locations	Advanced treated recycled water (i.e., plant product water) from WRD's Vander Lans AWTF; see Figure K-4
Constituents and Frequency	(see table below)

Parameter[a]	Monitoring Frequency
pH	Continuous
Conductivity	Continuous
Total Residual Chlorine	Continuous
Total Coliform	Daily
Total Organic Carbon	Weekly
Turbidity	Weekly
Nitrate as Nitrogen	Weekly
Nitrite as Nitrogen	Weekly
Nitrate plus Nitrite	Weekly
Total Nitrogen	Weekly
Organic Nitrogen	Weekly
Ammonia as Nitrogen	Weekly

<table>
<tr><td></td><td>
<table>
<tr><td>Inorganics with primary Maximum Contaminant Levels (MCLs)</td><td>Quarterly</td></tr>
<tr><td>Total Dissolved Solids</td><td>Quarterly</td></tr>
<tr><td>Chloride</td><td>Quarterly</td></tr>
<tr><td>Other Parameters with Secondary MCLs</td><td>Quarterly</td></tr>
<tr><td>Radioactivity</td><td>Quarterly</td></tr>
<tr><td>Regulated Organic Chemicals</td><td>Quarterly</td></tr>
<tr><td>Disinfection Byproducts</td><td>Quarterly</td></tr>
<tr><td>General Physical</td><td>Quarterly</td></tr>
<tr><td>General Minerals</td><td>Quarterly</td></tr>
<tr><td>Constituents with Notification Levels</td><td>Quarterly to Annually</td></tr>
<tr><td>Remaining Priority Pollutants</td><td>Annually</td></tr>
<tr><td>Constituents of Emerging Concern (CECs)</td><td>Quarterly to Annually</td></tr>
</table>
a. A more comprehensive list of monitored parameters is presented in Attachment K-C
</td></tr>
<tr><td>CECs Monitored</td><td>Annual sampling of advanced treated recycled water for:
• 17β estradiol
• Caffeine
• Triclosan
• DEET
• Sucralose
• NDMA (monitored on a quarterly basis)

CEC monitoring is conducted in accordance with the Recycled Water Policy and State regulations for groundwater replenishment using recycled water (see Section 4)</td></tr>
<tr><td>Other Media Monitored/ Monitoring Locations</td><td>• Influent of WRD's Vander Lans AWTF (i.e., tertiary-treated recycled water/effluent from the Sanitation Districts of Los Angeles County's Long Beach Water Reclamation Plant); see Section 3.2.1
• Blended water (i.e. blend of advanced treated recycled water produced by WRD's Vander Lans AWTF and treated imported water supplied by Metropolitan Water District of Southern California); the blended water is monitored for multiple constituents, including TDS, chloride, nitrate as nitrogen, and total nitrogen
• The RO feedwater is monitored continuously for conductivity and weekly for total organic carbon; these results are compared to levels in the plant product water in order to calculate the percent reduction in the advanced treated recycled water
• Reporting of California Code of Regulations, Title 22 monitoring data from the nearest drinking water well to the Alamitos Gap Seawater Intrusion Barrier (City of Seal Beach Well SB-LEI [State Well No. 05S/12W-OlA03]); see Section 3.6.4
• Groundwater monitoring wells located in proximity to the Alamitos Gap Seawater Intrusion Barrier; see Section 3.6.3.2</td></tr>
<tr><td>Reporting/ Databases</td><td>• Quarterly and annual reports submitted to LARWQCB and the State Water Resources Control Board (SWRCB), Division of Drinking Water (formerly CDPH)
• Data and reports are submitted to the SWRCB online GeoTracker database, including groundwater monitoring data in Electronic Data Format, well locational data (latitude and longitude), and monitoring reports in Adobe Acrobat™ format:</td></tr>
</table>

	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100006793
Quality Assurance/ Quality Control (QA/QC) Program	• Certified laboratories • Long Beach Water Department Laboratory: Comprehensive, written QA/QC program • Eurofins Eaton Analytical, Inc. and its State-certified subcontractor laboratories: Comprehensive, written QA/QC program • Data are checked for completeness as part of the reporting process
Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by WRD, SWRCB Division of Drinking Water, and LARWQCB

3.1.3 West Coast Basin Seawater Intrusion Barrier

The WCBB, owned and operated by LACDPW, was established in the mid-1950s along the western coast of the West Coast Basin (WCB) to prevent seawater intrusion and replenish the groundwater basin. Historically, the WCBB received only treated imported water (supplied by MWD), but began also utilizing AWT recycled water in 1995.

The Edward C. Little Water Recycling Facility (WRF), which is owned by West Basin Municipal Water District (WBMWD), produces AWT recycled water utilizing treatment processes that include RO, AOP, and chemical stabilization. The source water to the Edward C. Little WRF is secondary effluent from the City of Los Angeles' Hyperion Wastewater Treatment Plant. Information on monitoring AWT recycled water produced by the Edward C. Little WRF is summarized in **Table K-6**.

Table K-6 West Coast Basin Seawater Intrusion Barrier AWT Recycled Water Quality Monitoring

Program Origin	2006 Permit - Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. R4-2006-0009: http://63.199.216.6/larwqcb_new/permits/permit_display.php?order_no=R4-2006-0009&ci_no=7485&program_id=153002 2006 Permit Amendment – Permit amended by LARWQCB Order No. R4-2006-0069 http://63.199.216.6/larwqcb_new/permits/permit_display.php?order_no=R4-2006-0069&program_id=4729&ci_no=7485
Responsible Agency	West Basin Municipal Water District (WBMWD)
Number of Monitoring Points	1 – Advanced treated recycled water
Monitoring Locations	Plant product water (i.e., advanced treated recycled water) from WBMWD's Edward C. Little Water Recycling Facility (WRF); see Figure K-4

<table>
<tr><td>Constituents and Frequency</td><td>
<table>
<tr><th>Parameter[a]</th><th>Monitoring Frequency</th></tr>
<tr><td>pH</td><td>Continuous</td></tr>
<tr><td>Conductivity</td><td>Continuous</td></tr>
<tr><td>Total Residual Chlorine</td><td>Continuous</td></tr>
<tr><td>Total Coliform</td><td>Daily</td></tr>
<tr><td>Total Organic Carbon</td><td>Weekly</td></tr>
<tr><td>Temperature</td><td>Weekly</td></tr>
<tr><td>Carbonaceous Biochemical Oxygen Demand ($CBOD_5$ 20°C)</td><td>Weekly</td></tr>
<tr><td>Total Nitrogen</td><td>Twice/week</td></tr>
<tr><td>Inorganics with primary Maximum Contaminant Levels (MCLs)</td><td>Quarterly</td></tr>
<tr><td>Total Dissolved Solids</td><td>Quarterly</td></tr>
<tr><td>Chloride</td><td>Quarterly</td></tr>
<tr><td>Other Parameters with Secondary MCLs</td><td>Quarterly</td></tr>
<tr><td>Fluoride</td><td>Quarterly</td></tr>
<tr><td>Radioactivity</td><td>Quarterly</td></tr>
<tr><td>Regulated Organic Chemicals</td><td>Quarterly</td></tr>
<tr><td>Disinfection Byproducts</td><td>Quarterly</td></tr>
<tr><td>General Physical</td><td>Quarterly</td></tr>
<tr><td>General Minerals</td><td>Quarterly</td></tr>
<tr><td>Lead</td><td>Quarterly</td></tr>
<tr><td>Ethyl-tert-butyl ether</td><td>Quarterly</td></tr>
<tr><td>Tert-amyl-methyl ether</td><td>Quarterly</td></tr>
<tr><td>N-nitrosopyrrolidine</td><td>Quarterly</td></tr>
<tr><td>Chemicals with Notification Levels</td><td>Quarterly</td></tr>
<tr><td>Remaining Priority Pollutants</td><td>Quarterly</td></tr>
<tr><td>Endocrine Disrupting Chemicals</td><td>Annually</td></tr>
<tr><td>Pharmaceuticals and other Chemicals</td><td>Annually</td></tr>
</table>
a. A more comprehensive list of parameters is presented in Attachment K-D
</td></tr>
<tr><td>CECs Monitored</td><td>Annual sampling of advanced treated recycled water for:
• Endocrine Disrupting Chemicals
• Pharmaceuticals and other Chemicals

In future permit amendments, modifications to CEC monitoring will be made in accordance with the Recycled Water Policy and State regulations for groundwater replenishment using recycled water (see Section 4)</td></tr>
<tr><td>Other Media Monitored/ Monitoring Locations</td><td>• Influent of WBMWD’s Edward C. Little WRF (i.e., secondary recycled water/effluent from the City of Los Angeles’ Hyperion Treatment Plant)
• Blended water (i.e. blend of advanced treated recycled water produced by Edward C. Little WRF) and treated imported water supplied by the Metropolitan Water District of Southern California); the blended water is monitored for multiple constituents, including TDS, chloride, nitrate, and nitrite, on a weekly/biweekly basis [a]
• Reporting of California Code of Regulations, Title 22 monitoring data from the nearest</td></tr>
</table>

	drinking water well to the West Coast Basin Barrier (Manhattan Beach Well No. 11a); see Section 3.6.4 • Groundwater monitoring wells in proximity to the West Coast Basin Seawater Intrusion Barrier; see Section 3.6.3.3 • Tertiary treated recycled water that is produced by WBMWD's Edward C. Little WRF and distributed for non-potable reuse applications (irrigation, industrial and recreational activities) in the West Coast Basin; see Section 3.2.2 a – It is expected that 100% advanced treated recycled water will be injected at the West Coast Basin Seawater Intrusion Barrier beginning in Water Year 2013-14, so blended water monitoring will be conducted when it is utilized as necessary
Reporting/ Databases	• Quarterly and annual reports submitted to LARWQCB and the State Water Resources Control Board (SWRCB), Division of Drinking Water (formerly California Department of Public Health) • Data and reports are submitted to the SWRCB online GeoTracker database, including groundwater monitoring data in Electronic Data Format, sampling points locational data (latitude and longitude), and monitoring reports in Adobe Acrobat™ format: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100000047
Quality Assurance / Quality Control (QA/QC) Program	• Certified laboratories • As part of the State/Federal certification process, a lab must maintain a current QA/QC plan, current standards of practice for each analytical method, conduct method detection limit studies for each analytical method, and participate in performance evaluation blind check sample studies; in addition, the WBMWD laboratory has its own check sample program for its staff and for contract labs • Trip blanks are only used for volatile organic compounds • Eurofins Eaton Analytical, Inc. and other commercial laboratories: Comprehensive, written QA/QC program
Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by WBMWD, SWRCB Division of Drinking Water, and LARWQCB

In 2013, the Edward C. Little WRF was expanded from 14,000 AFY to 19,600 AFY and treatment now includes ozonation (O_3). The AWT recycled water is monitored for multiple constituents, including TDS, chloride, and total nitrogen, on a quarterly or biweekly basis. It was anticipated that 100 percent AWT recycled water would be injected at the WCBB beginning in WY 2013-14. However, minor volumes of treated imported water, supplied by MWD, may be utilized as necessary for injection through the future due to temporary operational and maintenance issues that may be encountered at the Edward C. Little WRF or at the WCBB. Blended water monitoring will be conducted as appropriate when it is utilized at the WCBB. The location of WBMWD's Edward C. Little WRF is shown in Figure K-4; and more details on the monitoring program are presented **Attachment K-D**.

3.1.4 Dominguez Gap Seawater Intrusion Barrier

The DGB, owned and operated by LACDPW, was established in the early 1970s at the southern portion of the West Coast Basin to prevent seawater intrusion and replenish the groundwater basin. Historically, the DGB received only treated imported water, but began also utilizing AWT recycled water in 2006.

The Terminal Island Water Reclamation Plant/Advanced Water Purification Facility (TIWRP), which is owned and operated by the City of Los Angeles, performs AWT of tertiary recycled water that is produced at the TIWRP. Tertiary treatment at the TIWRP consists of primary treatment, secondary treatment, and filtration; the advanced water treatment process includes MF, RO, and chlorination. Information on monitoring of AWT recycled water is presented in **Table K-7**.

Table K-7 Dominguez Gap Seawater Intrusion Barrier AWT Recycled Water Quality Monitoring

<table>
<tr><td>Program Origin</td><td>2003 Permit – Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. R4-2003-0134: http://www.waterboards.ca.gov/losangeles/board_decisions/adopted_orders/by_year.shtml

2007 Permit Amendment – Monitoring and Reporting Program amended per the California Department of Public Health (CDPH) letter dated June 25, 2007 and LARWQCB e-mail dated June 19, 2007

2010 Permit Amendment – Permit amended per LARWQCB Order R4-2010-0183: http://geotracker.waterboards.ca.gov/regulators/deliverable_documents/5496337711/8654_R4-2010-0183_AMD.pdf

2011 Permit Amendment – Permit amended per LARWQCB Order R4-2011-0034: http://geotracker.waterboards.ca.gov/regulators/deliverable_documents/232189745/8654_R4-2011-0034_WDR_amd.pdf

2012 Permit Amendment – Monitoring and Reporting Program amended by LARWQCB letter dated July 20, 2012 http://geotracker.waterboards.ca.gov/regulators/deliverable_documents/4160459220/Dominguez%20Gap%20Barrier%20Project_Amend%20to%20MRP%2C%20CI%208654_2012-07-20.pdf</td></tr>
<tr><td>Responsible Agency</td><td>City of Los Angeles</td></tr>
<tr><td>Number of Monitoring Points</td><td>1 – Advanced treated recycled water</td></tr>
<tr><td>Monitoring Locations</td><td>Plant product water (i.e., advanced treated recycled water) from City of Los Angeles’ Terminal Island Water Reclamation Plant/Advanced Water Purification Facility (TIWRP); see Figure K-4</td></tr>
<tr><td>Constituents and Frequency</td><td><table><tr><th>Parameter[a]</th><th>Monitoring Frequency</th></tr><tr><td>pH</td><td>Daily</td></tr><tr><td>Conductivity</td><td>Continuous</td></tr></table></td></tr>
</table>

Total Residual Chlorine	Daily
Total Coliform	Daily
Total Organic Carbon	Weekly
Temperature	Weekly
BOD_5 20°C	Quarterly
Total Nitrogen	Twice/week
Inorganics[b]	Quarterly
Total Dissolved Solids[b]	Quarterly
Chloride[b]	Quarterly
Radioactivity[b]	Quarterly
Regulated Organic Chemicals[b]	Quarterly
General Physical[b]	Quarterly
General Minerals[b]	Quarterly
Methyl-tert-butyl ether[b]	Monthly
Tert-butyl alcohol[b]	Monthly
Nitrosodimethylamine[b]	Quarterly
Boron[b]	Quarterly
1,4-Dioxane[b]	Quarterly
Perchlorate[b]	Quarterly
Dichlorodifluoromethane[b]	Quarterly
Ethyl-tert-butyl ether[b]	Quarterly
Tert-amyl-methyl ether[b]	Quarterly
1,2,3-Trichloropropane	Quarterly
Vanadium[b]	Quarterly
Remaining Priority Pollutants[b]	Quarterly
Endocrine Disrupting Chemicals[b]	Annually
Pharmaceuticals and other Chemicals[b]	Annually

a. A comprehensive list of monitored parameters is presented in Attachment K-E
b. Collected in recycled water with some imported water or delivered water

CECs Monitored	Annual sampling of advanced treated recycled water for: • Endocrine Disrupting Chemicals • Pharmaceuticals and other Chemicals In the future, modifications to CEC monitoring will be made in accordance with the Recycled Water Policy and State regulations for groundwater replenishment using recycled water (see Section 4)
Reporting/ Databases	• Quarterly and annual reports submitted to LARWQCB and the State Water Resources Control Board (SWRCB), Division of Drinking Water (formerly CDPH) • Data and reports submitted to the SWRCB GeoTracker online database, including groundwater monitoring data in Electronic Data Format, well locational data (latitude and longitude), and monitoring reports in Adobe Acrobat™ format: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100000534

Quality Assurance/ Quality Control (QA/QC) Program	• Certified laboratories • Utilize U.S. Environmental Protection Agency method acceptance criteria and laboratory internal controls for QC parameters, including preparation blanks, surrogates, spikes, duplicates and laboratory control samples • Laboratory data quality is quantitatively assessed through accuracy, precision, and respective method limitations • Qualitative assessment is conducted through comparability, representativeness, completeness, and sensitivity • Field QC includes field blanks, trip blanks for organics • Eurofins Eaton Analytical, Inc. and other commercial laboratories: Comprehensive, written QA/QC program
Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by the City of Los Angeles, SWRCB Division of Drinking Water, and LARWQCB

The AWT recycled water that is produced by the TIWRP is blended with treated imported water prior to injection at the DGB. The blended water is monitored for multiple constituents, including TDS, chloride, and total nitrogen, on a weekly/biweekly basis. In 2017-18, when expansion of the TIWRP is completed, 100 percent AWT recycled water will be injected at the DGB. The location of the TIWRP is presented in Figure K-4. More details on the monitoring program are presented **Attachment K-E**.

3.2 Recycled Water Monitoring for Nonpotable Reuse Projects

Recycled water monitoring is conducted for non-potable reuse projects in the Study Area by the:

- SDLAC,
- WBMWD, and
- City of Los Angeles.

The three indicators of salts and nutrients (i.e., TDS, chloride, and nitrate) and other related parameters are highlighted in yellow in the following tables for each monitoring program.

3.2.1 SDLAC Non-Potable Reuse Recycled Water Monitoring

There are five WRPs owned and operated by the SDLAC that produce tertiary recycled water for non-potable reuse applications (irrigation, industrial and recreational activities) in the CBWCB: Long Beach WRP, Los Coyotes WRP, Pomona WRP, San Jose Creek WRP, and Whittier Narrows WRP. Information on the monitoring of SDLAC's tertiary recycled water (i.e., the effluent of the WRPs) is presented in **Table K-8**. The locations of these SDLAC WRPs are presented in Figure K-4 and more details on the monitoring program are presented **Attachment K-F**.

Table K-8 SDLAC Non-Potable Reuse Recycled Water Quality Monitoring

<table>
<tr><td>Program Origin</td><td>Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. 97-072 Water Reclamation Requirements for all of the Sanitation Districts of Los Angeles County's water reclamation plants (WRPs); this Order re-adopted previous permits that were issued in 1987 and 1988 (as summarized below): http://63.199.216.6/larwqcb_new/permits/docs/6182_97-072_WRR.pdf

Long Beach WRP – LARWQCB Order No. Order 87-47: http://63.199.216.6/larwqcb_new/permits/docs/6184_87-047_WRR.pdf
Los Coyotes WRP – LARWQCB Order No. 87-51: http://63.199.216.6/larwqcb_new/permits/docs/6182_87-051_WRR.pdf
Pomona WRP – LARWQCB Order No. 81-34 (not accessible on RWQCB permit database)
San Jose Creek WRP – LARWQCB Order No. 87-50 (not accessible on RWQCB permit database)
Whittier Narrows WRP – LARWQCB Order No. 88-40 (not accessible on RWQCB permit database)
</td></tr>
<tr><td>Responsible Agency</td><td>Sanitation Districts of Los Angeles County (SDLAC)</td></tr>
<tr><td>Number of Monitoring Points</td><td>5 – Tertiary-treated recycled water</td></tr>
<tr><td>Monitoring Locations</td><td>Effluent (i.e., tertiary-treated recycled water) of SDLAC's five WRPs; see Figure K-4:

Long Beach WRP
Los Coyotes WRP
Pomona WRP
San Jose Creek WRP
Whittier Narrows WRP
</td></tr>
<tr><td>Constituents and Frequency</td><td>
<table>
<tr><th>Parameter</th><th>Monitoring Frequency</th></tr>
<tr><td>Total Dissolved Solids</td><td>Monthly</td></tr>
<tr><td>Chloride</td><td>Monthly</td></tr>
<tr><td>Nitrate</td><td>Quarterly[b]</td></tr>
<tr><td>Nitrate + Nitrite</td><td>Monthly[d]</td></tr>
<tr><td>Total Nitrogen</td><td>Monthly</td></tr>
<tr><td>Turbidity</td><td>Continuous</td></tr>
<tr><td>Coliform</td><td>Daily</td></tr>
<tr><td>pH</td><td>Daily</td></tr>
<tr><td>Boron</td><td>Monthly - Quarterly</td></tr>
<tr><td>Sulfate</td><td>Monthly</td></tr>
<tr><td>Biochemical Oxygen Demand (BOD_5 20°C)</td><td>Weekly[c,d]</td></tr>
<tr><td>Oil and Grease</td><td>Monthly[d]</td></tr>
<tr><td>Suspended Solids</td><td>Daily[c,d]</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td>Settleable Solids</td><td>Daily[c,d]</td></tr>
<tr><td>Arsenic</td><td>Quarterly[b]</td></tr>
<tr><td>Barium</td><td>Quarterly[b]</td></tr>
<tr><td>Cadmium</td><td>Quarterly[b]</td></tr>
<tr><td>Chromium</td><td>Quarterly[b]</td></tr>
<tr><td>Lead</td><td>Quarterly[b]</td></tr>
<tr><td>Mercury</td><td>Quarterly[b]</td></tr>
<tr><td>Selenium</td><td>Quarterly[b]</td></tr>
<tr><td>Silver</td><td>Quarterly[b]</td></tr>
<tr><td>Cyanide</td><td>Quarterly[b]</td></tr>
<tr><td>Fluoride</td><td>Monthly – Quarterly[b]</td></tr>
<tr><td>Radioactivity</td><td>Quarterly</td></tr>
<tr><td>Total Identifiable Chlorinated Hydrocarbons</td><td>Quarterly[b]</td></tr>
<tr><td>Priority Pollutants</td><td>Semi-annually[a,b]</td></tr>
</table>
a. A more comprehensive list of monitored parameters is presented in Attachment K-F
b. Not included in Pomona WRP permit
c. Pomona WRP permit only
d. Whittier Narrows WRP permit only
</td></tr>
<tr><td>Other Media Monitored</td><td>None</td></tr>
<tr><td>Reporting/ Databases</td><td>
• Quarterly and annual reports submitted to LARWQCB and the State Water Resources Control Board (SWRCB), Division of Drinking Water (formerly California Department of Public Health)
• Data and reports are submitted to the SWRCB online GeoTracker database, including discharge locational data (latitude and longitude), and monitoring reports in Adobe Acrobat™ format:
➢ Pomona WRP: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001746
➢ San Jose Creek WRP: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001083
➢ Los Coyotes WRP: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001745
➢ Long Beach WRP: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001744
➢ Whittier Narrows WRP: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001741
</td></tr>
<tr><td>Quality Assurance /</td><td>
• Certified laboratories
• SDLAC laboratories: Blanks, laboratory control standards, duplicate samples, and fortified samples; calibration standards as required by the analytical
</td></tr>
</table>

Quality Control (QA/QC) Program	methods; trip blanks for the analysis of volatile organic analytes; surrogate standards are added to every sample to monitor the overall performance of the procedure with recoveries compared to established acceptance limits; control limits have been established for both precision and accuracy of the laboratory analyses with specified corrective actions when data are outside the control limits • Commercial laboratories: must have a written comprehensive QA/QC program • Data are checked for completeness as part of the reporting process
Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by SDLAC, SWRCB Division of Drinking Water, and LARWQCB

3.2.2 WBMWD Non-Potable Reuse Recycled Water Monitoring

The Edward C. Little WRF, owned by WBMWD, produces tertiary recycled water for non-potable reuse applications (irrigation, industrial and recreational activities) in the WCB. As discussed in Section 3.1.3, the Edward C. Little WRF also produces advanced treated recycled water, which is subsequently blended with treated imported water and delivered to the WCBB for injection. Information on monitoring of the tertiary recycled water is presented in **Table K-9**. The location of the Edward C. Little WRF is shown in Figure K-4 and more details on the monitoring program are presented **Attachment K-F**.

Table K-9 WBMWD Non-Potable Reuse Recycled Water Quality Monitoring

Program Origin	2001 Permit – Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. 01-043: http://63.199.216.6/larwqcb_new/permits/permit_display.php?order_no=01-043&program_id=4728&ci_no=7453 2002 Permit Amendment – Permit amended by LARWQCB Order No. R4-2002-0173: http://63.199.216.6/larwqcb/permit_display.php?order_no=R4-2002-0173&ci_no=7453&program_id=4728
Responsible Agency	West Basin Municipal Water District (WBMWD)
Number of Monitoring Points	1 – Tertiary-treated recycled water
Monitoring Locations	Effluent (i.e., tertiary-treated recycled water) from WBMWD's Edward C. Little Water Recycling Facility (WRF); see Figure K-4
Constituents and Frequency	(see below)

Parameter	Monitoring Frequency
Total Dissolved Solids	Monthly
Chloride	Monthly
Nitrate	Quarterly

	Nitrite	Quarterly
	Ammonia	Quarterly
	Turbidity	Continuous
	Coliform	Daily
	pH	Daily
	Boron	Monthly
	Sulfate	Monthly
	Biochemical Oxygen Demand (BOD_5 20°C)	Weekly
	Oil and Grease	Monthly
	Suspended Solids	Weekly
	Settleable Solids	Weekly
	Hexavalent Chromium	Quarterly
	Total Organic Carbon	Quarterly
	Radioactivity	Annually
	Priority Pollutants	Semi-annually[a]
	a. A comprehensive list of parameters is presented in Attachment K-F	

Other Media Monitored/ Monitoring Locations	• Influent to WBMWD's Edward C. Little WRF (i.e., secondary recycled water/effluent from the City of Los Angeles' Hyperion Treatment Plant) • Blend of advanced treated recycled water (produced by Edward C. Little WRF) and treated imported water (supplied by the Metropolitan Water District of Southern California) that is delivered to the Dominguez Gap Seawater Intrusion Barrier (see Section 3.1.3) • Reporting of California Code of Regulations, Title 22 monitoring data from the nearest drinking water well, Manhattan Beach Well No. 11a, to the West Coast Basin Seawater Intrusion Barrier (see Section 3.6.4) • Groundwater monitoring wells in proximity to the West Coast Basin Seawater Intrusion Barrier (see Section 3.6.3.3)
Reporting/ Databases	Quarterly and annual reports in Adobe Acrobat™ format submitted to LARWQCB and the State Water Resources Control Board (SWRCB), Division of Drinking Water (formerly California Department of Public Health)
Quality Assurance / Quality Control (QA/QC) Program	• Certified laboratories • As part of the State/Federal certification process, a lab must maintain a current QA/QC plan, current standards of practice for each analytical method, conduct method detection limit studies for each analytical method, and participate in performance evaluation blind check sample studies; in addition, the WBMWD laboratory has its own check sample program for its staff and for contract labs • Trip blanks are only used for volatiles
Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by WBMWD, SWRCB Division of Drinking Water, and LARWQCB

3.2.3 City of Los Angeles Non-Potable Reuse Recycled Water Monitoring

As part of the Harbor Water Recycling Project, the City of Los Angeles produces tertiary-treated recycled water at its TIWRP for non-potable applications, including irrigation and industrial and recreational activities in the CBWCB. As discussed in Section 3.1.4, the TIWRP also produces advanced treated recycled water, which is subsequently blended with treated imported water and delivered to the DGB for injection. Details of the monitoring program for the tertiary recycled water are presented in **Table K-10**. The location of the City of Los Angeles' TIWRP is shown in Figure K-4.

Table K-10 City of Los Angeles Non-Potable Reuse Recycled Water Quality Monitoring

Program Origin	2003 Permit – Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. R4-2003-0025: http://63.199.216.6/larwqcb_new/permits/permit_display.php?order_no=R4-2003-0025&ci_no=8537&program_id=97885 2011 Permit Amendment – Permit amended per LARWQCB Order No. R4-2011-0033: http://63.199.216.6/larwqcb_new/permits/permit_display.php?order_no=R4-2011-0033&ci_no=8537&program_id=97885
Responsible Agency	City of Los Angeles
Number of Monitoring Points	1 – Tertiary-treated recycled water
Monitoring Locations	Effluent (i.e., tertiary-treated recycled water) from the City of Los Angeles' Terminal Island Water Reclamation Plant/Advanced Water Purification Facility (TIWRP); see Figure K-4
Constituents and Frequency	(see table below)
Other Media Monitored/ Monitoring Locations	• Advanced treated recycled water that is produced by the City of Los Angeles' TIWRP (see Section 3.1.4) • Blended and delivered water (i.e., blend of advanced treated recycled water produced by the TIWRP and imported water supplied by Metropolitan Water District of Southern California) that is injected at the Dominguez Gap Seawater Intrusion Barrier (DGB); the blended water is

Constituents and Frequency:

Parameter	Monitoring Frequency
Total Dissolved Solids	Monthly
Chloride	Monthly
Nitrate	Quarterly
Nitrite	Quarterly
Ammonia	Quarterly
Organic Nitrogen	Quarterly
Turbidity	Continuous
Total Coliform	Daily
pH	Daily
Boron	Monthly
Sulfate	Monthly
Hexavalent Chromium	Quarterly
Radioactivity	Annually
Priority Pollutants	Annually

	monitored for multiple constituents, including TDS, chloride, and total nitrogen, on a weekly/biweekly basis (see Section 3.1.4) • Reporting of California Code of Regulations, Title 22 monitoring data from the nearest drinking water well, California Water Service Company Well 275-01 (formerly Well CWS #75A) to the Dominguez Gap Barrier (see Section 3.6.4) • Groundwater monitoring wells in proximity to the DGB (see Section 3.6.3.4)
Reporting/Databases	• Quarterly and annual reports submitted to LARWQCB and the State Water Resources Control Board (SWRCB), Division of Drinking Water (formerly California Department of Public Health) • Data and reports submitted to the SWRCB GeoTracker online database: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001170
Quality Assurance/ Quality Control (QA/QC) Program	• Certified laboratories • Utilize the U.S. Environmental Protection Agency method acceptance criteria and laboratory internal controls for QC parameters, including preparation blanks, surrogates, spikes, duplicates and laboratory control samples • Laboratory data quality is quantitatively assessed through accuracy, precision, and respective method limitations • Qualitative assessment is conducted through comparability, representativeness, completeness, and sensitivity • Field QC includes field blanks, trip blanks for organics
Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by the City of Los Angeles, SWRCB Division of Drinking Water, and LARWQCB

3.3 Wastewater National Pollutant Discharge Elimination System Monitoring

NPDES monitoring for wastewater discharges to surface waters is conducted by SDLAC within and upstream of the Study Area for the Long Beach WRP, Los Coyotes WRP, San Jose Creek WRP, Whittier Narrows WRP, and Pomona WRP. No other wastewater treatment plants in the CBWCB discharge to surface water. Information on monitoring programs for each NPDES permit is presented in **Table K-11**; the locations of effluent discharge point monitoring for SDLAC's WRPs are presented in **Figures K-5** through **K-9**; and more details on the programs are presented **Attachment K-G**. The three indicators of salts and nutrients (i.e., TDS, chloride, and nitrate) and other related parameters are highlighted in yellow in the following table.

Table K-11 SDLAC NPDES Wastewater Quality Monitoring

Program Origin	Long Beach Water Reclamation Plant (WRP): Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. R4-2007-0047, National Pollutant Discharge Elimination System (NPDES) No. CA0054119 Waste Discharge Requirements for Discharge to Coyote Creek:

	http://63.199.216.6/larwqcb_new/permits/docs/5662_R4-2007-0047_WDR_PKG.pdf Los Coyotes WRP: LARWQCB Order No. R4-2007-0048, NPDES No. CA0054011 Waste Discharge Requirements for Discharge to San Gabriel River: http://63.199.216.6/larwqcb_new/permits/docs/5059_R4-2007-0048_WDR_PKG.pdf San Jose Creek WRP: LARWQCB Order No. R4-2009-0078, NPDES No. CA0053911 Waste Discharge Requirements for Discharge to San Gabriel River and San Jose Creek: http://63.199.216.6/larwqcb_new/permits/docs/5542_R4-2009-0078_WDR.pdf Whittier Narrows WRP: LARWQCB Order No. R4-2009-0077 NPDES No. CA0053716 Waste Discharge Requirements for Discharge to San Gabriel River, Rio Hondo, and Zone 1 Ditch: http://63.199.216.6/larwqcb_new/permits/docs/2848_R4-2009-0077_WDR_PKG.pdf Pomona WRP: LARWQCB Order No. R4-2009-0076 NPDES No. CA0053619 Waste Discharge Requirements for Discharge to South Fork San Jose Creek: http://63.199.216.6/larwqcb_new/permits/docs/0755_R4-2009-0076_WDR.pdf
Responsible Agency	Sanitation Districts of Los Angeles County (SDLAC)
Number of Monitoring Points	Tertiary-treated recycled water samples collected at discharge points from: • Long Beach WRP – 1 (discharge point to Coyote Creek) • Los Coyotes WRP – 1 (discharge point to San Gabriel River) • San Jose Creek WRP – 5 (discharge points to San Gabriel River and San Jose Creek) • Whittier Narrows WRP – 4 (discharge points to San Gabriel River, Rio Hondo, Test Basin, and Zone 1 Ditch) • Pomona WRP – 1 (discharge point to South Fork San Jose Creek)
Monitoring Locations	Plant effluent discharge points from the Long Beach WRP, Los Coyotes WRP, San Jose Creek WRP, Whittier Narrows WRP, and Pomona WRP; see Figures 4 through 8
Constituents and Frequency	(see table below)

Parameter[a]	Monitoring Frequency
Turbidity	Daily - Continuous
pH	Daily - Weekly
Settleable solids	Daily - Weekly
Suspended solids	Daily - Weekly
Bacteria	Daily - Weekly
Temperature	Daily - Weekly
Biochemical Oxygen Demand (BOD_5 20°C)	Weekly
Oil and grease	Monthly - Quarterly
Total Dissolved Solids	Monthly - Semi-annually
Chloride	Monthly - Semi-annually
Sulfate	Monthly - Semi-annually
Boron	Monthly - Semi-annually
Fluoride	Monthly - Quarterly - Semi-annually
Total Hardness	Monthly
Surfactants	Monthly - Quarterly
Nitrogen	Monthly

<table>
<tr>
<td></td>
<td>
<table>
<tr><td>Phosphorus and Phosphate[b]</td><td>Monthly</td></tr>
<tr><td>Chronic Toxicity</td><td>Monthly</td></tr>
<tr><td>Acute Toxicity</td><td>Quarterly - Annually</td></tr>
<tr><td>Metals</td><td>Monthly - Quarterly - Semi-annually</td></tr>
<tr><td>Cyanide</td><td>Monthly - Quarterly</td></tr>
<tr><td>Bis(2-ethylhexyl)phthalate</td><td>Monthly - Semi-annually</td></tr>
<tr><td>Radioactivity</td><td>Semi-annually</td></tr>
<tr><td>2,3,7,8-Tetrachlorodibenzo-p-dioxin</td><td>Semi-annually</td></tr>
<tr><td>Pesticides[c]</td><td>Semi-annually</td></tr>
<tr><td>Perchlorate</td><td>Semi-annually</td></tr>
<tr><td>1,4-Dioxane</td><td>Semi-annually</td></tr>
<tr><td>1,2,3-Trichloropropane</td><td>Semi-annually</td></tr>
<tr><td>Methyl tert-butyl ether</td><td>Semi-annually</td></tr>
<tr><td>Bromoform</td><td>Monthly - Semi-annually</td></tr>
<tr><td>Dibromochloromethane</td><td>Monthly - Semi-annually</td></tr>
<tr><td>Chloroform</td><td>Monthly - Semi-annually</td></tr>
<tr><td>Bromodichloromethane</td><td>Monthly - Semi-annually</td></tr>
<tr><td>Total Trihalomethanes</td><td>Monthly - Semi-annually</td></tr>
<tr><td>Polychlorinated Biphenyls</td><td>Monthly - Semi-annually</td></tr>
<tr><td>Remaining Priority Pollutants</td><td>Quarterly - Semi-annually</td></tr>
<tr><td>Endocrine Disrupting Chemicals[d]</td><td>Biennially</td></tr>
<tr><td>Pharmaceuticals[d]</td><td>Biennially</td></tr>
</table>
a. The programs vary by WRP permit; a more comprehensive list of parameters for each Monitoring and Reporting Program (MRP) is presented in Attachment K-G
b. Los Coyotes WRP only
c. San Jose Creek and Pomona WRPs only
d. Whittier Narrows and Pomona WRPs only; see Section 4 for program description and specific parameters
</td>
</tr>
<tr>
<td>CECs Monitored</td>
<td>Biennial sampling of tertiary treated recycled water from the Whittier Narrows and Pomona WRPs (i.e. plant effluent) and annual sampling of plant effluent for the five WRP (see Section 4) for:
• Endocrine Disrupting Chemicals
• Pharmaceuticals</td>
</tr>
<tr>
<td>Other Media Monitored/ Monitoring Locations</td>
<td>• Influent (i.e., wastewater) to each of the Long Beach WRP, Los Coyotes WRP, San Jose Creek WRP, Whittier Narrows WRP, and Pomona WRP
• Surface water receiving water stations along Coyote Creek, San Jose Creek, Rio Hondo, Zone 1 Ditch, and San Gabriel River (see Section 3.5)
• Watershed monitoring locations (see Section 3.5)</td>
</tr>
<tr>
<td>Reporting/ Databases</td>
<td>• Monthly and annual reports submitted to LARWQCB
• Data and reports submitted to the State Water Resources Control Board online California Integrated Water Quality System Project (CIWQS) database, including discharge locational data and water quality data and reports in Adobe Acrobat™ format: http://ciwqs.waterboards.ca.gov/ciwqs/readOnly/PublicReportEsmrAtGlanceServlet?inCommand=reset</td>
</tr>
</table>

Quality Assurance/ Quality Control (QA/QC) Program	• Certified laboratories • SDLAC laboratories: blanks, laboratory control standards, duplicate samples, and fortified samples; calibration standards as required by the analytical methods; trip blanks for the analysis of volatile organic analytes; surrogate standards are added to every sample to monitor the overall performance of the procedure with recoveries compared to established acceptance limits; control limits have been established for both precision and accuracy of the laboratory analyses with specified corrective actions when data are outside the control limits • Commercial laboratories: must have a written comprehensive QA/QC program • Data are checked for completeness as part of the reporting process
Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by SDLAC and LARWQCB

3.4 Imported Water Monitoring

As discussed in the SNMP, water is imported from different sources to the CBWCB for the water supply (uses include drinking water, irrigation, commercial/industrial activities, etc.) and groundwater replenishment. Water is imported to the CBWCB by MWD, the City of Los Angeles, City of Whittier, Suburban Water Company, California Domestic Water Company, and San Gabriel Valley Water Company. MWD imports water from the Colorado River (CR) and State Water Project (SWP). Untreated imported water is delivered to the Montebello Forebay Spreading Grounds and treated water is injected into the seawater intrusion barriers and used for water supply. LADWP imports water from the Owens Valley-Mono Basin and the treated water is used for water supply. LADWP, the City of Whittier, Suburban Water Company, California Domestic Water Company, and San Gabriel Valley Water Company import groundwater that was extracted from the San Gabriel Basin and is used for water supply in the Study Area.

Water imported by MWD and LADWP for supply and recharge comprises, by far, the largest source of imported water to the Study Area. Groundwater supplied by LADWP, City of Whittier, Suburban Water Company, California Domestic Water Company, and San Gabriel Valley Water Company for drinking water, industrial use, or irrigation are considered to be *de minimus* contributors to the salt/nutrient loading. Groundwater that is utilized as drinking water is monitored per California Code of Regulations, Title 22, as discussed in Section 3.6.4.[4]

This section provides details of the monitoring program for untreated imported water supplied by the MWD and recharged in the Montebello Forebay, treated imported water supplied by the MWD and used for injection at the seawater intrusion barriers and for supply in the Study Area, and imported water provided by LADWP for water supply in the Study Area.

[4] As discussed in the SNMP, the volume of water used for irrigation in the Study Area is estimated to be 40 percent of the total supply of imported water and groundwater, plus the recycled water. Assuming an irrigation return flow percentage of 3.6 percent, approximately 8,900 acre-feet (AF) of water recharges the groundwater basins through irrigation.

3.4.1 Untreated MWD Imported Water

Untreated MWD imported water is delivered to the Montebello Forebay spreading facilities for replenishment. Untreated imported water originates from Silverwood Lake and MWD's Lake Mathews reservoirs. Silverwood Lake contains 100 percent SWP water, while Lake Mathews contains 100 percent CR water. Information on MWD's voluntary and compliance monitoring is presented in **Table K-12**; a copy of the Compliance Monitoring Plan is presented **Attachment K-H** (MWD, 2011). **Figure K-10** shows the locations of the reservoirs. The three indicators of salts and nutrients (i.e., TDS, chloride, and nitrate) for the CBWCB SNMP are highlighted in yellow in the following table.

Table K-12 MWD Untreated Imported Water Quality Monitoring

<table>
<tr><td>Program Origin</td><td>Metropolitan Water District of Southern California's Chemical Compliance Monitoring Plan, Compliance Cycle 2011–2019 (see Attachment K-H), as prepared in accordance to Section 64416 of Title 22 of the California Code of Regulations (CCR):
http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Lawbook.aspx</td></tr>
<tr><td>Responsible Agency</td><td>Metropolitan Water District of Southern California (MWD)</td></tr>
<tr><td>Number of Monitoring Points</td><td>2 – Surface water sampling locations</td></tr>
<tr><td>Monitoring Locations</td><td>Lake Mathews and Silverwood Lake (see Figure K-10)</td></tr>
<tr><td>Constituents and Frequency</td><td>
<table>
<tr><th>Parameter</th><th>Monitoring Frequency</th></tr>
<tr><td>Total Dissolved Solids</td><td>2x/year</td></tr>
<tr><td>Chloride</td><td>2x/year</td></tr>
<tr><td>Other Secondary Maximum Contaminant Levels</td><td>Annually</td></tr>
<tr><td>Nitrate</td><td>Annually[a]</td></tr>
<tr><td>Other Inorganics</td><td>Annually-1x/cycle[b]</td></tr>
<tr><td>Volatile Organic Chemicals</td><td>Annually</td></tr>
<tr><td>Pesticides</td><td>2x/period[c]</td></tr>
<tr><td>Semi-volatile Organics</td><td>2x/period</td></tr>
<tr><td>Radiological</td><td>4x/period-1x/period</td></tr>
</table>
a. The annual monitoring frequency is lower than the prior frequency of quarterly for nitrate and nitrite based on results that show nitrate concentrations to be less than half the maximum contaminant level (MCL) of 10 mg/L and nitrite concentrations less than half the MCL of 1 mg/L
b. A "Compliance Cycle" defined as a nine calendar year cycle
c. Each Compliance Cycle is divided into three 3-year compliance periods
</td></tr>
<tr><td>CECs Monitored</td><td>Research project that evaluated 14 CECs in the State Water Project and Colorado River Aqueduct including pharmaceuticals, food additives, and pesticides (see Section 4)</td></tr>
<tr><td>Other Media Monitored/ Monitoring Locations</td><td>Various source and finished water locations within MWD's water system (see Table 1 in Attachment K-H)</td></tr>
</table>

Reporting/Databases	• Water quality data submitted to the State Water Resources Control Board (SWRCB) Division of Drinking Water (formerly California Department of Public Health) using the Write-On Electronic Data Transfer Program; the data can be downloaded from the following website: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/EDTlibrary.aspx • Annual water quality data reports are distributed to the SWRCB Division of Drinking Water and water purveyors and posted on MWD's website: http://www.mwdh2o.com/mwdh2o/pages/yourwater/wq-report/index.html
Quality Assurance/ Quality Control (QA/QC) Program	• Certified laboratories • Comprehensive, written QA/QC program
Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by MWD and the SWRCB Division of Drinking Water

3.4.2 Treated MWD Imported Water

The imported water used for replenishment at the seawater intrusion barriers is a blend of treated water from the CR and SWP, which is supplied by the MWD's Jensen and Diemer Water Treatment Plants (WTPs). The source water at the Jensen WTP is from the SWP. The source water at the Diemer WTP is from both the CR and SWP. Water from MWD's Jensen, Diemer, and Weymouth WTPs is delivered to the CBWCB for water supply. Information on MWD's voluntary and compliance monitoring is presented in **Table K-13**; the treatment plant locations are shown in Figure K-10; and a copy of the Compliance Monitoring Plan is presented Attachment K-H (MWD, 2011). The three indicators of salts and nutrients (i.e., TDS, chloride, and nitrate) for the CBWCB SNMP are highlighted in yellow in the following table.

Table K-13 MWD Treated Imported Water Quality Monitoring

Program Origin	Metropolitan Water District of Southern California's Chemical Compliance Monitoring Plan, Compliance Cycle 2011–2019 (see Attachment K-H), as prepared in accordance to Section 64416 of Title 22 of the California Code of Regulations: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Lawbook.aspx
Responsible Agency	Metropolitan Water District of Southern California (MWD)
Number of Monitoring Points	3 – Treatment plant effluent sampling locations
Monitoring Locations	Effluent from the following MWD water treatment plants (WTPs); see Figure K-10: • Jensen WTP • Diemer WTP • Weymouth WTP

<table>
<tr><td>Constituents and Frequency</td><td>
<table>
<tr><th>Parameter</th><th>Monitoring Frequency</th></tr>
<tr><td>Total Dissolved Solids</td><td>2x/year</td></tr>
<tr><td>Chloride</td><td>2x/year</td></tr>
<tr><td>Other Secondary Maximum Contaminant Levels</td><td>Annually</td></tr>
<tr><td>Nitrate</td><td>Annually[a]</td></tr>
<tr><td>Other Inorganics</td><td>Annually-1x/cycle[b]</td></tr>
<tr><td>Volatile Organics Chemicals</td><td>Annually</td></tr>
<tr><td>Pesticides</td><td>2x/period[c]</td></tr>
<tr><td>Semi-volatile organics</td><td>2x/period</td></tr>
<tr><td>Radiological</td><td>4x/period-1x/period</td></tr>
</table>
a. The annual monitoring frequency is lower than the prior frequency of quarterly for nitrate and nitrite based on results that show nitrate concentrations to be less than half the maximum contaminant level (MCL) of 10 mg/L and nitrite concentrations less than half the MCL of 1 mg/L
b. A “Compliance Cycle” defined as a nine calendar year cycle
c. Each Compliance Cycle is divided into three 3-year compliance periods
</td></tr>
<tr><td>Other Media Monitored/ Monitoring Locations</td><td>Various source and finished water locations within MWD’s water system (see Table 1 in Attachment K-H)</td></tr>
<tr><td>Reporting / Databases</td><td>
• Water quality data submitted to the State Water Resources Control Board (SWRCB) Division of Drinking Water (formerly California Department of Public Health) using the Write-On Electronic Data Transfer Program; the data can be downloaded from the following website:
http://www.cdph.ca.gov/certlic/drinkingwater/Pages/EDTlibrary.aspx
• Annual water quality data reports are distributed to the SWRCB Division of Drinking Water and water purveyors and posted on MWD’s website:
http://www.mwdh2o.com/mwdh2o/pages/yourwater/wq-report/index.html
</td></tr>
<tr><td>Quality Assurance / Quality Control (QA/QC) Program</td><td>
• Certified laboratories
• Comprehensive, written QA/QC program
</td></tr>
<tr><td>Compliance Oversight</td><td>Data are reviewed for compliance and any necessary corrective actions by MWD and the SWRCB Division of Drinking Water</td></tr>
</table>

3.4.3 LADWP Imported Water

LADWP imports water from the Owens Valley-Mono Lake via the Los Angeles Aqueduct to the Los Angeles Aqueduct Filtration Plant. The treated water is used for water supply in the WCB. Information on LADWP’s compliance monitoring is presented in **Table K-14**; more information on the details of the monitoring program is presented in **Attachment K-I**. Figure K-10 shows the location of the Los Angeles Aqueduct Filtration Plant. The three indicators of salts and nutrients (i.e., TDS, chloride, and nitrate) for the CBWCB SNMP are highlighted in yellow in the following table.

Table K-14 LADWP Imported Water Quality Monitoring

<table>
<tr><td>Program Origin</td><td>Los Angeles Department of Water and Power Vulnerability Assessment and Monitoring Program (Water System No. 1910067) prepared in accordance with California Department of Public (now the State Water Resources Control Board [SWRCB], Division of Drinking Water) Guidelines (see Attachment K-I):
http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Chemicalcontaminants.aspx</td></tr>
<tr><td>Responsible Agency</td><td>Los Angeles Department of Water and Power (LADWP)</td></tr>
<tr><td>Number of Monitoring Points</td><td>1 – Treatment plant effluent sampling location</td></tr>
<tr><td>Monitoring Locations</td><td>Effluent from the Los Angeles Aqueduct Filtration Plant (see Figure K-10)</td></tr>
<tr><td>Constituents and Frequency</td><td>
<table>
<tr><th>Parameter</th><th>Monitoring Frequency</th></tr>
<tr><td>Total Dissolved Solids</td><td>Annually</td></tr>
<tr><td>Chloride</td><td>Annually</td></tr>
<tr><td>Other Secondary Maximum Contaminant Levels</td><td>Annually</td></tr>
<tr><td>Nitrate</td><td>Annually</td></tr>
<tr><td>Other Inorganics</td><td>Annually-1x/cycle[a]</td></tr>
<tr><td>Volatile Organic Chemicals</td><td>Annually</td></tr>
<tr><td>Pesticides</td><td>2x/period[b]</td></tr>
<tr><td>Semi-volatile Organics</td><td>2x/period</td></tr>
<tr><td>Radiological</td><td>4x/period-1x/period</td></tr>
</table>
a. A "Compliance Cycle" defined as a nine calendar year cycle
b. Each Compliance Cycle is divided into three 3-year compliance periods (January 2011 through December 2019)
</td></tr>
<tr><td>Other Media Monitored/ Monitoring Locations</td><td>• 5 Reservoirs per the November 2013 Annual Water Quality Report 2012 Data Source Master Table
• Influent to the Los Angeles Aqueduct Filtration Plant
• Water distribution system</td></tr>
<tr><td>Reporting/ Databases</td><td>• Water quality data submitted to the SWRCB Division of Drinking Water using the Write-On Electronic Data Transfer Program; the data can be downloaded from the following website:
http://www.cdph.ca.gov/certlic/drinkingwater/Pages/EDTlibrary.aspx
• The annual water quality report is available on the LADWP website: https://www.ladwp.com/ladwp/faces/wcnav_externalId/a-w-anual-wqualty-rprt?_adf.ctrl-state=y63elm854_4&_afrLoop=1047980407298000</td></tr>
<tr><td>Quality Assurance/ Quality Control (QA/QC) Program</td><td>• Certified laboratories
• Comprehensive, written QA/QC program</td></tr>
</table>

Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by LADWP and the SWRCB Division of Drinking Water

3.5 Surface Water Monitoring

Surface water monitoring in the Study Area is comprised of the following programs:

- San Gabriel River Regional Monitoring Program (SGRRMP);
- Los Angeles River Watershed Monitoring Program (LARWMP);
- LACDPW Stormwater Program;
- MFGWR Project;
- SDLAC NPDES Permits; and
- LACDPW Surface Water Flow Monitoring Program.

The three SNMP indicators of salts and nutrients (i.e., TDS, chloride, and nitrate) and related parameters are highlighted in yellow in the following tables for each monitoring program.

3.5.1 San Gabriel River Regional Monitoring Program

Multiple stakeholders, including major NPDES permittees, regulatory and management agencies, and conservation groups, began development of the SGRRMP (http://watershedhealth.org/programsandprojects/sgrrmp.aspx) in 2004. Development of the program was motivated by a permit condition for SDLAC. The multi-level monitoring framework combines probabilistic and targeted sampling for water quality, toxicity, and bio-assessment. The program seeks to increase awareness of issues at the watershed scale and improve the coordination and integration of monitoring efforts for both compliance and ambient conditions. It is a watershed-scale counterpart to existing larger-scale regional monitoring efforts in Southern California that seeks to address questions and concerns about regional conditions and trends (CWH, 2010). Other related programs include: the SWRCB Surface Water Ambient Monitoring Program (SWAMP); http://www.waterboards.ca.gov/water_issues/programs/swamp/), USEPA's Western Environmental Monitoring and Assessment Program (WEMAP); http://www.epa.gov/region9/water/wemap/), and the Stormwater Monitoring Coalition (SMC); http://www.socalsmc.org/). The SGRRMP has incorporated some elements of traditional water quality and biological monitoring that focused on discharge points and extended monitoring throughout the entire watershed.

Information on the SGRRMP is summarized in **Table K-15**; monitoring locations in the Study Area are presented in **Figure K-11**; and more detailed information on the program is presented in **Attachment K-J**.

Table K-15 San Gabriel River Regional Monitoring Program

Program Origin	Long Beach Water Reclamation Plant (WRP): Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. R4-2007-0047, National

<table>
<tr><td></td><td>Pollutant Discharge Elimination System (NPDES) No. CA0054119 Waste Discharge Requirements for Discharge to Coyote Creek: http://63.199.216.6/larwqcb_new/permits/docs/5662_R4-2007-0047_WDR_PKG.pdf

Los Coyotes WRP: LARWQCB Order No. R4-2007-0048, NPDES No. CA0054011 Waste Discharge Requirements for Discharge to San Gabriel River: http://63.199.216.6/larwqcb_new/permits/docs/5059_R4-2007-0048_WDR_PKG.pdf

San Jose Creek WRP: LARWQCB Order No. R4-2009-0078, NPDES No. CA0053911 Waste Discharge Requirements for Discharge to San Gabriel River and San Jose Creek: http://63.199.216.6/larwqcb_new/permits/docs/5542_R4-2009-0078_WDR.pdf

Whittier Narrows WRP: LARWQCB Order No. R4-2009-0077 NPDES No. CA0053716 Waste Discharge Requirements for Discharge to San Gabriel River, Rio Hondo, and Zone 1 Ditch: http://63.199.216.6/larwqcb_new/permits/docs/2848_R4-2009-0077_WDR_PKG.pdf

Pomona WRP: LARWQCB Order No. R4-2009-0076 NPDES No. CA0053619 Waste Discharge Requirements for Discharge to South Fork San Jose Creek: http://63.199.216.6/larwqcb_new/permits/docs/0755_R4-2009-0076_WDR.pdf</td></tr>
<tr><td>Responsible Agency</td><td>Council for Watershed Health (other stakeholders are listed in Attachment K-J)</td></tr>
<tr><td>Number of Monitoring Points</td><td>Multiple – Surface water sampling locations</td></tr>
<tr><td>Monitoring Locations</td><td>Targeted and random surface water monitoring points within the San Gabriel River Watershed (see Figure K-11)</td></tr>
<tr><td>Constituents and Frequency</td><td>
<table>
<tr><th>Parameter[a]</th><th>Monitoring Frequency</th></tr>
<tr><td>Conductivity</td><td rowspan="15">Varies by monitoring site – see Attachment K-J</td></tr>
<tr><td>Salinity</td></tr>
<tr><td>Chloride</td></tr>
<tr><td>Other Secondary Maximum Contaminant Levels</td></tr>
<tr><td>Nitrogen</td></tr>
<tr><td>Sulfate</td></tr>
<tr><td>Temperature</td></tr>
<tr><td>pH</td></tr>
<tr><td>Alkalinity</td></tr>
<tr><td>Hardness</td></tr>
<tr><td>Total Suspended Solids</td></tr>
<tr><td>Silica</td></tr>
<tr><td>Trace Metals</td></tr>
<tr><td>Organophosphorus Pesticides</td></tr>
<tr><td>Pyrethroids Pesticides</td></tr>
</table>
</td></tr>
</table>

	Chronic Toxicity a. More details are presented in Attachment K-J
Other Media Monitored/ Monitoring Locations	• Estuarine water • Sediment • Fish tissue • Habitat
Reporting/ Databases	Two annual reports are posted on the Council for Watershed Health (CWH) website: 1. Annual SGRRMP Reports and 2. Annual San Gabriel River State of the Watershed Reports http://watershedhealth.org/dataandreference/Document.aspx?search=49
Quality Assurance / Quality Control (QA/QC) Program	• Certified labs • Measurement or Data Quality Objectives in accordance with the Quality Assurance Project Plan prepared by CWH for the San Gabriel River Regional Monitoring Program: completeness, precision (lab and field duplicates); accuracy (standards of known concentration); representativeness; sensitivity (CWH, 2012a)
Compliance Oversight	For requirements included in NPDES Permits, data are reviewed for compliance and any necessary corrective actions by the permit holder and LARWQCB; oversight of watershed monitoring is performed by CWH and other stakeholders

3.5.2 Los Angeles River Watershed Monitoring Program

The LARWMP (http://watershedhealth.org/programsandprojects/larwmp.aspx) was developed during 2007 by a group of stakeholders that included major NPDES permittees, regulatory and management agencies, and conservation groups. Surface water sampling within the Los Angeles River Watershed was initiated in 2008. The objectives of the program are patterned after the SGRRMP; namely, to increase awareness of the importance of issues at the watershed scale and to improve the coordination and integration of monitoring efforts for both compliance and ambient conditions (CWH, 2010). Coordination has been undertaken with regional efforts underway through other programs, including the SWRCB SWAMP, SMC, and Cleaner Rivers Through Effective Stakeholder TMDLs (CREST); http://dawhois.com/www/crestmdl.org.html).

The LARWMP has incorporated some elements of traditional water quality and biological monitoring that focus around discharge points and extended this to sample the entire watershed. Information on the LARWMP monitoring is presented in **Table K-16**; monitoring locations in the Study Area are presented in Figure K-11; and more detailed information on the program is presented in **Attachment K-K**.

Table K-16 Los Angeles River Watershed Monitoring Program

<table>
<tr><td>Program Origin</td><td>Donald C. Tillman Water Reclamation Plant (WRP): Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. R4-2011-0196, National Pollutant Discharge Elimination System (NPDES) No. CA0056227 Waste Discharge Requirements for Discharge to the Los Angeles River: http://63.199.216.6/larwqcb_new/permits/docs/5695_R4-2011-0196_WDR_PKG.pdf

Los Angeles – Glendale WRP: LARWQCB Order No. R4-2011-0197, NPDES No. CA0053953 Waste Discharge Requirements for Discharge to the Los Angeles River: http://63.199.216.6/larwqcb_new/permits/docs/5675_R4-2011-0197_WDR_PKG.pdf

Burbank WRP: LARWQCB Order No. R4-2012-0059, NPDES No. CA0055531 Waste Discharge Requirements for Discharge to the Burbank West Channel: http://63.199.216.6/larwqcb_new/permits/docs/4424_R4-2012-0059_WDR_PKG.pdf

Tapia Water Reclamation Facility (WRF): LARWQCB Order No. R4-2010-0165, NPDES No. CA0056014 Waste Discharge Requirements for Discharge to Malibu Creek and Los Angeles River: http://63.199.216.6/larwqcb_new/permits/docs/4760_R4-2010-0165_WDR_PKG.pdf</td></tr>
<tr><td>Responsible Agency</td><td>Council for Watershed Health (other stakeholders are listed in Attachment K-K)</td></tr>
<tr><td>Number of Monitoring Points</td><td>Multiple – Surface water sampling locations</td></tr>
<tr><td>Monitoring Locations</td><td>Targeted and random surface water monitoring points within the Los Angeles River Watershed (see Figure K-11)</td></tr>
<tr><td>Constituents and Frequency</td><td>
<table>
<tr><th>Parameter[a]</th><th>Monitoring Frequency</th></tr>
<tr><td>Conductivity</td><td rowspan="16">Varies by monitoring site – see Attachment K-K</td></tr>
<tr><td>Salinity</td></tr>
<tr><td>Chloride</td></tr>
<tr><td>Other Secondary Maximum Contaminant Levels</td></tr>
<tr><td>Nitrogen</td></tr>
<tr><td>Sulfate</td></tr>
<tr><td>Temperature</td></tr>
<tr><td>pH</td></tr>
<tr><td>Alkalinity</td></tr>
<tr><td>Hardness</td></tr>
<tr><td>Total Suspended Solids</td></tr>
<tr><td>Silica</td></tr>
<tr><td>Trace Metals</td></tr>
<tr><td>Organophosphorus Pesticides</td></tr>
<tr><td>Pyrethroids Pesticides</td></tr>
<tr><td>Chronic Toxicity</td></tr>
</table>
a. More details are presented in Attachment K-K</td></tr>
</table>

Other Media Monitored/ Monitoring Locations	• Estuarine water • Sediment • Fish tissue • Habitat
Reporting/ Databases	Two annual reports are posted on the Council for Watershed Health (CWH) website: 1. Annual Los Angeles River Watershed Monitoring (LARWMP) Reports and 2. Annual Los Angeles River State of the Watershed Reports (first published in 2013) http://watershedhealth.org/dataandreference/Document.aspx?search=38
Quality Assurance / Quality Control (QA/QC) Program	• Certified labs • Measurement or Data Quality Objectives in accordance with the Quality Assurance Project Plan (QAPP) prepared by CWH for the LARWMP: completeness, precision (lab and field duplicates); accuracy (standards of known concentration); representativeness; sensitivity (CWH, 2012b)
Compliance Oversight	For requirements included in NPDES Permits, data are reviewed for compliance and any necessary corrective actions by the permit holder and LARWQCB; oversight of watershed monitoring is performed by CWH and other stakeholders

3.5.3 Los Angeles County Stormwater Monitoring Program

For data available through 2012, stormwater monitoring was conducted in accordance with the 2001 LARWQCB Order No. 01-182, which served as the NPDES permit for municipal separate storm sewer system (MS4) discharges for 84 cities and a majority portion of the unincorporated areas of Los Angeles County, with the exception of the City of Long Beach. The City of Long Beach has a separate MS4 NPDES permit.

In December 2012, LARWQCB adopted Order No. R4-2012-0175 to replace Order No. 01-182. The 2012 MS4 Permit allows permittees the flexibility to develop Watershed Management Programs (WMPs) or Enhanced Watershed Management Programs (EWMPs) to implement the requirements of the permit on a watershed scale through customized strategies, control measures, and best management practices. A WMP can be implemented by an individual permittee or can be a collaborative effort among permittees within a watershed. An EWMP assumes collaboration among permittees and other partners within a watershed such as water suppliers. Permittees within the Study Area have elected to participate in individual WMPs, WMPs, or EWMPs (see http://www.swrcb.ca.gov/rwqcb4/water_issues/programs/stormwater/municipal/watershed_management/index.shtml).

To meet the monitoring and reporting requirements in the MS4 permit, permittees that elect to participate in a WMP or EWMP must develop the following: 1) an Integrated Monitoring Program (IMP) that covers the core elements of the monitoring program objectives on a jurisdictional basis; 2) an IMP in conjunction with a WMP; or 3) a Coordinated IMP (CIMP) in conjunction with a WMP or EWMP. An IMP leverages monitoring resources by selecting monitoring locations, parameters, or monitoring strategies that will satisfy multiple monitoring requirements. A CIMP has additional benefits including implementation of monitoring on a watershed basis and thereby allowing permittees to pool resources to achieve monitoring requirements.

For permittee developing WMPs or EWMPs, the pertinent deadlines for the MRP and development of the IMPs and CIMPs are as follows:

- December 28, 2012 - Continue monitoring per requirements of Order No. 01-182 and TMDL compliance monitoring requirements until an IMP and/or CIMP is approved.
- June 28, 2013 - Submit a letter of intent. For each core monitoring element, indicate whether an IMP or CIMP will be developed.
- December 28, 2013 - Submit a draft IMP or CIMP if developing a WMP within a 12-month planning horizon.
- June 28, 2014 - Submit draft IMP or CIMP if developing a WMP within an 18-month planning horizon, or if developing an EWMP.
- 30 Days after approval - Commence monitoring under approved IMP.
- 90 Days after approval - Commence monitoring under approved CIMP.

Concurrent with the development of an IMP or CIMP, or within one year of the effective date of Order No. R4-2012-0175, each permittee must submit a non-storm water outfall-based screening and monitoring program plan that is re-assessed at least once during the term of the permit. Permittees must also continue to contribute monitoring resources to the SGRRMP and LARWMP (both of these programs fund 6 sites per year to contribute to the SMC).

Information on Order R4-2012-0175 presented in **Table K-17** is based on current information known about the program, including Mass Emission Station (MES) and Tributary Station monitoring locations in the Study Area are presented in **Figure K-12**. More detailed information on the program, including information on TMDL compliance monitoring is presented in **Attachment K-L**.

Table K-17 Los Angeles County MS4 Stormwater Quality Monitoring

Program Origin	2001 Permit – Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. 01-182, Monitoring and Reporting Program No. CI-6948, National Pollutant Discharge Elimination System (NPDES) No. CAS004001: http://63.199.216.6/larwqcb_new/permits/docs/6948_01-182_MRP.pdf 2012 Permit (replaced 2001 Permit) – LARWQCB Order No. R4-2012-0175: http://www.swrcb.ca.gov/losangeles/water_issues/programs/stormwater/municipal/index.shtml
Responsible Agency	• Los Angeles County Flood Control District, the County of Los Angeles, and 84 incorporated cities within the coastal watersheds of Los Angeles County, with the exception of the City of Long Beach
Number of Monitoring Points	Receiving water monitoring samples collected from: • Mass Emission Stations (MES): 4

<table>
<tr><td></td><td>

- Tributary Stations: 6/seasonal
- Total Maximum Daily Load (TMDL) Compliance Stations

Order R4-2012-0175:

Stormwater and non-stormwater outfalls to be proposed as part of an Integrated Monitoring Program (IMP) or Coordinated Integrated Monitoring Program (CIMP)

Stormwater outfall monitoring samples collected from:

- Stormwater outfalls
- TMDL monitoring locations

Non-stormwater outfall monitoring samples collected from:

- Non-stormwater outfalls
- TMDL monitoring locations

</td></tr>
<tr><td>Monitoring Locations</td><td>

- MES (see Figure K-12) along the Los Angeles River, San Gabriel River, Coyote Creek, and Dominguez Channel
- Tributary Stations: 6 (see Figure K-12)
- TMDL Compliance Stations (see Attachment K-L)
- Stormwater and non-stormwater outfalls

</td></tr>
<tr><td>Constituents and Frequency</td><td>

Order No. 01-182 In Effect Until an IMP or CIMP Is Approved by LARWQCB

<table>
<tr><th>Parameter[a]</th><th>Monitoring Frequency</th></tr>
<tr><td>Total Suspended Solids</td><td>All storms events ≥ 0.25 inches of rainfall</td></tr>
<tr><td>Total Suspended Solids</td><td rowspan="14">First Storm Event at MES every year
First Storm Event at Tributary Stations on rotating basis</td></tr>
<tr><td>Conventional Pollutants</td></tr>
<tr><td>Bacteria</td></tr>
<tr><td>Nitrogen</td></tr>
<tr><td>BOD_5 20°C</td></tr>
<tr><td>Other General Parameters</td></tr>
<tr><td>Total Dissolved Solids</td></tr>
<tr><td>Chloride</td></tr>
<tr><td>Semi Volatile Organic Compounds</td></tr>
<tr><td>Chlorinated Pesticides</td></tr>
<tr><td>Polychlorinated Biphenyls</td></tr>
<tr><td>Organophosphate Pesticides</td></tr>
<tr><td>Herbicides</td></tr>
<tr><td>Toxicity: *Ceriodaphnia dubia* (water flea) 7-day survival/reproduction and *Strongylocentrotus purpuratus* (sea urchin) fertilization</td><td>Wet Weather: the first storm event and a minimum of 2 additional storm events for each season
Dry Weather: a minimum of 2 dry weather samples per year</td></tr>
</table>

a. More detailed information on specific parameters is presented in Attachment K-L

Order No. R4-2012-0175 In Effect 30 or 90 Days After LARWQCB Approval of IMP or CIMP

</td></tr>
</table>

Parameter[a]	Receiving Water Monitoring Frequency
Flow	Wet weather[b] - at a minimum 3 times per year (except toxicity – 2 per year or per TMDL), including the first significant rain event (predicted ≥ 0.25 inches of rainfall); screening parameters during first year for significant rain event (if the result is above a water quality objective, monitoring continues for that parameter) Dry weather[c] - at a minimum 2 per year or per TMDL; toxicity 1 per year (low flow); screening parameters during first year for significant rain event (if the result is above a water quality objective, monitoring continues for that parameter)
Pollutants with TMDL Waste Load Allocations (WLA) or receiving water limits	
Other pollutants on the Clean Water Act (CWA) Section 303(d) List	
Total Suspended Solids (TSS) and Suspended-Sediment Concentration (SSC) if the receiving water on the CWA Section 303(d) List for sedimentation, siltation or turbidity (for dry weather TSS and hardness if metals are measured)	
Hardness	
pH	
Dissolved Oxygen	
Temperature	
Specific Conductivity	
Toxicity	
Screening Parameters: Nitrate, Chloride, Total Dissolved Solids	
Other Screening Parameters: Bacteria, General Constituents, Metals, Semi Volatile Organic Compounds, Chlorinated Pesticides, Polychlorinated Biphenyls, Organophosphate Pesticides, Herbicides	
Parameter[a]	**Stormwater Outfall Monitoring Frequency**
Flow	At a minimum during wet weather[b] – 3 times per year, including the first significant rain event (predicted ≥ 0.25 inches of rainfall);
Pollutants with a water quality based effluent limit derived from a TMDL WLA	
Other pollutants on the CWA Section 303(d) List	
TSS and SCS if the receiving water on the CWA Section 303(d) List for sedimentation, siltation or turbidity	
Dissolved Oxygen	
pH	
Temperature	
Specific Conductivity	
Pollutants identified in a Toxicity Identification Evaluation (TIE) conducted at the downstream receiving water monitoring station or where the TIE was inconclusive; if the discharge exhibits	

	aquatic toxicity, conduct a TIE	
	Screening Parameters: Nitrate, Chloride, Total Dissolved Solids (if found in the nearest receiving water station above a water quality objective)	
	Other Screening Parameters: Bacteria, General Constituents, Metals, Semi Volatile Organic Compounds, Chlorinated Pesticides, Polychlorinated Biphenyls, Organophosphate Pesticides, Herbicides (if found in the nearest receiving water station above a water quality objective)	
	Parameter	**Non-Stormwater Outfall Monitoring**
	Flow	
	Pollutants with a water quality based effluent limit derived from a TMDL WLA	Assessment and selection of outfalls proposed in the IMP or CIMP Outfalls subject to dry weather TMDLs, monitoring proposed in the IMP or CIMP or TMDL Outfalls not subject to dry weather TMDLs, during first year 4 times and then may be reduced to 2 times per year based on results
	Other pollutants on the CWA Section 303(d) List	
	Pollutants identified in a TIE conducted at the downstream receiving water monitoring station or where the TIE was inconclusive; if the discharge exhibits aquatic toxicity, conduct a TIE	
	Screening Parameters: Nitrate, Chloride, Total Dissolved Solids (if found in the nearest receiving water station above a water quality objective)	
	Other Screening Parameters: Bacteria, General Constituents, Metals, Semi Volatile Organic Compounds, Chlorinated Pesticides, Polychlorinated Biphenyls, Organophosphate Pesticides, Herbicides (if found in the nearest receiving water station above a water quality objective)	

a. More detailed information on specific parameters is presented in Attachment K-L
b. Flow > 20 percent of base flow, an alternative approved in IMP or CIMP, or defined in applicable TMDL
c. Flow < 20 percent of base flow, an alternative approved in IMP or CIMP, or defined in applicable TMDL

Other Media Monitored/ Monitoring Locations	• Shoreline water samples • Trash runoff • Regional freshwater monitoring • Discharges from drinking water supplier distribution systems >100,000 gallons • Discharges from lake dewatering • Special Studies • Best Management Practices effectiveness tracking
Reporting/ Databases	• Annual reports and data submitted to LARWQCB and posted on LARWQCB website: http://www.swrcb.ca.gov/losangeles/water_issues/programs/stormwater/municipal/los_angeles_ms4/lams4annualreport.shtml • Annual stormwater monitoring reports posted on Los Angeles County Department of Public Works (LACDPW) website: http://ladpw.org/wmd/NPDES/report_directory.cfm • Stormwater monitoring data posted on LACDPW website: http://ladpw.org/wmd/npdes/wq_data.cfm
Quality Assurance / Quality Control (QA/QC) Program	• Certified laboratories • Bottle labeling, chain-of-custody tracking, sampler equipment checkout and setup, sample collection, field blanks, field duplicate samples, transportation to the laboratory, field personnel training, laboratory analysis program that includes QA/QC protocols (LACDPW, 2012)
Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by LACDPW, LARWQCB, Council for Watershed Health, and Southern California Stormwater Monitoring Coalition

3.5.4 Montebello Forebay Groundwater Recharge Project

The quality of surface water entering (i.e., headworks samples) the San Gabriel River and Rio Hondo Spreading Grounds is monitored in accordance with the permit requirements for the MFGWR Project. Information on the MRP is presented in **Table K-18**; monitoring locations are presented in **Figure K-13**; and more detailed information on the program is presented in Attachment K-B.

Table K-18 MFGWR Project Surface Water/Intake Quality Monitoring

Program Origin	1991 Permit – Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. 91-100: http://63.199.216.6/larwqcb_new/permits/permit_display.php?order_no=91-100&ci_no=5728&program_id=4723 2009 Permit Amendment – Permit amended by LARWQCB Order No. R4-2009-0048: http://63.199.216.6/larwqcb_new/permits/permit_display.php?order_no=R4-2009-0048&program_id=4723&ci_no=5728

	2012 Permit Amendment – Monitoring and Reporting Program (MRP) amended by LARWQCB letter dated August 30, 2012: http://63.199.216.6/larwqcb_new/permits/docs/5728_91-100_MRP_amd.pdf 2013 Permit Amendment – LARWQCB letter dated June 4, 2013 approving an increase in the compliance averaging period for recycled water contribution: http://geotracker.waterboards.ca.gov/esi/uploads/geo_report/3643924772/WDR100001790.PDF 2014 Permit Amendment – Permit amended by LARWQCB Order No. R4-2009-0048-A-01, increasing the permitted maximum quantity of recycled water from 35% to 45% of total inflow in any 10-year period: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001790
Responsible Agency	Sampling conducted by Water Replenishment District of Southern California (WRD); reporting conducted by Sanitation Districts of Los Angeles County (SDLAC)
Number of Monitoring Points	2 - Surface water/intake sampling points
Monitoring Locations	Intakes (headworks) to the Rio Hondo and San Gabriel River Spreading Grounds (see Figure K-13)
Constituents and Frequency	See table below
Other Media Monitored/ Monitoring Locations	• Recycled water (see Section 3.1.1) • Groundwater monitoring wells (see Section 3.6.3.1) • Production wells (see Section 3.6.4)
Reporting/ Databases	• Monthly and annual reports submitted to LARWQCB and the State Water Resources Control Board (SWRCB) Division of Drinking Water (formerly California Department of Public Health)

Parameter [a]	**Monitoring Frequency**
Total Dissolved Solids	Quarterly
Chloride	Quarterly
Other Major Minerals	Quarterly
Nitrate	Quarterly
Other Nitrogen Compounds	Quarterly
Oxidants and Reductants	Quarterly
Base/Neutral Extractable Organics	Quarterly
Acid Extractable Organics	Quarterly
Pesticides	Quarterly
Purgeable Organics	Quarterly
Miscellaneous Organics	Quarterly
Physical Properties	Quarterly
Iron and Manganese	Quarterly
Trace Constituents	Quarterly
Radioactivity	Quarterly

a. A more comprehensive list of parameters is presented in Attachment K-B

	• Data and reports submitted to the SWRCB GeoTracker online database, including groundwater monitoring data in Electronic Data Format, well locational data (latitude and longitude), and monitoring reports in Adobe Acrobat™ format: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001790
Quality Assurance/ Quality Control (QA/QC) Program	• Certified laboratories • Commercial laboratories: must have a written comprehensive QA/QC program • Data are checked for completeness as part of the reporting process
Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by SDLAC, WRD, SWRCB Division of Drinking Water, and LARWQCB

3.5.5 SDLAC NPDES Permits

NPDES permits issued for the WRPs owned and operated by SDLAC include receiving water monitoring requirements as part of the permits. Information on the monitoring program is presented in **Table K-19**; monitoring locations are presented in Figures K-4 through K-9; and more detailed information on the program is presented in Attachment K-G.

Table K-19 SDLAC NPDES Receiving Water Quality Monitoring

Program Origin	Long Beach Water Reclamation Plant (WRP): Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. R4-2007-0047, National Pollutant Discharge Elimination System (NPDES) No. CA0054119 Waste Discharge Requirements for Discharge to Coyote Creek: http://63.199.216.6/larwqcb_new/permits/docs/5662_R4-2007-0047_WDR_PKG.pdf Los Coyotes WRP: LARWQCB Order No. R4-2007-0048, NPDES No. CA0054011 Waste Discharge Requirements for Discharge to San Gabriel River: http://63.199.216.6/larwqcb_new/permits/docs/5059_R4-2007-0048_WDR_PKG.pdf San Jose Creek WRP: LARWQCB Order No. R4-2009-0078, NPDES No. CA0053911 Waste Discharge Requirements for Discharge to San Gabriel River and San Jose Creek: http://63.199.216.6/larwqcb_new/permits/docs/5542_R4-2009-0078_WDR.pdf Whittier Narrows WRP: LARWQCB Order No. R4-2009-0077 NPDES No. CA0053716 Waste Discharge Requirements for Discharge to San Gabriel River, Rio Hondo, and Zone 1 Ditch: http://63.199.216.6/larwqcb_new/permits/docs/2848_R4-2009-0077_WDR_PKG.pdf Pomona WRP: LARWQCB Order No. R4-2009-0076 NPDES No. CA0053619 Waste Discharge Requirements for Discharge to South Fork San Jose Creek: http://63.199.216.6/larwqcb_new/permits/docs/0755_R4-2009-0076_WDR.pdf

Responsible Agency	Sanitation Districts of Los Angeles County (SDLAC)
Number of Monitoring Points	Surface water samples collected at receiving locations of discharges from the following SDLAC WRPs: • Long Beach WRP: 7 receiving locations • Los Coyotes WRP: 4 receiving locations • San Jose Creek WRP: 7 receiving locations • Whittier Narrows WRP: 9 receiving locations • Pomona WRP: 3 receiving locations
Monitoring Locations	Long Beach WRP: Receiving locations along Coyote Creek and San Gabriel River at RSW-001 through RSW-006 (see Figure K-5); RSW-002 only monitored for temperature, pH, ammonia (monthly), and toxicity (quarterly) Los Coyotes WRP: Receiving locations along San Gabriel River at RSW-001, RSW-002, RSW-002A, and RSW-003 (see Figure K-6); RSW-002A only monitored for temperature, pH, ammonia (monthly), and toxicity (quarterly) San Jose Creek WRP: Receiving locations along San Gabriel River and San Jose Creek at RSW-001, RSW-002, RSW-003, RSW-004, RSW-005, RSW-006, and RSW-007 (see Figure K-7) Whittier Narrows WRP: Receiving locations along San Gabriel River, Zone 1 Ditch, Test Basin, and Rio Hondo at RSW-001, RSW-002, RSW-002A, RSW-003, RSW-003A, RSW-004, RSW-005, RSW-005A, RSW-006 (see Figure K-8); RSW-002A, RSW-003A, and RSW-005A monitored for ammonia compliance Pomona WRP: Receiving locations along San Jose Creek at RSW-001D, RSW-002D, and RSW-003D (see Figure K-9)
Constituents and Frequency	(see table below)

Parameter[a]	Monitoring Frequency
Turbidity[b]	Monthly
pH	Monthly
Settleable solids[b]	Monthly
Suspended solids[b]	Monthly
Bacteria	Monthly
Temperature	Monthly
Biochemical Oxygen Demand (BOD_5 20°C)	Monthly
Chemical Oxygen Demand (COD)[c,f]	Monthly
Oil and grease	Monthly - Quarterly
Total Hardness	Monthly
Surfactants	Monthly - Quarterly
Total Dissolved Solids[g]	Monthly
Conductivity[c,d,f]	Monthly
Chloride[g]	Monthly
Sulfate[g]	Monthly
Boron[g]	Monthly
Nitrate	Monthly
Other Nitrogen Compounds	Monthly

<table>
<tr>
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<table>
<tr><td>Phosphorus and Orthophosphate</td><td>Monthly</td></tr>
<tr><td>Chronic Toxicity</td><td>Quarterly</td></tr>
<tr><td>Acute Toxicity</td><td>Semi-annually - Annually</td></tr>
<tr><td>Metals</td><td>Monthly - Quarterly - Semi-annually</td></tr>
<tr><td>Cyanide</td><td>Monthly - Quarterly</td></tr>
<tr><td>2,3,7,8-Tetrachlorodibenzo-p-dioxin</td><td>Semi-annually</td></tr>
<tr><td>Bis(2-ethylhexyl)phthalate</td><td>Monthly[f]</td></tr>
<tr><td>Individual and Total Trihalomethanes</td><td>Monthly - Semi-annually</td></tr>
<tr><td>Pesticides/Herbicides</td><td>Quarterly - Semi-annually</td></tr>
<tr><td>Perchlorate</td><td>Semi-annually - Annually</td></tr>
<tr><td>1,4-Dioxane</td><td>Semi-annually - Annually</td></tr>
<tr><td>1,2,3-Trichloropropane[c,e,f]</td><td>Semi-annually - Annually</td></tr>
<tr><td>Methyl tert-buryl ether</td><td>Semi-annually - Annually</td></tr>
<tr><td>Remaining Priority Pollutants</td><td>Semi-annually</td></tr>
</table>
a. The programs vary by WRP permit; a more comprehensive list of parameters for each WRP is presented in Attachment K-G
b. Not included in San Jose Creek WRP permit
c. San Jose Creek WRP permit only
d. Los Coyotes WRP permit only
e. Whittier Narrows WRP permit only
f. Pomona WRP permit only
g. Not included in Long Beach WRP permit
</td>
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<tr>
<td>Other Media Monitored/ Monitoring Locations</td>
<td>• Influent (i.e., wastewater) to the Long Beach WRP, Los Coyotes WRP, San Jose Creek WRP, Whittier Narrows WRP, and Pomona WRP
• Effluent (i.e., tertiary treated recycled water) from the Long Beach WRP, Los Coyotes WRP, San Jose Creek WRP, Whittier Narrows WRP, and Pomona WRP (see Section 3.2.1)
• Watershed monitoring (see Section 3.5)</td>
</tr>
<tr>
<td>Reporting/ Databases</td>
<td>• Monthly and annual reports submitted to LARWQCB
• Data and reports submitted to the State Water Resources Control Board California Integrated Water Quality System Project (CIWQS) online database, including water quality data and reports in Adobe Acrobat™ format:
http://ciwqs.waterboards.ca.gov/ciwqs/readOnly/PublicReportEsmrAtGlanceServlet?inCommand=reset</td>
</tr>
<tr>
<td>Quality Assurance / Quality Control (QA/QC) Program</td>
<td>• Certified laboratories
• SDLAC laboratories: blanks, laboratory control standards, duplicate samples, and fortified samples; calibration standards as required by the analytical methods; trip blanks for the analysis of volatile organic analytes; surrogate standards are added to every sample to monitor the overall performance of the procedure with recoveries compared to established acceptance limits; control limits have been established for both precision and accuracy of the laboratory analyses with specified corrective actions when data are outside the control limits
• Commercial laboratories: must have a written comprehensive QA/QC program
• Data are checked for completeness as part of the reporting process</td>
</tr>
</table>

Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by SDLAC and LARWQCB

3.5.6 LACDPW Surface Water Flow Monitoring Program

The LACDPW operates a number of stream gauge stations in and tributary to the Study Area. A map and list of the stations are provided in **Attachment K-M**. Stream gauge data are published by the LACDPW in their annual *Hydrologic Reports* (LACDPW, undated) and on their website (http://dpw.lacounty.gov/wrd/report/). The LACDPW uses these gauge stations to help quantify the volume of water actively recharge (i.e., conserved) in Los Angeles County. The LACDPW reports the volumes of surface water recharged in spreading grounds in their annual reports and on their website (http://ladpw.org/wrd/spreadingground/).

3.6 Groundwater Monitoring

Groundwater monitoring is performed for the following programs/projects in the Study Area:

- WRD Regional Groundwater Monitoring Program (RGWMP);
- LACDPW Seawater Intrusion Barriers Chloride Groundwater Monitoring Program;
- Groundwater Recharge Projects, per California Code of Regulations, Title 22, Division 4, Chapter 3, Water Recycling Criteria:
    - MFGWR Project,
    - AGB,
    - WCBB, and
    - DGB;
- California Code of Regulations, Title 22 Drinking Water Well Program;
- SWRCB Groundwater Ambient Monitoring and Assessment Program (GAMA);
- Environmental release sites (mandatory and voluntary programs under the purview of LARWQCB, DTSC, USEPA, and local regulatory agencies); and
- Regional Groundwater Level Monitoring Programs.

Information on each program is presented in the following sections. The three indicators of salts and nutrients (i.e., TDS, chloride, and nitrate) and associated parameters are highlighted in yellow in the following tables for each monitoring program.

3.6.1 WRD Regional Groundwater Monitoring Program

As mentioned in Section 2.2, WRD has been monitoring groundwater in the CBWCB for over 50 years. Through its RGWMP, WRD installs nested groundwater monitoring wells and conducts well sampling, groundwater level monitoring, groundwater modeling, and data evaluation to ensure the long-term viability of groundwater in the CBWCB. This information in turn provides WRD, the pumpers in the basins, other stakeholders, and the public with the knowledge necessary for responsible water resources planning and management. In order to obtain accurate data for specific aquifers from which to infer localized water level (and water quality conditions), depth-specific (nested) monitoring wells that tap discrete aquifer zones are evaluated as part of WRD's regional groundwater monitoring program. Currently, the RGWMP consists of a network of over 300 nested groundwater monitoring wells installed at over 55 locations throughout the CBWCB. Between 2013 and 2014, WRD plans on constructing up to 20 additional nested monitoring wells at three locations in the Study Area, as depicted in **Figure K-14**, to better manage regional groundwater.

Attachment K-N contains a table showing construction information for the WRD nested monitoring wells (over 300 wells) in the CBWCB. Figure K-14 shows the locations of the nested wells and the 13 key nested wells that are designated for assessment of regional groundwater quality and water level trends. The 13 key nested well locations, which consists of a total of 70 depth-specific monitoring wells, have been designated for S/N sampling and reporting as part of the SNMP Monitoring Program. As discussed in Section 2.2, these 70 nested wells are also referred to as the SNMP monitoring wells.

Each year, WRD publishes the annual RGWMR, which provides the results of WRD's current and ongoing regional groundwater monitoring program. The RGWMR provides water quality summary tables (including data for TDS, chloride, nitrate) for each of the nested wells, water quality maps for the nested wells and active drinking water wells, maps and hydrographs depicting groundwater level data, and TDS and chloride trend graphs (see Section 2.2). Water quality data regarding active drinking water wells are provided by the SWRCB Division of Drinking Water (formerly CDPH) through the California Code of Regulations, Title 22 monitoring program (see Section 3.6.4).

In addition to being the groundwater manager for the CBWCB, WRD is the designated groundwater monitoring entity for the CBWCB under the CASGEM program (see Section 3.6.7). As part of WRD's Groundwater Contamination Prevention Program, WRD also tracks the investigations of priority environmental release sites within the CBWCB and works with regulatory agencies to expedite cleanup of these contaminated sites (see Section 3.6.6).

Annually, WRD collects nearly 600 groundwater samples from its monitoring well network and analyzes them for over 100 constituents to produce nearly 60,000 individual data points to help track groundwater quality. Because each nested well is screened in a specific aquifer, constituents including S/Ns are accurately monitored and can be effectively managed. The RGWMP is summarized in **Table K-20** and presented in **Attachment K-N**. Details regarding the regional groundwater level monitoring programs in the CBWCB are discussed in Section 3.6.7.

Table K-20 WRD Regional Groundwater Monitoring Program

Program Origin	Water Replenishment District of Southern California's (WRD's) Regional Groundwater Monitoring Program Plan (see Attachment K-N)
Responsible Agency	WRD
Number of Monitoring Points	>300 nested groundwater monitoring wells at >55 locations throughout the Central Basin and West Coast Basin (CBWCB); of these wells, a total of 70 nested wells at 13 locations are designated as key wells to assess

<table>
<tr><td></td><td>salt/nutrient water quality of the CBWCB (see Section 2.2 for the SNMP Monitoring Program)</td></tr>
<tr><td>Monitoring Locations</td><td>Nested groundwater monitoring wells owned and sampled by WRD (see Figure K-14); each nested monitoring well is screened in a specific aquifer, unlike a drinking water production well which is typically screened in multiple aquifers</td></tr>
<tr><td>Constituents and Frequency

(see Section 3.6.4 for drinking water production wells)</td><td>
<table>
<tr><th>Parameter[a]</th><th>Monitoring Frequency</th></tr>
<tr><td>Apparent Color</td><td rowspan="20">Semi-annually</td></tr>
<tr><td>Odor</td></tr>
<tr><td>Specific Conductance</td></tr>
<tr><td>pH</td></tr>
<tr><td>Alkalinity</td></tr>
<tr><td>Bicarbonate</td></tr>
<tr><td>Carbonate</td></tr>
<tr><td>Nitrite</td></tr>
<tr><td>Nitrate</td></tr>
<tr><td>Total Organic Carbon</td></tr>
<tr><td>Hardness</td></tr>
<tr><td>Chloride[b]</td></tr>
<tr><td>Other Minerals</td></tr>
<tr><td>Total Dissolved Solids[b]</td></tr>
<tr><td>Fluoride</td></tr>
<tr><td>Other Inorganics</td></tr>
<tr><td>Volatile Organic Chemicals</td></tr>
<tr><td>Synthetic Organic Chemicals</td></tr>
<tr><td>Total Trihalomethanes</td></tr>
<tr><td>Perchlorate</td></tr>
</table>
a. A more comprehensive list of parameters is presented in Attachment K-N
b. Evaluations include trend graphs for 70 key nested wells in the CBWCB</td></tr>
<tr><td>Other Media Monitored/ Monitoring Locations</td><td>• Groundwater levels in the nested monitoring wells; see Section 3.6.7
• Assessment of California Code of Regulations, Title 22 monitoring data and groundwater levels for >400 production wells located throughout the CBWCB; see Section 3.6.4</td></tr>
<tr><td>Reporting / Databases</td><td>• Annual Regional Groundwater Monitoring Reports (provides water quality data tables, trend graphs for water levels and various constituents that include total dissolved solids and chloride, water quality concentration maps, and water elevation contour maps) sent to the CBWCB water purveyors and posted on the WRD website for downloading: http://www.wrd.org/engineering/groundwater-engineering-reports.php
• WRD's online Geographical Information System database provides groundwater quality data, well locations, well construction, and water levels for drinking water wells and the nested monitoring wells: http://gis.wrd.org/wrdmap/login.asp</td></tr>
</table>

	• At least annually, WRD will upload TDS, chloride, and nitrate data collected from the SNMP monitoring wells to the SWRCB online GeoTracker database (see Section 2.2): http://geotracker.waterboards.ca.gov/
Quality Assurance / Quality Control (QA/QC) Program	• Certified laboratories • Field blanks and blind duplicates; unusual analytical results are noted and compared to historical values/trends and if the result appears to be an outlier or anomaly, the result is flagged in the WRD database • Laboratory method blanks, control standards, matrix spike/matrix spike duplicates, and surrogate spikes • Eurofins Eaton Analytical, Inc. and other commercial laboratories: Comprehensive, written QA/QC program (see Attachment K-N)
Compliance Oversight	Data are currently reviewed for compliance and any necessary corrective actions by WRD, groundwater pumpers, and the State Water Resources Control Board (SWRCB), Division of Drinking Water (formerly California Department of Public Health)

3.6.2 LACDPW Seawater Intrusion Barriers Chloride Groundwater Quality Monitoring Program

The LACDPW monitors chloride concentrations in groundwater monitoring wells near the AGB, DGB, and WCBB as summarized in **Table K-21**. **Figure K-15** shows the locations of the wells monitored, as well as the barrier injection wells.

Table K-21 LACDPW Seawater Intrusion Barriers Chloride Groundwater Quality Monitoring

Program Origin	Los Angeles County Department of Public Works (LACDPW) and other groundwater stakeholders
Responsible Agency	Los Angeles County Department of Public Works (LACDPW)
Number of Monitoring Points	Groundwater sampling of these monitoring wells in the vicinity of: • Alamitos Gap Seawater Intrusion Barrier (AGB) – 194 wells • West Coast Basin Seawater Intrusion Barrier (WCBB) – 355 wells • Dominguez Gap Seawater Intrusion Barrier (DGB) – 243 wells
Monitoring Locations	Groundwater monitoring wells owned and sampled by LACDPW (see Figure K-15)
Constituents and Frequency	**Parameter**: Chloride — **Monitoring Frequency**: Annual - Semi-annual
Other Media Monitored/ Monitoring Locations	Groundwater levels in monitoring wells owned by Los Angeles County and located throughout the CBWCB; see Section 3.6.7
Reporting / Databases	• Annual Operation Reports for the AGB are posted on the LACDPW website for downloading: http://ladpw.org/wrd/barriers/

	• Data regarding the WCBB and DGB are available upon request from the Water Resources Division of LACDPW: http://dpw.lacounty.gov/contact/
Quality Assurance / Quality Control (QA/QC) Program	• Certified laboratories • Comprehensive, written QA/QC program
Compliance Oversight	Data are reviewed for barrier operation by LACDPW and groundwater stakeholders

3.6.3 Groundwater Recharge Monitoring

3.6.3.1 MFGWR Project Groundwater Quality Monitoring

Information on groundwater monitoring for the MFGWR Program is presented in **Table K-22**; the groundwater monitoring locations are presented in **Figure K-16**; and more details on the groundwater monitoring program are presented in **Attachment K-B**.

Table K-22 MFGWR Project Groundwater Quality Monitoring

Program Origin	1991 Permit – Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. 91-100 Water Recycling Requirements and Monitoring and Reporting Program: http://63.199.216.6/larwqcb_new/permits/docs/5728_91-100_WRR.pdf 2009 Permit Amendment – Permit amended by LARWQCB Order No. R4-2009-0048: http://63.199.216.6/larwqcb_new/permits/docs/5728_R4-2009-0048_WDR_amd.pdf 2012 Permit Amendment – Monitoring and Reporting Program amended by LARWQCB letter dated August 30, 2012: http://63.199.216.6/larwqcb_new/permits/docs/5728_91-100_MRP_amd.pdf 2013 Permit Amendment – LARWQCB letter dated June 4, 2013 approving an increase in the compliance averaging period for recycled water contribution: http://geotracker.waterboards.ca.gov/esi/uploads/geo_report/3643924772/WDR100001790.PDF 2014 Permit Amendment – Permit amended by LARWQCB Order No. R4-2009-0048-A-01, increasing the permitted maximum quantity of recycled water from 35% to 45% of total inflow in any 10-year period: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001790
Responsible Agency	Sampling conducted by the Water Replenishment District of Southern California (WRD); reporting conducted by the Sanitation Districts of Los Angeles County (SDLAC)
Number of Monitoring Points	Groundwater samples collected by WRD from: • 6 shallow monitoring wells (monitored bimonthly) and • 19 production wells (monitored semiannually)

Monitoring Locations	Shallow monitoring wells and production wells located in proximity to the Montebello Forebay Spreading Grounds (see Figure K-16)
Constituents and Frequency	<table><tr><th>Parameter</th><th>Monitoring Frequency[a]</th></tr><tr><td>Total Dissolved Solids</td><td>Bimonthly - Semi-annually</td></tr><tr><td>Chloride</td><td>Bimonthly - Semi-annually</td></tr><tr><td>Other Major Minerals</td><td>Bimonthly - Semi-annually</td></tr><tr><td>Nitrate</td><td>Bimonthly - Semi-annually</td></tr><tr><td>Other Nitrogen Compounds</td><td>Bimonthly - Semi-annually</td></tr><tr><td>Oxidants & Reductants</td><td>Bimonthly - Semi-annually</td></tr><tr><td>Base/Neutral Extractable Organics</td><td>Bimonthly - Semi-annually</td></tr><tr><td>Acid Extractable Organics</td><td>Bimonthly - Semi-annually</td></tr><tr><td>Pesticides</td><td>Bimonthly - Semi-annually</td></tr><tr><td>Purgeable Organics</td><td>Bimonthly - Semi-annually</td></tr><tr><td>Miscellaneous Organics</td><td>Bimonthly - Semi-annually</td></tr><tr><td>Physical Properties</td><td>Bimonthly - Semi-annually</td></tr><tr><td>Iron and Manganese</td><td>Bimonthly - Semi-annually</td></tr><tr><td>Trace Constituents</td><td>Bimonthly - Semi-annually</td></tr><tr><td>Radioactivity</td><td>Bimonthly - Semi-annually</td></tr></table>a. Shallow wells monitored bimonthly; production wells monitored semiannually
CEC Monitoring	CEC monitoring is currently not required by the permit; however, when the permit is amended in the future, it is expected to include CEC monitoring in accordance with the Recycled Water Policy and State regulations for groundwater replenishment using recycled water (also see CEC research in Section 4)
Other Media Monitored/ Monitoring Locations	• Recycled water (see Sections 3.1 and 3.2); • Surface water for the intake points to the Rio Hondo Spreading Grounds and San Gabriel River Spreading Grounds (see Section 3.5.4)
Reporting/ Databases	• Monthly and annual reports submitted to LARWQCB and the State Water Resources Control Board (SWRCB), Division of Drinking Water (formerly California Department of Public Health) • Data and reports submitted to the SWRCB GeoTracker online database, including groundwater monitoring data in Electronic Data Format, well locational data (latitude and longitude), and monitoring reports in Adobe Acrobat™ format: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100001790
Quality Assurance / Quality Control (QA/QC) Program	• Certified laboratories • Field blanks and blind duplicates; unusual analytical results are noted and compared to historical values/trends and if the result appears to be an outlier or anomaly, the result is flagged in the WRD database • Laboratory method blanks, control standards, matrix spike/matrix spike duplicates, and surrogate spikes • Eurofins Eaton Analytical, Inc. and other commercial laboratories: Comprehensive, written QA/QC program

Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by WRD, SDLAC, SWRCB Division of Drinking Water, and LARWQCB

3.6.3.2 Alamitos Gap Seawater Intrusion Barrier Groundwater Quality Monitoring

As discussed in Section 3.1.2, the AGB is operated by LACDPW and WRD's Vander Lans AWTF produces the AWT recycled water that is delivered to the AGB for injection. Information on groundwater monitoring associated with the AGB is presented in **Table K-23**; and more details on the groundwater monitoring program are presented in **Attachment K-C**. The AGB groundwater monitoring well locations are shown in **Figure K-17**. WRD currently is pursuing a permit amendment for the current expansion of the Vander Lans AWTF.

Table K-23 Alamitos Gap Seawater Intrusion Barrier Groundwater Quality Monitoring

Program Origin	2005 Permit – Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. R4-2005-0061: http://63.199.216.6/larwqcb_new/permits/permit_display.php?order_no=R4-2005-0061&ci_no=8956&program_id=152914 2006 Permit Amendment – Permit amended by State Water Resources Control Board (SWRCB) Water Quality Order No. 2006-0001: http://www.swrcb.ca.gov/board_decisions/adopted_orders/water_quality/2006/wqo/wqo2006_0001.pdf 2007 Permit Amendment – Monitoring and Reporting Program amended per the California Department of Public Health (CDPH) letter dated March 23, 2007
Responsible Agency	Water Replenishment District of Southern California (WRD)
Number of Monitoring Points	10 groundwater monitoring wells
Monitoring Locations	Groundwater monitoring wells located in proximity to the Alamitos Gap Seawater Intrusion Barrier (see Figure K-17)
Constituents and Frequency	(see below)

Parameter[a]	Monitoring Frequency
Total Coliform	Quarterly
Total Organic Carbon	Quarterly
Biochemical Oxygen Demand (BOD_5 20°C)	Semi-annually[b]
Oil and Grease	Quarterly
Total Nitrogen	Quarterly
Boron	Quarterly
Suspended Solids	Quarterly
Turbidity	Quarterly
Inorganics with Primary Maximum Contaminant Levels (MCLs)	Quarterly

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<tr><td>Total Dissolved Solids</td><td>Quarterly</td></tr>
<tr><td>Chloride</td><td>Quarterly</td></tr>
<tr><td>Other Parameters with Secondary MCLs</td><td>Quarterly</td></tr>
<tr><td>Fluoride</td><td>Quarterly</td></tr>
<tr><td>Radioactivity</td><td>Quarterly</td></tr>
<tr><td>Regulated Organic Chemicals</td><td>Quarterly</td></tr>
<tr><td>Disinfection Byproducts</td><td>Quarterly</td></tr>
<tr><td>General Physical</td><td>Quarterly</td></tr>
<tr><td>General Minerals</td><td>Quarterly</td></tr>
<tr><td>Chemicals of Concern to LARWQCB[b,c]</td><td>Semi-annually</td></tr>
<tr><td>N-Nitrosopyrrolidine</td><td>Semi-annually</td></tr>
<tr><td>Remaining Priority Pollutants</td><td>Annually - Semi-annually[3]</td></tr>
</table>
a. A more comprehensive list of parameters is presented in Attachment K-C
b. Changed from quarterly to semi-annually per CDPH March 23, 2007 letter
c. Changed from semi-annually to annually per CDPH March 23, 2007 letter, with the exception of Well 34'L-503M where bis(2-ethylhexyl)phthalate and phenanthrene are subject to semi-annual monitoring
</td>
</tr>
<tr>
<td>Other Media Monitored/ Monitoring Locations</td>
<td>
• Influent of WRD's Leo J. Vander Lans Advanced Water Treatment Facility (Vander Lans AWTF), i.e., tertiary-treated recycled water/effluent from Sanitation Districts of Los Angeles County's Long Beach Water Reclamation Plant (see Section 3.2.1)
• Blend of advanced treated recycled water (produced by WRD's Vander Lans AWTF) and treated imported water (supplied by the Metropolitan Water District of Southern California) prior to delivery to the Alamitos Gap Seawater Intrusion Barrier for injection (see Section 3.1.2)
• Advanced treated recycled water produced by WRD's Vander Lans AWTF (see Section 3.1.2)
• Reporting of California Code of Regulations, Title 22 monitoring data from the nearest drinking water well to the Alamitos Gap Seawater Intrusion Barrier (City of Seal Beach Well SB-LEI [State Well No. 05S/12W-OlA03]) (see Section 3.6.4)
</td>
</tr>
<tr>
<td>Reporting/ Databases</td>
<td>
• Quarterly and annual reports submitted to LARWQCB and the State Water Resources Control Board (SWRCB), Division of Drinking Water (formerly California Department of Public Health)
• Data and reports are submitted to the SWRCB GeoTracker online database, including groundwater quality data in Electronic Data Format, well locational data (latitude and longitude), and monitoring reports in Adobe Acrobat™ format:
http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100006793
</td>
</tr>
<tr>
<td>Quality Assurance / Quality Control (QA/QC) Program</td>
<td>
• Certified laboratories
• Field blanks and blind duplicates; unusual analytical results are noted and compared to historical values/trends and if the result appears to be an outlier or anomaly, the result is flagged in the WRD database
• Laboratory method blanks, control standards, matrix spike/matrix spike duplicates, and surrogate spikes
• Data are checked for completeness as part of the reporting process
</td>
</tr>
</table>

	• Eurofins Eaton Analytical, Inc. and other commercial laboratories: Comprehensive, written QA/QC program
Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by WRD, the SWRCB Division of Drinking Water, and LARWQCB

3.6.3.3 West Coast Basin Seawater Intrusion Barrier Groundwater Quality Monitoring

As discussed in Section 3.1.3, the WCBB is owned and operated by LACDPW and WBMWD's Edward C. Little WRF produces AWT recycled water that is delivered to the WCBB for injection. Information on groundwater monitoring associated with the WCBB Project is summarized in **Table K-24;** and more details on the groundwater monitoring program are presented in **Attachment K-D**. **Figure K-18** shows groundwater monitoring wells associated with the WCBB.

Table K-24 West Coast Basin Seawater Intrusion Barrier Groundwater Quality Monitoring

Program Origin	2006 Permit - Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. R4-2006-0009: http://63.199.216.6/larwqcb_new/permits/permit_display.php?order_no=R4-2006-0009&ci_no=7485&program_id=153002 2006 Permit Amendment – Permit amended by LARWQCB Order No. R4-2006-0069 http://63.199.216.6/larwqcb_new/permits/permit_display.php?order_no=R4-2006-0069&program_id=4729&ci_no=7485
Responsible Agency	West Basin Municipal Water District (WBMWD)
Number of Monitoring Points	9 groundwater monitoring wells
Monitoring Locations	Groundwater monitoring wells located in proximity to the West Coast Basin Seawater Intrusion Barrier; see Figure K-18
Constituents and Frequency	(see below)

Parameter[a]	Monitoring Frequency
Total Coliform	Quarterly
Total Organic Carbon	Quarterly
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$ 20°C)	Quarterly
Oil and Grease	Quarterly
Total Nitrogen	Quarterly
Boron	Quarterly
Suspended Solids	Quarterly
Turbidity	Quarterly
Inorganics with Primary Maximum Contaminant Levels	Quarterly
Total Dissolved Solids	Quarterly
Chloride	Quarterly
Radioactivity	Quarterly

<table>
<tr><td></td><td>
<table>
<tr><td>Regulated Organic Chemicals</td><td>Quarterly</td></tr>
<tr><td>Disinfection Byproducts</td><td>Quarterly</td></tr>
<tr><td>General Physical</td><td>Quarterly</td></tr>
<tr><td>General Minerals</td><td>Quarterly</td></tr>
<tr><td>Ethyl-tert-butyl ether</td><td>Semi-annually</td></tr>
<tr><td>Tert-amyl-methyl ether</td><td>Semi-annually</td></tr>
<tr><td>N-nitrosopyrrolidine</td><td>Semi-annually</td></tr>
<tr><td>Chemicals with Notification Levels (NLs) (except WB-1)</td><td>Semi-annually</td></tr>
<tr><td>Chemicals with NLs at WB-1</td><td>Monthly</td></tr>
<tr><td>Remaining Priority Pollutants</td><td>Semi-annually</td></tr>
</table>
a. More detailed information on specific parameters is presented in Attachment K-D</td></tr>
<tr><td>Other Media Monitored/ Monitoring Locations</td><td>
• Influent to WBMWD’s Edward C. Little Water Recycling Facility (i.e., secondary recycled water/effluent from the City of Los Angeles’ Hyperion Treatment Plant)
• Effluent (i.e., advanced treated recycled water) from WBMWD’s Edward C. Little Water Recycling Facility; see Section 3.1.3
• Blend of advanced treated recycled water (produced by Edward C. Little Water Recycling Facility) and treated imported water (supplied by the Metropolitan Water District of Southern California); see Section 3.1.3
• Reporting of California Code of Regulations, Title 22 monitoring data from the nearest drinking water well to the West Coast Basin Seawater Intrusion Barrier (Manhattan Beach Well No. 11a); see Section 3.6.4
• Groundwater monitoring wells in proximity to the West Coast Basin Seawater Intrusion Barrier that are not required by the permit</td></tr>
<tr><td>Reporting/ Databases</td><td>
• Quarterly and annual reports submitted to LARWQCB and the State Water Resources Control Board (SWRCB), Division of Drinking Water (formerly California Department of Public Health)
• Data and reports are submitted to the SWRCB GeoTracker online database, including groundwater quality data in Electronic Data Format, sampling points locational data (latitude and longitude), and monitoring reports in Adobe Acrobat™ format:
http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100000047</td></tr>
<tr><td>Quality Assurance / Quality Control (QA/QC) Program</td><td>
• Certified laboratories
• As part of the state/federal certification process, a lab must maintain a current QA/QC plan, current standards of practice for each analytical method, conduct method detection limit studies for each analytical method, and participate in performance evaluation blind check sample studies; in addition, the WBMWD laboratory has its own check sample program for its staff and for contract labs
• Trip blanks are only used for volatile organic compounds
• Eurofins Eaton Analytical, Inc. and other commercial laboratories: Comprehensive, written QA/QC program</td></tr>
<tr><td>Compliance Oversight</td><td>Data are reviewed for compliance and any necessary corrective actions by WBMWD, SWRCB Division of Drinking Water, and LARWQCB</td></tr>
</table>

3.6.3.4 Dominguez Gap Seawater Intrusion Barrier Groundwater Quality Monitoring

As discussed in Section 3.1.4, the DGB is owned and operated by the LACDPW and the City of Los Angeles' TIWRP produces AWT recycled water that is delivered to the DGB for injection. Information on groundwater monitoring in proximity to the DGB is summarized in **Table K-25**; and more details on the parameters monitored as part of the DGB Project are presented **Attachment K-E**. **Figure K-19** shows the locations of the permit compliance monitoring wells. Water quality monitoring locations and frequency has been revised in accordance with permit amendments (WRD, 2012b).

Table K-25 Dominguez Gap Seawater Intrusion Barrier Groundwater Quality Monitoring

Program Origin	2003 Permit – Los Angeles Regional Water Quality Control Board (LARWQCB) Order No. R4-2003-0134: http://www.waterboards.ca.gov/losangeles/board_decisions/adopted_orders/by_year.shtml 2007 Permit Amendment – Monitoring and Reporting Program amended per the California Department of Public Health (CDPH) letter dated June 25, 2007 and LARWQCB e-mail dated June 19, 2007 2010 Permit Amendment – Permit amended per LARWQCB Order R4-2010-0183: http://geotracker.waterboards.ca.gov/regulators/deliverable_documents/5496337711/8654_R4-2010-0183_AMD.pdf 2011 Permit Amendment – Permit amended per LARWQCB Order R4-2011-0034: http://geotracker.waterboards.ca.gov/regulators/deliverable_documents/2321897745/8654_R4-2011-0034_WDR_amd.pdf 2012 Permit Amendment – Monitoring and Reporting Program amended by LARWQCB letter dated July 20, 2012 http://geotracker.waterboards.ca.gov/regulators/deliverable_documents/4160459220/Dominguez%20Gap%20Barrier%20Project_Amend%20to%20MRP%2C%20CI%208654_2012-07-20.pdf
Responsible Agency	Groundwater monitoring and reporting conducted by the Water Replenishment District of Southern California (WRD); treatment plant (Terminal Island Water Reclamation Plant/Advanced Water Purification Facility [TIWRP]) monitoring and reporting conducted by City of Los Angeles
Number of Monitoring Points	Groundwater samples are collected by WRD from the following: • 3-month nested monitoring wells [a] – Total of 6 wells at three locations • ¼-distance nested monitoring wells [b] – Total of 10 wells at two locations a. Refers to monitoring wells located within 3 months travel time from the Dominguez Gap Barrier (DGB) b. Refers to monitoring wells located ¼ distance from the DGB
Monitoring Locations	The 3-month nested monitoring wells and the ¼-distance nested monitoring wells are located in proximity to the DGB (see Figure K-19)

<table>
<tr><td>Constituents and Frequency</td><td>
<table>
<tr><th>Parameter[a]</th><th>Monitoring Frequency</th></tr>
<tr><td>Chlorine Residual</td><td>Annual</td></tr>
<tr><td>Total Coliform</td><td>Quarterly</td></tr>
<tr><td>Total Organic Carbon</td><td>Quarterly</td></tr>
<tr><td>Biochemical Oxygen Demand (BOD_5 20°C)</td><td>Annual</td></tr>
<tr><td>Oil and Grease</td><td>Annual</td></tr>
<tr><td>Total Nitrogen</td><td>Quarterly</td></tr>
<tr><td>Boron</td><td>Annual</td></tr>
<tr><td>Suspended Solids</td><td>Annual</td></tr>
<tr><td>Turbidity</td><td>Quarterly</td></tr>
<tr><td>Inorganics</td><td>Quarterly-Annual [b]</td></tr>
<tr><td>Total Dissolved Solids</td><td>Quarterly</td></tr>
<tr><td>Chloride</td><td>Quarterly</td></tr>
<tr><td>Radioactivity</td><td>Annual</td></tr>
<tr><td>Regulated Organic Chemicals</td><td>Quarterly-Annual [b]</td></tr>
<tr><td>Disinfection Byproducts</td><td>Annual</td></tr>
<tr><td>General Physical</td><td>Quarterly-Annual [b]</td></tr>
<tr><td>General Minerals</td><td>Quarterly-Annual [b]</td></tr>
<tr><td>Ethyl-tert-butyl ether</td><td>Annual</td></tr>
<tr><td>Tert-amyl-methyl ether</td><td>Annual</td></tr>
<tr><td>Tert-butyl-alcohol</td><td>Annual</td></tr>
<tr><td>1,2,3-Trichloropropane</td><td>Annual</td></tr>
<tr><td>N-nitrosodimethylamine</td><td>Annual</td></tr>
<tr><td>1,4-Dioxane</td><td>Annual</td></tr>
<tr><td>Dichlorodifluoromethane</td><td>Annual</td></tr>
<tr><td>Chemicals with Notification Levels</td><td>Annual</td></tr>
<tr><td>Remaining Priority Pollutants</td><td>Annual</td></tr>
</table>
a. More detailed information on specific parameters is presented in Attachment K-E
b. Frequency variable depending on constituent
</td></tr>
<tr><td>Other Media Monitored/ Monitoring Locations</td><td>

Tertiary treated recycled water also produced by the City of Los Angeles’ TIWRP; see Section 3.2.3
Effluent (i.e., advanced treated recycled water) from the TIWRP; see Section 3.1.4
Blend of advanced treated recycled water that is produced by the TIWRP and imported water that is supplied by the Metropolitan Water District of Southern California; see Section 3.1.4
Reporting of California Code of Regulations, Title 22 monitoring data from the nearest drinking water well to the DGB (California Water Service Company Well 275-01); see Section 3.6.4

</td></tr>
<tr><td>Reporting/ Databases</td><td>

Quarterly and annual reports submitted to LARWQCB and the State Water Resources Control Board (SWRCB), Division of Drinking Water (formerly California Department of Public Health)

</td></tr>
</table>

	• Data and reports submitted to the SWRCB GeoTracker online database, including groundwater quality data in Electronic Data Format, well locational data (latitude and longitude), and monitoring reports in Adobe Acrobat™ format: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100000534
Quality Assurance / Quality Control (QA/QC) Program	• Certified laboratories • Utilize U.S. Environmental Protection Agency method acceptance criteria and laboratory internal controls for QC parameters, including preparation blanks, surrogates, spikes, duplicates and laboratory control samples • Laboratory data quality is quantitatively assessed through accuracy, precision, and respective method limitations • Qualitative assessment is conducted through comparability, representativeness, completeness, and sensitivity • Field QC includes field blanks, trip blanks for organics • Eurofins Eaton Analytical, Inc. and other commercial laboratories: Comprehensive, written QA/QC program
Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by the City of Los Angeles, the SWRCB Division of Drinking Water, and LARWQCB

3.6.4 California Code of Regulations, Title 22 Drinking Water Well Program

The City of Whittier, LADWP, Suburban Water Company, California Domestic Water Company, and San Gabriel Valley Water Company import groundwater that was extracted from the San Gabriel Basin and is used for water supply in the Study Area. This imported groundwater is specifically used for drinking water, industrial activities, and/or irrigation and is considered to be *de minimus* contributors to the salt/nutrient loading. Groundwater that will be utilized as drinking water is regulated under Title 22 of the California Code of Regulations.

The SWRCB Division of Drinking Water (formerly CDPH) regulates public drinking water systems in the State to ensure the delivery of safe drinking water to the public. A public drinking water system is defined as a system for the provision of water for human consumption through pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year. Private domestic wells are not regulated by the SWRCB Division of Drinking Water.

The SWRCB Division of Drinking Water enforces the monitoring requirements established in Title 22 of the California Code of Regulations for drinking water wells and all the data collected must be reported to the SWRCB Division of Drinking Water, as summarized in **Table K-26** below. Title 22 also designates the regulatory limits (e.g., MCLs) for various water contaminants, including volatile organic compounds, non-volatile synthetic organic compounds, inorganic chemicals, radionuclides, disinfection byproducts, general physical constituents, and other parameters.

Table K-26 California Code of Regulations, Title 22 Drinking Water Well Monitoring

Program Origin	Title 22 of the California Code of Regulations: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Lawbook.aspx
Responsible Agency	Drinking water well owners
Number of Monitoring Points	Groundwater samples from >400 production wells in the Central Basin and West Coast Basin (CBWCB)
Monitoring Locations	Active drinking water wells permitted by the State Water Resources Control Board (SWRCB), Division of Drinking Water (formerly California Department of Public Health) that are located throughout the CBWCB (see Figure K-20)
Constituents and Frequency	Drinking water wells are sampled for many parameters, including coliform bacteria/E-coli, volatile organic compounds, non-volatile synthetic organic compounds, inorganic chemicals, radionuclides, disinfection byproducts, and other general physical constituents The constituents monitored and the frequency of monitoring varies based on the well location, size of the water system, and history of water quality results These programs include the three indicators of salts and nutrients (total dissolved solids, chloride, and nitrate) designated in the Salt & Nutrient Management Plan Drinking water wells must be sampled in accordance with monitoring schedules (http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Monitoring.aspx) enforced by the SWRCB Division of Drinking Water
Other Media Monitored/ Monitoring Locations	Water samples are collected at various locations throughout the distribution system, including: • Service connections to other systems or imported water service connections • Designated sampling points along the distribution piping • Effluent of water storage tanks and blending tanks • Effluent of treatment plants
Reporting/ Databases	• Analytical results are submitted directly to the SWRCB Division of Drinking Water database as Electronic Database Files: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/EDT.aspx • Title 22 monitoring data can be downloaded from the SWRCB Division of Drinking Water website: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/EDTlibrary.aspx • Title 22 monitoring data is also uploaded into the Water Replenishment District of Southern California's (WRD's) online Geographical Information System database, which provides groundwater quality data, well locations, well construction, and water levels for drinking water wells and WRD's nested monitoring wells: http://gis.wrd.org/wrdmap/login.asp
Quality Assurance / Quality Control	• Certified laboratories and their established QA/QC programs • Utilize U.S Environmental Protection Agency method acceptance criteria and laboratory internal controls for QC parameters, including preparation blanks, surrogates, spikes, duplicates and laboratory control samples

(QA/QC) Program	
Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by groundwater pumpers and the SWRCB Division of Drinking Water

Figure K-20 depicts the drinking water wells with recent (last five years) water quality data in the SWRCB Division of Drinking Water database.

3.6.5 GAMA and USGS Groundwater Monitoring

In 2000, the SWRCB established the GAMA Program, California's comprehensive groundwater quality monitoring program (http://www.swrcb.ca.gov/water_issues/programs/gama/). The main goals of GAMA are to improve statewide groundwater monitoring, increase the availability of groundwater quality information to the public, and better understand and identify risks to groundwater resources. There are currently four components to the GAMA Program:

1. Priority Basin Project – To assess California's drinking water aquifers, the U.S. Geological Survey (USGS) collects groundwater samples from public supply wells throughout the State and analyzes the samples for regulated and unregulated chemicals, including emerging contaminants such as pharmaceuticals and personal care products, isotopes, and age-dating tracers. Monitoring and assessments are on a 10-year cycle, with trend monitoring more frequent. More details on this project can be found at: http://www.swrcb.ca.gov/water_issues/programs/gama/priority_basin_projects.shtml.
2. Domestic Well Project – Private wells in the State are sampled by volunteer well owners and samples are analyzed for nitrate, trace metals, volatile organic compounds, pesticides, and radionuclides.
3. Special Studies Project – With the Lawrence Livermore National Laboratory as the project lead, specific groundwater quality studies have been conducted using state of the art scientific techniques and methods that help researchers and public policy planners to better understand how groundwater contamination occurs and behaves. Studies have included sources of nitrate, wastewater mixing, groundwater recharge, trace detection of pharmaceutical compounds and personal care products, using low-level anthropogenic compounds as tracers, and isotopic composition as a contamination source tool.
4. GeoTracker GAMA – A publicly-accessible, on-line groundwater information system that integrates and displays water quality data on an interactive, searchable map (http://geotracker.waterboards.ca.gov/gama/). Its analytical tools and reporting features help users assess groundwater quality and identify potential groundwater issues. GeoTracker GAMA contains over 125 million data records from different sources such as cleanup sites, well logs, the SWRCB Division of Drinking Water (formerly CDPH) water quality data from public supply wells, water levels from the California Department of Water Resources, California Department of Pesticide Regulation, the GAMA Priority Basin Project, the GAMA Domestic Well Project, and the GAMA Special Studies Project.

As part of the GAMA Priority Basin Project (http://ca.water.usgs.gov/projects/gama/), the USGS collects and analyzes groundwater samples from public supply wells in the CBWCB for:

- Synthetic organic constituents – Includes volatile organic compounds, gasoline oxygenates and their degradates, pesticides, polar pesticides and pesticide degradates, pharmaceutical compounds, and potential wastewater indicators);
- Constituents of special interest – Includes perchlorate, n-nitrosodimethylamine, 1,4-dioxane, and 1,2,3-trichloropropane;
- Inorganic constituents that can occur naturally – Includes nutrients, major and minor ions, and trace elements;
- Radioactive constituents;
- Microbial indicators; and
- Naturally occurring isotopes and dissolved noble gases – Measured to help identify the sources and ages of the sampled groundwater (USGS, 2009).

Data collected by the USGS in the CBWCB as part of the GAMA Priority Basin Project were sent to well owners in July 2007; the Assessment Report was released in September 2012 (Goldwrath et al., 2012).

Quality assurance samples (blanks, replicates, and samples for matrix spikes) are collected by USGS at approximately one-fourth of the wells. In addition, the USGS has conducted other recent groundwater quality studies in the CBWCB to characterize groundwater quality and saline intrusion (USGS, 2003 and 2004).

3.6.6 Environmental Release Sites

In general, groundwater in the main producing aquifers of the CBWCB is of good quality. However, localized areas of marginal to poor quality water does exist, primarily at the basin margins where seawater intrusion occurred in the past and also in shallow groundwater near "environmental release sites." Environmental release sites are commercial and industrial properties where improper activities (e.g., leaking aboveground and underground storage tanks, leaking pipelines, spills, illegal discharges, etc.) have contaminated groundwater with localized plumes of petroleum fuels, solvents, and other hazardous substances. In general, these plumes are predominantly limited to shallow groundwater. However, as the aquifers and confining layers in the CBWCB are typically inter-fingered, the quality of groundwater in the deeper production aquifers is threatened by the migration of pollutants from the upper aquifers. This is particularly true in the forebay areas.

Thousands of environmental release sites in the CBWCB are actively investigated, monitored, and remediated under existing programs managed by the LARWQCB, DTSC, USEPA, and local regulatory agencies. In addition, voluntary monitoring and investigations are conducted at some contaminated sites. At many of these contaminated sites, groundwater monitoring wells have been installed and samples are collected on a regular basis and results are reported to the lead regulatory agency.

Figure K-21 shows all active and inactive environmental release sites in the Study Area including land disposal sites, military sites, cleanup program sites, and active or proposed Superfund sites. Active sites are properties currently being investigated or cleaned up under regulatory agency review or oversight. Inactive sites are cases that have been closed by the relevant regulatory agency. For Superfund sites and active land disposal sites indicated in Figure 21, call-out boxes show the name of the site and the main constituents of concern (COCs).

Chemicals commonly associated with the environmental release sites in the CBWCB are trichloroethylene (TCE), tetrachloroethylene (PCE), metals, perchlorate, and hexavalent chromium. While 1,4-dioxane is not identified as a COC at any contaminated sites listed in the SWRCB's GeoTracker database, widespread detections in groundwater in the Study Area indicate that 1,4-dioxane is likely associated with contaminated sites. **Figure K-22** shows active and inactive leaking underground storage tank (LUST) sites. The primary COCs associated with LUST sites are petroleum hydrocarbons and gasoline additives including benzene, toluene, ethylbenzene, xylenes, and methyl tertiary butyl ether (MTBE).

In an effort to minimize or eliminate threats to groundwater supplies, WRD established the Groundwater Contamination Prevention Program. As part of this program, WRD created and administers the CBWCB Groundwater Contamination Forum, a data-sharing and discussion forum with key stakeholders that include the USEPA, DTSC, LARWQCB, CDPH (now the SWRCB Division of Drinking Water), USGS, and various cities and drinking water purveyors. In 2005, these stakeholders drafted and signed a Memorandum of Understanding, agreeing to meet regularly and share data on groundwater contaminated sites within the CBWCB. As a key stakeholder, WRD has been tracking and working in close consultation with the regulatory agencies to provide data and technical support to expedite investigations and cleanups at priority groundwater contaminated sites within the CBWCB.

Priority environmental release sites in the CBWCB were selected by WRD, with input from the other members of the CBWCB Groundwater Contamination Forum, based on certain criteria such as hydrogeology, depth and concentration of the contaminants, fate and transport of the COCs, distance to nearby water supply wells, presence of contaminated drinking water wells in the site vicinity, proximity to recharge areas, and status of site characterization/remediation. The current list of WRD's priority groundwater contaminated sites are provided in Appendix G *Hydrogeologic Conceptual Model and Existing Salt and Nutrient Groundwater Quality* of the SNMP**.**

Recent reports and data collected for environmental release sites can be downloaded from the following publicly-accessible websites:

1. SWRCB GeoTracker database: http://geotracker.waterboards.ca.gov/
2. DTSC EnviroStor database: http://www.envirostor.dtsc.ca.gov/public/
3. USEPA Superfund Sites in Los Angeles County: http://cfpub.epa.gov/supercpad/cursites/srchrslt.cfm?start=1&CFID=119282638&CFTOKEN=86264905&jsessionid=3830a8482203d5c3ca4d5176316f4a365760

- Revised 1/27/2015

3.6.7 Regional Groundwater Level Monitoring

Groundwater levels in the CBWCB have been monitored and recorded since the early 1900s. WRD tracks groundwater levels continuously in their nested monitoring wells located throughout the CBWCB using automatic data-loggers and by manually measuring the depth to water in the wells quarterly. Water levels in production wells located throughout the CBWCB are also tracked by WRD.

On November 4, 2009, the State Legislature amended the Water Code with SBx7-6, which mandated a statewide groundwater elevation monitoring program to track seasonal and long-term trends in groundwater elevations in California's groundwater basins. In accordance with this amendment to the Water Code, DWR developed the California Statewide Groundwater Elevation Monitoring (CASGEM) program. In October 2011, WRD was assigned to be the Designated Monitoring Entity (DME) responsible for collecting and reporting CBWCB groundwater level data to CASGEM. DWR developed an online system for DMEs to submit groundwater elevation data, which is compatible with DWR's Water Data Library. Water level data collected by DWR is available to the public at the following website: http://www.water.ca.gov/waterdatalibrary/.

In order to capture the daily and seasonal variations in water levels, WRD installed automatic data-logging equipment in most of the nested monitoring wells to measure and record water levels four times per day. In addition, water levels are manually measured at least quarterly in all the nested monitoring wells. WRD also obtains water level data from cooperating entities such as the pumpers, DWR, and LACDPW, who collect water levels from their wells. These data are entered into WRD's Geographic Information System (GIS) water level database for archiving and analysis.

Water level measurements recorded during the water year, groundwater elevation contour maps based on Fall measurements, and groundwater level change maps based on the difference between that Fall and the previous Fall measurements are presented and discussed in each RGWMR (see Section 3.6.1). Long-term water level hydrographs and historical annual change in groundwater storage are presented in WRD's annual *Engineering Survey and Report*. These reports are available for download on the WRD website: http://www.wrd.org/engineering/groundwater-engineering-reports.php.

The LACDPW also monitors water levels in a network of wells in the Study Area and these data can be accessed on their website (http://dpw.lacounty.gov/general/wells/).

3.7 Climatological Monitoring

Precipitation has been continuously recorded in the region since the beginning of the twentieth century. LACDPW operates 244 rain gauges and 15 evapotranspiration stations in Los Angeles County. Maps and index lists of the stations are provided in **Attachment K-O**. Rainfall and evaporation data are published by the LACDPW in their annual Hydrologic Reports (http://dpw.lacounty.gov/wrd/report/).

Data relating to precipitation in the region is also available from the California Irrigation Management Information System (CIMIS). CIMIS, a division of the California Department of

Water Resources (DWR), tracks and records climate data in the State. In addition to precipitation, these weather stations collect data for sunlight, wind speed, humidity, and calculate evaporation rates. A map and information on the two stations located in the Study Area are provided in Attachment K-O. Data can be downloaded from the CIMIS website (http://wwwcimis.water.ca.gov/cimis/welcome.jsp).

Precipitation water quality data are available from the Clean Air Status and Trends Network (CASTNET) on the USEPA website (http://epa.gov/castnet/javaweb/index.html). CASTNET is a national air quality monitoring network designed to provide data to assess trends in air quality, atmospheric deposition, and ecological effects due to changes in air pollutant emissions. Precipitation water quality was collected from the CASNET Converse Station for estimation of the S/N loading associated with precipitation infiltration and dry deposition. A map showing the location of the Converse station is provided in Attachment K-O. Generally, precipitation has very low S/N concentrations. Dry deposition or atmospheric deposition is the process by which airborne pollutants are deposited to the earth. These pollutants include, but are not limited to, sulfur dioxide, nitrogen oxides, ammonia, and mercury and represent a source of S/N loading to groundwater.

4 Constituents of Emerging Concern (CECs)

CECs are a diverse group of relatively unregulated chemicals that have been shown to occur at trace levels in municipal wastewater discharges, ambient receiving waters, and drinking water supplies. CECs include pharmaceuticals, personal care products, and other commercial and industrial compounds. These chemicals are now detected as the result of more sensitive analytical methods. Information regarding their public health significance is evolving with the development of acceptable daily intake levels and drinking water equivalent levels.

In the Study Area, monitoring for CECs is being conducted for the groundwater recharge projects that utilize recycled water and for special studies as summarized in **Table K-27**. There are also ongoing leading edge research projects sponsored by entities such as the Water Research Foundation and the WateReuse Research Foundation and some of the SNMP stakeholders. Given the robustness of data for CECs, including the reliability of analytical methods, there is a sufficient level of CEC monitoring being performed in the Study Area, including annual monitoring at several groundwater recharge sites. This monitoring is supplemented by ongoing leading edge research efforts.

4.1 California Regulatory Requirements for CECs

In accordance with the SWRCB Recycled Water Policy, a Science Advisory Panel (Panel) was formed to identify a list of CECs for monitoring recycled water used for groundwater recharge and landscape irrigation. The Panel completed its report (Panel Report) on CECs in June 2010 (http://ftp.sccwrp.org/pub/download/DOCUMENTS/CECpanel/CECMonitoringInCARecycledWater_FinalReport.pdf) and recommended monitoring of selected health-based and treatment performance indicator CECs and surrogates for groundwater recharge projects. No CEC monitoring was recommended for landscape irrigation due to the low risk for ingestion of the water. The groundwater recharge monitoring recommendations were directed at surface spreading using tertiary treated recycled water (specifically for recycled water and groundwater monitoring) and injection projects using reverse osmosis and advanced oxidation (specifically for recycled water monitoring). The Panel did not address or make recommendations related to CEC monitoring for SNMPs.

The Recycled Water Policy was amended by the SWRCB on January 22, 2013 (http://www.swrcb.ca.gov/water_issues/programs/water_recycling_policy/draft_amendment_to_policy.shtml) and was approved by the Office of Administrative Law on April 25, 2013 (SWRCB, 2013). The Recycled Water Policy Amendment (http://www.swrcb.ca.gov/board_decisions/adopted_orders/resolutions/2013/rs2013_0003_a.pdf) provides the final list of specific CECs for monitoring (summarized in **Table K-28**) and monitoring frequencies to be incorporated into permits for planned groundwater recharge projects. The next update by an expert panel is scheduled to occur in 2015.

Regulations regarding groundwater replenishment (both surface and subsurface applications) using recycled municipal wastewater are specified in California Code of Regulations, Title 22, Division 4, Chapter 3, Articles 5.1 and 5.2. These regulations include a number of measures to ensure protection of groundwater quality, including CEC monitoring.

Table K-27 Summary of CEC Monitoring / Studies for the CBWCB

Project	**Media Monitored**	**Monitoring Locations**	**Constituents of Emerging Concern (CECs) Monitored**	**Frequency**	**Responsible Agency and Reporting/Database**
MONITORING PROGRAM					
Alamitos Gap Seawater Intrusion Barrier	Advanced treated recycled water	Plant product water from WRD's Leo J. Vander Lans Advanced Water Treatment Facility (Vander Lans AWTF)	• 17β estradiol • Caffeine • Triclosan • DEET • Sucralose • NDMA	Annually, with the exception of NDMA, which is monitored quarterly *CEC monitoring is conducted in accordance with the Recycled Water Policy and State regulations for groundwater replenishment using recycled water (California Code of Regulations (CCR), Title 22, Division 4, Chapter 3, Water Recycling Criteria)*	Water Replenishment District of Southern California (WRD) Quarterly and annual reports submitted to the Los Angeles Regional Water Quality Control Board (LARWQCB) and the State Water Resources Control Board (SWRCB) Division of Drinking Water (formerly California Department of Public Health [CDPH]) and posted on the SWRCB GeoTracker online database: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100006793

Project	Media Monitored	Monitoring Locations	Constituents of Emerging Concern (CECs) Monitored	Frequency	Responsible Agency and Reporting/Database
MONITORING PROGRAM					
Dominguez Gap Seawater Intrusion Barrier	Advanced treated recycled water	Plant product water from City of Los Angeles' Terminal Island Water Reclamation Plant/Advanced Waste Treatment Facilities	• EDCs • Pharmaceuticals and other Chemicals	Annually *In future permit amendments, modifications to CEC monitoring will be made in accordance with the Recycled Water Policy and State regulations for groundwater replenishment using recycled water (CCR, Title 22, Division 4, Chapter 3, Water Recycling Criteria)*	City of Los Angeles Quarterly and annual reports submitted to LARWQCB and the SWRCB Division of Drinking Water (formerly CDPH) and posted on the SWRCB GeoTracker online database: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100000534

Project	Media Monitored	Monitoring Locations	Constituents of Emerging Concern (CECs) Monitored	Frequency	Responsible Agency and Reporting/Database
MONITORING PROGRAM					
West Coast Basin Seawater Intrusion Barrier	Advanced treated recycled water	Plant product water from WBMWD's Edward C. Little Water Recycling Facility (ELWRF)	• EDCs • Pharmaceuticals and other Chemicals	Annually *In future permit amendments, modifications to CEC monitoring will be made in accordance with the Recycled Water Policy and State regulations for groundwater replenishment using recycled water (CCR, Title 22, Division 4, Chapter 3, Water Recycling Criteria)*	West Basin Municipal Water District (WBMWD) Quarterly and annual reports submitted to LARWQCB and the SWRCB Division of Drinking Water (formerly CDPH) and posted on the SWRCB GeoTracker online database: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100000047

Project	Media Monitored	Monitoring Locations	Constituents of Emerging Concern (CECs) Monitored	Frequency	Responsible Agency and Reporting/Database
MONITORING PROGRAM					
SDLAC's National Pollutant Discharge Elimination System Permits	Tertiary-treated recycled water	Effluent from SDLAC's: • Pomona Water Reclamation Plant (WRP) • Whittier Narrows WRP • San Jose Creek WRP (expected monitoring in the future) • Los Coyotes WRP (expected monitoring in the future) • Long Beach WRP (expected monitoring in the future)	• Endocrine Disrupting Chemicals (EDCs) • Pharmaceuticals and Personal Care Products (PPCPs) • Pesticides • Other CECs	Annually for 2 years	Sanitation Districts of Los Angeles County (SDLAC) Annual reports submitted to LARWQCB and posted on the SWRCB California Integrated Water Quality System (CIWQS) online database: http://ciwqs.waterboards.ca.gov/ciwqs/readOnly/PublicReportEsmrAtGlanceServlet?inCommand=reset

Project	Media Monitored	Monitoring Locations	Constituents of Emerging Concern (CECs) Monitored	Frequency	Responsible Agency and Reporting/Database
MONITORING PROGRAM					
Groundwater Ambient Monitoring and Assessment Program (GAMA)	Groundwater	Public supply wells located throughout the State, including those located within the CBWCB	• Pharmaceuticals • Potential wastewater indicator compounds	Once every 10 years	United States Geological Survey (USGS) and SWRCB Goldwrath et al., 2012 Report available from: http://www.swrcb.ca.gov/water_issues/programs/gama/docs/dsr_coastallabasin.pdf
SPECIAL STUDIES/RESEARCH PROJECTS					
1,4-Dioxane and 1,2,3-Trichloropropane (1,2,3-TCP) Occurrence Studies	Groundwater	WRD's nested groundwater monitoring wells, which are screened in specific aquifers	• 1,4-Dioxane • 1,2,3-TCP	1,4-Dioxane sampling conducted in nested wells located in the Montebello Forebay from 2002 through 2003 1,4-Dioxane and 1,2,3-TCP sampling conducted in all nested wells in 2012	WRD WRD's annual Regional Groundwater Monitoring Reports: http://www.wrd.org/engineering/groundwater-engineering-reports.php WRD's online GIS database: http://gis.wrd.org/wrdmap/login.asp

Project	Media Monitored	Monitoring Locations	Constituents of Emerging Concern (CECs) Monitored	Frequency	Responsible Agency and Reporting/Database
SPECIAL STUDIES/RESEARCH PROJECTS					
Expert Panel Advanced Treated Recycled Water Study	Advanced treated recycled water	Effluent from WBMWD's Edward C. Little Water Recycling Facility	• EDCs • PPCPs	Quarterly for one year beginning in August 2009; frequency lowered to once per year and monitoring is conducted as part of routine permit compliance program	WBMWD Quarterly and annual reports submitted to LARWQCB and the SWRCB Division of Drinking Water (formerly CDPH) and posted on the SWRCB GeoTracker online database: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=WDR100000047
Development Of Indicators and Surrogates for Chemical Contaminant Removal during Wastewater Treatment and Reclamation	• Tertiary recycled water • Groundwater	In Central Basin: • Spreading basin • Monitoring wells • Soil columns	• EDCs • PPCPs	N/A	WateReuse Research Foundation (WRF) Project No. 03-014 WRF Report No. 03-014-01 (Drewes et al., 2008): http://www.waterboards.ca.gov/water_issues/programs/grants_loans/water_recycling/research/03_014_01.pdf

Project	Media Monitored	Monitoring Locations	Constituents of Emerging Concern (CECs) Monitored	Frequency	Responsible Agency and Reporting/Database
SPECIAL STUDIES/RESEARCH PROJECTS					
Toxicological Relevance of Endocrine Disruptors and Pharmaceuticals in Drinking Water	Influent and effluent samples of water treatment plants	20 Drinking water treatment plants and 4 wastewater treatment plants across the continental U.S., including 195 plants located in States within the Pacific Time Zone	Developed acceptable daily intake (ADI) values and drinking water equivalent levels (DWEL) for: • Pharmaceuticals • EDCs • Steroid hormones • Phytoestrogens	N/A	Water Research Foundation Project No. 3085 and WRRF Project No. 04-003 Report (Snyder et al., 2008) available from WRRF: https://www.watereuse.org/files/images/2008-AwwaRF-3085.pdf
NDMA Fate and Transport Study	• Groundwater • Surface water • Tertiary treated recycled water	• Wells in the vicinity of the Montebello Forebay Spreading Grounds • Surface water in the vicinity of SDLAC's Pomona, Whittier Narrows, and San Jose Creek WRPs • Effluent (tertiary treated recycled water) from SDLAC's Pomona, Whittier Narrows, and San Jose Creek WRPs	NDMA (Also conducted modeling for key receptor wells, surface water, and groundwater)	N/A	SDLAC Montebello Forebay Attenuation and Dilution Studies Report (Kennedy/Jenks/Todd, 2008) available at: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/docs/cmnt081712/srcsd/kennedystudies.pdf

Project	Media Monitored	Monitoring Locations	Constituents of Emerging Concern (CECs) Monitored	Frequency	Responsible Agency and Reporting/Database
SPECIAL STUDIES/RESEARCH PROJECTS					
Contributions of Household Chemicals to Sewage and their Relevance to Municipal Wastewater Systems and the Environment	• Raw sewage • Secondary effluent from wastewater reclamation plant • Tertiary recycled water	Water reclamation plant (facility unnamed in the report) in the Central Basin including a pilot scale membrane bioreactor	• EDCs • PPCPs	N/A	WRRF Project No. 04-018 and Water Environment Research Foundation Report (Drewes et al., 2009) available from WRRF: http://www.watereuse.org/files/images/03-CTS-21UR.pdf
Monitoring Strategies for CECs in Recycled Water	Existing recycled water data	Survey sent to California stakeholders	• PPCPs • EDCs	N/A	Southern California Coastal Water Research Project (SCCWRP) and SWRCB Report (Anderson et al., 2010) available at: http://ftp.sccwrp.org/pub/download/DOCUMENTS/CECpanel/CECMonitoringInCARecycledWater_FinalReport.pdf

Project	Media Monitored	Monitoring Locations	Constituents of Emerging Concern (CECs) Monitored	Frequency	Responsible Agency and Reporting/Database
SPECIAL STUDIES/RESEARCH PROJECTS					
Development and Application of Tools to Assess and Understand the Relative Risks of Drugs and Other Chemicals in Indirect Potable Reuse	Existing monitoring data associated with the Montebello Forebay Groundwater Recharge Project	N/A	Developed tolerable daily intake (TDI) values and DWELs values for: • PPCPs • EDCs	N/A	WRRF Project No. 06-018 Report (Bruce et al., 2010) available from WRRF: http://www.watereuse.org/product/06-018
Sampling Report for Emerging Constituents in the Santa Ana Region	• Treated wastewater • Surface water • Untreated imported water	• Effluent of 22 wastewater treatment plants in the Santa Ana River Watershed • 2 locations along the Santa Ana River) • 1 location from the State Water Project • 1 location near the terminus of the Colorado River Aqueduct	• Pharmaceuticals • Food additives • Pesticides	Samples collected in 2010, 2011, and 2012	Santa Ana Watershed Project Authority (SAWPA) Report (SAWPA, 2012) available from: http://www.sawpa.org/wp-content/uploads/2012/05/EC-Report-for-2012-Final.pdf

Project	Media Monitored	Monitoring Locations	Constituents of Emerging Concern (CECs) Monitored	Frequency	Responsible Agency and Reporting/Database
SPECIAL STUDIES/RESEARCH PROJECTS					
1,4-Dioxane Occurrence and Fate Study	• Raw wastewater • Tertiary-treated recycled water	Influent and effluent of SDLAC's Pomona, Whittier Narrows, and San Jose Creek WRPs	1,4-Dioxane	Study conducted in 2011	SDLAC Data available upon request from SDLAC
Development of Surrogates to Determine the Efficacy of Soil Aquifer Treatment Systems for the Removal of Organic Chemicals	• Tertiary-treated recycled water • Groundwater	Montebello Forebay Spreading Grounds: • Spreading basins • Monitoring Wells in the proximity to the spreading basins	• EDCs • PPCPs	N/A	WRRF Project No. 05-004 Report (Drewes and Snyder, 2011) available from WRRF: http://www.watereuse.org/product/05-004-1
Monitoring Strategies for CECs in California's Aquatic Ecosystems	Existing data for: • Recycled water • Surface water • Stormwater	Review of literature, CEC recycled water data, and available data from the 2011 Los Angeles Regional Water Quality Control Board Surface Water CEC Study	• EDCs • PPCPs • Pesticides	N/A	Southern California Coastal Water Research Project (SCCWRP) Report (Anderson et al., 2012) available from SCCWRP: http://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/692_CECEcosystemsPanelReport_Final.pdf

Project	Media Monitored	Monitoring Locations	Constituents of Emerging Concern (CECs) Monitored	Frequency	Responsible Agency and Reporting/Database
SPECIAL STUDIES/RESEARCH PROJECTS					
Role of Retention Time in the Environmental Buffer of Indirect Potable Reuse Projects	• Tertiary-treated recycled water • Groundwater	Montebello Forebay Spreading Grounds: • Spreading basins • Monitoring Wells in the proximity to the spreading basins	• EDCs • PPCPs	N/A	WRRF Project No. 10-005 This study is In progress; a report is expected to be issued by WRRF in 2014/15
Occurrence and Fate of Chemicals of Emerging Concern in Coastal Urban Rivers Receiving Treated Municipal Wastewater	• Tertiary-treated recycled water • Surface water	• San Gabriel River • Los Angeles River	• EDCs • PPCPs • Pesticides • Other CECs	Study conducted in 2011	SCCWRP http://www.sccwrp.org Study is in progress; report will be issued by SCCWRP when available
CECs in Coastal Watersheds in the Los Angeles Region and in Sediment & Fish Tissue (Phase II)	• Surface water • Sediment • Fish Tissue	• Santa Clara River • San Gabriel River • Los Angeles River	• EDCs • PPCPs • Pesticides • Other CECs	Sampling expected to be conducted in 2013	SCCWRP http://www.sccwrp.org Study is in progress; report is expected to be issued by SCCWRP in 2014

Table K-28 SWRCB Recycled Water Policy CECs to be Monitored

Constituent[a]	Constituent Group	Relevance/Indicator Type	Reporting Limit (µg/L)
Groundwater Recharge and Reuse – Surface Application			
17β-estradiol	Steroid hormones	Health	0.001
Caffeine	Stimulant	Health & Performance	0.05
N-Nitrosodimethylamine (NDMA)	Disinfection byproduct	Health	0.002
Triclosan	Antimicrobial	Health	0.05
Gemfibrozil	Pharmaceutical	Performance	0.01
Iopromide	Pharmaceutical	Performance	0.05
N,N-Diethyl-meta-toluamide (DEET)	Personal care product	Performance	0.05
Sucralose	Food additive	Performance	0.1
Groundwater Recharge and Reuse – Subsurface Application			
17β-estradiol	Steroid hormones	Health	0.001
Caffeine	Stimulant	Health & Performance	0.05
NDMA	Disinfection byproduct	Health & Performance	0.002
Triclosan	Antimicrobial	Health	0.05
DEET	Personal care product	Performance	0.05
Sucralose	Food additive	Performance	0.1

µg/L – micrograms per liter

a. Monitoring frequency is quarterly for the initial assessment phase, semi-annually for the baseline phase, and semi-annually to annually for the standard operation phase; CECs can be removed or monitoring can increase based on the results

Regulations regarding groundwater replenishment (both surface and subsurface applications) using recycled water are specified in California Code of Regulations, Title 22, Division 4, Chapter 3, Articles 5.1 and 5.2. These regulations establish monitoring requirements for indicator compounds that will be selected by the project sponsor based on several factors, including the indicator compound's ability to characterize the presence of CECs. Project sponsors must conduct studies at initial operation of the groundwater recharge project and at 5-year intervals thereafter to determine the occurrence of indicator compounds in the recycled water. The protocol for the occurrence study, the study's results, and the indicator compounds to be monitored shall be reviewed and approved by the SWRCB Division of Drinking Water (formerly CDPH).

The LARWQCB has taken actions to begin to address CECs and has begun to include requirements for CEC Special Studies in NPDES permits for Publicly Owned Treatment Works in the region. The development of a CEC monitoring strategy for the Los Angeles region was identified as a priority project during the project selection phase of the 2011-13 Basin Plan triennial review.

In January 2013, the LARWQCB sent letters to NPDES dischargers in the Los Angeles Region discharging to fresh surface water with requirements to conduct CEC special studies, including SDLAC's Pomona and Whittier Narrows WRPs, which amended existing CEC requirements. Effective immediately, the CECs required to be analyzed in NPDES-permit required special studies are to be replaced by the CECs in **Table K-29** and monitored annually for at least two years, with results to be included in annual reports. Unless required by another condition of the permit, data collection is not required for constituents for which at least two years of data have already been collected.

Table K-29 January 2013 Los Angeles Regional Water Quality Control Board NPDES Special Study CEC Effluent Monitoring

Constituents – Monitoring 1/year for 2 Years	
17-Alpha Ethinylestradiol	Lipitor
17-Beta Estradiol	Iopromide
Estrone	Sulfamethoxazole
Bisphenol A	Trimethoprim
Nonylphenol	Salicylic acid
Nonylphenol Polyethoxylates	Tris (2-chloroethyl) phosphate (TCEP)
Octylphenol	Tris (1-chloro-2-propyl) phosphate (TCPP)
Octylphenol Polyethoxylates	Tris (2-chloroethyl) phosphate (TDCP)
Polybrominated Diphneyl Ethers	Triclosan
Acetaminophen	Bifenthrin
Amoxicillin	Permethrin
Azithromycin	Chlorpyrifos
Carbamazepine	Galaxolide
Caffeine	Diclofenac
Ciproflaxin	Butyl benzyl phthalate
N,N-Diethyl-m-toluamide (DEET)	Perfluorooctane Sulfonate (PFOS)
Dilantin	Fipronil
Gemfibrozil	Meprobamate
Ibuprofen	

CEC monitoring requirements have been included in existing permits issued for the injection of AWT recycled water at the AGB, DGB, and WCBB (see Section 3.1), as summarized in Table K-27. The list of CECs is based on former (pre-2008) draft groundwater recharge regulations that had been issued by the California Department of Public Health (designated as the Endnote 5 compounds) and consists of the following:

- Hormones: ethinyl estradiol, 17-B estradiol, estrone.
- "Industrial" endocrine disruptors: bisphenol A, nonylphenol and nonylphenol polyethoxylate, octylphenol and octylphenol polyethoxylate, polybrominated diphenyl ethers.

- Pharmaceuticals and others substances: acetaminophen, amoxicillin, azithromycin, caffeine, carbamazepine, ciprofloxacin, ethylenediamine tetra-acetic acid, gemfibrozil, ibuprofen, iodinated contrast media, lipitor, methadone, morphine, salicylic acid, and triclosan.

As discussed in Section 3.6.5 of this Plan, the USGS (2009) has conducted some groundwater monitoring for CECs in the CBWCB under the GAMA Program.

In addition, the Southern California Coastal Water Research Project (SCCWRP, 2012) with the David and Lucile Packard Foundation sponsored an expert panel that prepared a report (Monitoring Strategies for Chemicals of Emerging Concern (CECs) in California's Aquatic Ecosystems: Recommendations of a Science Advisory Panel, http://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/692_CECEcosystemsPanelReport_Final.pdf) that provides the State with recommendations on appropriate monitoring and management strategies for CECs to limit the impact on oceans, estuaries and coastal wetlands, and freshwater ecosystems. The recommendations were presented to the SWRCB in October 2012. Based on these recommendations and input from stakeholders, the SWRCB is preparing a staff report that will be presented to their Board to seek input and direction on CEC monitoring for NPDES permits, including discharges to inland surface waters.

4.2 CEC Special Studies

Stakeholders in the Study Area have conducted or are currently affiliated with a number of studies that are investigating CECs. Examples include:

- In September 2007, SDLAC began analyzing for CECs in the effluent of their wastewater treatment plants, including the Long Beach WRP, Los Coyotes WRP, Pomona WRP, Whittier Narrows WRP, and San Jose Creek WRP. SDLAC prepared a report (provided as **Attachment K-P**) that discusses the program for WRP effluent samples collected from September 2007 to July 2012. SDLAC's report also includes results for N-nitrosodimethylamine (NDMA), butyl benzyl phthalate, bis(2-ethylhexyl)phthalate, and chlorpyrifos. Although these constituents are not typically classified as CECs, they were treated as CECs by the Recycled Water Policy Science Advisory Panel's investigation of CECs and thus included in this evaluation. The list of CECs and number of data points for each constituent for WRPs in the Study Area is presented in **Table K-30**. Other than NDMA, none of the detected CECs exceeded monitoring triggers for human-health related effects established by the SWRCB Recycled Water Policy Panel.

Table K-30 Number of Data Points – SDLAC WRP Effluent CEC Monitoring

Constituent	SDLAC WRPs[a] – Number of Data Points					
	LB	LC	POM	SJCE	SJCW	WN
1,2,3-Trichloropropane	12	11	12	11	11	7
17-Alpha Ethinylestradiol	30	5	34	39	39	31
17-Beta Estradiol	30	5	34	39	39	31

Constituent	SDLAC WRPs[a] – Number of Data Points					
	LB	LC	POM	SJCE	SJCW	WN
4-Nonylphenol (tech mix)	28	5	32	37	37	29
4-tert Octylphenol	28	5	32	37	37	29
Acetaminophen	22	5	10	9	9	9
Amoxicillin	2	2	4	4	4	4
Androstenedione	1	1	0	0	1	0
Atenolol	2	2	2	3	3	2
Atorvastatin	22	5	25	28	28	22
Azithromycin	22	5	25	28	28	22
Bifenthrin	0	0	0	0	0	0
Bisphenol A	22	5	25	28	28	22
Bis(2-ethylhexyl)phthalate	14	22	66	35	33	34
Butyl benzyl phthalate	12	13	12	12	11	12
Caffeine	5	5	6	7	7	6
Carbamazepine	22	5	25	28	28	22
Chlorpyrifos	0	0	7	1	1	0
Ciproflaxin	2	2	4	4	4	4
DEET[2]	5	5	6	7	7	6
Diclofenac	22	5	23	26	26	20
Dilantin (Phenytoin)	5	5	6	7	7	6
Erythromycin-H2O	19	2	21	23	23	17
Estriol	1	1	0	0	1	0
Estrone	30	5	34	39	39	31
Fluoxetine	22	5	23	26	26	20
Furosemide	19	2	21	24	24	18
Gemfibrozil	22	5	25	28	28	22
Hydrazine	2	2	2	2	2	2
Ibuprofen	22	5	25	28	28	22
Iohexol	4	4	6	7	7	6
Iopromide	22	5	25	28	28	22
Ketoprofen	2	2	2	3	3	2
Meprobamate	3	3	4	4	4	4
Metoprolol	2	2	2	3	3	2
Naproxen	19	2	21	24	24	18
N-Nitrosodimethylamine	81	3	66	67	69	67
N-Nitrosopyrrolidine	3	3	2	2	2	2
Nonylphenol diethoxylate	3	3	4	4	4	4
Nonylphenol monoethoxylate	3	3	4	4	4	4
Octylphenol diethoxylate	3	3	4	4	4	4
Octylphenol monoethoxylate	3	3	4	4	4	4
o-OH Atorvastatin	2	2	2	3	3	2
p-OH Atorvastatin	2	2	2	3	3	2
PBDE[2]-28	2	2	4	4	4	4
PBDE-47	2	2	4	4	4	4
PBDE-99	2	2	4	4	4	4

Constituent	SDLAC WRPs[a] – Number of Data Points					
	LB	LC	POM	SJCE	SJCW	WN
PBDE-100	2	2	4	4	4	4
PBDE-153	2	2	4	4	4	4
PDBE-154	2	2	4	4	4	4
PBDE-183	2	2	4	4	4	4
PBDE-209	2	2	4	4	4	4
Permethrin	0	0	0	3	0	0
Primidone	19	2	21	24	24	18
Progesterone	29	4	32	37	37	29
Propanolol	5	5	4	5	5	4
Quinoline	2	2	2	2	2	2
Salicylic acid	2	2	4	4	4	4
Sucralose	3	3	2	2	2	2
Sulfamethoxazole	22	5	25	28	28	22
TCEP[b]	5	5	6	7	7	6
Testosterone	1	1	0	0	1	0
Triclocarban	5	5	4	5	5	4
Triclosan	22	5	25	28	28	22
Trimethoprim	21	4	25	28	28	22

a. Sanitation District of Los Angeles County's (SDLAC's) Water Reclamation Plants (WRPs): Long Beach (LB); Los Coyotes (LC); Pomona (POM); San Jose Creek East (SJCE); San Jose Creek West (SJCW); and Whittier Narrows (WN)

b. N,N-Diethyl-meta-toluamide (DEET), Polybrominated diphenyl ethers (PBDE), Tris (2-chloroethyl) phosphate (TCEP)

- SDLAC study of NDMA fate and transport at the Montebello Forebay (Kennedy/Jenks/Todd, 2008). The study was designed to assess the transport and fate of NDMA between groundwater and SDLAC's Pomona WRP, San Jose Creek WRP, and Whittier Narrows WRP. NDMA is both formed and degraded in the wastewater treatment process, and levels in the effluent can vary substantially with different treatment processes. The study found that NDMA is attenuated in both surface water systems due to UV from exposure to sunlight and groundwater systems due to biodegradation through soil aquifer treatment. The study concluded that NDMA in recycled water recharged at the MFSG does not impact nearby water supply wells.
- In May, June, and July 2011, the SDLAC monitored effluent samples at the San Jose Creek WRP, Pomona WRP, and Whittier Narrows WRP as part of a three-month study to investigate the occurrence of 1,4-dioxane in the influent and its fate through the WRP treatment processes. There appears to be a consistent low level of 1,4-dioxane in all WRP effluent.
- Between 2002 and 2003, WRD conducted a groundwater investigation in the Montebello Forebay and results showed that 1,4-dioxane was not detected in any of its routinely monitored nested groundwater monitoring wells.

- In 2012, WRD analyzed samples from all their nested groundwater monitoring wells for 1,4-dioxane and 1,2,3-TCP. In the Central Basin, 1,4-dioxane was detected in 12 out of 30 nested monitoring well locations between 1 and 10 µg/L; most detections are in and around the Montebello Forebay. 1,2,3-TCP was detected in shallow zones at two nested monitoring locations in the Central Basin. In the West Coast Basin, 1,4-dioxane was detected at one nested monitoring location in the shallowest zone and no 1,2,3-TCP was detected.
- Drinking water systems are not required by State regulations to monitor for 1,4-dioxane. Nevertheless, because of concerns about possible contamination, a number of systems were directed by CDPH (now the SWRCB Division of Drinking Water) or voluntarily sampled their supplies for 1,4-dioxane. Based on samples collected between 2000 and 2011, 1,4-dioxane was detected in some drinking water wells located within the CBWCB. A summary of the 1,4-dioxane data is reported on the following website: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/1,4-Dioxane.aspx.
- In August 2009, WBMWD commenced a CEC study of its AWT recycled water based on recommendations from an expert panel that was convened by WBMWD to support increasing the percentage of recycled water injected at the WCBB to 100 percent. The study consists of quarterly monitoring for one year for atrazine, boron, carbamazepine, DEET, 1,4-dioxane, estrone, gemfibrozil, iopromide, meprobamate, dilantin, sulfamethoxazone, and TECP. The data were provided to CDPH (now the SWRCB Division of Drinking Water) and the LARWQCB. The monitoring frequency was subsequently lowered to once per year and included in LARWQCB reports.
- During 2010 through 2011, samples were collected from 23 different wastewater treatment plants operating in the Santa Ana region, from two locations along the Santa Ana River (MWD crossing and Prado Dam), one location in the State Water Project (Devil Canyon), and one location near the terminus of the Colorado River Aqueduct (San Jacinto West Portal) (Risk Sciences, 2011). The State Project Water and Colorado River water samples were representative of imported water used in the SNMP Study Area. Samples were analyzed for 11 analytes in 2010, 13 analytes in 2011, and 15 analytes in 2012 including pharmaceuticals, food additives, and pesticides. The report is available at: http://www.sawpa.org/wp-content/uploads/2012/05/EC-Report-for-2012-Final.pdf.
- There have been multiple WateReuse Research Foundation (WRRF), Water Environment Research Foundation, and Water Research Foundation studies related to CEC indicators and surrogates, treatment, analytical methods, and health effects. Many are specific to the existing groundwater recharge projects in the Study Area including the following studies.
    - WateReuse Research Foundation (WRF) Project No. 03-014 – Drewes et al. (2008) evaluated CEC surrogates and indicators for an unnamed facility in Central Basin to evaluate soil aquifer treatment performance looking at tertiary recycled water and groundwater. CEC were grouped into removal categories (good > 90 percent), intermediate (25 to 90 percent), and poor (< 25 percent). Only two CEC were in the poor removal category (carbamazepine and

primidone). The report is available at: http://www.waterboards.ca.gov/water_issues/programs/grants_loans/water_recycling/research/03_014_01.pdf.

- Water Research Foundation Project No. 3085 and WRRF Project No. 04-003 – Synder et al. (2008) addressed the fundamental issue of potential human health impacts from the trace concentrations of endocrine disrupting chemicals (EDCs) and pharmaceuticals and personal care products (PPCPs) detected in drinking waters from across the United States by combining toxicological literature reviews and analytical monitoring results. The study developed drinking water equivalent levels (DWELs) for 16 PPCPs and 13 EDCs and risk metrics that can be used to evaluate concentrations of CECs in recycled water and drinking water. The report is available at: https://www.watereuse.org/files/images/2008-AwwaRF-3085.pdf.
- WRRF Project No. 04-018 and Water Environment Research Foundation Study – Drewes et al. (2009) evaluated CECs for a water reclamation plant (unnamed in report) located in the Central Basin and looked at removal during biological treatment. For most of the compounds evaluated, secondary treatment achieved 80 percent removals of the CECs studied. The report is available at: http://www.watereuse.org/files/images/03-CTS-21UR.pdf.
- WRRF Project No. 06-018 – Bruce et al. (2010) continued the work of Snyder et al. (2008) by developing tolerable daily intake (TDI) values and DWELs for 43 CECs, including pharmaceuticals and EDCs. The study also developed risk metrics that can be used to evaluate concentrations of CECs in recycled water and drinking water. The report is available at: http://www.watereuse.org/product/06-018.
- WRRF Project No. 05-004 – Drewes and Snyder (2011) evaluated the removal of ECDs and PPCPs in the Montebello Forebay Spreading Grounds by evaluating tertiary recycled water in the spreading basins and the San Gabriel River Spreading Grounds test basin and observing concentrations in adjacent monitoring wells. Of the compounds studies, most were well removed with the exception of some CECs, including carbamazepine, primidone, DEET, and flame retardants. It is noteworthy, based on other research, to point out that the concentration of recalcitrant compounds found in the recycled water and groundwater are in nanograms per liter (ng/L) levels compared to corresponding DWELs that are at microgram per liter (ug/L) levels. The report is available at: http://www.watereuse.org/product/05-004-1.
- WRRF Project No. 10-005 – Jörg E. Drewes is the principal investigator for a project that is evaluating CEC removal at the San Gabriel River Spreading Grounds test basin and adjacent monitoring wells. The CECs include PPCPs and EDCs. The report for the research is expected to be issued in 2014/15.

5 Conclusion

In accordance with the Recycled Water Policy, this *Monitoring Plan* for the CBWCB SNMP was developed through a collaborative process involving major CBWCB stakeholders, including the WRD, LACDPW, WBMWD, LADWP, SDLAC, and MWD. For over 50 years, these agencies as well as other local agencies and numerous cities have been collaborating and implementing critical measures, such as water reclamation and reuse, water conservation, improved maintenance of supply and delivery infrastructure, and the capture and use of stormwater, to prevent overdraft and replenish the CBWCB aquifer system.

This SNMP Monitoring Program that was developed to assess TDS, chloride, and nitrate, which were determined in the SNMP to be the indicator compounds for S/Ns in the CBWCB. Seventy (70) WRD nested groundwater monitoring wells (referred to as the SNMP monitoring wells) at 13 locations throughout the CBWCB have been designated for S/N sampling and reporting as part of the SNMP Monitoring Program. WRD shall be responsible for collecting TDS, chloride, and nitrate data from the SNMP monitoring wells on a semi-annual basis and submitting this data to SWRCB's online GeoTracker database.

Other existing monitoring programs in the CBWCB, as well as special studies that have been conducted or are in progress were documented in this report. As documented, the existing monitoring programs provide a comprehensive and continuing assessment of the overall health of the basins and allow for proper management of S/N loading on a sustainable basis. The extensive amount of historical data collected in the CBWCB has allowed a regional characterization of S/N groundwater quality, development of water quality trends, and projection of future groundwater quality to be included in the SNMP, thereby demonstrating the adequacy of the existing monitoring programs. Thus, the CBWCB are highly managed and rigorously monitored groundwater basins and no additional monitoring programs were found to be warranted at this time.

Monitoring for CECs in the Study Area is being conducted for the groundwater recharge projects that utilize recycled water, wastewater treatment plants that discharge to surface water, and for special studies. There are also ongoing leading edge research efforts to further develop analytical methods and understand the health implications of low level detections. As such, no additional CEC monitoring was found to be warranted in the CBWCB and thus, not proposed as part of the SNMP Monitoring Program.

Based on results from the SNMP Monitoring Program, the SNMP *Monitoring Plan* will be updated as necessary. Additionally, the SNMP *Monitoring Plan* will be reviewed and updated as necessary as part of the SNMP review every 10 years.

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Figures

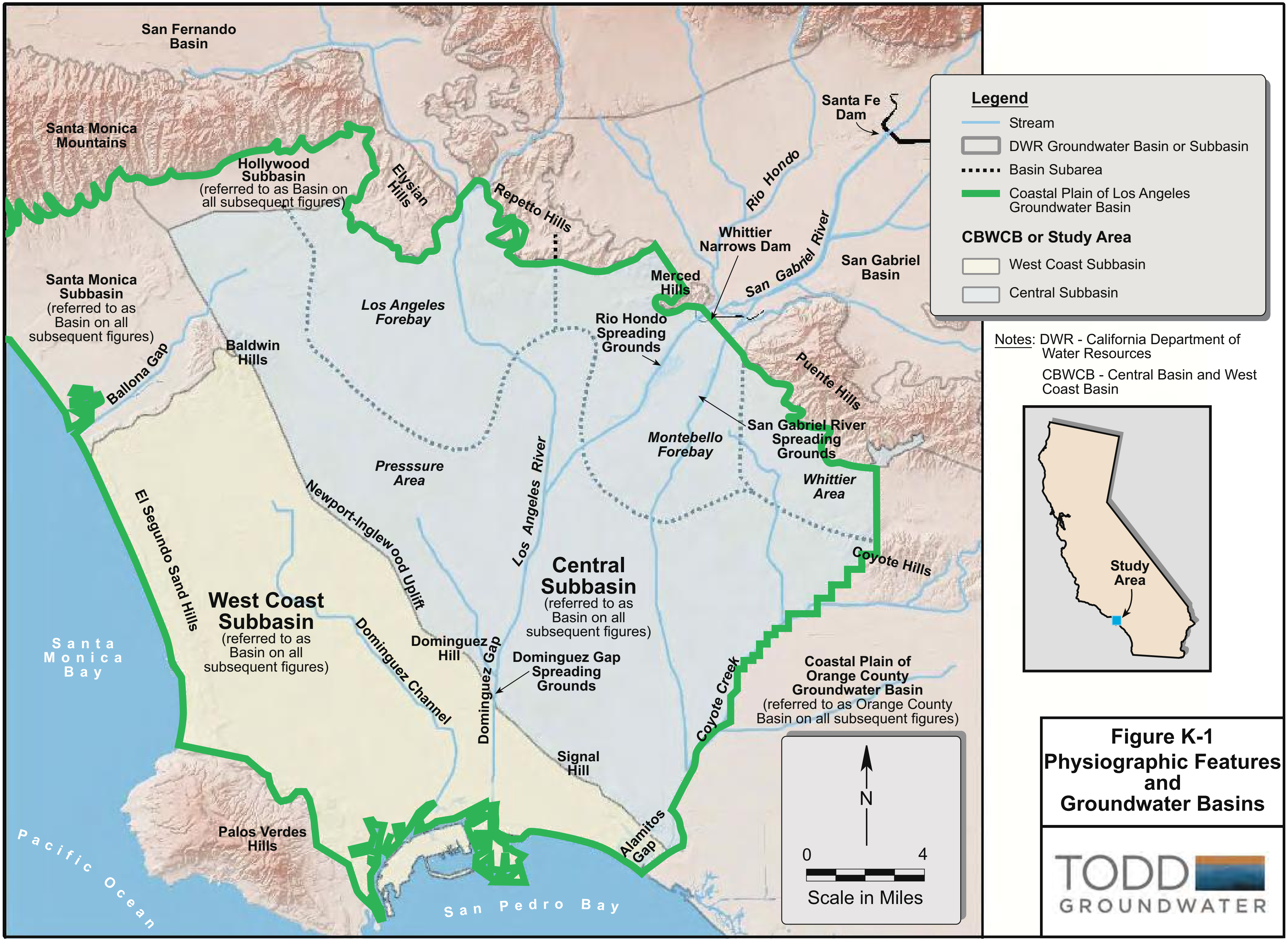


Figure K-1
Physiographic Features and Groundwater Basins

TODD GROUNDWATER

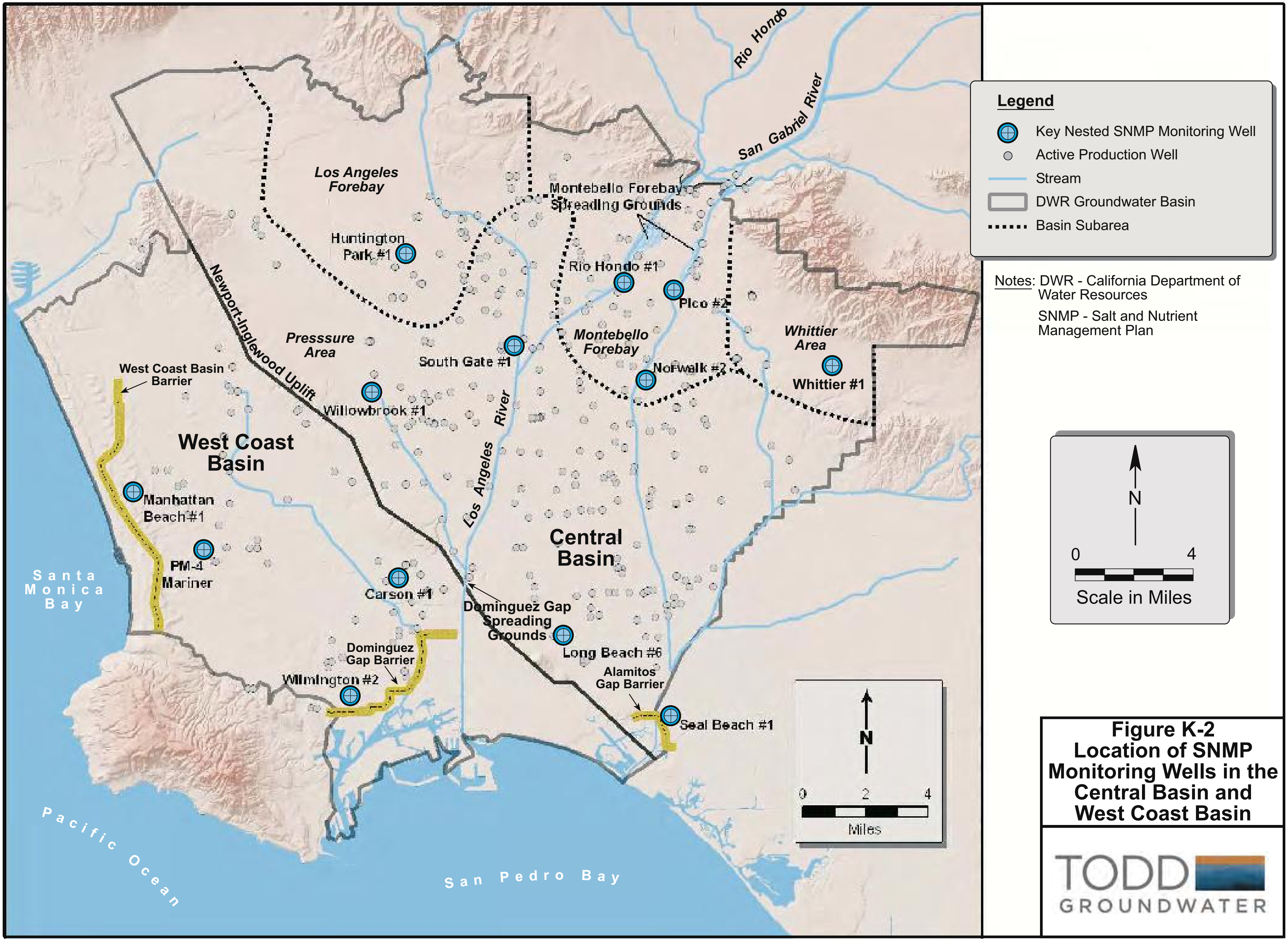
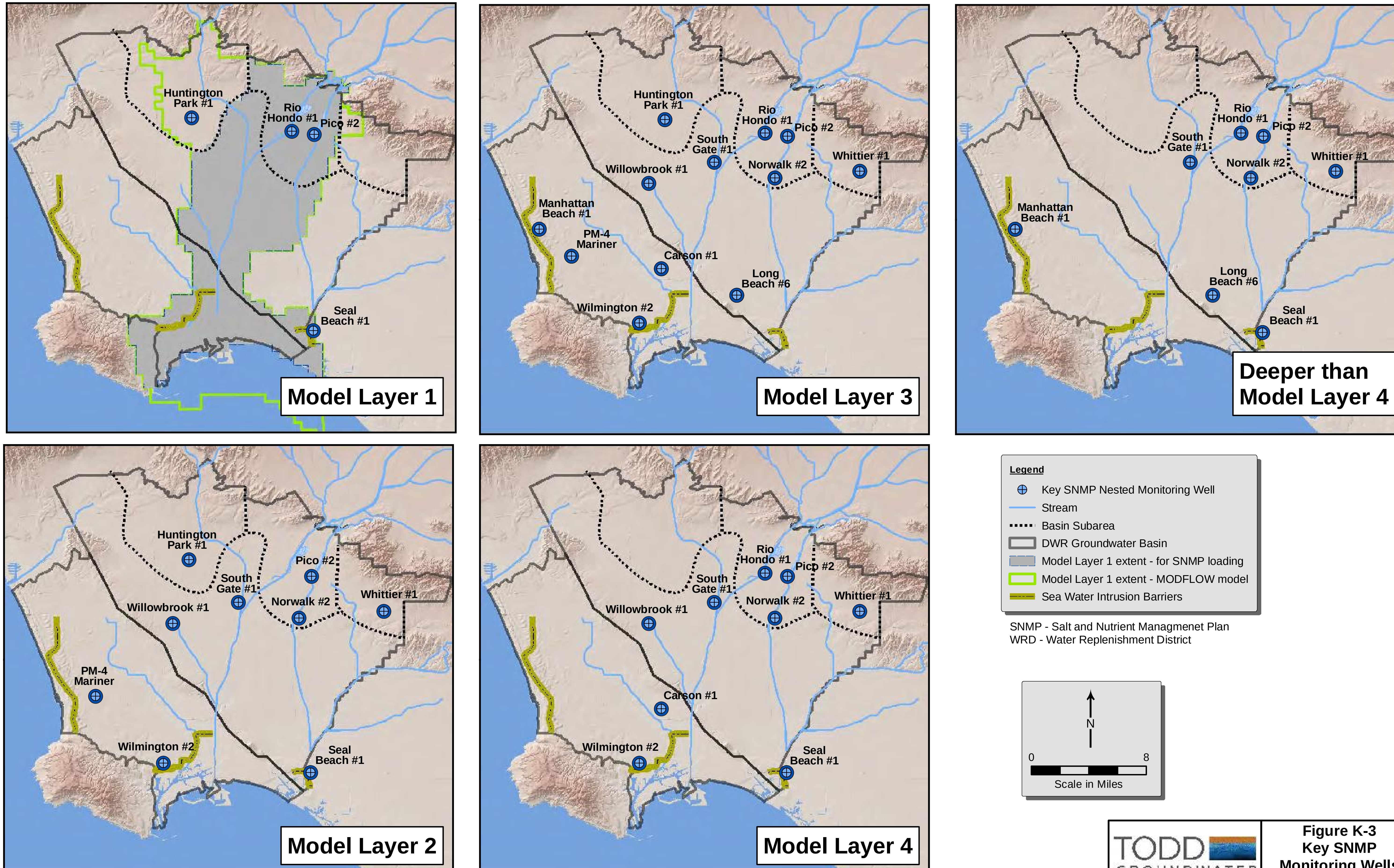
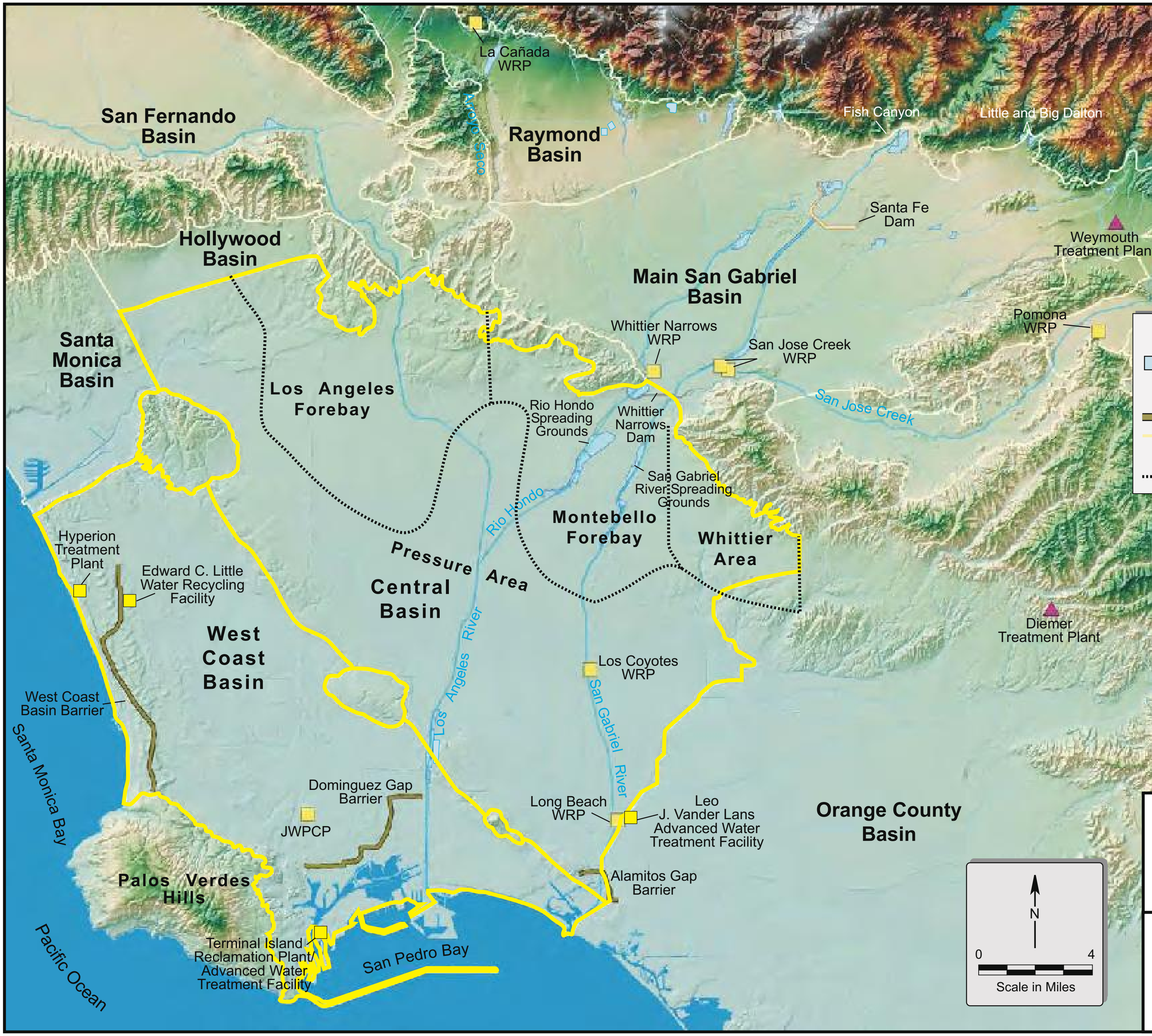


Figure K-2 Location of SNMP Monitoring Wells in the Central Basin and West Coast Basin



TODD GROUNDWATER

Figure K-3
Key SNMP Monitoring Wells by Model Layer



LEGEND

- Spreading Grounds
- MWD Imported Water Treatment Plant
- Seawater Intrusion Barrier
- DWR Groundwater Basin
- Wastewater Treatment Facility
- Basin Subarea

Notes:

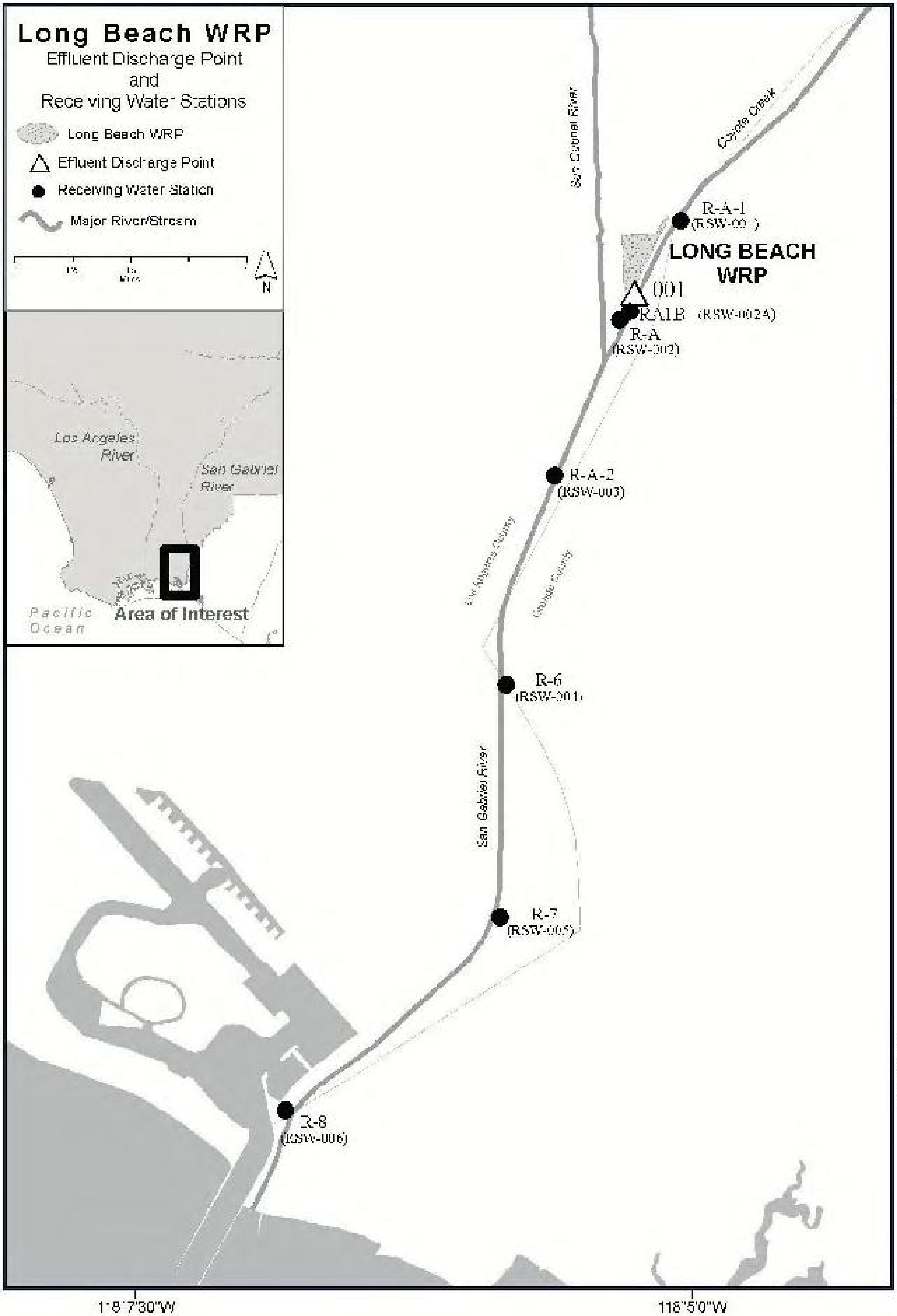
WRP - Water Reclamation Plant

JWPCP - Joint Water Pollution Control Plant

DWR - California Department of Water Resources

Figure K-4
Location of Wastewater and Imported Water Treatment Facilities

TODD GROUNDWATER

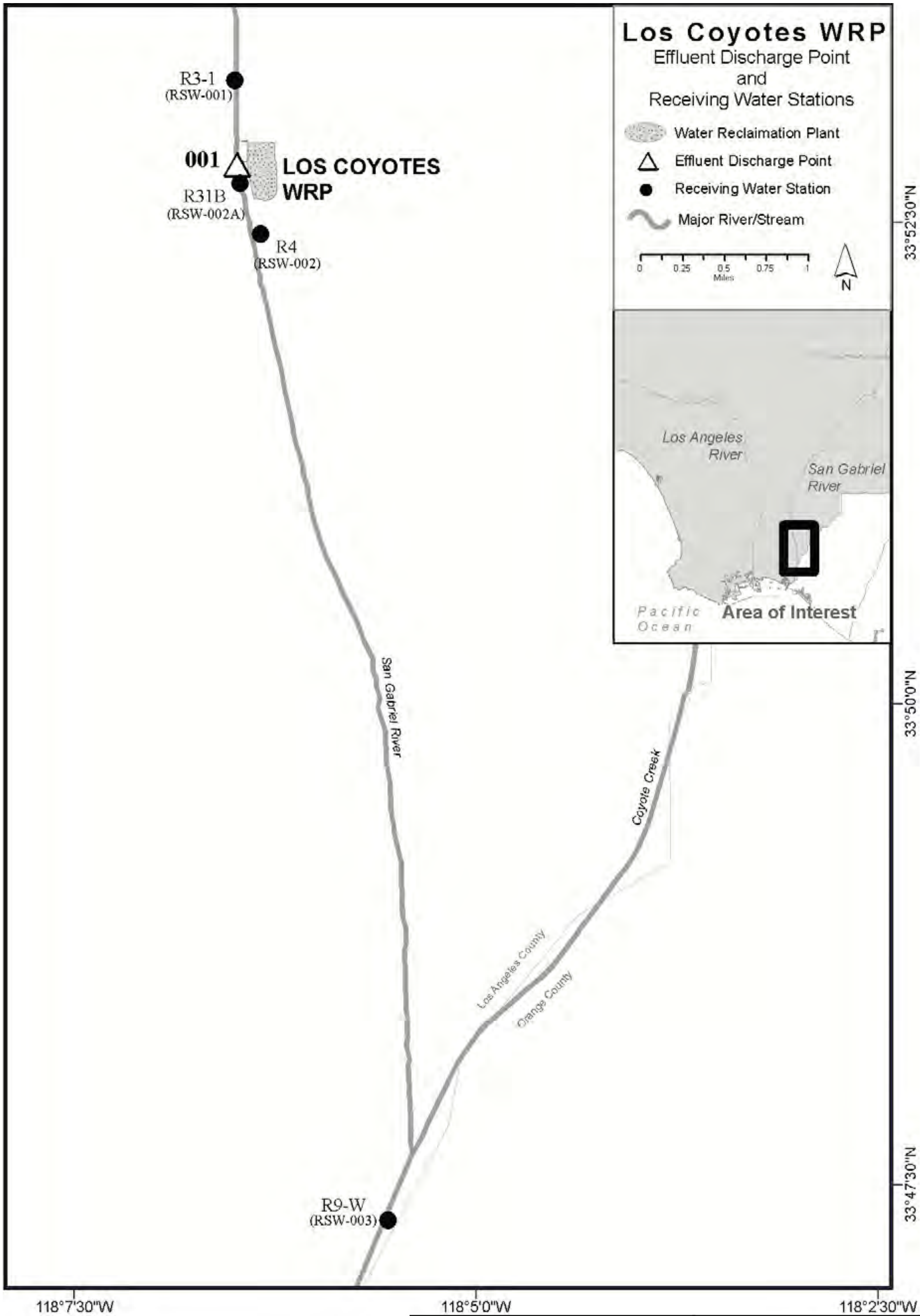


Notes: WRP - Water Reclamation Plant

From: Los Angeles Regional Water Quality Control Board, 2007a

TODD GROUNDWATER

Figure K-5
Long Beach WRP Effluent Discharge Point and Receiving Water Monitoring Locations

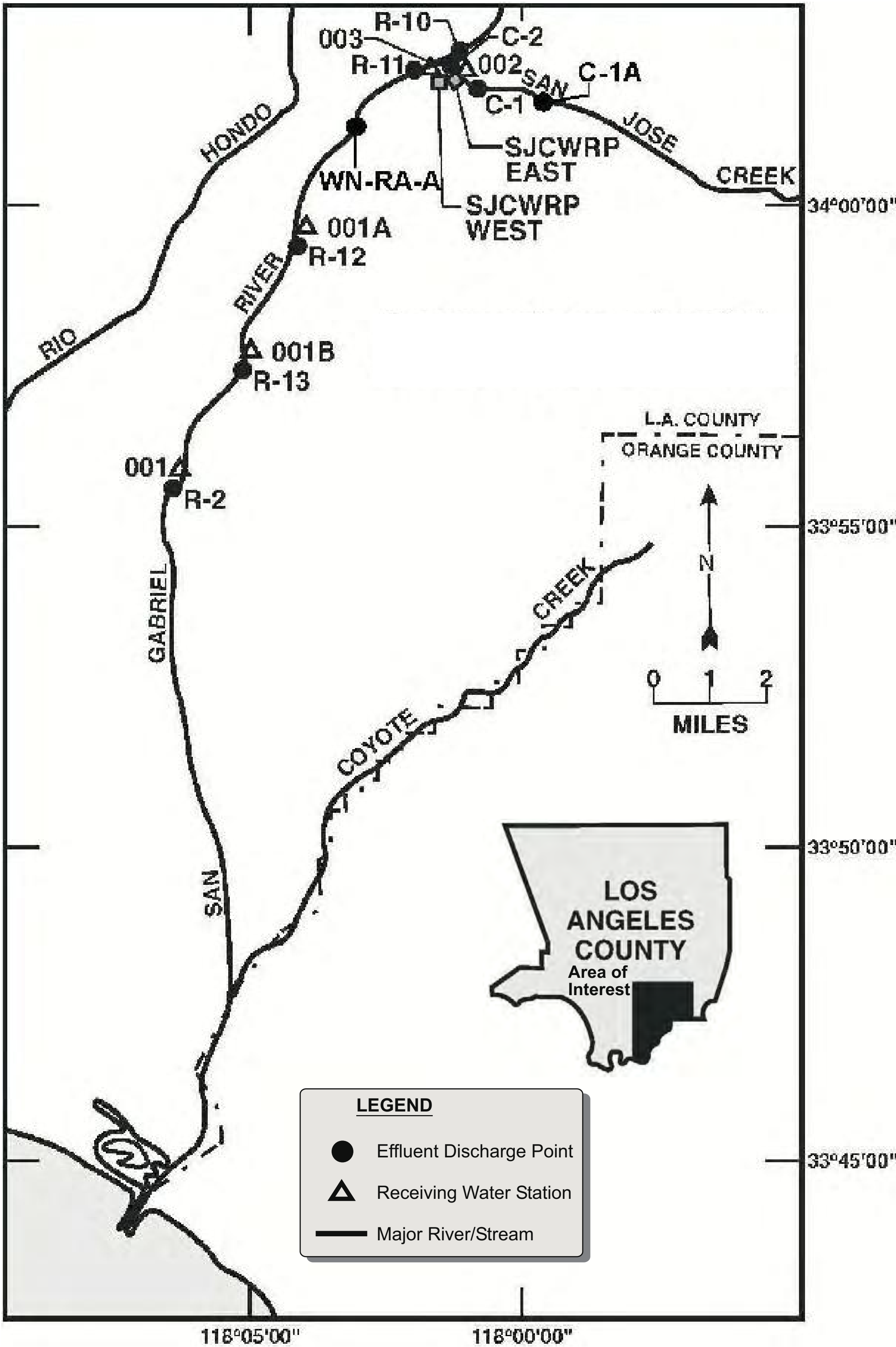


Notes: WRP - Water Reclamation Plant

From: Los Angeles Regional Water Quality Control Board, 2007b

TODD GROUNDWATER

Figure K-6
Los Coyotes WRP Effluent Discharge Point and Receiving Water Monitoring Locations

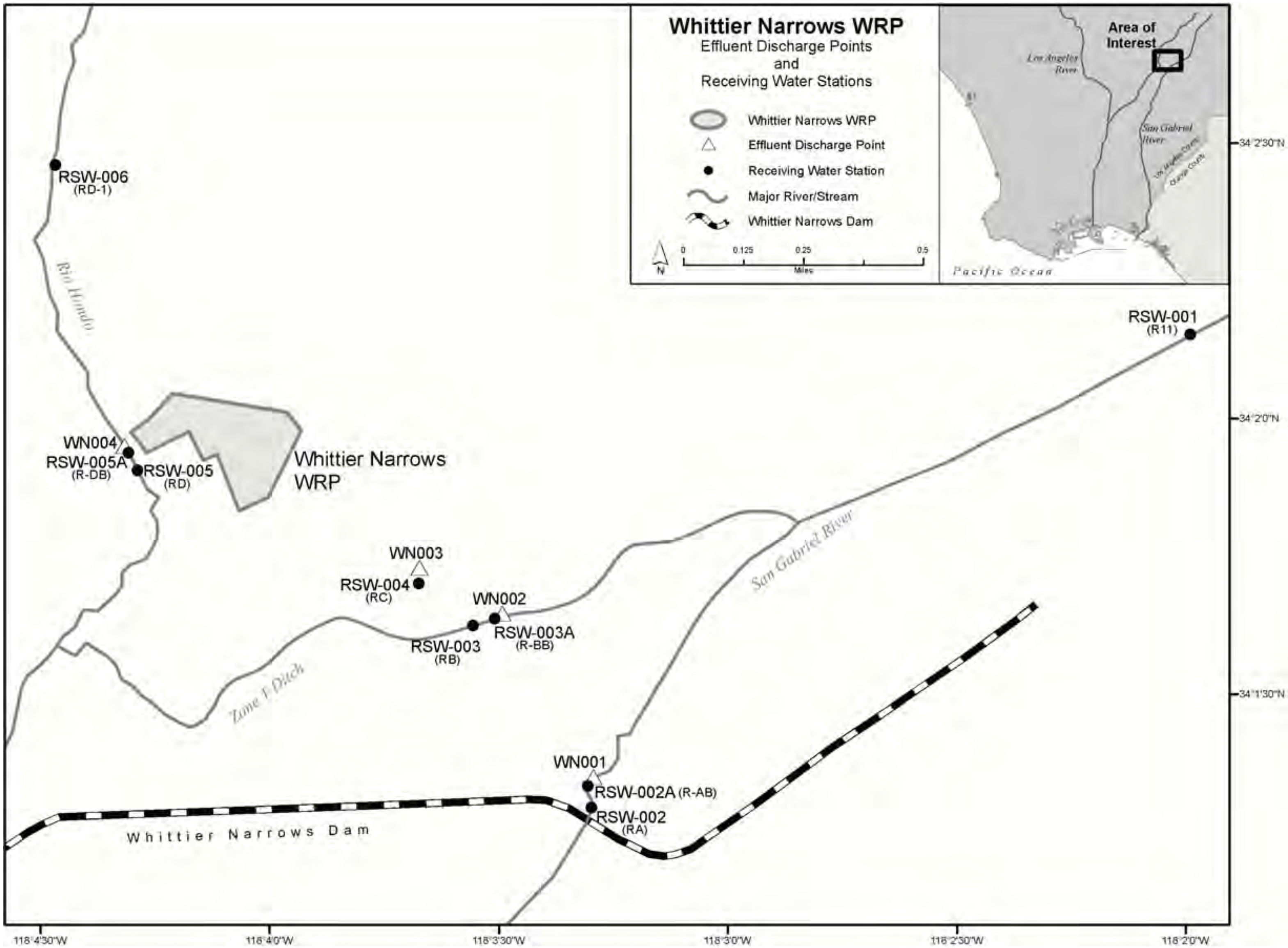


Notes: WRP - Water Reclamation Plant

From: Los Angeles Regional Water Quality Control Board, 2009a

TODD GROUNDWATER

Figure K-7
San Jose Creek WRP Effluent Discharge Points and Receiving Water Monitoring Locations

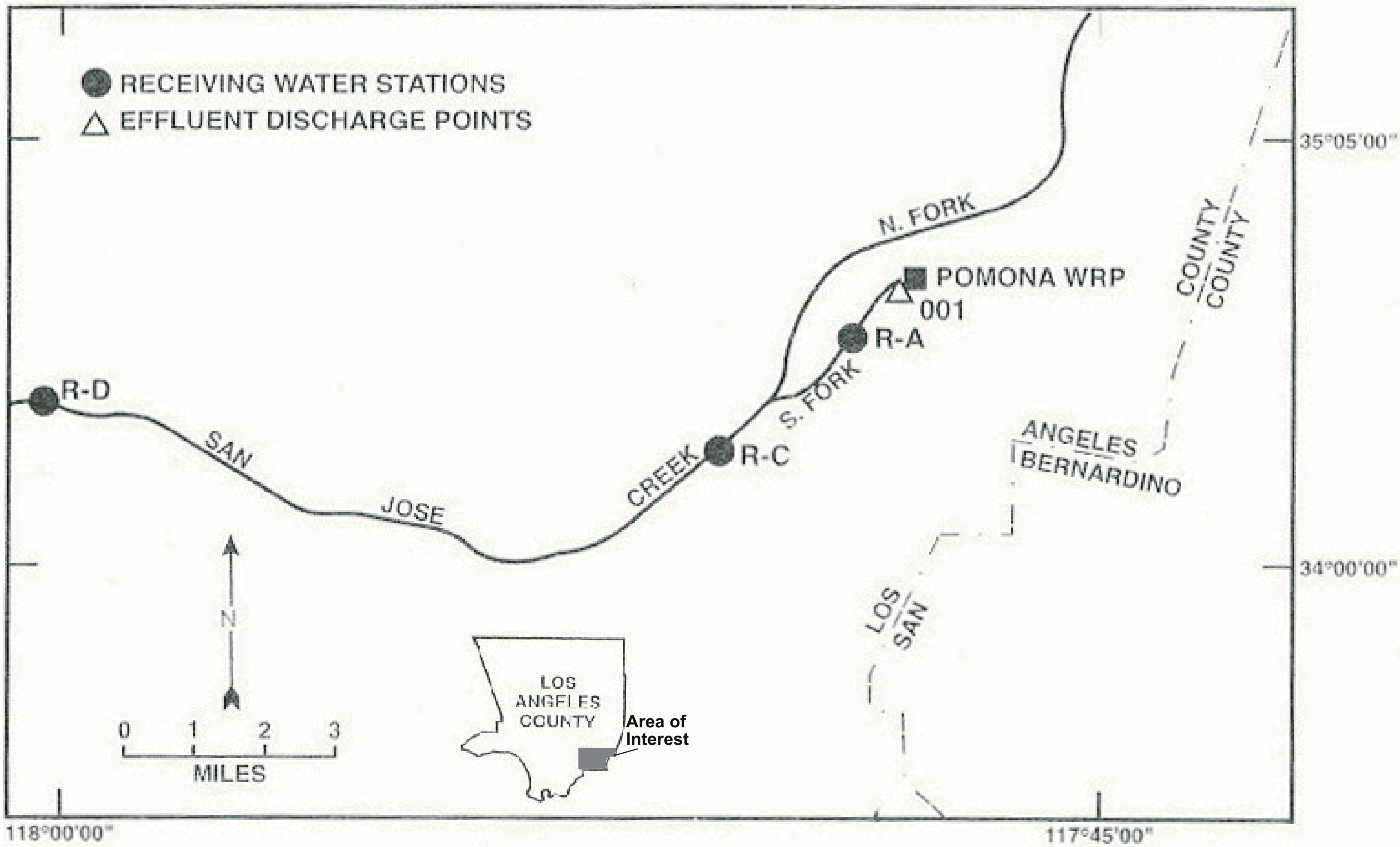


Notes: WRP - Water Reclamation Plant

From: Los Angeles Regional Water Quality Control Board, 2009b

TODD GROUNDWATER

Figure K-8
Whittier Narrows WRP Effluent Discharge Points and Receiving Water Monitoring Locations

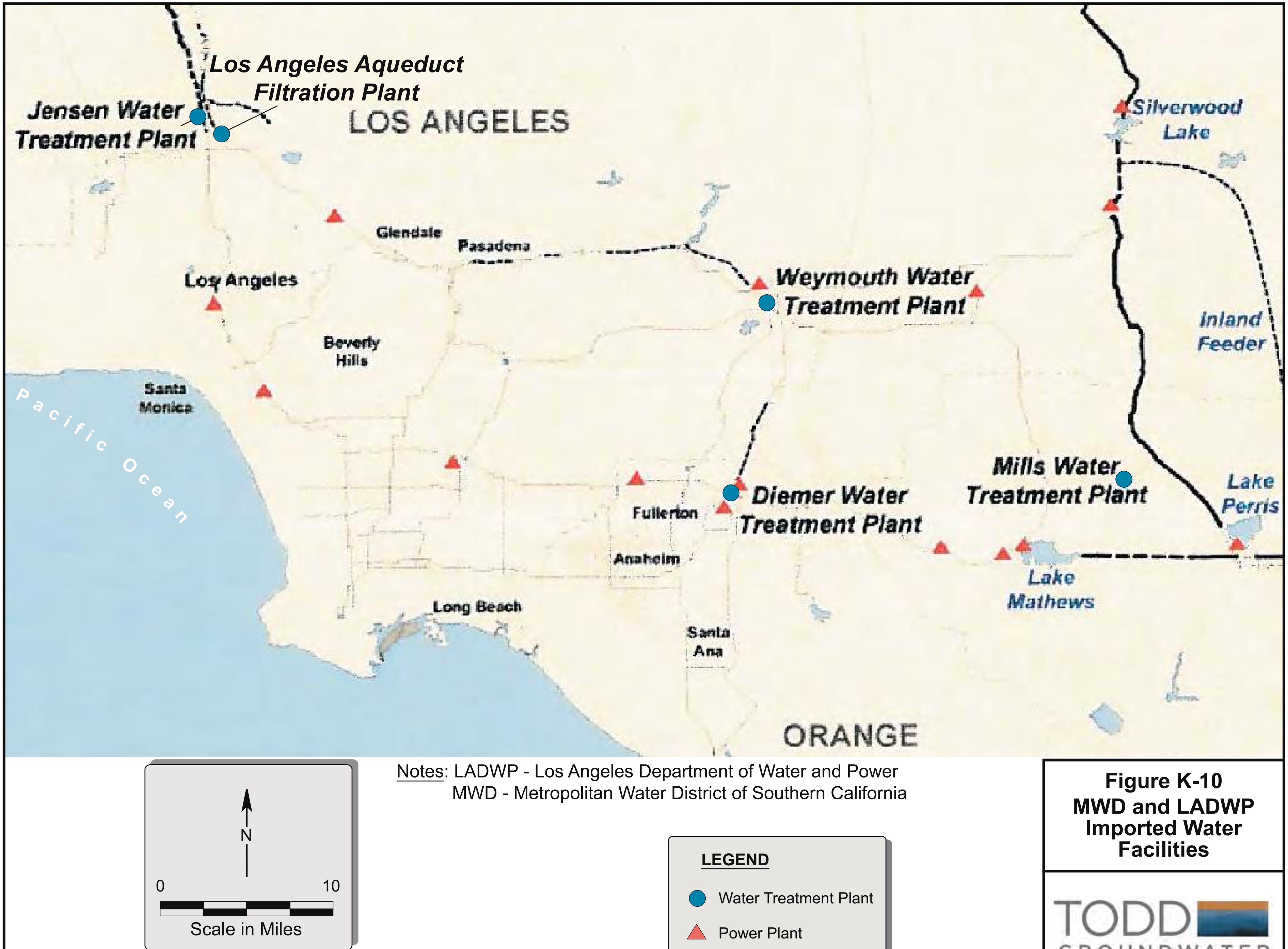


Notes: WRP - Water Reclamation Plant

From: Los Angeles Regional Water Quality Control Board, 2009c

TODD GROUNDWATER

Figure K-9
Pomona WRP
Effluent Discharge
Points and Receiving Water
Monitoring Locations

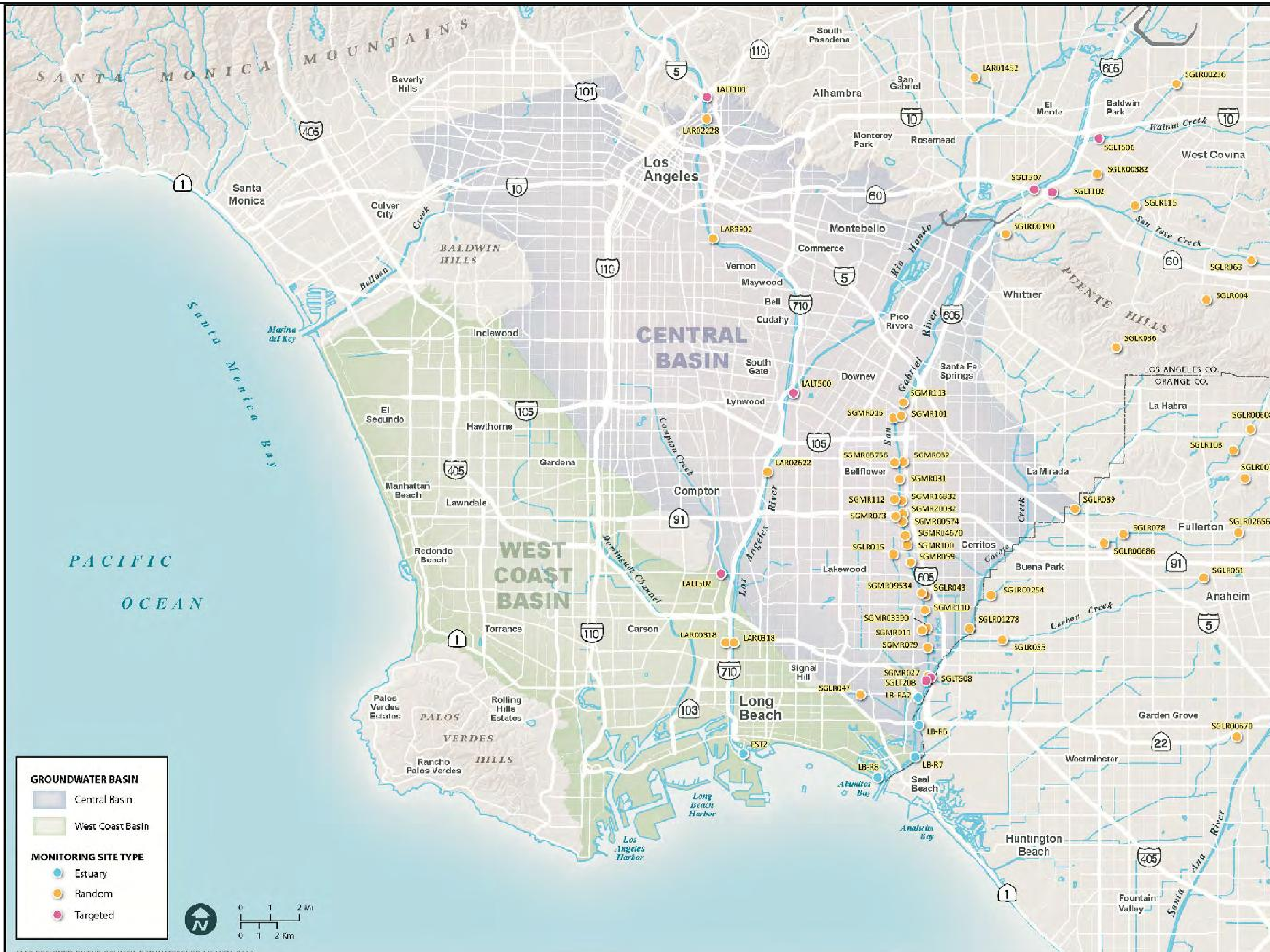


Notes: LADWP - Los Angeles Department of Water and Power
MWD - Metropolitan Water District of Southern California

Modified from: Metropolitan Water District of Southern California, March 2011

Figure K-10
MWD and LADWP Imported Water Facilities

TODD GROUNDWATER



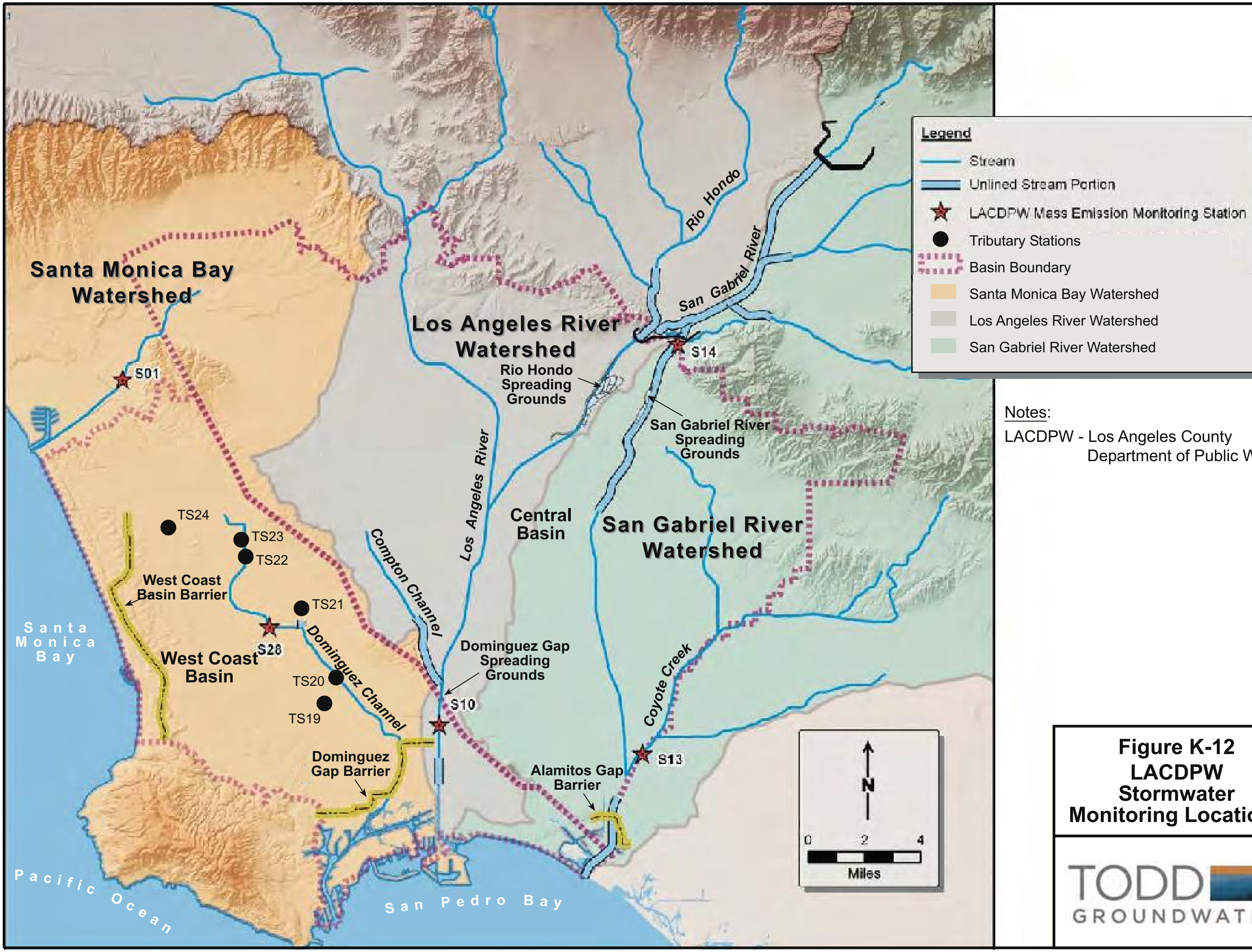
Notes:

SGRRMP - San Gabriel River Regional Monitoring Program

LARWMP - Los Angeles River Watershed Monitoring Program

Figure K-11
SGRRMP and LARWMP Monitoring Locations

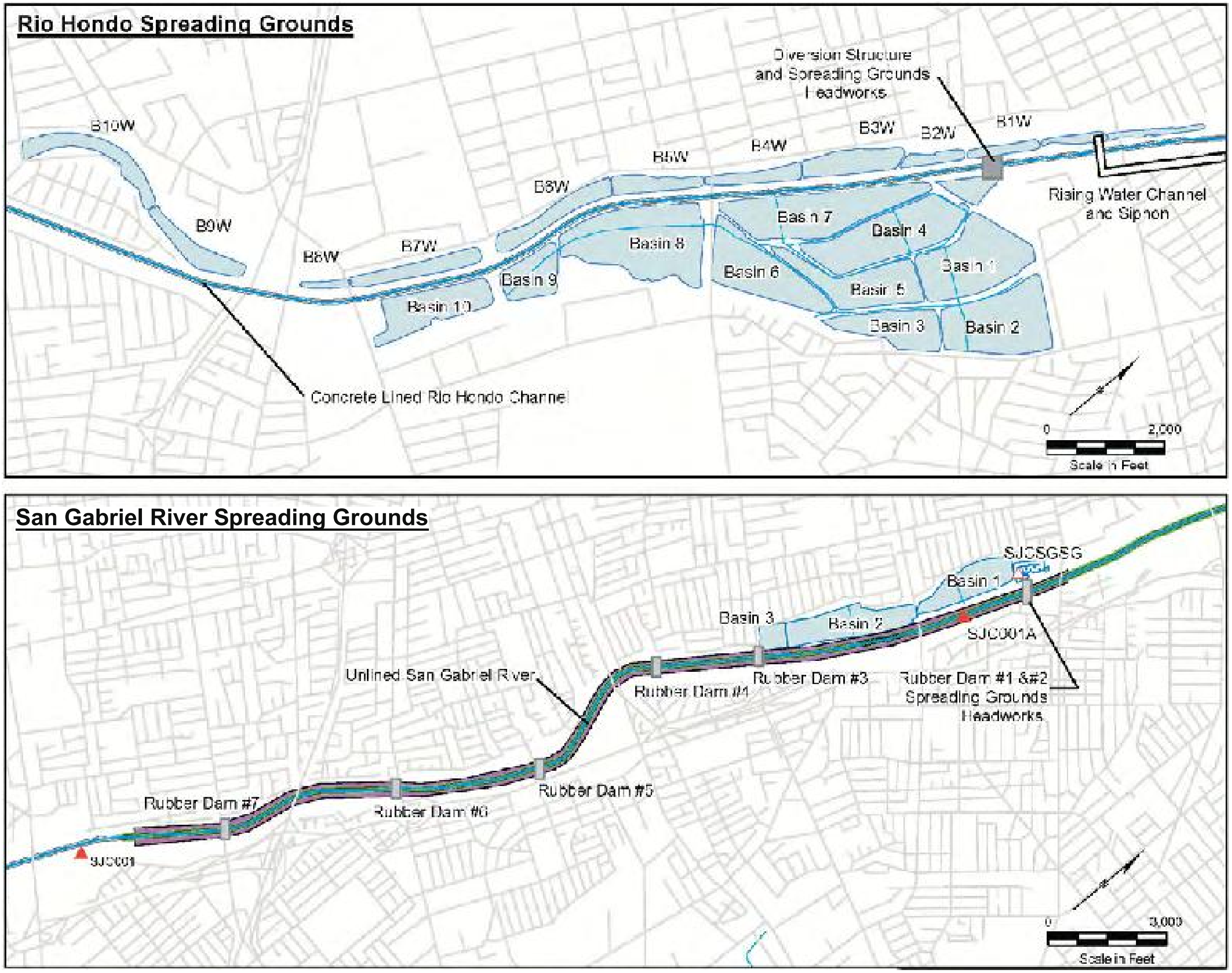
TODD GROUNDWATER



Notes:
LACDPW - Los Angeles County Department of Public Works

Figure K-12
LACDPW Stormwater Monitoring Locations

TODD GROUNDWATER



Notes:

MFGWR - Montebello Forebay Groundwater Recharge

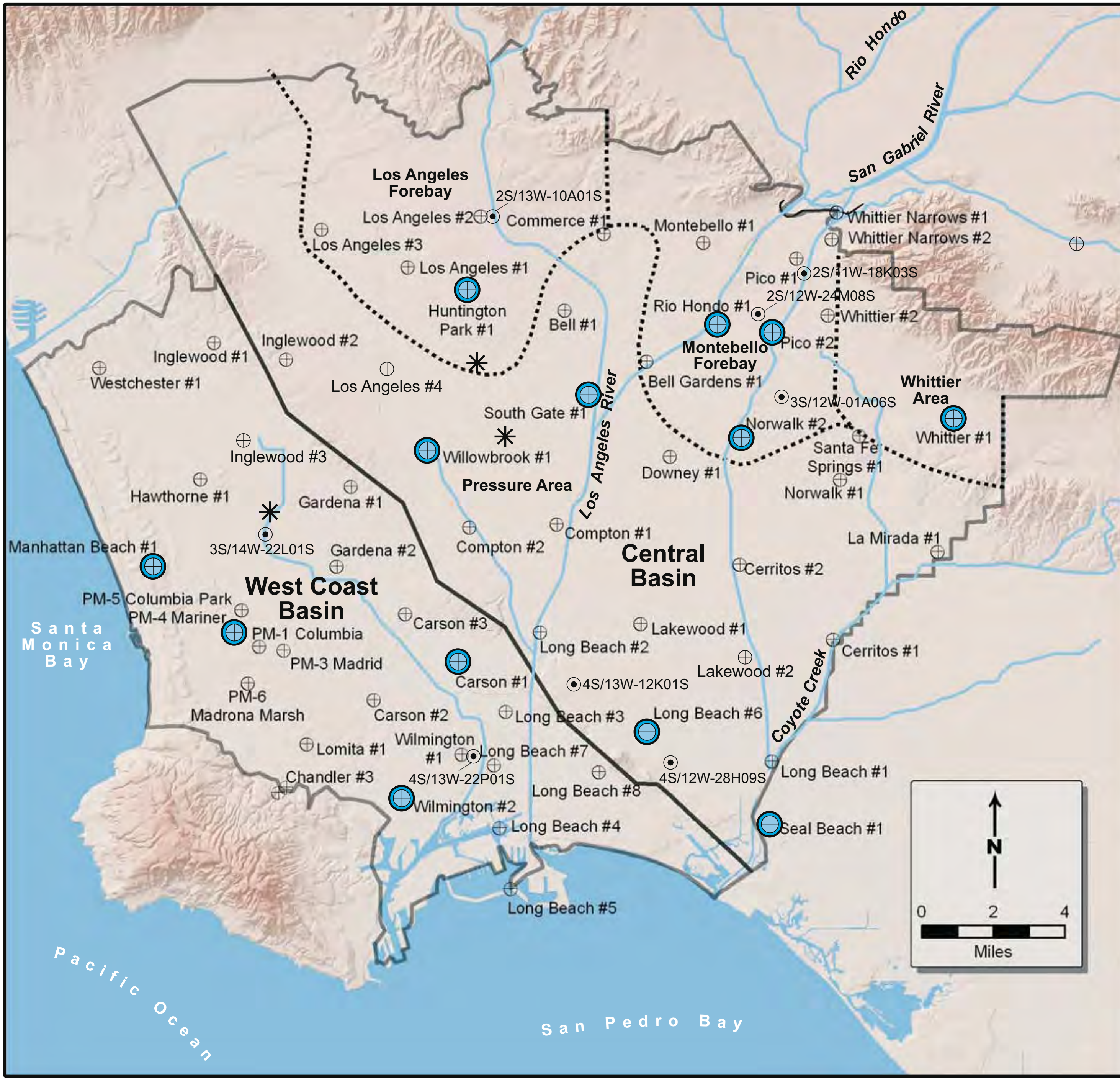
NPDES - National Pollutant Discharge Elimination System

LEGEND

- Effluent Diversion Location
- NPDES Effluent Discharge Location
- In-Stream Recharge Facility

TODD GROUNDWATER

Figure K-13
MFGWR
Project Headworks
Sample Locations



Legend

- WRD Nested Monitoring Well
- Key Nested SNMP Monitoring Well
- Planned WRD Nested Monitoring Well
- Stream
- Basin Subarea
- DWR Groundwater Basin
- Current Key Water Level Monitoring Program Well

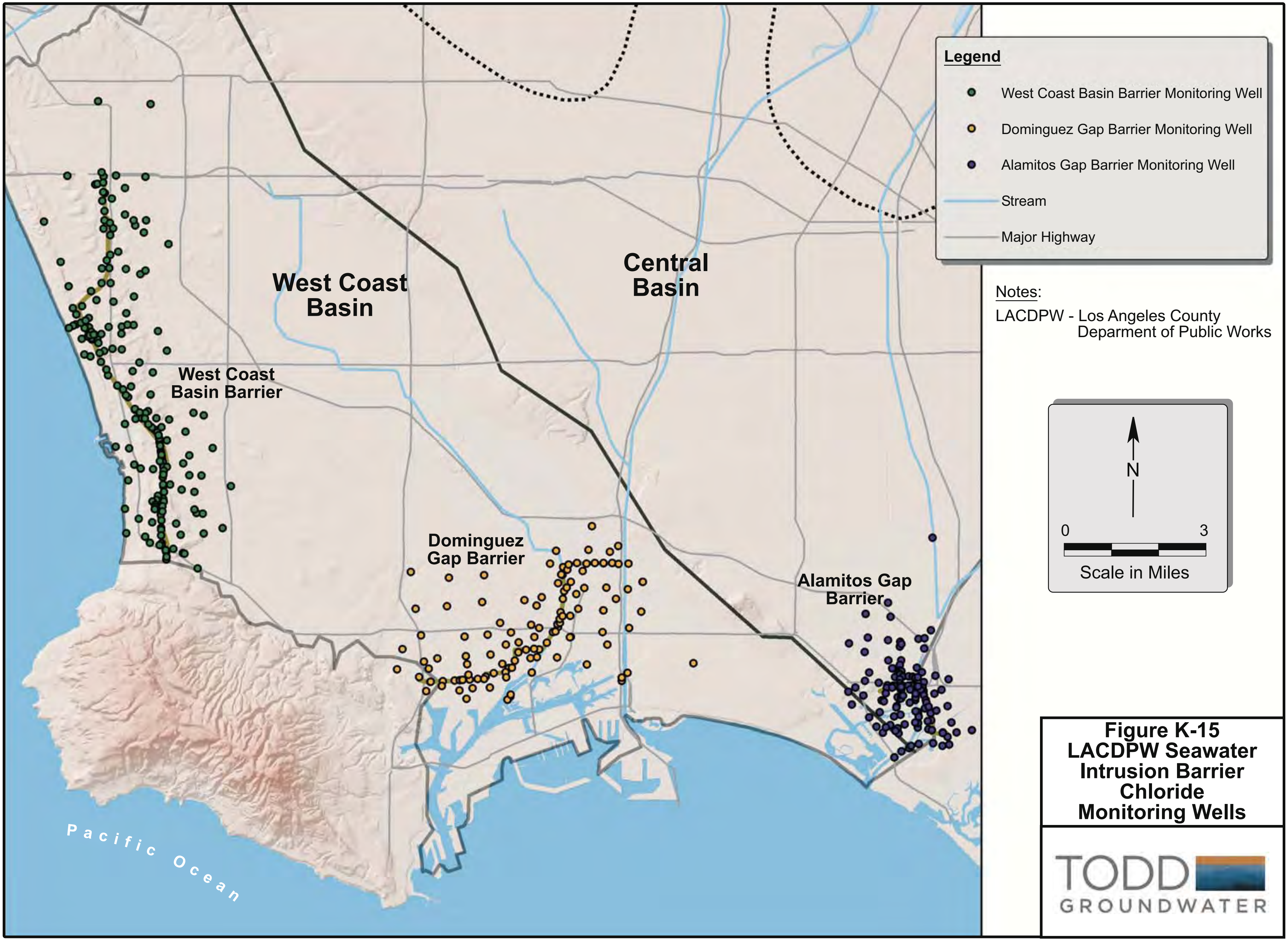
Notes:

DWR - California Department of Water Resources

WRD - Water Replenishment District Southern California

Figure K-14
Existing and Planned WRD Nested Groundwater Monitoring Wells

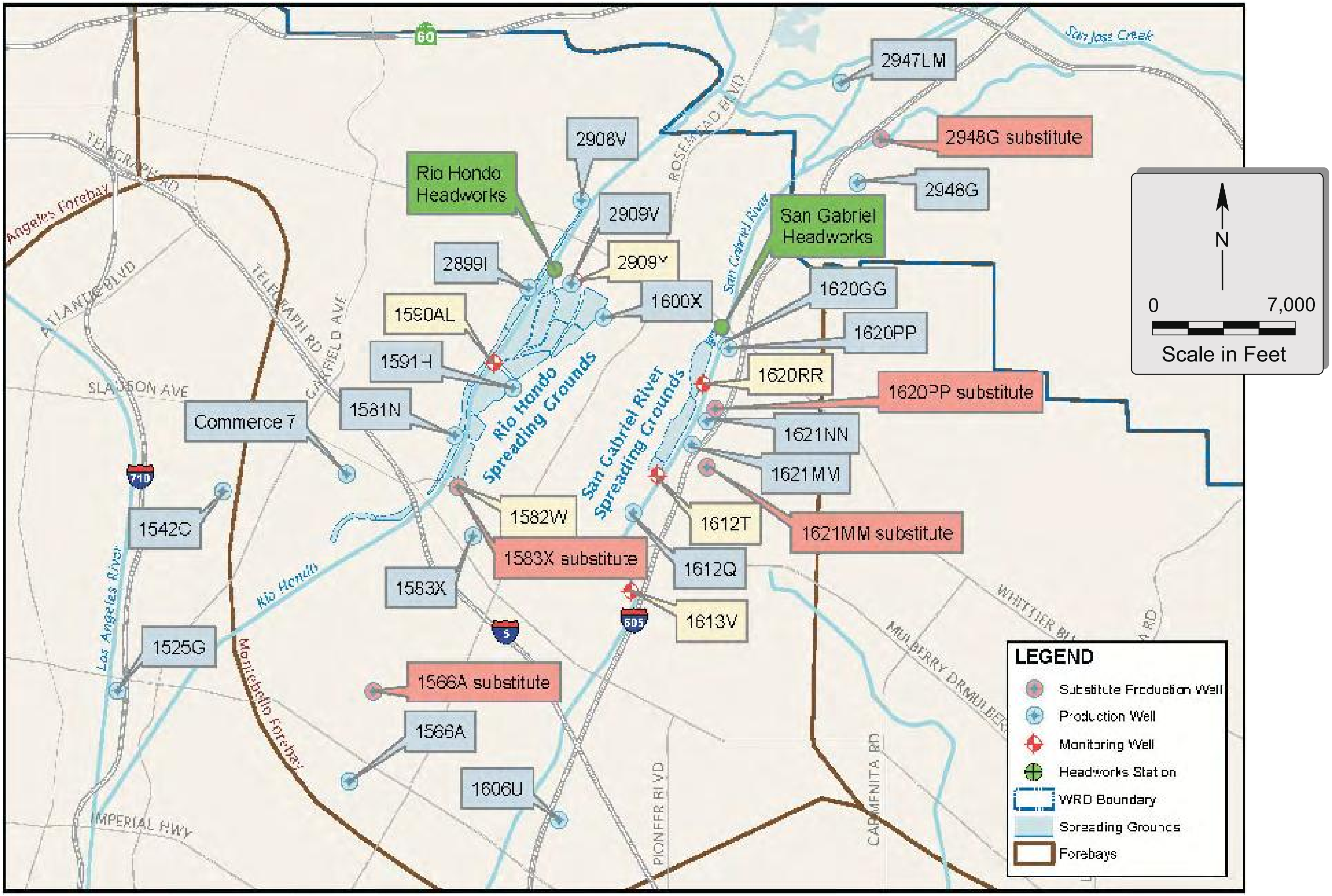
TODD GROUNDWATER



Notes:
LACDPW - Los Angeles County Deparment of Public Works

Figure K-15
LACDPW Seawater Intrusion Barrier Chloride Monitoring Wells

TODD GROUNDWATER



Notes: MFGWR - Montebello Forebay Groundwater Recharge
WRD - Water Replenishment District of Southern California

From: Los Angeles County Sanitation Districts, 2012.

TODD GROUNDWATER

Figure K-16
MFGWR Project Groundwater Monitoring Wells

Legend

- Nearest Drinking Water Well
- 1/4 Distance Well
- 3 Month Monitoring Well
- Tracer Monitoring Well
- WRD Monitoring Well
- Alamitos Barrier

Notes: WRD - Water Replenishment District of Southern California

From: Water Replenishment District of Southern California, 2012.

Figure K-17
Alamitos Gap Barrier Groundwater Monitoring Wells

TODD GROUNDWATER

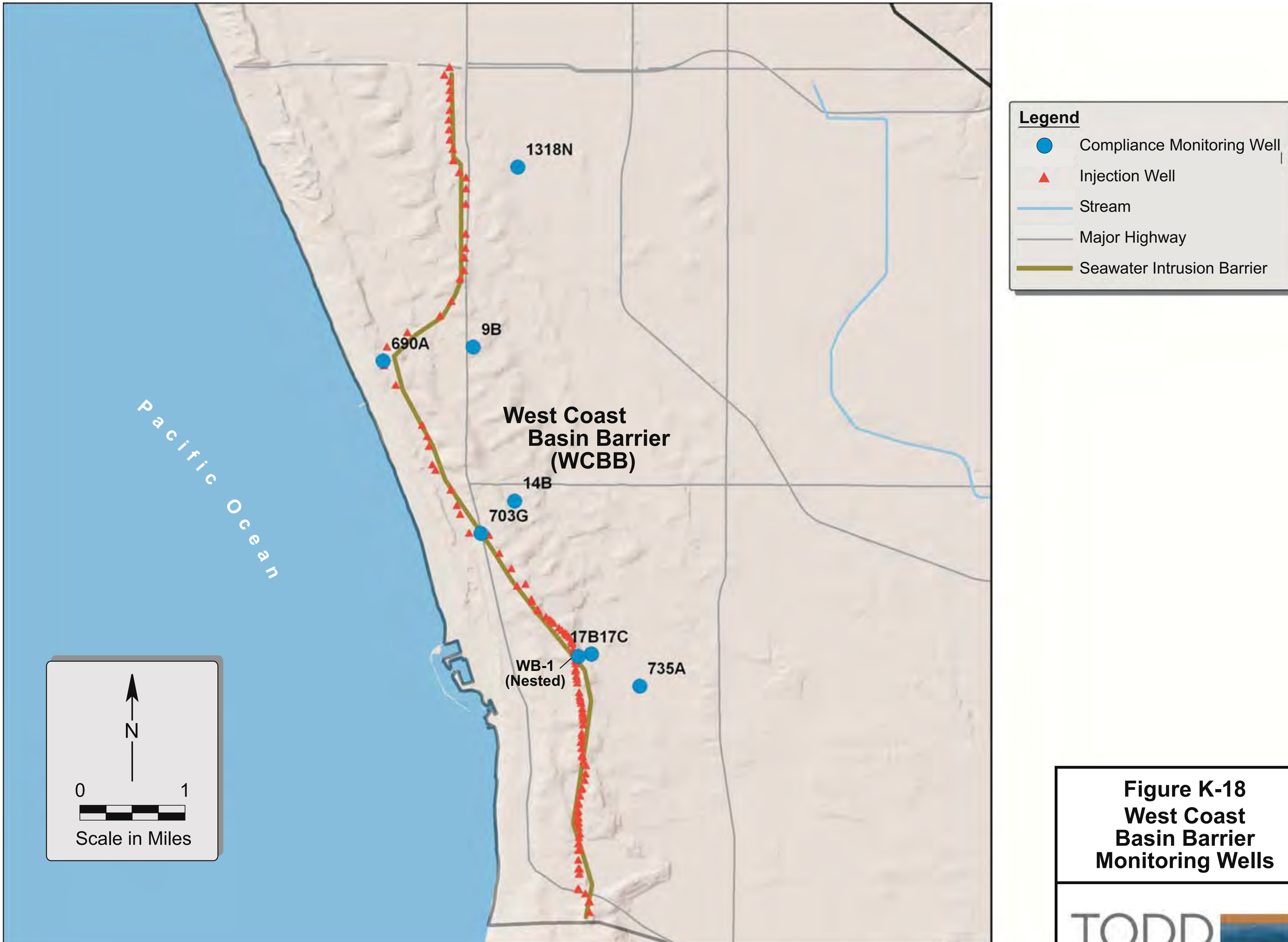


Figure K-18
West Coast Basin Barrier Monitoring Wells

TODD GROUNDWATER

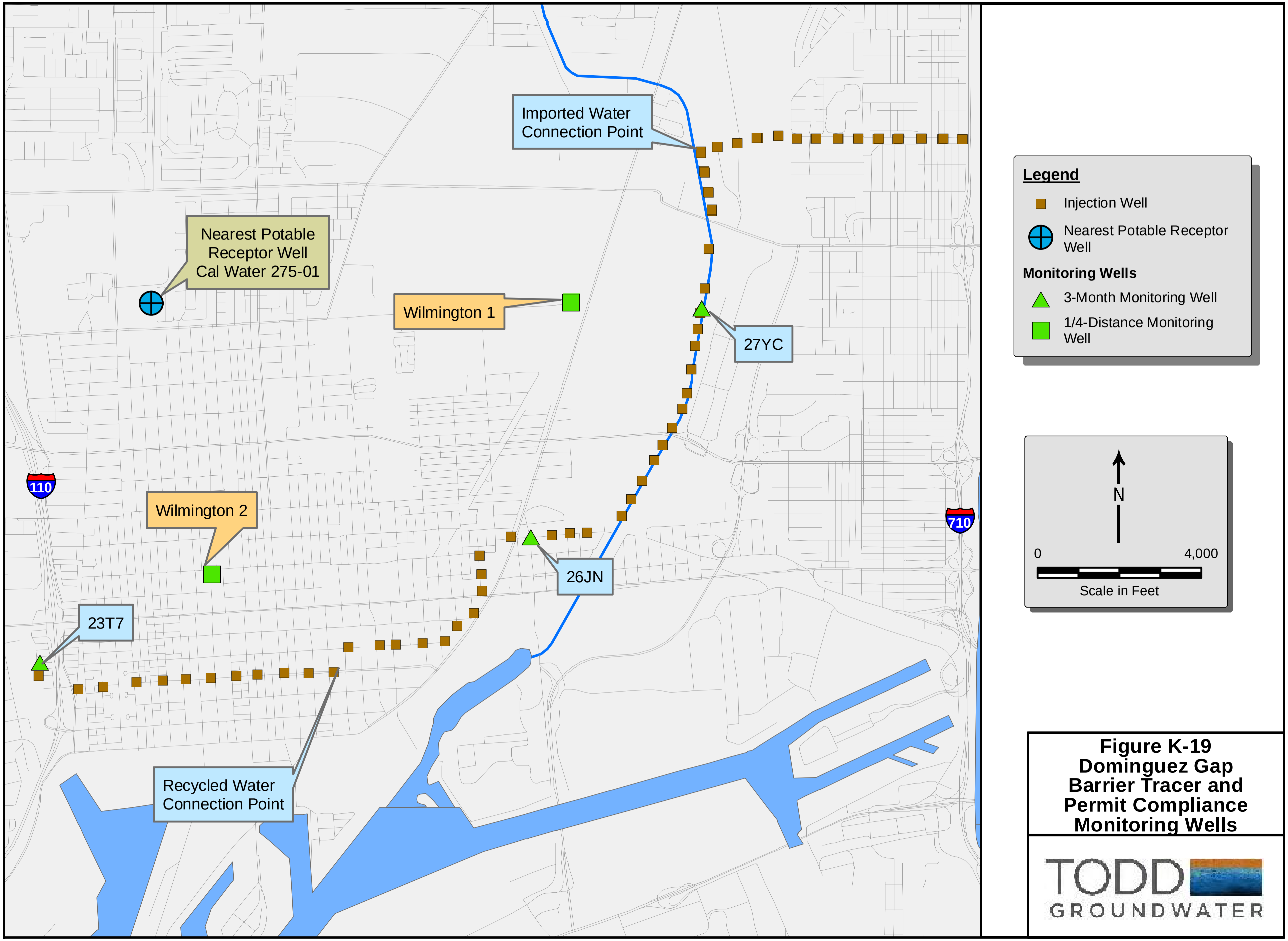
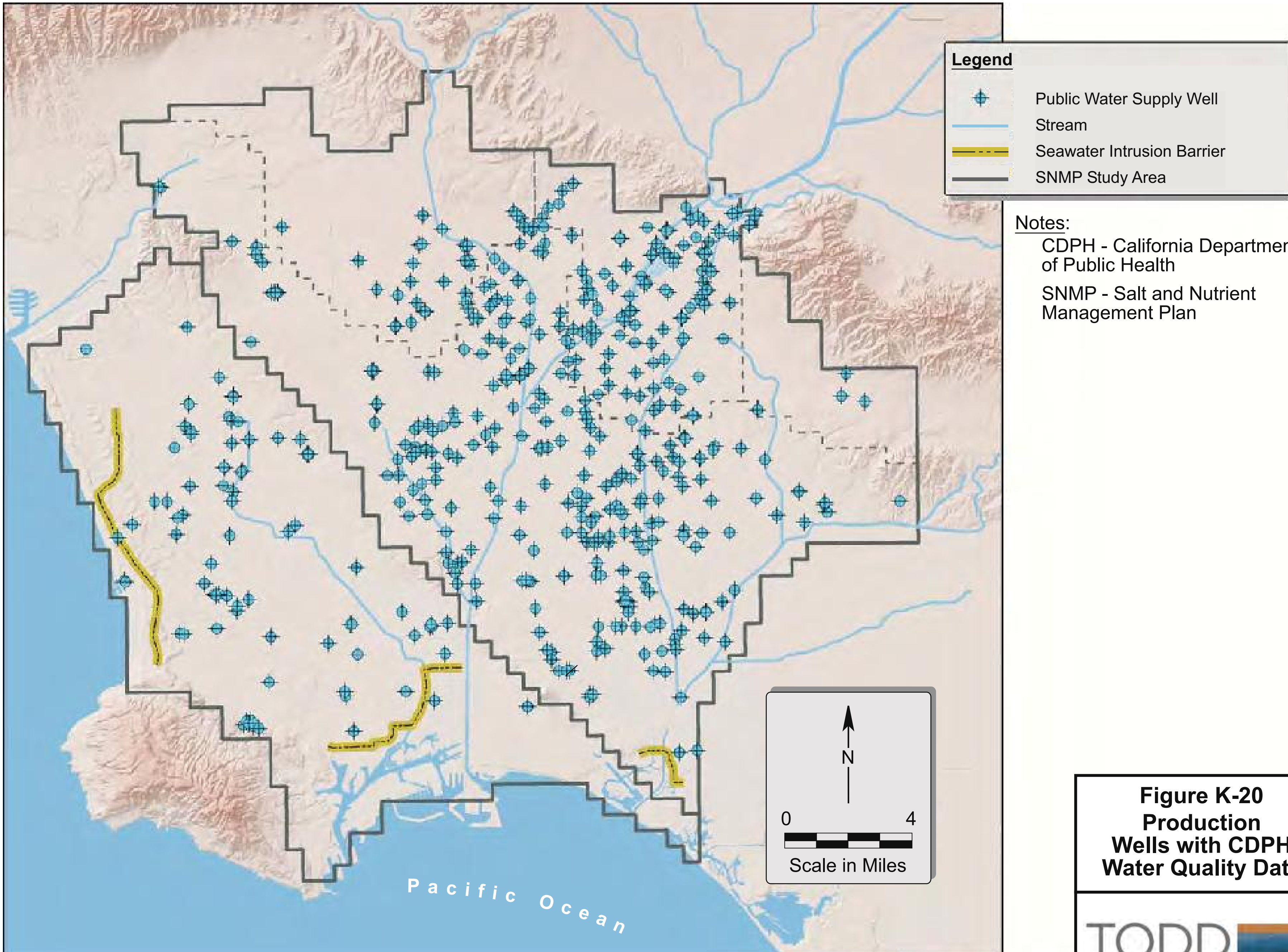


Figure K-19
Dominguez Gap Barrier Tracer and Permit Compliance Monitoring Wells

TODD GROUNDWATER



Notes:

CDPH - California Department of Public Health

SNMP - Salt and Nutrient Management Plan

Figure K-20
Production Wells with CDPH Water Quality Data

TODD GROUNDWATER

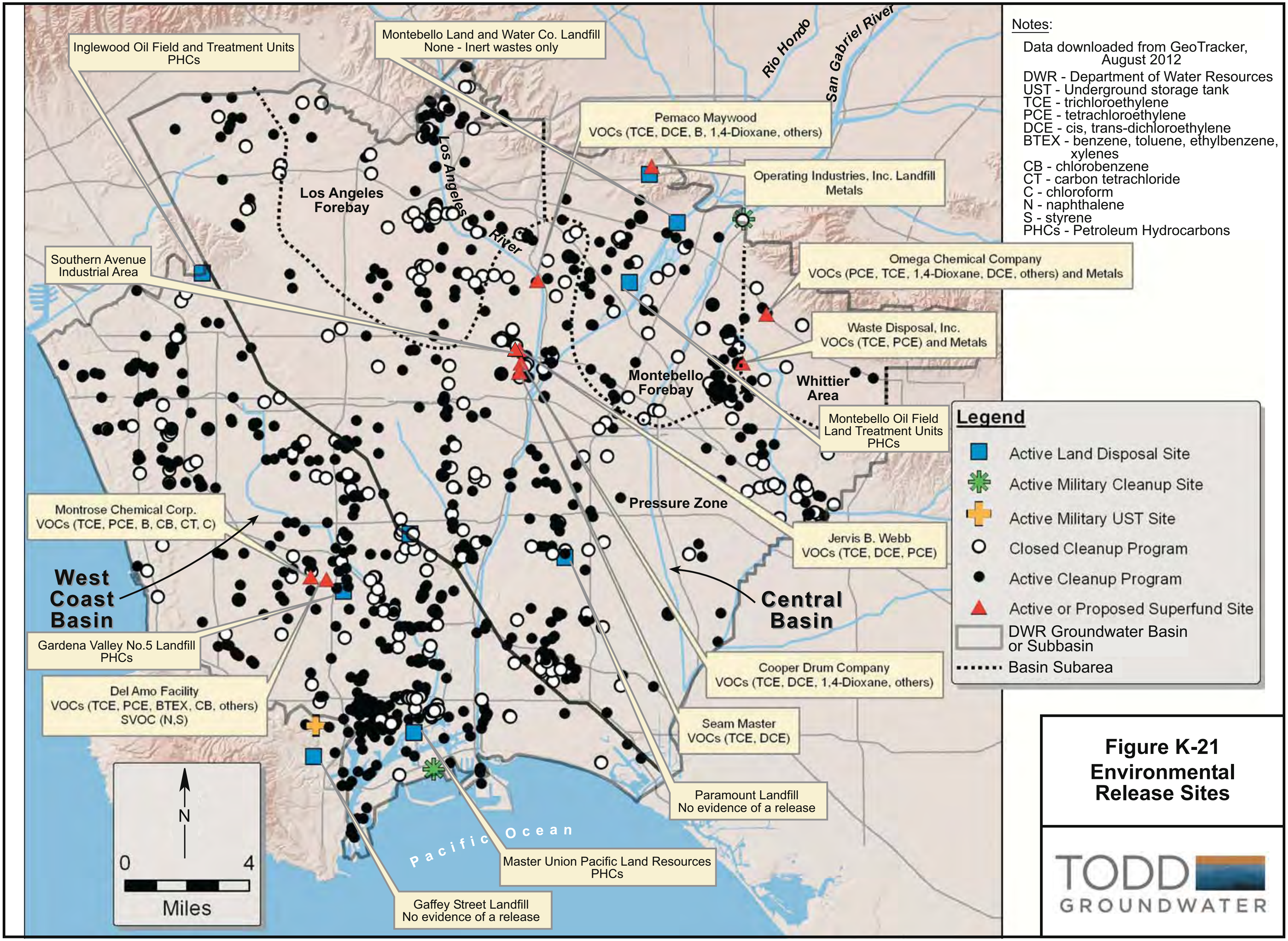
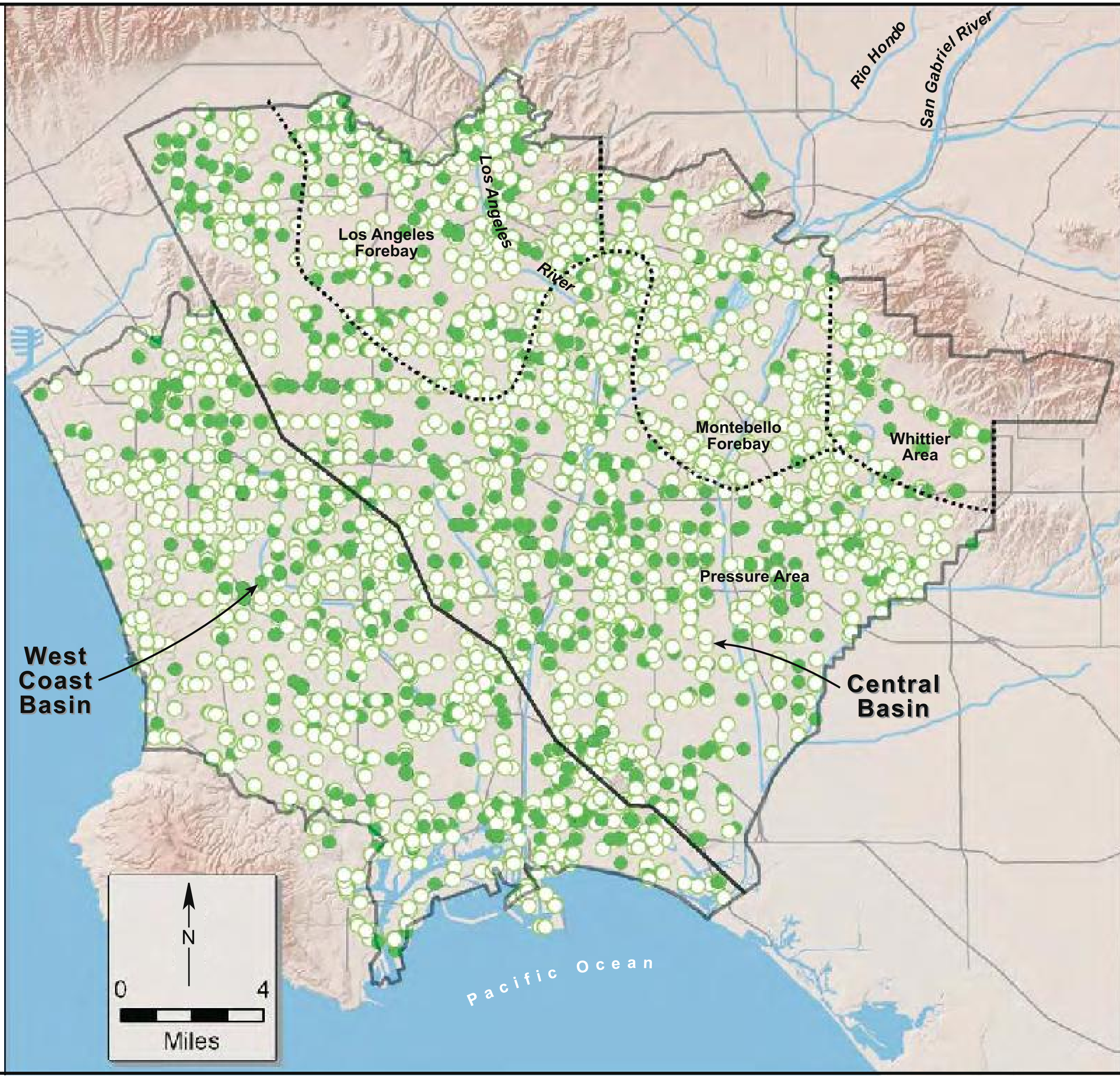


Figure K-21 Environmental Release Sites

TODD GROUNDWATER



Legend

- Active LUST Sites
- Closed LUST Sites
- DWR Groundwater Basin or Subbasin
- Basin Subarea

Notes:

Data downloaded from GeoTracker, August 2012

DWR - Department of Water Resources

Figure K-22
Leaking Underground Storage Tank (LUST) Sites

TODD GROUNDWATER

Attachment K-A
List of Definitions

Below is a list of terms that provide an overall understanding of the Salt and Nutrient Management Plan (SNMP), including those used in this document.

Activated Sludge Biological Treatment – A treatment process that uses aeration tanks to bubble air through primary treated wastewater to supply air to microorganisms that feed on the organic materials in these tanks. The water is sent to settling tanks, where the microorganisms clump together and settle to the bottom, where they are removed and recycled back into the treatment process (also called Secondary Treatment).

Added salts and nutrients – Salt and nutrients that are added through the use of water sources, including fertilizers and amendments, leaching from dry deposition, and dissolution from formation media.

Advanced Oxidation – A chemical oxidation process that relies on the hydroxyl radical for the destruction of trace organic constituents found in water.

Advanced Water Treatment (AWT) – Wastewater treatment technologies used to remove total dissolved solids and or trace constituents for specific reuse applications.

Allowable Pumping Allocations – The Courts adjudicated maximum groundwater pumping rights for an individual or entity under the Central Basin Judgment and West Coast Basin Judgment.

Anti-Degradation – California's Anti-Degradation Policy requires that existing high quality water be maintained to the maximum extent possible. Lowering of the quality is allowed only if the change is consistent with maximum benefit to people of State, will not unreasonably affect present and potential beneficial uses, will not result in water quality lower than applicable standards. Waste discharge requirements for proposed discharges will result in the best practicable treatment or control of the discharge necessary to assure no pollution or nuisance and the highest water quality consistent with maximum benefit to people of the State.

Aquifer – A geologic formation under the ground that is saturated with groundwater and sufficiently permeable to allow movement of quantities of water to wells and springs.

Aquifer Storage and Recovery – The injection of water into an aquifer for later recovery and use.

Artificial Recharge – The process of adding a water source such as recycled water, stormwater, or imported water to aquifers under controlled conditions for withdrawal at a later date, or used as a barrier to prevent seawater or other contaminants from entering the aquifer. Water can be recharged by a number of methods including infiltration via basins or galleries or by the use of injection wells. See definition for Managed Aquifer Recharge.

Assimilative Capacity – The condition in which existing water quality is better than that required to support the most sensitive beneficial use(s) of the basin, i.e. existing salt and nutrient concentrations in groundwater are below Water Quality Objectives. See Current Assimilative Capacity and Future Assimilative Capacity.

Base Case (same as baseline and historical period) – The average source water and salt and nutrient inflows and outflows during the baseline/historical period (Water Year 2000-01 to 2009-10). The average of the Base Case is used for predicting the future 15-year water balances with adjustments in inflow and outflow based solely on future projects. See definition for Future Planning Period.

Baseline (same as Base Case and historical period) – The average source water and salt and nutrient inflows and outflows during the historical period (Water Year 2000-01 to 2009-10). The average of the Baseline is used for predicting the future 15-year water balances with adjustments in inflow and outflow based solely on future projects. See definition for Future Planning Period.

Basin Plan – Water Quality Control Plan that was issued by the Los Angeles Regional Water Quality Control Board (LARWQCB) in 1994 to preserve and enhance water quality and protect the beneficial uses of all regional waters in the Los Angeles Region. Specifically, the Basin Plan designates the beneficial uses for surface water and groundwater, establishes numerical objectives (referred to as Water Quality Objectives [WQOs]) that must be attained or maintained to protect the designated beneficial uses and conform to the State's Anti-Degradation Policy, and describes implementation programs to protect all waters in the region. The Basin Plan can be downloaded from this website: http://www.waterboards.ca.gov/losangeles/water_issues/programs/basin_plan/basin_plan_documentation.shtml.

Basin Plan Objective (BPO) – Numerical limits established for various constituents in groundwater. BPOs, also referred to as Water Quality Objectives (WQOs), are set forth in the Basin Plan that was issued by the LARWQCB. See definition for Basin Plan.

Best Management Practices (BMPs) – BMPs for stormwater address the increased volume and rate of runoff from impervious surfaces and the concentration of pollutants in the runoff. BMPs can include structural systems and non-structural programs.

Calibration – For the existing United States Geological Services (USGS) groundwater flow model of the Central Basin and West Coast Basin, calibration is the process of adjusting hydraulic properties to better simulate observed groundwater levels and trends. A calibration process was also conducted for the salt and nutrient loading analysis for the Salt and Nutrient Management Plan, whereby historical groundwater quality trends were compared with the mixing model predicted groundwater quality trends. Adjustments to loading assumptions were made to more closely match observed data.

California Environmental Quality Act – The State Water Resources Control Board (SWRCB) Recycled Water Policy requires that the Salt and Nutrient Management Plan (SNMP) comply with the applicable CEQA requirements. CEQA requires State and local agencies determine the potential significant environmental impacts of proposed projects and identify measures to avoid or mitigate these impacts where feasible. The CEQA Guidelines, which provide the protocol by which State and local agencies comply with CEQA requirements, are detailed in

California Code of Regulations, Title 14 § 15000 et seq. The basic purposes of CEQA are to: 1) inform decision makers and public about the potential significant environmental effects of a proposed project, 2) identify ways that environmental damage may be mitigated, 3) prevent significant, avoidable damage to the environment by requiring changes in projects, through the selection of alternative projects or the use of mitigation measures when feasible, and 4) disclose to the public why an agency approved a project if significant effects are involved (California Code Regulations, Title 14, § 15002(a)). CEQA analysis is a required part of the SNMP adoption process in accordance with the SWRCB's certified regulatory program. As such, for the purpose of RWQCB adoption of a Basin Plan amendment, the RWQCB will be the lead agency for purposes of CEQA and stakeholders will fund SNMP development including any necessary analysis and documentation to comply with CEQA.

Central Basin – The California Department of Water Resources (DWR) defines the Central Subbasin (DWR Subbasin Number 4-11.04) as occupying a substantial portion (277 square miles) of the Coastal Plain of the Los Angeles Groundwater Basin. In the SNMP, the Central "Subbasin" is referred to as the Central "Basin". The WRD boundaries include a portion, but not all of the DWR Central Basin extent.

Chemicals of Concern – Specific constituents identified at environmental release sites to be the focus of monitoring and potential remediation.

Chloride – A common inorganic salt that is naturally-occurring and is commonly expressed in terms of milligrams per liter (mg/L). High concentrations of chloride near the coast may indicate seawater influence. Elevated chloride concentrations above the Secondary Maximum Contaminant Level of 500 mg/L are undesirable for aesthetic reasons related to taste, odor, or appearance of the water and not for health reasons; however, elevated chloride concentrations in water can damage crops, affect plant growth, and damage municipal and industrial equipment. For the SNMP, chloride, total dissolved solids (TDS), and nitrate have been determined to be the most appropriate indicators of salts and nutrients in the Central Basin and West Coast Basin (CBWCB). See definition for Salt and Nutrients.

Coastal Areas – Groundwater basin areas seaward of the seawater intrusion barriers and near the coast that have very high concentrations of total dissolved solids (TDS) and chloride and a lack of significant production. These areas were both included and excluded from calculation of Central Basin and West Coast Basin salt and nutrient (S/N) water quality averages.

Confined Aquifer – These aquifers exist where the groundwater is bounded between layers of impermeable substances like clay or dense rock. When tapped by a well, water in confined aquifers is forced up, sometimes above the soil surface.

Confining Unit or Aquitard – A layer of sediments of low hydraulic conductivity located adjacent to an aquifer.

Conservative – Conservative with respect to a constituent means a constituent that does not significantly interact with subsurface media (vadose zone and saturated zone) and therefore, is not readily attenuated in the subsurface.

Constituents of Emerging Concern (CECs) – CECs are generally chemicals for which there are no established water quality standards or Notification Levels (see definition below). These chemicals may be present in waters at very low concentrations and are now detected as the result of more sensitive analytical methods. Information regarding their health significance is evolving with the development of acceptable daily intake levels and drinking water equivalent levels; however, information is lacking on the full spectrum of potential CECs and their health significance in mixtures. CECs include several types of chemicals such as (i) pesticides, (ii) pharmaceuticals and ingredients in personal care products, (iii) veterinary medicines, (iv) endocrine disruptors, and others. The State Water Resources Control Board (SWRCB) Recycled Water Policy states that Salt and Nutrient Management Plan shall include a *". . . provision for annual monitoring of Emerging Constituents of Emerging Concern (e.g. endocrine disrupters, personal care products or pharmaceuticals) (CECs) consistent with recommendations by CDPH and consistent with any actions by the State Water Board taken pursuant to paragraph 10(b) of this Policy." (SWRCB, 2009 and 2013)*

Contaminated Sites – See Environmental Release Sites.

Current Assimilative Capacity – The difference between Basin Plan Water Quality Objectives and average ambient groundwater quality in the individual basin or subarea.

Delivered Water – Blend of various waters that are delivered to the seawater intrusion barriers for injection or to the Montebello Forebay Spreading Grounds and San Gabriel River for groundwater recharge. At the seawater intrusion barriers, a blend/mix of recycled and treated imported water is used for injection and at the Montebello Forebay Spreading Grounds and San Gabriel River, a blend/mix of recycled, untreated imported, and local surface water is used for recharge.

Desalters – Treatment facilities that extract and treat high chloride and TDS groundwater from areas impacted by seawater intrusion.

Dry Deposition or Atmospheric Deposition – The process by which airborne pollutants are deposited to the earth. These pollutants include, but are not limited to, sulfur dioxide, nitrogen oxides, ammonia, and mercury and represent a source of salt and nutrient (S/N) loading to groundwater.

Environmental Release Sites – Commercial and industrial sites where activities (e.g., leaking aboveground and underground storage tanks, leaking sewer and oil pipelines, and illegal discharges) have contaminated groundwater with localized plumes of petroleum fuels, solvents, and other hazardous substances.

Existing Water Quality – Current quality of groundwater in the basin over the most recent 5-year averaging period of 2007 through 2012. See definition for water quality averaging period.

Fate and Transport – The movement and attenuation of constituents in the environment. Salt and nutrient fate and transport is based on groundwater flow directions and rates and on the characteristics of individual salts and nutrients and subsurface media.

First Flush – Stormwater sample collected immediately following the first significant rainfall event of the year.

Fiscal Year – The period from July 1 to June 30 of the following year.

Forebay – An area where large volumes of surface water recharge the regional aquifers.

Future Assimilative Capacity – The difference between the predicted future groundwater quality at the end of the future planning period and basin plan water quality objectives.

Future Planning Period – Period of time over which future loading will be assessed. Since the historical period covers water years 2000-01 through 2009-10, the future planning period encompasses water years 2010-11 through 2024-25. See definition for historical period. While water year 2010-11 has passed, it is not included in the historical period because reporting tends to lag data collection and some data collected during water year 2010-11 that is required to support the historical period analysis may not be available or published yet.

Gaining Reach – A gaining reach of a river or stream is where groundwater recharges surface water.

Goals and Objectives – Goals and objectives for this project are related to plans for recharge and use of recycled water, stormwater/surface water, and imported water.

Greater Los Angeles County (GLAC) Integrated Regional Water Management Plan (IRWMP) – A regional project with the goal of optimizing local water resources to reduce the region's reliance on imported water.

Groundwater – Water found in the spaces between soil particles and cracks in rocks underground (located in the saturation zone). Groundwater is a natural resource that is used for drinking, recreation, industry, and growing crops.

Groundwater Basins Master Plan (GBMP) – The Water Replenishment District of Southern California (WRD), in coordination with other basin stakeholders, has developed a Draft Groundwater Basins Master Plan (GBMP). The intent of this plan is to provide a single reference document for parties operating within and maintaining the Central Basin and West Coast Basin (CBWCB). This GBMP complements the efforts of the Water Independence Now (WIN) program by identifying projects and programs to enhance basin replenishment, increase the reliability of groundwater resources, improve and protect groundwater quality, and ensure that the groundwater supplies are suitable for beneficial uses.

Groundwater Reliability Improvement Program (GRIP) – The Water Replenishment District of Southern California (WRD), in coordination with the Sanitation Districts of Los Angeles County (SDLAC) is developing the GRIP recycled water project as a part of WRD's Water Independence Now (WIN) strategy. The overall goal of GRIP is to offset the current use of imported water with recycled water for groundwater replenishment in the Central Basin. Specifically, GRIP objectives include: 1) provide a sustainable and reliable source of recycled water for groundwater basin replenishment via the Montebello Forebay, 2) implement a cost-effective and environmentally sound project, 3) protect the groundwater quality of the basin, 4) comply with pertinent regulatory requirements employing an institutionally feasible approach, and 5) provide up to 21,000 acre-feet per year (AFY) of recycled water consistent with current and future needs within approximately 10 years. As a result of multiple studies over a number of years to evaluate of a wide spectrum of potential water supply reliability improvement projects, two different GRIP projects, as described below, were determined to be the best alternatives to completely replace imported water (up to 21,000 AFY) for recharge at the Montebello Forebay Spreading Grounds. Potential water quality impacts of both GRIP alternatives were simulated by the SNMP mixing model.

- GRIP Recycled Water Project A (GRIP A) – A combination of tertiary-treated (11,000 acre-feet per year [AFY]) and AWT (10,000 AFY) recycled water to replace imported water.
- GRIP Recycled Water Project B (GRIP B) – 100% tertiary-treated recycled water (21,000 AFY) to replace imported water.

Historical Period – The period of time for assessment of baseline or base case salt and nutrient inflows and outflows, which covers Water Years 2000-01 through 2009-10.

Historical Sources of Salt and Nutrients – Includes historical agriculture, livestock, septic systems, and other sources that have contributed to salt and nutrient loading in the Central Basin and West Coast Basin.

Implementation Measures – Strategies, projects, or programs that were developed by stakeholders in the Central Basin and West Coast Basin to control, reduce, or manage (mitigate) salt and nutrient loading to the groundwater basin on a sustainable basis.

Imported Water – Water that is imported to the Central Basin and West Coast Basin (CBWCB) from three major sources: the Sacramento-San Joaquin Delta (northern California), Colorado River, and Owens Valley/Mono Basin (eastern Sierra Nevada Mountains). Metropolitan Water District of Southern California (MWD) imports surface water from northern California (State Water Project) and the Colorado River (via the 242-mile Colorado River Aqueduct) to the CBWCB. The Los Angeles Department of Water and Power (LADWP) imports water from the Owens Valley/Mono Basin to the City of Los Angeles via the Los Angeles Aqueduct.

Inflow – A type of water or constituent (or water balance component) that is flowing into the groundwater basin or subarea within the basin. See definition for Water Budget/Balance.

In-Lieu Program – Program established by the Water Replenishment of Southern California to offset the pumping in the Central Basin and West Coast Basin to lower the annual overdraft and reduce artificial replenishment needs. It helps provide an alternate means of replenishing the groundwater supply by encouraging basin pumpers to purchase surplus imported water when available instead of pumping groundwater. This can help raise water levels in areas that are otherwise more difficult to address.

Irrigation and Precipitation Return Flows – The portion of precipitation and applied irrigation that percolates to groundwater.

Local Water – Local water includes stormwater and base surface water flow.

Low Impact Development (LID) – Design techniques that infiltrate, filter, store, evaporate, and detain surface water runoff close to its source. LID can include management measures such as maintenance practices, street sweeping, public education, and outreach programs. The main goals of LID are to increase groundwater recharge and improve stormwater quality.

Managed Aquifer Recharge – The process of adding a water source such as recycled water to aquifers under controlled conditions for withdrawal at a later date, or used as a barrier to prevent saltwater or other contaminants from entering the aquifer. Water can be recharged by a number of methods including infiltration via spreading basins or by the use of injection wells. (See definition of Artificial Recharge; also called Groundwater Recharge.)

Managed Safe Yield – The amount of groundwater that can be withdrawn from the Central Basin and West Coast Basin without long-term adverse effects assuming natural managed aquifer recharge.

Maximum Contaminant Levels (MCL) – The highest level of a contaminant that is allowed in drinking water and is protective of human health. Primary MCLs are established by the United States Environmental Protection Agency and the State Water Resources Control Board, Division of Drinking Water (formerly the California Department of Public Health) and reflect not only the chemicals' health risks but also factors such as their detectability and treatability, as well as the cost of treatment.

Microfiltration (MF) – A treatment system that passes liquid through semipermeable membranes to exclude particles ranging in size from 0.005-2.0 micrometer (µm).

Mixing Model – A spreadsheet model that was developed for the Salt and Nutrient Management Plan to estimate salt and nutrient concentrations in groundwater. Future salt and nutrients inflows and outflows are mixed (instantaneously) with baseline concentrations to estimate future water quality.

Natural Safe Yield – The amount of groundwater that can be withdrawn from the Central Basin and West Coast Basin without adverse effect, assuming natural groundwater replenishment.

Nitrification/Denitrification (NdN) – A biological treatment process used for nitrogen removal that converts ammonia to nitrate, and nitrate to nitrogen gas.

Nitrate (NO_3) – A colorless, odorless, and tasteless compound that is present in some groundwater and is commonly expressed in terms of milligrams per liter (mg/L). Nitrate is the primary form of nitrogen detected in groundwater. High levels of nitrate in groundwater are associated with agricultural activities, septic systems, confined animal facilities, landscape fertilization, and wastewater treatment facilities. In the Central Basin and West Coast Basin (CBWCB), natural nitrate levels in groundwater are generally very low (typically less than the Maximum Contaminant Level of 10 mg/L as nitrogen) and well below the Basin Plan Objective of 45 mg/L. For the CBWCB Salt and Nutrient Management Plan, nitrate chloride, and total dissolved solids (TDS) have been determined to be the most appropriate indicators of salts and nutrients in the CBWCB. See definition for salt and nutrients.

Notification Levels (NLs) – Health-based advisory levels established by the State Water Resources Control Board, Division of Drinking Water (formerly the California Department of Public Health) for chemicals in drinking water that lack Maximum Contaminant Levels. When chemicals are found at concentrations greater than their NLs, certain requirements and recommendations apply to drinking water purveyors.

Nutrient Plant Uptake – The process by which plants absorb nutrients from applied water and surrounding soil.

Outflow – A type of water or constituent (or water balance component) that is flowing out of the groundwater basin or subarea within the basin. See definition for water budget/balance.

Ozonation – A chemical oxidation treatment process that uses ozone to react with contaminants in water. It is also used for disinfection.

Public Health Goals (PHGs) – Levels of contaminants in drinking water that would not be expected to pose a significant health risk to individuals consuming an average of two liters a day of that water over a 70-year lifetime. PHGs are established by the Office of Environmental Health Hazard Assessment (OEHHA). They are based solely on health risk considerations and do not consider costs or technical feasibility. Public water systems do not have to meet public health goals. However, water systems with more than 10,000 service connections are legally required to prepare an exceedance report every three years if one or more chemical contaminants exceed PHG levels.

Primary Treatment – A treatment process that allows for heavier solids in raw sewage to settle to the bottom of a tank and for the lighter materials, like plastic and grease, which float to the top, to be skimmed and removed and recycled back into the treatment process.

Priority Sites – Environmental release sites in the Central Basin and West Coast Basin that were selected by the Water Replenishment District of Southern California (WRD), with input from regulatory agencies, based on certain criteria, such as hydrogeology, depth and concentration of the contaminants, fate and transport of the constituents of concern, distance to nearby water supply wells, presence of contaminated drinking water wells in the site vicinity, proximity to recharge areas, and status of site characterization/remediation. WRD has been tracking and working in close consultation with the regulatory agencies to provide data and technical support to expedite investigations and cleanups at priority groundwater contaminated sites within the CBWCB. See definition for environmental release sites.

Project Contact – E-mail where comments, suggested edits, and questions on the Technical Memorandums (TMs), other project materials, or SNMP process may be directed (WRD@saltnutrient.com).

Projected Future Inflows and Outflows – The projected salt and nutrient inflows and outflows will be based on the average of the past ten years (2000-01 through 2009-10) of flows with changes based on future projects planned to be implemented in the next 15 years (2010-11 through 2024-25).

Project Website – The website established to disseminate information related to the Central Basin and West Coast (CBWCB) SNMP and includes a calendar of events and meetings, meeting agendas and minutes, meeting presentations, project schedules, contact information, deliverables, data, graphics and other materials (www.WRD.saltnutrient.com).

Public Drinking Water System – A public drinking water system means a system for the provision of water for human consumption through pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year. Private domestic wells are not regulated by the State Water Resources Control Board, Division of Drinking Water (formerly California Department of Public Health).

Quality Assurance/Quality Control (QA/QC) – Quality Assurance (QA) is a procedure or set of procedures intended to ensure that a product or service under development (before work is complete, as opposed to afterwards) meets specified requirements. Quality Control (QC) is a procedure or set of procedures intended to ensure that a manufactured product or performed service adheres to a defined set of quality criteria or meets the requirements of the client or customer. Due to the large size of the Central Basin and West Coast Basin and numerous managed recharge projects, a large amount of data collected from many agencies and entities is required to support the Salt and Nutrient Management development effort. Generally, the data will be accepted as correct and reliable; however, data will be evaluated for inconsistencies and outliers.

Recharge Area – An area where surface water can infiltrate downward to reach the water table and contribute to the groundwater supply. A recharge area can also refer to an injection well that pumps water down and into an aquifer thereby replenishing the aquifer.

Recycled Water – Domestic or municipal wastewater which has been treated to a quality suitable for a beneficial use.

Replenishment Operations – Managed aquifer recharge operations including spreading grounds and seawater intrusion barriers.

Reverse Osmosis (RO) – A treatment process where pressure greater than the osmotic pressure is applied to water to drive the more concentrated solution to the other side of the membrane and the membrane acts as a barrier to contaminants, such as salts. The permeate (product) water passes through the membrane and has reduced contaminant concentration. A reject flow stream is produced that contains salts and other constituents rejected by the membrane process.

Review Period –The 30-day period allocated for comments from stakeholders on project Technical Memorandums (TMs). The review period for the CEQA Substitute Environmental Document (SED) is 45 days.

Saline Plumes – Seawater-impacted areas in the groundwater basin that were caused by historical over-pumping which created a hydraulic gradient that resulted in seawater intrusion. These large plumes of saline water are trapped inland of the barrier injection wells, thereby degrading significant volumes of groundwater with high concentrations of chloride and decreasing the ability of affected aquifers to provide groundwater storage.

Salt and Nutrient Management Plan (SNMP) Assistance Document – On June 28, 2012, the Los Angeles Regional Water Quality Control Board issued the *Regional Water Board Assistance in Guiding Salt and Nutrient Management Plan Development in the Los Angeles Region* (SNMP

Assistance Document), which provided guidance for preparation of SNMPs within the Los Angeles region.

Salts and Nutrients – The dissolved ions in water that reflect its salts and nutrients and include calcium, magnesium, sodium, potassium, chloride, fluoride, nitrate, bicarbonate, carbonate, iron, boron, manganese, and phosphate. For the SNMP, total dissolved solids (TDS), chloride, and nitrate have been determined to be the most appropriate indicators of salts and nutrients in the Central Basin and West Coast Basin. See definition for TDS.

Salt and Nutrients Inflows and Outflows – Salt and nutrient inflows and outflows are developed based on the assigning water quality concentrations to the inflows and outflows in the water balance (see definition below). Additional salt and nutrient loading may occur as a result of various water uses, such as fertilizer application. Salt and nutrient loading may also be reduced due to fate and transport processes, e.g. reduction in nitrate due to denitrification and plant uptake.

Secondary Maximum Contaminant Level (SMCL) – Water quality standard established by the State Water Resources Control Board, Division of Drinking Water (formerly the California Department of Public Health) to manage drinking water for aesthetic considerations, such as taste, color, and odor. Contaminants with only SMCLs are not considered to pose a risk to human health.

Self Regenerating Water Softener (SRWS) – A water conditioning device that removes hardness (primarily calcium and magnesium) from water by ion exchange. The calcium and magnesium ions replace sodium or potassium ions on the ion exchange resin. The water softener ion exchange resin is regenerated using salt and results in a brine solution that is flushed to sewers.

Sensitivity Analysis – An analysis that is performed to provide the uncertainty or range of possible future predicted water quality conditions.

Soil Aquifer Treatment – Natural processes that occur in the soil and aquifer that act to filter particulate matter and to remove or reduce chemical and biological constituents of concern to improve groundwater quality.

Source Water – Waters that recharge or flow out of the Central Basin and West Coast Basin and include precipitation, subsurface groundwater inflow from adjacent basins and the ocean, local surface water/stormwater, imported water, recycled water, and wastewater.

Specific Yield – Specific yield is the ratio of the volume of water the aquifer will yield by gravity drainage to the total volume of aquifer and is a measure of the volume of water in the formation.

Stakeholders – Local water and wastewater entities, parties contributing salts and nutrients to groundwater, and parties with an interest in the SNMP process and findings.

Storage Coefficient – The volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head.

Streamlined Permitting for Irrigation Projects – The Recycled Water Policy sets forth criteria for irrigation projects that establish eligibility for streamlined permitting including compliance with the requirements for recycled water established in Title 22 of the California Code of Regulations; application of recycled water at agronomic rates; development and implementation of a site operations and maintenance plan; compliance with any applicable salt and nutrient management plan; and appropriate use of fertilizers.

Study Area – The area of analysis for the Salt and Nutrient Management Plan; it includes all of the Central Basin and West Coast Basin, as defined by the California Department of Water Resources.

Subarea – Smaller areas designated within the groundwater basin to more accurately define the water quality of the basin.

Tertiary Treatment – A treatment process where wastewater that has undergone secondary treatment is processed using granular media or carbon filters and then disinfected.

Time /Concentration Charts – Graphs that show constituent concentrations on the x axis and sampling concentrations on the y axis of an x-y plot and are used to illustrate changes in water quality concentrations over time.

Todd Groundwater Team – Staff from Todd Groundwater (formerly Todd Engineers), RMC Water and Environment, Nellor Environmental Associates Inc., and Environmental Science Associates assisting the Central Basin and West Coast Basin stakeholders in preparing the SNMP.

Total Dissolved Solids (TDS) – An overall measure of the minerals in water. Total salinity is commonly expressed in terms of TDS as milligrams per liter (mg/L). Elevated TDS concentrations above the Secondary Maximum Contaminant Level of 1,000 mg/L are undesirable for aesthetic reasons related to taste, odor, or appearance of the water and not for health reasons; however, elevated TDS concentrations in water can damage crops, affect plant growth, and damage municipal and industrial equipment. For the SNMP, TDS, chloride, and nitrate have been determined to be the most appropriate indicators of salts and nutrients in the CBWCB. See definition for salt and nutrients.

Total Maximum Daily Load (TMDL) – The maximum amount of a pollutant from point sources and nonpoint sources that an impaired water body can receive and still meet water quality standards, within a margin of safety and considering seasonal variation.

Ultraviolet (UV) – UV irradiation is the process by which chemical bonds of the contaminants are broken by the energy associated with UV light (photolysis). UV also has germicidal properties and is used for disinfection.

Unconfined Aquifer – An aquifer in which there are no confining beds between the aquifer and the ground surface. The groundwater surface or water table in an unconfined aquifer is at atmospheric pressure.

Unconformities – A break or gap in the geologic record, such as a break between older eroded bedrock and overlying younger sedimentary units.

Urban Water Management Plans (UWMPs) – Plans prepared by California's urban water suppliers to support their long-term resource planning and ensure adequate water supplies are available to meet existing and future water demands over a 20-year planning horizon considering normal, dry, and multiple dry years. UWMPs are required to be prepared every 5 years and submitted to the California Department of Water Resources.

Vadose Zone – The depth between the land surface and the regional water table. Generally, water in this zone is under less than atmospheric pressure, and some of the voids may contain air or other gases at atmospheric pressure.

Wastewater – Liquid waste discharged from municipal activities, including residential, commercial, and industrial activities. Once treated and discharged from a water reclamation plant, this water becomes recycled water. See definition of Recycled Water.

Water Budget/Balance – An estimate of specific inflows and outflows for each individual basin or sub area and the entire Central Basin and West Coast Basin (CBWCB). Water budgets are extracted from the existing groundwater model of the CBWCB that was previously developed by the United States Geological Services and was recently updated for the Groundwater Basins Master Plan.

Water Quality Averaging Period – The period of time used to determine the existing water quality or representative current concentration of salts and nutrients in groundwater. In accordance with the State Water Resources Control Board (SWRCB) Recycled Water Policy, it is the most recent five years of data, which is the period from mid-2007 to mid-2012 or from January 2007 to January 2012, depending on the data source.

Water Quality Objective (WQO) – Also referred to as Basin Plan Objective (see definition)

Water Year (WY) – The period from October 1 through September 30 of the following year.

West Coast Basin – The California Department of Water Resources (DWR) defines the West Coast Subbasin (DWR Subbasin Number 4-11.03) as occupying a portion (142 square miles) of the Coastal Plain of the Los Angeles Groundwater Basin. In the SNMP, the West Coast "Subbasin" is referred to as the West Coast "Basin." The WRD boundaries encompass all of the DWR defined West Coast Basin extent.

Workplan – In 2011, the *Workplan of the Salt/Nutrient Management Plan* [SNMP]*, Central Basin and West Coast Basin* was prepared by the Central Basin and West Coast Basin (CBWCB) stakeholders and was subsequently approved by the California Regional Water Quality Control Board, Los Angeles Region, on December 13, 2011. The Workplan described the key components and approach for preparation of the SNMP.

Attachment K-B

Water Quality Parameters and Monitoring Frequencies Montebello Forebay Groundwater Recharge Project

Below is a list of parameters and their respective monitoring frequencies associated with the Montebello Forebay Groundwater Recharge (MFGWR) Project, specifically for recycled water that is delivered to the spreading grounds, surface water at the points of intake to the Rio Hondo Spreading Grounds and San Gabriel River Spreading Grounds, and at the permit-required groundwater monitoring wells and production wells.

Parameter	Monitoring Frequency		
	Recycled Water	Intake Surface Water	Groundwater
Total Dissolved Solids	Monthly	Quarterly	Bimonthly-Semiannually
Major Minerals			
Calcium	Bimonthly	Quarterly	Bimonthly-Semiannually
Magnesium	Bimonthly	Quarterly	Bimonthly-Semiannually
Sodium	Bimonthly	Quarterly	Bimonthly-Semiannually
Potassium	Bimonthly	Quarterly	Bimonthly-Semiannually
Chloride	Bimonthly	Quarterly	Bimonthly-Semiannually
Boron	Bimonthly	Quarterly	Bimonthly-Semiannually
Hardness	Bimonthly	Quarterly	Bimonthly-Semiannually
Alkalinity	Bimonthly	Quarterly	Bimonthly-Semiannually
Fluoride	Bimonthly	Quarterly	Bimonthly-Semiannually
Carbonate	Bimonthly	Quarterly	Bimonthly-Semiannually
Bicarbonate	Bimonthly	Quarterly	Bimonthly-Semiannually
Sulfate	Bimonthly	Quarterly	Bimonthly-Semiannually
Nitrogen (N)			
Nitrate-N	Monthly	Quarterly	Bimonthly-Semiannually
Nitrite-N	Monthly	Quarterly	Bimonthly-Semiannually
Ammonia-N	Monthly	Quarterly	Bimonthly-Semiannually
Organic-N	Monthly	Quarterly	Bimonthly-Semiannually
Oxidants and Reluctant			
Chemical Oxygen Demand	Monthly	Quarterly	Bimonthly-Semiannually
Biochemical Oxygen Demand	Weekly	Quarterly	---
Total Organic Carbon	Monthly	Quarterly	Bimonthly-Semiannually
Base/Neutral Extractable Organics			
Bis (2-ethylhexyl) phthalate	Bimonthly	Quarterly	Bimonthly-Semiannually
Phenanthrene	Bimonthly	Quarterly	Bimonthly-Semiannually
Fluoranthene	Bimonthly	Quarterly	Bimonthly-Semiannually

Parameter	Monitoring Frequency		
	Recycled Water	Intake Surface Water	Groundwater
Aroclor 1242	Bimonthly	Quarterly	Bimonthly-Semiannually
Aroclor 1254	Bimonthly	Quarterly	Bimonthly-Semiannually
Polychlorinated Biphenyls	Bimonthly	Quarterly	Bimonthly-Semiannually
Acid Extractable Organics			
1,2,4-Trichlorobenzene	Bimonthly	Quarterly	Bimonthly-Semiannually
2,4,6-Trichlorophenol	Bimonthly	Quarterly	Bimonthly-Semiannually
2,4,5-Trichlorophenol	Bimonthly	Quarterly	Bimonthly-Semiannually
2,3,4-Trichlorophenol	Bimonthly	Quarterly	Bimonthly-Semiannually
2,3,6-Trichlorophenol	Bimonthly	Quarterly	Bimonthly-Semiannually
3,4,5-Trichlorophenol	Bimonthly	Quarterly	Bimonthly-Semiannually
Pentachlorophenol	Bimonthly	Quarterly	Bimonthly-Semiannually
Phenol	Bimonthly	Quarterly	Bimonthly-Semiannually
Pesticides			
DDT	Bimonthly	Quarterly	Bimonthly-Semiannually
BHC	Bimonthly	Quarterly	Bimonthly-Semiannually
Aldrin	Bimonthly	Quarterly	Bimonthly-Semiannually
Dieldrin	Bimonthly	Quarterly	Bimonthly-Semiannually
Endrin	Bimonthly	Quarterly	Bimonthly-Semiannually
Toxaphene	Bimonthly	Quarterly	Bimonthly-Semiannually
Atrazine	Bimonthly	Quarterly	Bimonthly-Semiannually
Simazine	Bimonthly	Quarterly	Bimonthly-Semiannually
Methoxychlor	Bimonthly	Quarterly	Bimonthly-Semiannually
2,4-D	Bimonthly	Quarterly	Bimonthly-Semiannually
2,4,5-TP (Silvex)	Bimonthly	Quarterly	Bimonthly-Semiannually
Lindane	Bimonthly	Quarterly	Bimonthly-Semiannually
Heptachlor	Bimonthly	Quarterly	Bimonthly-Semiannually
Heptachlor Epoxide	Bimonthly	Quarterly	Bimonthly-Semiannually
Purgeable Organics			
Methylene Chloride	Bimonthly	Quarterly	Bimonthly-Semiannually
Chloroform	Bimonthly	Quarterly	Bimonthly-Semiannually
Bromodichloromethane	Bimonthly	Quarterly	Bimonthly-Semiannually
Dibromochloromethane	Bimonthly	Quarterly	Bimonthly-Semiannually
Bromoform	Bimonthly	Quarterly	Bimonthly-Semiannually
Carbon Tetrachloride	Bimonthly	Quarterly	Bimonthly-Semiannually
1,1-Dichloroethane	Bimonthly	Quarterly	Bimonthly-Semiannually
1,2-Dichloroethane	Bimonthly	Quarterly	Bimonthly-Semiannually
1,1,1-Trichloroethane	Bimonthly	Quarterly	Bimonthly-Semiannually
1,1,2-Trichloroethane	Bimonthly	Quarterly	Bimonthly-Semiannually
1,1-Dichloroethylene	Bimonthly	Quarterly	Bimonthly-Semiannually
Cis-1,2-Dichloroethylene	Bimonthly	Quarterly	Bimonthly-Semiannually
Trichloroethylene	Bimonthly	Quarterly	Bimonthly-Semiannually
Tetrachloroethylene	Bimonthly	Quarterly	Bimonthly-Semiannually

Parameter	Monitoring Frequency		
	Recycled Water	Intake Surface Water	Groundwater
Benzene	Bimonthly	Quarterly	Bimonthly-Semiannually
Toluene	Bimonthly	Quarterly	Bimonthly-Semiannually
Chlorobenzene	Bimonthly	Quarterly	Bimonthly-Semiannually
o-Dichlorobenzene	Bimonthly	Quarterly	Bimonthly-Semiannually
m-Dichlorobenzene	Bimonthly	Quarterly	Bimonthly-Semiannually
p-Dichlorobenzene	Bimonthly	Quarterly	Bimonthly-Semiannually
Trans-1,2-Dichloroethylene	Bimonthly	Quarterly	Bimonthly-Semiannually
Bromoethane	Bimonthly	Quarterly	Bimonthly-Semiannually
Chloroethane	Bimonthly	Quarterly	Bimonthly-Semiannually
2-Chloroethylvinylether	Bimonthly	Quarterly	Bimonthly-Semiannually
Chloromethane	Bimonthly	Quarterly	Bimonthly-Semiannually
1,2-Dichloropropene	Bimonthly	Quarterly	Bimonthly-Semiannually
Cis-1,3-Dichloropropene	Bimonthly	Quarterly	Bimonthly-Semiannually
Trans-1,3-Dichloropropene	Bimonthly	Quarterly	Bimonthly-Semiannually
1,1,2,2-Tetrachloroethane	Bimonthly	Quarterly	Bimonthly-Semiannually
Vinyl Chloride	Bimonthly	Quarterly	Bimonthly-Semiannually
Xylenes	Bimonthly	Quarterly	Bimonthly-Semiannually
Trichlorofluoromethane	Bimonthly	Quarterly	Bimonthly-Semiannually
Bromomethane	Bimonthly	Quarterly	Bimonthly-Semiannually
Dichlorodifluoromethane	Bimonthly	Quarterly	Bimonthly-Semiannually
Ethylbenzene	Bimonthly	Quarterly	Bimonthly-Semiannually
Methyl ethyl ketone	Bimonthly	Quarterly	Bimonthly-Semiannually
Methyl isobutyl ketone	Bimonthly	Quarterly	Bimonthly-Semiannually
Miscellaneous Organics			
Phenylacetic Acid	Bimonthly	Quarterly	Bimonthly-Semiannually
Methylene Blue Active Substances	Bimonthly	Quarterly	Bimonthly-Semiannually
Physical Properties			
pH	Daily	Quarterly	Bimonthly-Semiannually
Temperature	Daily	Quarterly	Bimonthly-Semiannually
Color	Monthly	Quarterly	Bimonthly-Semiannually
Turbidity	Daily	Quarterly	Bimonthly-Semiannually
Iron and Manganese			
Iron	Quarterly	Quarterly	Bimonthly-Semiannually
Manganese	Quarterly	Quarterly	Bimonthly-Semiannually
Trace Constituents			
Arsenic	Quarterly	Quarterly	Bimonthly-Semiannually
Barium	Quarterly	Quarterly	Bimonthly-Semiannually
Cadmium	Quarterly	Quarterly	Bimonthly-Semiannually
Chromium (Hexavalent)	Quarterly	Quarterly	Bimonthly-Semiannually

Parameter	Monitoring Frequency		
	Recycled Water	Intake Surface Water	Groundwater
Chromium (Total)	Quarterly	Quarterly	Bimonthly-Semiannually
Copper	Quarterly	Quarterly	Bimonthly-Semiannually
Lead	Quarterly	Quarterly	Bimonthly-Semiannually
Mercury	Quarterly	Quarterly	Bimonthly-Semiannually
Nickel	Quarterly	Quarterly	Bimonthly-Semiannually
Selenium	Quarterly	Quarterly	Bimonthly-Semiannually
Silver	Quarterly	Quarterly	Bimonthly-Semiannually
Zinc	Quarterly	Quarterly	Bimonthly-Semiannually
Radioactivity			
Gross alpha	Quarterly	Quarterly	Bimonthly-Semiannually
Gross beta	Quarterly	Quarterly	Bimonthly-Semiannually
Uranium	Quarterly	Quarterly	Bimonthly-Semiannually
Radium-226	Quarterly	Quarterly	Bimonthly-Semiannually
Radium-228	Quarterly	Quarterly	Bimonthly-Semiannually
Tritium	Quarterly	Quarterly	Bimonthly-Semiannually
Strontium-90	Quarterly	Quarterly	Bimonthly-Semiannually
Radon	Quarterly	Quarterly	Bimonthly-Semiannually

Attachment K-C

Water Quality Parameters and Monitoring Frequencies Alamitos Gap Seawater Intrusion Barrier

Below is a list of parameters and their current respective monitoring frequencies associated with the Alamitos Gap Seawater Intrusion Barrier, specifically for the advanced treated recycled water produced by WRD's Leo J. Vander Lans Advanced Water Treatment Facility (AWTF) and at the permit-required groundwater monitoring wells.

AWT Recycled Water Discharge Limits Monitoring [a]

Constituent/Parameter	Frequency
Total Recycled Water Flow	Continuous
pH	Continuous
Total coliform	Daily
Total organic carbon (TOC)	Weekly
Turbidity	Weekly
Total nitrogen	Weekly
Nitrate as nitrogen	Weekly
Nitrite as nitrogen	Weekly
Nitrate plus nitrite	Weekly
Inorganics with primary MCLs (see tables below)	Quarterly
Constituents/parameters with Secondary MCLs (see tables below)	Quarterly
Radioactivity (see tables below)	Quarterly
Regulated organic chemicals (see tables below)	Quarterly
Disinfection byproducts (see tables below)	Quarterly
General physical (see tables below)	Quarterly
General minerals (see tables below)	Quarterly
Constituents with Notification Levels (see tables below)	Varies
Remaining priority pollutants (see tables below)	Annually
Constituents of emerging concern (see tables below)	Varies

a. Based on LARWQCB Order No. R4-2014-0111, Table M-3

AWT – advanced water treatment

LARWQCB – Los Angeles Regional Water Quality Control Board

MCLs – Maximum Contaminant Levels

Groundwater Monitoring [a]

Constituent/Parameter	Frequency
Water Level Elevation	Quarterly
Chlorine residual	Quarterly
Total coliform	Quarterly
Total organic carbon (TOC)	Quarterly
BOD_5 20°C	Semi-Annually
Oil and grease	Quarterly
Total suspended solids	Semi-Annually
Turbidity	Quarterly
Total nitrogen	Quarterly
n-Nitrosopyrrolidine	Annually
Fluoride	Quarterly
Inorganics with primary MCLs (see tables below)	Quarterly
Constituents/parameters with Secondary MCLs (see tables below)	Quarterly
Radioactivity (see tables below)	Quarterly or Semi-Annually
Regulated organic chemicals (see tables below)	Quarterly or Semi-Annually
Disinfection byproducts (see tables below)	Quarterly
General physical (see tables below)	Quarterly
General minerals (see tables below)	Quarterly
Constituents with Notification Levels (see tables below)	Quarterly or Annually
Remaining priority pollutants (see tables below)	Annually

a. Based on LARWQCB Order No. R4-2014-0111, Table M-16
LARWQCB – Los Angeles Regional Water Quality Control Board
MCLs – Maximum Contaminant Levels

Inorganics with Primary MCLs

Parameter[a]	Monitoring Frequency for AWT Recycled Water and Groundwater
Aluminum	Quarterly
Antimony	Quarterly
Arsenic	Quarterly
Asbestos	Quarterly
Barium	Quarterly
Beryllium	Quarterly
Cadmium	Quarterly
Chromium (Total)	Quarterly
Cyanide	Quarterly
Fluoride	Quarterly
Mercury	Quarterly
Nickel	Quarterly
Nitrate (as Nitrogen)	Quarterly
Nitrate + Nitrite (sum as Nitrogen)	Quarterly
Nitrite (as Nitrogen)	Quarterly
Perchlorate	Quarterly
Selenium	Quarterly
Thallium	Quarterly

b. Based on Title 22 of the California Code of Regulations, Table 64431-A
AWT – advanced water treatment
LARWQCB – Los Angeles Regional Water Quality Control Board
MCL – Maximum Contaminant Level

Regulated Organics – Volatile Organic Chemicals [a]

Constituent	Monitoring Frequency	
	AWT Recycled Water	Groundwater
Benzene	Quarterly	Semi-Annually
Carbon Tetrachloride (CTC)	Quarterly	Semi-Annually
1,2-Dichlorobenzene	Quarterly	Semi-Annually
1,4-Dichlorobenzene	Quarterly	Semi-Annually
1,1-Dichloroethane	Quarterly	Semi-Annually
1,2-Dichloroethane (1,2-DCA)	Quarterly	Semi-Annually
1,1-Dichloroethylene (1,1-DCE)	Quarterly	Semi-Annually
cis-1,2-Dichloroethylene	Quarterly	Semi-Annually
trans-1,2-Dichloroethylene	Quarterly	Semi-Annually
Dichloromethane	Quarterly	Semi-Annually
1,2-Dichloropropane	Quarterly	Semi-Annually
1,3-Dichloropropene	Quarterly	Semi-Annually
Ethylbenzene	Quarterly	Semi-Annually
Methyl-*tert*-butyl ether (MTBE)	Quarterly	Semi-Annually
Monochlorobenzene	Quarterly	Semi-Annually
Styrene	Quarterly	Semi-Annually
1,1,2,2-Tetrachloroethane	Quarterly	Semi-Annually
Tetrachloroethylene (PCE)	Quarterly	Semi-Annually
Toluene	Quarterly	Semi-Annually
1,2,4-Trichlorobenzene	Quarterly	Semi-Annually
1,1,1-Trichloroethane	Quarterly	Semi-Annually
1,1,2-Trichloroethane	Quarterly	Semi-Annually
Trichloroethylene (TCE)	Quarterly	Semi-Annually
Trichlorofluoromethane	Quarterly	Semi-Annually
1,1,2-Trichloro-1,2,2-Trifluoroethane	Quarterly	Semi-Annually
Vinyl Chloride	Quarterly	Semi-Annually or Quarterly
Xylenes (m,p)	Quarterly	Semi-Annually

a. Based on Title 22 of the California Code of Regulations, Table 64444-A

AWT – advanced water treatment

MCL – Maximum Contaminant Level

Regulated Organics – Non-Volatile Synthetic Organic Constituents [a]

Constituent	Monitoring Frequency	
	AWT Recycled Water	Groundwater
Alachlor	Quarterly	Semi-Annually
Atrazine	Quarterly	Semi-Annually
Bentazon	Quarterly	Semi-Annually
Benzo(a)pyrene	Quarterly	Semi-Annually
Carbofuran	Quarterly	Semi-Annually
Chlordane	Quarterly	Semi-Annually
2,4-Dichlorophenoxyacetic acid (2,4-D)	Quarterly	Semi-Annually
Dalapon	Quarterly	Semi-Annually
Dibromochloropropane (DBCP)	Quarterly	Semi-Annually
Di(2-ethylhexyl)adipate	Quarterly	Semi-Annually
Di(2-ethylhexyl)phthalate	Quarterly	Semi-Annually or Annual
Dinoseb	Quarterly	Semi-Annually
Diquat	Quarterly	Semi-Annually
Endothall	Quarterly	Semi-Annually
Endrin	Quarterly	Semi-Annually
Ethylene Dibromide (EDB)	Quarterly	Semi-Annually
Glyphosate	Quarterly	Semi-Annually
Heptachlor	Quarterly	Semi-Annually
Heptachlor Epoxide	Quarterly	Semi-Annually
Hexachlorobenzene	Quarterly	Semi-Annually
Hexachlorocyclopentadiene	Quarterly	Semi-Annually
Lindane	Quarterly	Semi-Annually
Methoxychlor	Quarterly	Semi-Annually
Molinate	Quarterly	Semi-Annually
Oxamyl	Quarterly	Semi-Annually
Pentachlorophenol	Quarterly	Semi-Annually
Picloram	Quarterly	Semi-Annually
Polychlorinated Biphenyls	Quarterly	Semi-Annually
Simazine	Quarterly	Semi-Annually
Thiobencarb	Quarterly	Semi-Annually
Toxaphene	Quarterly	Semi-Annually
2,3,7,8-TCDD (Dioxin)	Quarterly	Semi-Annually
2,4,5-TP (Silvex)	Quarterly	Semi-Annually

a. Based on Title 22 of the California Code of Regulations, Table 64444-A
AWT – advanced water treatment
MCL – Maximum Contaminant Level

Disinfection Byproducts [a]

Constituent	Monitoring Frequency	
	AWT Recycled Water	Groundwater
Total Trihalomethanes (TTHM)	Quarterly	Quarterly
Bromodichloromethane	Quarterly	Quarterly
Bromoform	Quarterly	Quarterly
Chloroform	Quarterly	Quarterly
Dibromochloromethane	Quarterly	Quarterly
Haloacetic Acids (five) (HAA5)	Quarterly	Quarterly
Monochloroacetic Acid	Quarterly	Quarterly
Dichloroacetic Acid	Quarterly	Quarterly
Trichloroacetic Acid	Quarterly	Quarterly
Monobromoacetic Acid	Quarterly	Quarterly
Dibromoacetic Acid	Quarterly	Quarterly
Bromate	Quarterly	Quarterly
Chlorite	Quarterly	Quarterly

a. Based on Title 22 of the California Code of Regulations, Table 64533-A
AWT – advanced water treatment
MCL – Maximum Contaminant Level

General Physical and General Minerals [a]

Parameter	Monitoring Frequency for AWT Recycled Water and Groundwater
Asbestos	Quarterly
Calcium	Quarterly
Chloride	Quarterly
Copper	Quarterly
Iron	Quarterly
Manganese	Quarterly
Potassium	Quarterly
Sodium	Quarterly
Sulfate	Quarterly
Zinc	Quarterly
Color	Quarterly
Corrosivity	Quarterly
Foaming Agents	Quarterly
Odor	Quarterly
Specific Conductance	Quarterly
Total Dissolved Solids	Quarterly
Total Hardness	Quarterly

a. Based on Title 22 of the California Code of Regulations, Section 64449
AWT – advanced water treatment

Constituents/Parameters with Secondary MCLs [a]

Parameter	Monitoring Frequency for AWT Recycled Water and Groundwater
Aluminum	Quarterly
Chloride	Quarterly
Color	Quarterly
Copper	Quarterly
Foaming Agents (MBAS)	Quarterly
Iron	Quarterly
Manganese	Quarterly
Methyl-*tert*-butyl ether (MTBE)	Quarterly
Odor – Threshold	Quarterly
Silver	Quarterly
Specific Conductance	Quarterly
Sulfate	Quarterly
Thiobencarb	Quarterly
Total Dissolved Solids	Quarterly
Turbidity	Quarterly
Zinc	Quarterly

a. Based on Title 22 of the California Code of Regulations, Table 64449-A
MCL – Maximum Contaminant Level
AWT – advanced water treatment

Radioactivity [a]

Parameter	Monitoring Frequency	
	AWT Recycled Water	Groundwater
Radium-226	Quarterly	Semi-Annually or Quarterly
Radium-228	Quarterly	Semi-Annually
Combined Radium-226 and Radium-228	Quarterly	Semi-Annually
Gross Alpha Particle Activity (Including Radium-226 but Excluding Radon and Uranium)	Quarterly	Semi-Annually
Tritium	Quarterly	Semi-Annually
Strontium-90	Quarterly	Semi-Annually
Gross Beta Particle Activity	Quarterly	Semi-Annually or Quarterly
Uranium	Quarterly	Semi-Annually

a. Based on Title 22 of the California Code of Regulations, Table 64442
AWT – advanced water treatment
MCL – Maximum Contaminant Level

Constituents with Notification Levels [a]

Parameter	Monitoring Frequency	
	AWT Recycled Water	Groundwater
Boron	Quarterly	Quarterly
n-Butylbenzene	Annually	Annually
sec-Butylbenzene	Annually	Annually
tert-Butylbenzene	Annually	Annually
Carbon disulfide	Quarterly	Semi-Annually or Annually
Chlorate	Quarterly	Annually
2-Chlorotoluene	Annually	Annually
4-Chlorotoluene	Annually	Annually
Diazinon	Annually	Annually
Dichlorodifluoromethane (Freon 12)	Annually	Annually
1,4-Dioxane	Annually	Annually
Ethylene glycol	Annually	Annually
Formaldehyde	Annually	Annually
HMX	Annually	Annually
Isopropylbenzene	Annually	Annually
Manganese	Quarterly	Semi-Annually
Methyl isobutyl ketone (MIBK)	Annually	Annually
Naphthalene	Annually	Annually
n-Nitrosodiethylamine (NDEA)	Annually	Annually
n-Nitrosodimethylamine (NDMA)	Quarterly	Quarterly
n-Nitroso-n-propylamine (NDPA)	Annually	Annually
Propachlor	Annually	Annually
n-Propylbenzene	Annually	Annually
RDX	Annually	Annually
Tertiary butyl alcohol (TBA)	Quarterly	Annually
1,2,3-Trichloropropane (1,2,3-TCP)	Annually	Annually
1,2,4-Trimethylbenzene	Annually	Annually
1,3,5-Trimethylbenzene	Annually	Annually
2,4,6-Trinitrotoluene (TNT)	Annually	Annually
Vanadium	Annually	Annually

a. Based on State Water Resources Control Board, Division of Drinking Water list of NLs: http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/notificationlevels/notificationlevels.pdf

AWT – advanced water treatment

NLs – Notification Levels

Remaining Priority Pollutants [a]

Pesticides	Base/Neutral Extractables	Di-n-octyl phthalate
Aldrin	Acenaphthene	Diethyl phthalate
Dieldrin	Benzidine	Dimethyl phthalate
4,4'-DDT	Hexachloroethane	Benzo(a)anthracene
4,4'-DDE	Bis(2-chloroethyl)ether	Benzo(a)fluoranthene
4,4'-DDD	2-chloronaphthalene	Benzo(k)fluoranthene
Alpha-endosulfan	1,3-dichlorobenzene	Chrysene
Beta-endosulfan	3,3'-dichlorobenzidine	Acenaphthylene
Endosulfan sulfate	2,4-dinitrotoluene	Anthracene
Endrin aldehyde	2,6-dinitrotoluene	1,12-benzoperylene
Alpha-BHC	1,2-diphenylhydrazine	Fluorene
Beta-BHC	Fluoranthene	Phenanthrene
Delta-BHC	4-chlorophenyl phenyl ether	1,2,5,6-dibenzanthracene
Acid Extractibles	4-bromophenyl phenyl ether	Indeno(1,2,3-cd)pyrene
2,4,6-trichlorophenol	Bis(2-chloroisopropyl)ether	Pyrene
P-chloro-m-cresol	Bis(2-chloroethoxyl)methane	**Volatile Organics**
2-chlorophenol	Hexachlorobutadiene	Acrolein
2,4-dichlorophenol	Isophorone	Acrylonitrile
2,4-dimethylphenol	Nitrobenzene	Chlorobenzene
2-nitrophenol	n-Nitrosodi-n-propylamine	Chloroethane
4-nitrophenol	n-Nitrosodiphenylamine	1,1-dichloroethylene
2,4-dinitrophenol	Bis(2-ethylhexyl)phthalate	Methyl chloride
4,6-dinitro-o-cresol	Butyl benzyl phthalate	Methyl bromide
Phenol	Di-n-butyl phthalate	2-chloroethyl vinyl ether

a. Frequency for AWT recycled water is quarterly; frequency for groundwater is annually except for Well 34'L-503M where bis(2-ethylhexyl)phthalate and phenanthrene are subject to semi-annual monitoring

AWT – advanced water treatment

Constituents of Emerging Concern [a]
AWT Recycled Water

Parameter	Frequency
17β estradiol	Annually
Caffeine	Annually
n-Nitrosodiphenylamine (NDMA)	Quarterly
Triclosan	Annually
DEET	Annually
Sucralose	Annually

a. Pending availability of laboratory/laboratory method

AWT – advanced water treatment

Attachment K-D

Water Quality Parameters and Monitoring Frequencies West Coast Basin Seawater Intrusion Barrier

Below are lists of parameters and their respective monitoring frequencies associated with the West Coast Basin Seawater Intrusion Barrier, specifically for advanced treated recycled water produced by WBWMD's Edward C. Little Water Recycling Facility and at the permit-required groundwater monitoring wells.

Inorganics with MCLs

Parameter[a]	Monitoring Frequency for AWT Recycled Water and Groundwater
Aluminum	Quarterly
Antimony	Quarterly
Arsenic	Quarterly
Asbestos	Quarterly
Barium	Quarterly
Beryllium	Quarterly
Cadmium	Quarterly
Chromium	Quarterly
Cyanide	Quarterly
Fluoride	Quarterly
Mercury	Quarterly
Nickel	Quarterly
Nitrate (as NO_3)	Quarterly
Nitrate+Nitrite (sum as nitrogen)	Quarterly
Nitrite (as nitrogen)	Quarterly
Selenium	Quarterly
Thallium	Quarterly

a. Based on Title 22 of the California Code of Regulations, Table 64431-A; at the time the permit was issued, there was no MCL for perchlorate; It was included in the monitoring for Chemicals of Concern to the LARWQCB

AWT – advanced water treatment

MCL – Maximum Contaminant Level

LARWQCB – Los Angeles Regional Water Quality Control Board

Radioactivity MCLs [a]

Parameter	Monitoring Frequency for AWT Recycled Water and Groundwater
Combined Radium-226 and Radium-228	Quarterly
Gross Alpha Particle Activity (Including Radium-226 but excluding Radon and Uranium)	Quarterly
Tritium	Quarterly
Strontium-90	Quarterly
Gross Beta Particle Activity	Quarterly
Uranium	Quarterly

a. Based on Title 22 of the California Code of Regulations, Table 64442
AWT – advanced water treatment
MCLs – Maximum Contaminant Levels

Parameters with Secondary MCLs Consumer Acceptance Limits [a]

Parameter	Monitoring Frequency for AWT Recycled Water and Groundwater
Aluminum	Quarterly
Color	Quarterly
Copper	Quarterly
Foaming Agents (MBAS)	Quarterly
Iron	Quarterly
Manganese	Quarterly
Methyl-*tert*-butyl ether (MTBE)	Quarterly
Odor—Threshold	Quarterly
Silver	Quarterly
Thiobencarb	Quarterly
Turbidity	Quarterly
Zinc	Quarterly

a. Based on Title 22 of the California Code of Regulations, Table 64449-A
AWT – advanced water treatment

Volatile Organic Chemicals with MCLs [a]

Parameter	Monitoring Frequency for AWT Recycled Water and Groundwater
Benzene	Quarterly
Carbon Tetrachloride	Quarterly
1,2-Dichlorobenzene	Quarterly
1,4-Dichlorobenzene	Quarterly
1,1-Dichloroethane	Quarterly
1,2-Dichloroethane	Quarterly
1,1-Dichloroethylene	Quarterly
cis-1,2-Dichloroethylene	Quarterly
trans-1,2-Dichloroethylene	Quarterly
Dichloromethane	Quarterly
1,2-Dichloropropane	Quarterly
1,3-Dichloropropene	Quarterly
Ethylbenzene	Quarterly
Methyl-*tert*-butyl ether	Quarterly
Monochlorobenzene	Quarterly
Styrene	Quarterly
1,1,2,2-Tetrachloroethane	Quarterly
Tetrachloroethylene	Quarterly
Toluene	Quarterly
1,2,4-Trichlorobenzene	Quarterly
1,1,1-Trichloroethane	Quarterly
1,1,2-Trichloroethane	Quarterly
Trichloroethylene	Quarterly
Trichlorofluoromethane	Quarterly
1,1,2-Trichloro-1,2,2-Trifluoroethane	Quarterly
Vinyl Chloride	Quarterly
Xylenes	Quarterly

a. Based on Title 22 of the California Code of Regulations, Table 64444-A
AWT – advanced water treatment
MCL – Maximum Contaminant Level

Non-Volatile Synthetic Organic Chemicals with MCLs [a]

Parameter	Monitoring Frequency for AWT Recycled Water and Groundwater
Alachlor	Quarterly
Atrazine	Quarterly
Bentazon	Quarterly
Benzo(a)pyrene	Quarterly
Carbofuran	Quarterly
Chlordane	Quarterly
2,4-D	Quarterly
Dalapon	Quarterly
Dibromochloropropane	Quarterly
Di(2-ethylhexyl)adipate	Quarterly
Di(2-ethylhexyl)phthalate	Quarterly
Dinoseb	Quarterly
Diquat	Quarterly
Endothall	Quarterly
Endrin	Quarterly
Ethylene Dibromide	Quarterly
Glyphosate	Quarterly
Heptachlor	Quarterly
Heptachlor Epoxide	Quarterly
Hexachlorobenzene	Quarterly
Hexachlorocyclopentadiene	Quarterly
Lindane	Quarterly
Methoxychlor	Quarterly
Molinate	Quarterly
Oxamyl	Quarterly
Pentachlorophenol	Quarterly
Picloram	Quarterly
Polychlorinated Biphenyls	Quarterly
Simazine	Quarterly
Thiobencarb	Quarterly
Toxaphene	Quarterly
2,3,7,8-TCDD (Dioxin)	Quarterly
2,4,5-TP (Silvex)	Quarterly

a. Based on Title 22 of the California Code of Regulations, Table 64444-A
AWT – advanced water treatment
MCL – Maximum Contaminant Level

Disinfection Byproducts with MCLs [a]

Parameter	Monitoring Frequency for AWT Recycled Water and Groundwater
Total trihalomethanes (TTHM)	Quarterly
Bromodichloromethane	
Bromoform	
Chloroform	
Dibromochloromethane	
Haloacetic acids (five) (HAA5)	Quarterly
Monochloroacetic Acid	
Dichloroacetic Acid	
Trichloroacetic Acid	
Monobromoacetic Acid	
Dibromoacetic Acid	
Bromate	Quarterly
Chlorite	Quarterly

a. Based on Title 22 of the California Code of Regulations, Table 64533-A
AWT – advanced water treatment
MCL – Maximum Contaminant Level

General Physical and General Mineral [a]

Parameter	Monitoring Frequency for AWT Recycled Water and Groundwater
Asbestos	Quarterly
Calcium	Quarterly
Chloride	Quarterly
Copper	Quarterly
Iron	Quarterly
Manganese	Quarterly
Potassium	Quarterly
Sodium	Quarterly
Sulfate	Quarterly
Zinc	Quarterly
Color	Quarterly
Corrosivity	Quarterly
Foaming Agents	Quarterly
Odor	Quarterly
Specific Conductance	Quarterly
Total Dissolved Solids (TDS)	Quarterly
Total Hardness	Quarterly

a. Based on Title 22 of the California Code of Regulations, Section 64449
AWT – advanced water treatment

Chemicals with Notification Levels (Chemicals of Concern) [a]

Parameter	Monitoring Frequency	
	AWT Recycled Water	Groundwater [b]
n-Butylbenzene	Quarterly	Semi-annually
sec-Butylbenzene	Quarterly	Semi-annually
tert-Butylbenzene	Quarterly	Semi-annually
Carbon disulfide	Quarterly	Semi-annually
Chlorate	Quarterly	Semi-annually
2-Chlorotoluene	Quarterly	Semi-annually
4-Chlorotoluene	Quarterly	Semi-annually
Diazinon	Quarterly	Semi-annually
Dichlorodifluoromethane	Quarterly	Semi-annually
1,4-Dioxane	Quarterly	Semi-annually
Ethylene glycol	Quarterly	Semi-annually
Formaldehyde	Quarterly	Semi-annually
Isopropylbenzene	Quarterly	Semi-annually
Manganese	Quarterly	Semi-annually
Methyl isobutyl ketone	Quarterly	Semi-annually
Naphthalene	Quarterly	Semi-annually
N-Nitrosodiethylamine	Quarterly	Semi-annually
N-Nitrosodimethylamine	Quarterly	Semi-annually
Perchlorate	Quarterly	Semi-annually
n-Propylbenzene	Quarterly	Semi-annually
Tertiary butyl alcohol (TBA)	Quarterly	Semi-annually
1,2,3-Trichloropropane	Quarterly	Semi-annually
1,2,4-Trimethylbenzene	Quarterly	Semi-annually
1,3,5-Trimethylbenzene	Quarterly	Semi-annually
Vanadium	Quarterly	Semi-annually

a. This was the list of CDPH constituents with NLs at the time the permit was issued
b. Semi-annually for all wells except Well WB-1; frequency for Well WB-1 is monthly

AWT – advanced water treatment

CDPH – California Department of Public Health (now the State Water Resources Control Board, Division of Drinking Water)

NLs – Notification Levels

Remaining Priority Pollutants
(AWT recycled water is monitored quarterly and groundwater monitoring wells are sampled semi-annually)

Pesticides	**Base/Neutral Extractibles**	Di-n-octyl phthalate
Aldrin	Acenaphthene	Diethyl phthalate
Dieldrin	Benzidine	Dimethyl phthalate
4,4'-DDT	Hexachloroethane	Benzo(a)anthracene
4,4'-DDE	Bis(2-chloroethyl)ether	Benzo(a)fluoranthene
4,4'-DDD	2-chloronaphthalene	Benzo(k)fluoranthene
Alpha-endosulfan	1,3-dichlorobenzene	Chrysene
Beta-endosulfan	3,3'-dichlorobenzidine	Acenaphthylene
Endosulfan sulfate	2,4-dinitrotoluene	Anthracene
Endrin aldehyde	2,6-dinitrotoluene	1,12-benzoperylene
Alpha-BHC	1,2-diphenylhydrazine	Fluorene
Beta-BHC	Fluoranthene	Phenanthrene
Delta-BHC	4-chlorophenyl phenyl ether	1,2,5,6-dibenzanthracene
Acid Extractibles	4-bromophenyl phenyl ether	Indeno(1,2,3-cd)pyrene
2,4,6-trichlorophenol	Bis(2-chloroisopropyl)ether	Pyrene
P-chloro-m-cresol	Bis(2-chloroethoxyl)methane	**Volatile Organics**
2-chlorophenol	Hexachlorobutadiene	Acrolein
2,4-dichlorophenol	Isophorone	Acrylonitrile
2,4-dimethylphenol	Nitrobenzene	Chlorobenzene
2-nitrophenol	N-nitrosodi-n-propylamine	Chloroethane
4-nitrophenol	N-nitrosodiphenylamine	1,1-dichloroethylene
2,4-dinitrophenol	Bis(2-ethylhexyl)phthalate	Methyl chloride
4,6-dinitro-o-cresol	Butyl benzyl phthalate	Methyl bromide
Phenol	Di-n-butyl phthalate	2-chloroethyl vinyl ether

AWT – advanced water treatment

Endocrine Disrupting Chemicals [a]
AWT Recycled Water

Parameter	Frequency
Ethinyl estradiol	Annually
17-B estradiol	Annually
Estrone	Annually
Bisphenol A	Annually
Nonylphenol	Annually
Nonylphenol polyethoxylate	Annually
Octylphenol	Annually
Octylphenol polyethoxylate	Annually
Polybrominated diphenyl ethers	Annually

a. Pending availability of laboratory/laboratory method
AWT – advanced water treatment

Pharmaceuticals and Other Chemicals [a]
AWT Recycled Water

Parameter	Frequency
Acetaminopen	Quarterly
Amoxicillin	Quarterly
Azithromycin	Quarterly
Caffeine	Quarterly
Carbamazepine	Quarterly
Ciprofloxacin	Quarterly
Ethylenediamine tetraacetic acid (EDTA)	Quarterly
Gemfibrozil	Quarterly
Ibuprofen	Quarterly
Iodinated contrast media	Quarterly
Lipitor	Quarterly
Methadone	Quarterly
Morphine	Quarterly
Salicylic acid	Quarterly
Triclosan	Quarterly

a. Pending availability of laboratory/laboratory method
AWT – advanced water treatment

Attachment K-E

Water Quality Parameters and Monitoring Frequencies Dominguez Gap Seawater Intrusion Barrier

Below are lists of parameters and their respective monitoring frequencies associated with the Dominguez Gap Seawater Intrusion Barrier, specifically for advanced treated recycled water produced by the City of Los Angeles' Terminal Island Water Reclamation Plant / Advanced Water Purification Facility (TIWRP), blended and delivered recycled water/imported water, and at the permit-required groundwater monitoring wells.

Advanced Treated Recycled Water Monitoring

Parameter	Frequency
Flow	Daily
Turbidity	Daily
Chlorine residual	Daily
pH	Daily
Total coliform	Daily
Total organic carbon	4X/Month
Temperature	At least weekly
Total nitrogen	2X/Week
Ammonia	2X/Week
Organic nitrogen	2X/Week
Nitrite	2X/Week
Nitrate	2X/Week

Blended Water

Parameter	Frequency
Flow	Daily
Total dissolved solids	Weekly
Sulfate	Weekly
Chloride	Weekly
Boron	Weekly
Total nitrogen	2X/Week

Delivered Water

Parameter	Frequency
Methyl tertiary butyl ether	Monthly
Tert-butyl alcohol	Monthly
N-nitrosodimethlyamine	Quarterly
General Physical/Mineral & Inorganic Chemicals	
Aluminum	Quarterly
Aluminum	Quarterly
Antimony	Quarterly
Arsenic	Quarterly
Asbestos	Quarterly
Barium	Quarterly
Beryllium	Quarterly
Cadmium	Quarterly
Calcium	Quarterly
Chromium	Quarterly
Color	Quarterly
Copper	Quarterly
Cyanide	Quarterly
Fluoride	Quarterly
Foaming agents	Quarterly
Iron	Quarterly
Manganese	Quarterly
Mercury	Quarterly
Nickel	Quarterly
Nitrate	Quarterly
Odor	Quarterly
Potassium	Quarterly
Selenium	Quarterly
Silver	Quarterly
Sodium	Quarterly
Specific conductance	Quarterly
Thallium	Quarterly
Total hardness	Quarterly
Zinc	Quarterly

Radioactivity

Parameter	Frequency
Combined Radium-226 and Radium-228	Quarterly
Gross Alpha Particle Activity (Including Radium-226 but Excluding Radon and Uranium)	Quarterly
Tritium	Quarterly
Strontium-90	Quarterly
Gross Beta Particle Activity	Quarterly
Uranium	Quarterly

Volatile Organic Chemicals

Parameter	Frequency
Benzene	Quarterly
Carbon Tetrachloride	Quarterly
1,2-Dichlorobenzene	Quarterly
1,4-Dichlorobenzene	Quarterly
1,1-Dichloroethane	Quarterly
1,2-Dichloroethane	Quarterly
1,1-Dichloroethylene	Quarterly
cis-1,2-Dichloroethylene	Quarterly
trans-1,2-Dichloroethylene	Quarterly
Dichloromethane	Quarterly
1,2-Dichloropropane	Quarterly
1,3-Dichloropropene	Quarterly
Ethylbenzene	Quarterly
Methyl-*tert*-butyl ether	Quarterly
Monochlorobenzene	Quarterly
Styrene	Quarterly
1,1,2,2-Tetrachloroethane	Quarterly
Tetrachloroethylene	Quarterly
Toluene	Quarterly
1,2,4-Trichlorobenzene	Quarterly
1,1,1-Trichloroethane	Quarterly
1,1,2-Trichloroethane	Quarterly
Trichloroethylene	Quarterly
Trichlorofluoromethane	Quarterly
1,1,2-Trichloro-1,2,2-Trifluoroethane	Quarterly
Vinyl Chloride	Quarterly
Xylenes	Quarterly

Non-Volatile Synthetic Organic Chemicals

Parameter	Frequency
Alachlor	Quarterly
Atrazine	Quarterly
Bentazon	Quarterly
Benzo(a)pyrene	Quarterly
Carbofuran	Quarterly
Chlordane	Quarterly
2,4-D	Quarterly
Dalapon	Quarterly
Dibromochloropropane	Quarterly
Di(2-ethylhexyl)adipate	Quarterly
Di(2-ethylhexyl)phthalate	Quarterly
Dinoseb	Quarterly
Diquat	Quarterly
Endothall	Quarterly
Endrin	Quarterly
Ethylene Dibromide	Quarterly
Glyphosate	Quarterly
Heptachlor	Quarterly
Heptachlor Epoxide	Quarterly
Hexachlorobenzene	Quarterly
Hexachlorocyclopentadiene	Quarterly
Lindane	Quarterly
Methoxychlor	Quarterly
Molinate	Quarterly
Oxamyl	Quarterly
Pentachlorophenol	Quarterly
Picloram	Quarterly
Polychlorinated Biphenyls	Quarterly
Simazine	Quarterly
Thiobencarb	Quarterly
Toxaphene	Quarterly
2,3,7,8-TCDD (Dioxin)	Quarterly
2,4,5-TP (Silvex)	Quarterly

Disinfection Byproducts

Parameter	Frequency
Total trihalomethanes (TTHM)	Quarterly
Bromodichloromethane	
Bromoform	
Chloroform	
Dibromochloromethane	
Haloacetic acids (five) (HAA5)	Quarterly
Monochloroacetic Acid	
Dichloroacetic Acid	
Trichloroacetic Acid	
Monobromoacetic Acid	
Dibromoacetic Acid	
Bromate	Quarterly
Chlorite	Quarterly

Chemicals of Current Interest

Parameter	Frequency
Chlorate	Quarterly
Dichlorodifluoromethane (Freon	Quarterly
1,4-Dioxane	Quarterly
Formaldehyde	Quarterly
Perchlorate	Quarterly
Tertiary butyl alcohol (TBA)	Quarterly
1,2,3-Trichloropropane (1,2,3-TCP)	Quarterly
Vanadium	Quarterly

Historic or Rarely Detected Contaminants

Parameter	Frequency
Methyl parathion	Quarterly
Naphthalene	Quarterly
Parathion	Quarterly
Pentachloronitrobenzene	Quarterly
Phenol	Quarterly
n-Propylbenzene	Quarterly
1,2,4-Trimethylbenzene	Quarterly
1,3,5-Trimethylbenzene	Quarterly
Trithion	Quarterly

Pesticides and PCBs

Parameter	Frequency
Aldicarb	Quarterly
Aldrin	Quarterly
Baygon	Quarterly
a-Benzene hexachloride	Quarterly
b-Benzene hexachloride	Quarterly
n-butylbenzene	Quarterly
sec-butylbenzene	Quarterly
tert-butylbenzene	Quarterly
Captan	Quarterly
Carbaryl	Quarterly
Carbon disulfide	Quarterly
Chloropicrin	Quarterly
2-Chlorotoluene	Quarterly
4-Chlorotoluene	Quarterly
Chylorpropham	Quarterly
Diazinon	Quarterly
1,3-Dichlorobenzene	Quarterly
Dieldrin	Quarterly
Dimethoate	Quarterly
2,4-Dimethylphenol	Quarterly
Diphenamide	Quarterly
Ethion	Quarterly
Ethylene glycol	Quarterly
Isopropylbenzene	Quarterly
Malathion	Quarterly
Metam sodium	Quarterly
Methyl isobutyl ketone	Quarterly
Methylisocyanante	Quarterly

Endocrine Disrupting Chemicals

Parameter	Frequency
Ethinyl estradiol	Annually
17-B estradiol	Annually
Estrone	Annually
Bisphenol A	Annually
Nonylphenol	Annually
Nonylphenol polyethoxylate	Annually
Octylphenol	Annually
Octylphenol polyethoxylate	Annually
Polybrominated diphenyl ethers	Annually

Pharmaceuticals

Parameter	Frequency
Acetaminopen	Annually
Amoxicillin	Annually
Azithromycin	Annually
Caffeine	Annually
Carbamazepine	Annually
Ciprofloxacin	Annually
Ethylenediamine tetraacetic acid (EDTA)	Annually
Gemfibrozil	Annually
Ibuprofen	Annually
Iodinated contrast media	Annually
Lipitor	Annually
Methadone	Annually
Morphine	Annually
Salicylic acid	Annually
Triclosan	Annually

Groundwater Monitoring (GW)

Constituent	Units	Current Reduced Frequency , allowed by CDPH and LARWQCB, July 19, 2007	GW Mont Frequency, reduction approved by LARWQCB in 2010
Table E - Groundwater Monitoring			
Water Level Elevation	feet msl	Qrtly	Qrtly
Chlorine Residual	mg/L	Qrtly	Annual
Total Organic Carbon (TOC)	mg/L	Qrtly	Qrtly
Total Coliform	MPN/100ml	Qrtly	Qrtly
Biochemical Oxygen Demand (BOD_5 20 C)	mg/L	Semiannual	Annual
Oil and Grease	mg/L	Qrtly	Annual
Total Nitrogen	mg/L	Qrtly	Qrtly
Boron	mg/L	Qrtly	Annual
Suspended Solid	mg/L	Semiannual	Annual
Turbidity	NTU	Qrtly	Qrtly
Nitrosodimethylamine (NDMA)	ng/l	Semiannual	Annual
1,4-Dioxane	ug/L	Semiannual	Annual
Dichlorodifluoromethane (Freon 12)	ug/L	Semiannual	Annual
Ethyl-Tertiary-Butyl Ether (ETBE)	ug/L	Semiannual	Annual
Perchlorate	ug/L	Semiannual	Annual
Tertiary-amyl-methyl ether (TAME)	ug/L	Semiannual	Annual
Tertiary-butyl alcohol (TBA)	ug/L	Semiannual	Annual
1,2,3-Trichloropropane (1,2,3-TCP)	ug/L	Semiannual	Annual
Vanadium	mg/l	Semiannual	Annual
Attachment A-8: Gen. Physical & Gen. Mineral, Attachment A-5 below also lists other SMCLs			
Asbestos	MFL	Qrtly	Annual
Calcium	mg/l	Qrtly	Annual
Chloride	mg/l	Qrtly	Qrtly
Color	ACU	Qrtly	Qrtly
Copper	ug/l	Qrtly	Qrtly
Corrosivity	None	Qrtly	Qrtly
Foaming Agents	mg/l	Qrtly	Qrtly
Iron	mg/l	Qrtly	Qrtly
Manganese	ug/l	Qrtly	Qrtly
Odor	TON	Qrtly	Qrtly
Potassium	mg/l	Qrtly	Annual
Sodium	mg/l	Qrtly	Annual
Specific Conductance	umho/cm	Qrtly	Qrtly
Sulfate	mg/l	Qrtly	Qrtly
Total Dissolved Solids (TDS)	mg/l	Qrtly	Qrtly
Total Hardness	mg/l	Qrtly	Annual
Zinc	ug/l	Qrtly	Qrtly
Attachment A-8: Inorganic Chemicals			
Aluminum	ug/l	Qrtly	Qrtly

Constituent	Units	Current Reduced Frequency , allowed by CDPH and LARWQCB, July 19, 2007	GW Mont Frequency, reduction approved by LARWQCB in 2010
Antimony	ug/l	Qrtly	Annual
Arsenic	ug/l	Qrtly	Annual
Barium	ug/l	Qrtly	Annual
Beryllium	ug/l	Qrtly	Annual
Cadmium	ug/l	Qrtly	Annual
Chromium (III) (as Total Digested Chromium)	ug/l	Qrtly	Annual
Chromium (VI)	ug/l	Qrtly	Annual
Cyanide	mg/l	Qrtly	Annual
Cyanide	mg/l	Qrtly	Annual
Fluoride	mg/l	Qrtly	Annual
Lead	ug/l	Qrtly	Annual
Mercury	ug/l	Qrtly	Annual
Nickel	ug/l	Qrtly	Annual
Nitrate (as Nitrogen)	mg/l	Qrtly	Qrtly
Nitrite (as Nitrogen)	mg/l	Qrtly	Qrtly
Selenium	ug/l	Qrtly	Annual
Silver	ug/l	Qrtly	Qrtly
Thallium	ug/l	Qrtly	Annual
Attachment A-3: Organic/Regulated Chemicals			
Volatile Organic Chemicals			
1,1,1-Trichloroethane	ug/L	Semiannual	Annual
1,1,2,2-Tetrachloroethane	ug/L	Semiannual	Annual
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/L	Semiannual	Annual
1,1,2-Trichloroethane	ug/L	Semiannual	Annual
1,1-Dichloroethane	ug/L	Semiannual	Annual
1,1-Dichloroethene (1,1-DCE)	ug/L	Semiannual	Annual
1,2,4-Trichlorobenzene	ug/L	Semiannual	Annual
1,2-Dichlorobenzene	ug/L	Semiannual	Annual
1,2-Dichloroethane (1,2-DCA)	ug/L	Semiannual	Annual
1,2-Dichloropropane	ug/L	Semiannual	Annual
1,3-Dichloropropene	ug/L	Semiannual	Annual
1,4-Dichlorobenzene	ug/L	Semiannual	Annual
Benzene	ug/L	Semiannual	Annual
Carbon Tetrachloride (CTC)	ug/L	Semiannual	Annual
cis-1,2-Dichloroethylene	ug/L	Semiannual	Annual
Dichloromethane	ug/L	Semiannual	Annual
Ethylbenzene	ug/L	Semiannual	Annual
Methyl-tert-butyl-ether (MTBE)	ug/L	Semiannual	Qrtly
Monochlorobenzene	ug/L	Semiannual	Annual
Styrene	ug/L	Semiannual	Annual
Tetrachloroethylene (PCE)	ug/L	Semiannual	Annual
Toluene	ug/L	Semiannual	Annual
trans-1,2-Dichloroethylene	ug/L	Semiannual	Annual

Constituent	Units	Current Reduced Frequency , allowed by CDPH and LARWQCB, July 19, 2007	GW Mont Frequency, reduction approved by LARWQCB in 2010
Trichloroethylene (TCE)	ug/L	Semiannual	Annual
Trichlorofluoromethane	ug/L	Semiannual	Annual
Vinyl Chloride	ug/L	Semiannual	Annual
Xylenes (m,p)	ug/L	Semiannual	Annual
Non-Volatile Synthetic Organic Chemicals			
1,2-Dibromo-3-chloropropane (DBCP)	ug/L	Semiannual	Annual
2,3,7,8-TCDD (Dioxin)	pg/L	Semiannual	Annual
2,4,5-TP (Silvex)	ug/L	Semiannual	Annual
2,4-D	ug/L	Semiannual	Annual
Alachlor	ug/L	Semiannual	Annual
Atrazine	ug/L	Semiannual	Annual
Bentazon	ug/L	Semiannual	Annual
Benzo(a) pyrene	ug/L	Semiannual	Annual
Carbofuran	ug/L	Semiannual	Annual
Chloradane	ug/L	Semiannual	Annual
Dalapon	ug/L	Semiannual	Annual
Di(2-ethylhexyl) adipate	ug/L	Semiannual	Annual
Di(2-ethylhexyl) phthalate	ug/L	Semiannual	Annual
Dinoseb	ug/L	Semiannual	Annual
Diquat	ug/L	Semiannual	Annual
Endothall	ug/L	Semiannual	Annual
Ethyl Dibromide (EDB)	ug/L	Semiannual	Annual
Glyphosate	ug/L	Semiannual	Annual
Heptachlor	ug/L	Semiannual	Annual
Heptachlor Epoxide	ug/L	Semiannual	Annual
Hexachlorobenzene	ug/L	Semiannual	Annual
Hexachlorocyclopentadiene	ug/L	Semiannual	Annual
Lindane (Gamma BHC)	ug/L	Semiannual	Annual
Methoxychlor	ug/L	Semiannual	Annual
Molinate	ug/L	Semiannual	Annual
Oxamyl	ug/L	Semiannual	Annual
PCB 1016	ug/L	Semiannual	Annual
PCB 1221	ug/L	Semiannual	Annual
PCB 1232	ug/L	Semiannual	Annual
PCB 1242	ug/L	Semiannual	Annual
PCB 1248	ug/L	Semiannual	Annual
PCB 1254	ug/L	Semiannual	Annual
PCB 1260	ug/L	Semiannual	Annual
Pentachlorophenol	ug/L	Semiannual	Annual
Picloram	ug/L	Semiannual	Annual
Simazine	ug/L	Semiannual	Annual
Thiobencarb	ug/L	Semiannual	Annual
Toxaphene	ug/L	Semiannual	Annual

Constituent	Units	Current Reduced Frequency , allowed by CDPH and LARWQCB, July 19, 2007	GW Mont Frequency, reduction approved by LARWQCB in 2010
Attachment A-2: Radioactivity			
Combined Radium-226 and Radium-228	pCi/L	Semiannual	Annual
Gross Alpha Particle Activity (Including Ra-226 but excluding Radon and Uranium)	pCi/L	Semiannual	Annual
Gross Beta Particle Activity	pCi/L	Semiannual	Annual
Strontium-90	pCi/L	Semiannual	Annual
Tritium	pCi/L	Semiannual	Annual
Uranium	pCi/L	Semiannual	Annual
Attachment A-4: Disinfection Byproducts			
Bromate	ug/L	Semiannual	Annual
Bromodichloromethane	ug/L	Semiannual	Annual
Bromoform	ug/L	Semiannual	Annual
Chlorite	mg/L	Semiannual	Annual
Chloroform	ug/L	Semiannual	Annual
Dibromoacetic Acid	ug/L	Semiannual	Annual
Dibromochloromethane	ug/L	Semiannual	Annual
Dichloroacetic Acid	ug/L	Semiannual	Annual
Haloacetic Acid (five) (HAA5)	ug/L	Semiannual	Annual
Monobromoacetic Acid	ug/L	Semiannual	Annual
Monochloracetic Acid	ug/L	Semiannual	Annual
Total Trihalomethanes (TTHM)	ug/L	Semiannual	Annual
Trichloroacetic Acid	ug/L	Semiannual	Annual
Attachment A-5: Secondary MCLs, Consumer Acceptance Limits, (note that Attachment A-8: Gen Physical and General Minerals above also list SMCLs)			
Aluminum	ug/L	Semiannual	Qrtly
Color	ACU units	Semiannual	Qrtly
Copper	ug/L	Semiannual	Qrtly
Corrosivity	corrosivity units	Semiannual	Qrtly
Foam Agents (MBAS)	mg/L	Semiannual	Qrtly
Iron	mg/L	Semiannual	Qrtly
Manganese	ug/L	Semiannual	Qrtly
Methyl-tert-butyl-ether (MTBE)	ug/L	Semiannual	Qrtly
Odor - Threshold	TON	Semiannual	Qrtly
Silver	ug/L	Semiannual	Qrtly
Thiobencarb	ug/L	Semiannual	Qrtly
Turbidity	NTU	Semiannual	Qrtly
Zinc	ug/L	Semiannual	Qrtly
Attachment A-6: Drinking Water Action Levels			
Contaminants of Current Interest			

Constituent	Units	Current Reduced Frequency , allowed by CDPH and LARWQCB, July 19, 2007	GW Mont Frequency, reduction approved by LARWQCB in 2010
1,2,3-Trichloropropane (1,2,3-TCP)	ug/L	Annual	Annual
1,4-Dioxane	ug/L	Annual	Annual
Boron	mg/L	Annual	Annual
Chlorate	ug/L	Annual	Annual
Dichlorodifluoromethane (Freon 12)	ug/L	Annual	Annual
Formaldehyde	ug/L	Annual	Annual
n-Nitrosodimethlyamine (NDMA)	ng/L	Annual	Annual
Perchlorate	ug/L	Annual	Annual
Tertiary butyl alcohol (TBA)	ug/L	Annual	Annual
Vanadium	mg/L	Annual	Annual
Historic or Rarely Detected			
1,2,4-Trimethylbenzene	ug/L	Annual	Annual
1,3,5-Trimethylbenzene	ug/L	Annual	Annual
1,3-dichlorobenzene	ug/L	Annual	Annual
2,4-dimethylphenol	ug/L	Annual	Annual
2-Chlorotoluene	ug/L	Annual	Annual
4-Chlorotoluene	ug/L	Annual	Annual
Aldicarb	ug/L	Annual	Annual
Aldrin	ug/L	Annual	Annual
Alpha-BHC	ug/L	Annual	Annual
Baygon	ug/L	Annual	Annual
Beta-BHC	ug/L	Annual	Annual
Captan	ug/L	Annual	Annual
Carbaryl	ug/L	Annual	Annual
Carbon disulfide	ug/L	Annual	Annual
Chloropicrin	ug/L	Annual	Annual
Chloropropham (CIPC)	ug/L	Annual	Annual
Diazinon	ug/L	Annual	Annual
Dieldrin	ug/L	Annual	Annual
Dimethoate	ug/L	Annual	Annual
Diphenamide	ug/L	Annual	Annual
Ethion	ug/L	Annual	Annual
Ethylene glycol	ug/L	Annual	Annual
Isopropylbenzene	ug/L	Annual	Annual
Malathion	ug/L	Annual	Annual
Methyl isobutyl ketone (MIBK)	ug/L	Annual	Annual
Methyl Parathion	ug/L	Annual	Annual
Methylisothiocyanate	ug/L	Annual	Annual
Naphthalene	ug/L	Annual	Annual
n-Butylbenzene	ug/L	Annual	Annual
n-Propylbenzene	ug/L	Annual	Annual
Parathion	ug/L	Annual	Annual
Phenol	ug/L	Annual	Annual

Constituent	Units	Current Reduced Frequency , allowed by CDPH and LARWQCB, July 19, 2007	GW Mont Frequency, reduction approved by LARWQCB in 2010
sec-Butylbenzene	ug/L	Annual	Annual
tert-Butylbenzene	ug/L	Annual	Annual
Trithion	ug/L	Annual	Annual
Priority Pollutants			
1,12-benzoperylene (Benzo(g,h,i) Perylene)	ug/l	Semiannual	Annual
1,2,5,6-dibenzanthracene (Dibenzo(a,h)-anthracene)	ug/l	Semiannual	Annual
1,2-Dichlorobenzene	ug/l	Semiannual	Annual
1,2-diphenylhydrazine	ug/l	Semiannual	Annual
2,4,6-trichlorophenol	ug/l	Semiannual	Annual
2,4-dichlorophenol	ug/l	Semiannual	Annual
2,4-dinitrophenol	ug/l	Semiannual	Annual
2,4-dinitrotoluene	ug/l	Semiannual	Annual
2,6-dinitrotoluene	ug/l	Semiannual	Annual
2-chloroethyl vinyl ether	ug/l	Semiannual	Annual
2-chloronaphthalene	ug/l	Semiannual	Annual
2-chlorophenol	ug/l	Semiannual	Annual
2-nitrophenol	ug/l	Semiannual	Annual
3,3'-dichlorobenzidine	ug/l	Semiannual	Annual
4,4,4'-DDD	ug/l	Semiannual	Annual
4,4,4'-DDE	ug/l	Semiannual	Annual
4,4,4'-DDT	ug/l	Semiannual	Annual
4,6-dinitro-o-cresol (2-Methyl-4,6 Dinitrophenol)	ug/l	Semiannual	Annual
4-bromophenyl phenyl ether	ug/l	Semiannual	Annual
4-chlorophenyl phenyl ether	ug/l	Semiannual	Annual
4-nitrophenol	ug/l	Semiannual	Annual
Acenaphthene	ug/l	Semiannual	Annual
Acenaphthylene	ug/l	Semiannual	Annual
Acrolein	ug/l	Semiannual	Annual
Acrylonitrile	ug/l	Semiannual	Annual
Alpha-endosulfan	ug/l	Semiannual	Annual
Anthracene	ug/l	Semiannual	Annual
Benzidine	ug/l	Semiannual	Annual
Benzo(a) anthracene	ug/l	Semiannual	Annual
Benzo(b) fluoranthene	ug/l	Semiannual	Annual
Benzo(k) fluoranthene	ug/l	Semiannual	Annual
Beta-endosulfan	ug/l	Semiannual	Annual
Bis(2-chloroethoxyl)methane	ug/l	Semiannual	Annual
Bis(2-chloroethyl) ether	ug/l	Semiannual	Annual
Bis(2-chloroisopropyl)ether	ug/l	Semiannual	Annual
Butyl benzyl phthalate	ug/l	Semiannual	Annual
Chlorobenzene	ug/l	Semiannual	Annual
Chloroethane	ug/l	Semiannual	Annual
Chrysene	ug/l	Semiannual	Annual

Constituent	Units	Current Reduced Frequency , allowed by CDPH and LARWQCB, July 19, 2007	GW Mont Frequency, reduction approved by LARWQCB in 2010
Delta-BHC	ug/l	Semiannual	Annual
Di(2-ethylhexyl) phthalate	ug/l	Qrtly/Semiannual	Annual
Diethyl phthalate	ug/l	Semiannual	Annual
Dimethyl phthalate	ug/l	Semiannual	Annual
di-n-butyl phthalate	ug/l	Semiannual	Annual
di-n-octyl phthalate	ug/l	Semiannual	Annual
Endosulfan Sulfate	ug/l	Semiannual	Annual
Endrin aldehyde	ug/l	Semiannual	Annual
Fluoranthene	ug/l	Semiannual	Annual
Fluorene	ug/l	Semiannual	Annual
Hexachlorobutadiene	ug/l	Semiannual	Annual
Hexachloroethane	ug/l	Semiannual	Annual
Indeno(1,2,3-cd) pyrene	ug/l	Semiannual	Annual
Isophorone	ug/l	Semiannual	Annual
Methyl bromide	ug/l	Semiannual	Annual
Methyl chloride	ug/l	Semiannual	Annual
Methylene Chloride	ug/l	Semiannual	Annual
Nitrobenzene	ug/l	Semiannual	Annual
n-nitrosodi-n-propylamine	ug/l	Semiannual	Annual
n-nitrosodiphenylamine	ug/l	Semiannual	Annual
p-chloro-m-cresol (3-Methyl-4-Chlorophenol)	ug/l	Semiannual	Annual
Phenanthrene	ug/l	Semiannual	Annual
Pyrene	ug/l	Semiannual	Annual
Total Chromium	ug/l	Qrtly/ Semiannual	Annual

BHC – Hexachlorocyclohexane
MBAS – Methylene Blue Active Substances
MCL – Maximum Contaminant Level
MFL – Million fibers per liter
mg/L – milligram per liter
ml - milliliters
MPN – most probably number
msl – mean sea level
NTU – Nephelometric turbidity unit
PCB – Polychlorinated biphenyl
pCi/L – picocuries per liter
Qrtly – Quarterly
SMCL – Secondary Maximum Contaminant Level
TON – Threshold Order Number
ug/L – microgram per liter
umho/cm – micromhos per centimeter

Attachment K-F

Water Quality Parameters
SDLAC and WBMWD Nonpotable Recycled Water

SDLAC

Below is a list of some of the additional parameters monitored for tertiary treated recycled water produced by SDLAC's water reclamation plants.

U.S. Environmental Protection Agency Priority Pollutants

Metals

Antimony
Arsenic
Beryllium
Cadmium
Chromium
Copper
Lead
Mercury
Nickel
Selenium
Silver
Thallium
Zinc

Miscellaneous

Cyanide
Asbestos (only if specifically required

Pesticides & PCBs

Aldrin
Chlordane
Dieldrin
4,4'-DDT
4,4'-DDE
4,4'-DDD
Alpha-endosulfan
Beta-endosulfan
Endosulfan sulfate
Endrin
Endrin aldehyde
Heptachlor
Heptachlor epoxide
Alpha-BHC
Beta-BHC
Gamma-BHC
Delta-BHC
Toxaphene
PCB 1016
PCB 1221
PCB 1232
PCB 1242
PCB 1248
PCB 1254
PCB 1260

Base/Neutral Extractables

Acenaphthene
Benzidine
1,2,4-trichlorobenzene
Hexachlorobenzene
Hexachloroethane
Bis(2-chloroethyl)ether
2-chloronaphthalene
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
3,3'-dichlorobenzidine
2,4-dinitrotoluene
2,6-dinitrotoluene
1,2-diphenylhydrazine
Fluoranthene
4-chlorophenyl phenyl ether
4-bromophenyl phenyl ether
Bis(2-chloroisopropyl)ether
Bis(2-chloroethoxy) methane
Hexachlorobutadiene
Hexachlorocyclopentadiene
Isophorone
Naphthalene
Nitrobenzene
N-nitrosodimethylamine
N-nitrosodi-n-propylamine
N-nitrosodiphenylamine
Bis(2-ethylhexyl)phthalate
Butyl benzyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Diethyl phthalate
Dimethyl phthalate
Benzo(a) anthracene
Benzo(a) pyrene
Benzo(b) fluoranthene
Benzo(k) fluoranthene
Chrysene
Acenaphthylene
Anthracene
1,12-benzoperylene
Fluorene
Phenanthrene
1,2,5,6-dibenzanthracene
Indeno(1,2,3-cd) pyrene
Pyrene
TCDD

Acid Extractables

2,4,6-trichlorophenol
P-chloro-m-cresol
2-chlorophenol
2,4-dichlorophenol
2,4-dimethylphenol
2-nitrophenol
4-nitrophenol
2,4-dinitrophenol
4,6-dinitro-o-cresol
Pentachlorophenol
Phenol

Volatile Organics

Acrolein
Acrylonitrile
Benzene
Carbon tetrachloride
Chlorobenzene
1,2-dichloroethane
1,1,1-trichloroethane
1,1-dichloroethane
1,1,2-trichloroethane
1,1,2,2-tetrachloroethane
Chloroethane
Chloroform
1,1-dichloroethylene
1,2-trans-dichloroethylene
1,2-dichloropropane
1,3-dichloropropylene
Ethylbenzene
Methylene chloride
Methyl chloride
Methyl bromide
Bromoform
Dichlorobromomethane
Chlorodibromomethane
Tetrachloroethylene
Toluene
Trichloroethylene
Vinyl chloride
2-chloroethyl vinyl ether
Xylene

WBMWD

Below is a list of parameters monitored for tertiary-treated recycled water produced by WBMWD.

Constituent	Frequency
Total waste flow	Continuous
Turbidity	Continuous
Chlorine residual	Continuous
pH	Daily
Coliform	Daily
Suspended solids	Weekly
Biochemical Oxygen Demand	Weekly
Settleable solids	Weekly
Oil and grease	Monthly
Total dissolved solids	Monthly
Chloride	Monthly
Boron	Monthly
Sulfate	Monthly
Nitrate nitrogen	Quarterly
Nitrite nitrogen	Quarterly
Ammonia nitrogen	Quarterly
Total organic carbon	Quarterly
Hexavalent chromium	Quarterly
Priority pollutants[a]	Quarterly
Radioactivity	Annually

a. See prior list above in Attachment K-F for SDLAC

Attachment K-G

Water Quality Parameters and Monitoring Frequencies NPDES Wastewater and Receiving Water SDLAC Long Beach, Los Coyotes, San Jose Creek, Whittier Narrows, and Pomona WRPs

Below are lists of parameters and their respective monitoring frequencies for wastewater discharges (i.e., plant effluent or tertiary recycled water) from SDLAC's Long Beach, Los Coyotes, San Jose Creek, Whittier Narrows, and Pomona Water Reclamation Plants (WRPs).

Long Beach WRP Effluent

Parameter	Monitoring Frequency	
	Wastewater (Recycled Water)	Receiving Waters
Turbidity	Continuous	Monthly
Total Residual Chlorine	Daily - Continuous	Monthly
pH	Daily	Monthly
Settleable solids	Daily	Monthly
Suspended solids	Daily	Monthly
Total Coliform	Daily	Monthly
Fecal Coliform	Daily	Monthly
E. coli[a]	Daily	Monthly
Temperature	Daily	Monthly
BOD_5 20°C	Weekly	Monthly
Oil and Grease	Monthly	Monthly
Dissolved Oxygen	Monthly	Monthly
Total Dissolved Solids	Semi-annually	---
Chloride	Semi-annually	---
Sulfate	Semi-annually	---
Boron	Semi-annually	---
Fluoride	Semi-annually	---
Total Hardness	Monthly	Monthly
Surfactants (MBAS and CTAS)	Monthly	Monthly
Ammonia	Monthly	Monthly
Nitrite	Monthly	Monthly
Nitrate	Monthly	Monthly
Organic Nitrogen	Monthly	Monthly
Total Kjeldahl Nitrogen	---	Monthly
Total Nitrogen	Monthly	Monthly
Total Phosphorous	---	Monthly
Orthophosphate	---	Monthly
Chronic Toxicity	Monthly	Quarterly
Acute Toxicity	Quarterly	Semi-annually

Parameter	Monitoring Frequency	
	Wastewater (Recycled Water)	Receiving Waters
Copper	Monthly	Monthly
Lead	Monthly	Monthly
Zinc	Monthly	Monthly
4,4-DDE	Monthly	Monthly
Antimony	Quarterly	Quarterly
Arsenic	Quarterly	Quarterly
Beryllium	Quarterly	Quarterly
Cadmium	Quarterly	Quarterly
Chromium III	Quarterly	Quarterly
Chromium VI	Quarterly	Quarterly
Mercury	Quarterly	Quarterly
Nickel	Quarterly	Quarterly
Selenium	Quarterly	Quarterly
Silver	Quarterly	Quarterly
Thallium	Quarterly	Quarterly
Cyanide	Quarterly	Quarterly
Radioactivity	Semi-annually	---
2,3,7,8-TCDD	Semi-annually	Semi-annually
Perchlorate	Semi-annually	Semi-annually
1,4-Dioxane	Semi-annually	Semi-annually
1,2,3-Trichloropropane	Semi-annually	---
Methyl tert-buryl ether	Semi-annually	Semi-annually
Diazinon	---	Quarterly
Iron	---	Semi-annually
Methoxychlor	---	Quarterly
2,4-D	---	Quarterly
2,4,5-Silvex	---	Quarterly
Remaining Priority Pollutants (see Attachment K-F)	Semi-annually	Semi-annually

a. Only if fecal coliform positive
CTAS - Cetyltrimethylammonium Bromide
MBAS - Methylene Blue Active Substances
WRP – water reclamation plant

Los Coyotes WRP Effluent

Parameter	Monitoring Frequency	
	Wastewater (Recycled Water)	Receiving Waters
Turbidity	Continuous	Monthly
Total Residual Chlorine	5 Days/Week - Continuous	Monthly
pH	Daily	Monthly
Settleable solids	Daily	Monthly
Suspended solids	Daily	Monthly
Total Coliform	Daily	Monthly
Fecal Coliform	Daily	Monthly
E. coli[a]	Daily	Monthly
Temperature	Daily	Monthly
BOD_5 20°C	Weekly	Monthly
Oil and Grease	Monthly	Monthly
Dissolved Oxygen	Monthly	Monthly
Total Dissolved Solids	Monthly	Monthly
Conductivity	---	Monthly
Chloride	Monthly	Monthly
Sulfate	Monthly	Monthly
Boron	Monthly	Monthly
Fluoride	Monthly	---
Total Hardness	Monthly	Monthly
Surfactants (MBAS and CTAS)	Monthly	Monthly
Ammonia	Monthly	Monthly
Nitrite	Monthly	Monthly
Nitrate	Monthly	Monthly
Organic Nitrogen	Monthly	Monthly
Total Kjeldahl Nitrogen	Monthly	Monthly
Total Nitrogen	Monthly	Monthly
Total Phosphorus	Monthly	Monthly
Orthophosphate	Monthly	Monthly
Chronic Toxicity	Monthly	Quarterly
Acute Toxicity	Quarterly	Semi-annually
Lead	Quarterly	Semi-annually
Zinc	Quarterly	Semi-annually
Antimony	Quarterly	Semi-annually
Arsenic	Quarterly	Semi-annually
Beryllium	Quarterly	Semi-annually
Cadmium	Quarterly	Semi-annually
Chromium III	Quarterly	Semi-annually
Chromium VI	Quarterly	Semi-annually
Copper	Monthly	Monthly
Mercury	Quarterly	Semi-annually

Parameter	Monitoring Frequency	
	Wastewater (Recycled Water)	**Receiving Waters**
Nickel	Quarterly	Semi-annually
Selenium	Quarterly	Semi-annually
Silver	Quarterly	Semi-annually
Thallium	Quarterly	Semi-annually
Cyanide	Monthly	Monthly
Radioactivity	Semi-annually	---
2,3,7,8-TCDD	Semi-annually	Semi-annually
Perchlorate	Semi-annually	Semi-annually
1,4-Dioxane	Semi-annually	Semi-annually
1,2,3-Trichloropropane	Semi-annually	---
Methyl tert-buryl ether	Semi-annually	Semi-annually
Diazinon	---	Quarterly
Remaining Priority Pollutants (see Attachment K-F)	Semi-annually	Semi-annually

a. Only if fecal coliform positive
CTAS - Cetyltrimethylammonium Bromide
MBAS - Methylene Blue Active Substances
WRP – water reclamation plant

San Jose Creek WRP Effluent

Parameter	Monitoring Frequency	
	Wastewater (Recycled Water)	Receiving Waters
Turbidity	Continuous - Daily	---
Total Residual Chlorine	Continuous - Daily	Monthly
pH	Daily	Monthly
Settleable solids	Daily	---
Suspended solids	Daily	---
Total Coliform	Daily	Monthly
Fecal Coliform	Daily	Monthly
E. coli[a]	Daily	Monthly
Temperature	Daily	Monthly
BOD_5 20°C	Weekly	Monthly
COD	---	Monthly
Oil and grease	Monthly	Monthly
Dissolved Oxygen	Monthly	Monthly
Total Dissolved Solids	Monthly	Monthly
Conductivity	---	Monthly
Chloride	Monthly	Monthly
Sulfate	Monthly	Monthly
Boron	Monthly	Monthly
Fluoride	Semi-annually	---
Total Hardness	Monthly	Monthly
Surfactants (MBAS and CTAS)	Monthly	Monthly
Ammonia	Monthly	Monthly
Nitrite	Monthly	Monthly
Nitrate	Monthly	Monthly
Organic Nitrogen	Monthly	Monthly
Total Kjeldahl Nitrogen	---	Monthly
Total Nitrogen	Monthly	Monthly
Total Phosphate		Monthly
Chronic Toxicity	Monthly	Quarterly
Acute Toxicity	Annually	Annually
Copper	Monthly	Monthly
Lead	Monthly – Quarterly	Monthly
Selenium	Monthly - Quarterly	Monthly
Remaining EPA Priority Metals (see Attachment K-F)	Quarterly	Quarterly
Cyanide	Quarterly	Quarterly
Iron	Semi-annually	---
Barium	Semi-annually	Semi-annually
Diazinon	Semi-annually	Semi-annually
Pesticides (demeton, guthion, malathion,	Semi-annually	Semi-annually

Parameter	Monitoring Frequency	
	Wastewater (Recycled Water)	**Receiving Waters**
methoxychlor, mirex, and parathion)		
Radioactivity	Semi-annually	---
2,3,7,8-TCDD	Semi-annually	Semi-annually
Perchlorate	Semi-annually	Semi-annually
1,4-Dioxane	Semi-annually	Semi-annually
1,2,3-Trichloropropane	Semi-annually	Semi-annually
Methyl tert-buryl ether	Semi-annually	Semi-annually
Remaining Priority Pollutants (see Attachment K-F)	Semi-annually	Semi-annually

a. Only if fecal coliform positive
CTAS - Cetyltrimethylammonium Bromide
MBAS - Methylene Blue Active Substances
WRP – water reclamation plant

Whittier Narrows WRP Effluent

Parameter	Monitoring Frequency	
	Wastewater (Recycled Water)	Receiving Waters
Turbidity	Continuous	Monthly
Total Residual Chlorine	Daily- Continuous	Monthly
pH	Daily	Monthly
Settleable solids	Daily	Monthly
Suspended solids	Daily	Monthly
Total Coliform	Daily	Monthly
Fecal Coliform	Daily	Monthly
E. coli[a]	Daily	Monthly
Temperature	Daily	Monthly
BOD_5 20°C	Weekly	Monthly
Oil and Grease	Monthly	Monthly
Dissolved Oxygen	Monthly	Monthly
Total Dissolved Solids	Monthly	Monthly
Chloride	Monthly	Monthly
Sulfate	Monthly	Monthly
Boron	Monthly	Monthly
Total Hardness	Monthly	Monthly
Surfactants (MBAS and CTAS)	Monthly	Monthly
Ammonia	Monthly	Monthly
Nitrite	Monthly	---[b]
Nitrate	Monthly	---[b]
Organic Nitrogen	Monthly	---[b]
Total Kjeldahl Nitrogen	---	Monthly
Total Nitrogen	Monthly	Monthly
Total Phosphorous	---	Monthly
Orthophosphate	---	Monthly
Chronic Toxicity	Monthly	Quarterly
Acute Toxicity	Quarterly	Semi-annually
Copper	Monthly	Monthly
Lead	Monthly	Monthly
Zinc	Monthly	Monthly
Antimony	Quarterly	Quarterly
Arsenic	Quarterly	Quarterly
Beryllium	Quarterly	Quarterly
Cadmium	Monthly	Monthly
Chromium III	Quarterly	Quarterly
Chromium VI	Quarterly	Quarterly
Mercury	Monthly	Monthly
Nickel	Quarterly	Quarterly
Selenium	Quarterly	Quarterly

Parameter	Monitoring Frequency	
	Wastewater (Recycled Water)	Receiving Waters
Silver	Quarterly	Quarterly
Thallium	Quarterly	Quarterly
Cyanide	Quarterly	Quarterly
Radioactivity	Semi-annually	---
2,3,7,8-TCDD	Semi-annually	Semi-annually
Perchlorate	Semi-annually	Annually
1,4-Dioxane	Semi-annually	Annually
1,2,3-Trichloropropane	Semi-annually	Annually
Methyl tert-buryl ether	Semi-annually	Annually
Iron	Semi-annually	Semi-annually
Fluoride	Semi-annually	Semi-annually
Barium	Semi-annually	Quarterly
Methoxychlor	Semi-annually	Quarterly
2,4-D	Semi-annually	Quarterly
2,4,5-TP	Semi-annually	Quarterly
Diazinon	---	Quarterly
Remaining Priority Pollutants (see Attachment K-F)	Semi-annually	Semi-annually
Endocrine Disrupting Chemicals (see Section 4)	Biennially	---
Pharmaceuticals (see Section 4)	Biennially	---

a. Only if fecal coliform positive
b. Part of total nitrogen determination

CTAS - Cetyltrimethylammonium Bromide
MBAS - Methylene Blue Active Substances
WRP – water reclamation plant

Pomona WRP Effluent

Parameter	Monitoring Frequency	
	Wastewater (Recycled Water)	Receiving Waters
Turbidity	Continuous	Monthly
Total Residual Chlorine	Daily- Continuous	Monthly
pH	Weekly	Monthly
Settleable solids	Weekly	Monthly
Suspended solids	Weekly	Monthly
Total Coliform	Weekly	Monthly
Fecal Coliform	Weekly	Monthly
E. coli[a]	Weekly	Monthly
Temperature	Weekly	Monthly
BOD_5 20°C	Weekly	Monthly
COD	---	Monthly
Oil and Grease	Quarterly	Quarterly
Dissolved Oxygen	Monthly	Monthly
Total Dissolved Solids	Monthly	Monthly
Conductivity	---	Monthly
Chloride	Monthly	Monthly
Sulfate	Monthly	Monthly
Boron	Monthly	Monthly
Fluoride	Quarterly	Quarterly
Total Hardness	Monthly	Monthly
Surfactants MBAS	Monthly	Monthly
Surfactants CTAS	Quarterly	Quarterly
Ammonia	Monthly	Monthly
Nitrite	Monthly	Monthly
Nitrate	Monthly	Monthly
Organic Nitrogen	Monthly	Monthly
Total Kjeldahl Nitrogen	Monthly	Monthly
Total Nitrogen	Monthly	Monthly
Total Phosphorus	---	Monthly
Orthophosphate	---	Monthly
Chronic Toxicity	Monthly	Quarterly
Acute Toxicity	Quarterly	Semi-annually
Copper	Quarterly	Quarterly
Lead	Monthly	Monthly
Zinc	Quarterly	Quarterly
Antimony	Quarterly	Quarterly
Arsenic	Quarterly	Quarterly
Beryllium	Semi-annually	Semi-annually
Cadmium	Quarterly	Quarterly
Chromium III	Semi-annually	Semi-annually
Chromium VI	Semi-annually	Semi-annually
Total Chromium	Semi-annually	Semi-annually
Mercury	Semi-annually	Semi-annually

Parameter	Monitoring Frequency	
	Wastewater (Recycled Water)	Receiving Waters
Nickel	Quarterly	Quarterly
Selenium	Monthly	Monthly
Silver	Quarterly	Quarterly
Thallium	Semi-annually	Semi-annually
Cyanide	Quarterly	Quarterly
Radioactivity	Semi-annually	---
2,3,7,8-TCDD	Semi-annually	Semi-annually
Perchlorate[2]	Semi-annually	Annually
1,4-Dioxane[2]	Semi-annually	Annually
1,2,3-Trichloropropane[b]	Semi-annually	Annually
Methyl tert-buryl ether[b]	Semi-annually	Annually
Iron	Quarterly	Quarterly
Bis(2-ethylhexyl)phthalate	Monthly	Monthly
Bromoform	Monthly	Monthly
Dibromochloromethane	Monthly	Monthly
Chloroform	Monthly	Monthly
Bromodichloromethane	Monthly	Monthly
Total Trihalomethanes (calculated sum)	Monthly	Monthly
Polychlorinated Biphenyls	Semi-annually	Semi-annually
Remaining Priority Pollutants (see Attachment K-F)	Semi-annually	Semi-annually
Chlorpyrifos	Semi-annually	Quarterly
Diazinon	Semi-annually	Quarterly
Toxaphene	Semi-annually	Semi-annually
Endocrine Disrupting Chemicals (see Section 4)	Biennially	---
Pharmaceuticals (see Section 4)	Biennially	---

a. Only if fecal coliform positive
b. Called “Emerging Chemicals” in the permit
CTAS - Cetyltrimethylammonium Bromide
MBAS - Methylene Blue Active Substances
WRP – water reclamation plant

Attachment K-H

MWD Compliance Plan

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Office of the General Manager

March 3, 2011

Kurt Souza
California Department of Public Health
Drinking Water Field Operations Branch
1180 Eugenia Place, Suite 200
Carpinteria, CA 93013

Reply to: 700 Moreno Avenue
La Verne, CA 91750

System No. 1910087

Dear Mr. Souza:

Chemical Compliance Monitoring Plan, Compliance Cycle 2011–2019

Per CDPH recommendations, the Small Systems Chemical Compliance Monitoring has been removed from this plan.

Metropolitan Water District of Southern California (Metropolitan) is submitting a chemical compliance monitoring plan for your review and approval. Changes to the plan include reducing nitrate monitoring to annually because all quarterly results have been < ½ the MCL of 10 mg/L as nitrogen for the past year. Nitrite monitoring will be reduced to annually because all results have been < ½ the MCL of 1.0 mg/L for the past year. Also, asbestos monitoring will be reduced from annually to once per 9 year compliance cycle. The plan addresses the following constituents: inorganic chemicals, organic chemicals, radiologicals, general mineral, and general physical parameters for compliance cycle 3 (2011–2019). The sampling sites include Metropolitan's source waters, treatment plant influents, and treatment plant effluents (entry points to the distribution system). The monitoring information for disinfection by-products (DBPs) and DBP precursors can be found in the most recently submitted DBP Monitoring Plan.

Submittal of this document satisfies the chemical compliance monitoring plan requirement of California Code of Regulations Title 22, section 64416. If you have any questions, please call me at (909) 392-5081.

Sincerely,

Melissa Dale

EWC:smh
H:\\letters\\ewc chemical compliance monitoring plan 2011–2019.docx

Enclosure

cc w/enclosures:

Heather Collins, P.E.
California Department of Public Health
Drinking Water Field Operations Branch
Government Center-Fourth Floor
464 West 4th Street, Suite 437
San Bernardino, CA 92401

Grazyna Newton
California Department of Public Health
Drinking Water Field Operations
500 North Central Avenue, Suite 500
Glendale, CA 91203

Sutida Bergquist, P.E., District Engineer
California Department of Public Health
Drinking Water Field Operations Branch
500 North Central Avenue, Suite 500
Glendale, CA 91203

COMPLIANCE MONITORING PLAN

METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

System No. 1910087
January 2011

DESCRIPTION OF SYSTEM

The Metropolitan Water District of Southern California (Metropolitan) is a public, municipal corporation of the State of California. Metropolitan is a consortium of 26 cities and water districts that provides drinking water to nearly 19 million people in parts of Los Angeles, Orange, San Diego, Riverside, San Bernardino, and Ventura counties. Water is imported from the Colorado River via Metropolitan's Colorado River Aqueduct and from northern California via the State Water Project's Edmund G. Brown California Aqueduct. This water is supplied within a 5,200 square mile service area through Metropolitan's 26 member agencies and 150 sub-agencies.

Metropolitan utilizes a total of seven reservoirs for storing untreated source waters (Figure 1). Three reservoirs store the State Project water (SPW): Castaic Lake (West Branch), Silverwood Lake (East Branch), and Lake Perris (East Branch). Four reservoirs store the Colorado River water (CRW) or a blend of CRW and SPW: Lake Havasu (CRW), Lake Mathews (CRW or blend), Lake Skinner (blend), and Diamond Valley Lake (blend).

Metropolitan operates five treatment plants (Jensen, Weymouth, Diemer, Mills, and Skinner; Figure 1) by conventional treatment, with the exception of Skinner filtration plant No. 2, which uses direct filtration. Jensen and Mills water treatment plants treat the West Branch and East Branch SPW, respectively. Diemer and Weymouth filtration plants treat CRW or a blend of CRW and East Branch SPW from Lake Mathews and Silverwood Lake. Skinner filtration plant treats water from Lake Skinner, which is capable of receiving water from the Colorado River Aqueduct, and East Branch SPW from Silverwood Lake, Lake Perris, or Diamond Valley Lake (DVL).

CHEMICAL COMPLIANCE MONITORING PROGRAM

The U.S. Environmental Protection Agency (USEPA) and State of California Department of Public Health (CDPH) regulations require monitoring of Metropolitan's source and finished water for general mineral, general physical, cyanide, foaming agents, trace metals, pesticides, herbicides, synthetic organic compounds (SOCs), volatile organic compounds (VOCs), disinfection by-products (DBPs), DBP precursors, disinfectants, asbestos, and radiological constituents. Title 22 of the Health and Safety code requires samples to be collected from each water source (except for DBP related constituents), or from the point of entry into the distribution system that is representative of each water source after treatment. Table 1 lists the compliance sites, source water/point of entry, CDPH station location number, latitude, and longitude. Several sites (Lake Havasu, San Jacinto Tunnel West Portal, and Lake Mathews) along the CRW aqueduct system were chosen to characterize the water quality along the aqueduct. Two terminal reservoirs (Castaic Lake and Silverwood Lake) of the SPW system, along with an emergency source (Lake Perris), are sampled. Lake Perris is used only occasionally and samples will be collected from the lake effluent when water is being withdrawn and from the outlet tower at 9 m when the water is not being withdrawn. Lake Skinner and DVL are also sampled. DVL will be sampled from the inlet/outlet structure when water is flowing out of the lake and near the outlet tower in the west basin at 12 m when water is not flowing out. Smaller raw water reservoirs (Live Oak Reservoir and Etiwanda) located within Metropolitan's system are not sampled because they are considered protected from any outside influence and changes in water quality (i.e., related to regulated and required unregulated contaminants) are not expected. Each treatment plant effluent is sampled and represents the point of entry into the distribution system.

The CDPH required monitoring schedule is based on a "Compliance Cycle" defined as a nine calendar year cycle (Table 2). Each compliance cycle is divided into three 3-year compliance periods. The initial compliance cycle was completed on December 31, 2001. Monitoring for the second compliance cycle will be completed December 31, 2010. Table 3 shows the monitoring requirements for each analytical group. Table 4 shows Metropolitan's compliance and voluntary monitoring schedule, by analytical group, through the third compliance cycle (ending 2019). **All monitoring listed in Table 4 will be reported to CDPH via the Write-On Electronic Data Transfer program.**

Most of the secondary standards are analyzed along with a regulated group. Methyl *tert*-butyl ether is included with the VOC group. Thiobencarb, which also has a primary standard, is measured with the SOCs. General mineral/general physical analysis includes chloride, color, specific conductance, sulfate, total dissolved solids, and turbidity. Trace metals analysis captures aluminum, copper, iron, manganese, silver, and zinc. The remaining secondary standards—foaming agents (MBAS) and odor threshold—are analyzed by specific methods.

Metropolitan continues to monitor for several of the California Unregulated Contaminant Monitoring Regulation (UCMR) compounds, which are no longer required. The gasoline additives ethyl-*tert* butyl ether, tert-amyl methyl ether, and tert-butyl alcohol are measured with the VOC group. Boron and vanadium are included in the trace metals analysis. Hexavalent chromium is analyzed by a compound-specific method.

Initial monitoring for the Federal UCMR cycles 1 and 2 compounds was completed between 2001–2003 and 2008–2009, respectively. Follow-up monitoring for the Federal UCMR is not required; additional monitoring will be implemented when the next cycle of the Federal UCMR (UCMR 3) is promulgated.

D/DBP RULE MONITORING

Disinfectants, DBPs, and DBP precursors are monitored in compliance with the USEPA D/DBP Rule (refer to the most recently submitted D/DBP Monitoring Plan).

METROPOLITAN'S TASTE AND ODOR MONITORING PROGRAM

Metropolitan maintains a proactive monitoring program for taste and odor control. Samples are analyzed by a group of trained panelists by the flavor profile analysis (FPA) technique. At least once each week, the panel monitors treatment plant samples. In addition, the treatment plant laboratory personnel conduct daily FPA screenings. Also, the panel monitors selected distribution locations on a weekly basis. Threshold odor numbers are determined annually for compliance with the secondary standard for odor.

Table 1. Metropolitan Water District of Southern California (System Number 1910087) Monitoring Sample Sites

Primary Station Code	Sample Location	Source Water/ Treated Water	Station Location #	Latitude	Longitude
	COMPLIANCE LOCATIONS				
016	Devil Canyon Afterbay Silverwood Lake	Effluent from Silverwood Lake	G19/087-SLDCAFB	[redacted]	[redacted]
024	Diamond Valley Lake (DVL) WB Center (12 m)	Near outlet tower of DVL	G19/087-DVLWBC	[redacted]	[redacted]
024	Diamond Valley Lake Inlet/Outlet (I/O)	Effluent from the inlet/outlet line	G19/087-DVLIO	[redacted]	[redacted]
007	Lake Havasu Near Whitsett Intake (12 m)	Effluent from Lake Havasu	G19/087-LHNWHIN	[redacted]	[redacted]
008	Lake Mathews Headworks	Effluent from Lake Mathews	G19/087-LMHDKEF	[redacted]	[redacted]
012	Lake Skinner Outlet Conduit (Outlet Structure)	Effluent from Lake Skinner	G19/087-LKESKNR	[redacted]	[redacted]
010	Lake Perris – Effluent	Effluent from Lake	G19/087-LKEPERS	[redacted]	[redacted]
010	Lake Perris outlet tower (9 m)	Outlet tower from lake	G19/087-LKPRSOT	[redacted]	[redacted]
015	San Jacinto Tunnel West Portal	Colorado river aqueduct	G19/087-SANJNTT	[redacted]	[redacted]
003	Diemer Plant Effluent	Point of entry	G19/087-SYSTMDP	[redacted]	[redacted]
006	Jensen Plant Influent (Castaic Lake)	Influent to plant	G19/087-JPINFLT	[redacted]	[redacted]
005	Jensen Plant Effluent	Point of entry	G19/087-SYSTMJP	[redacted]	[redacted]
013	Mills Plant Effluent	Point of entry	G19/087-SYSTMMP	[redacted]	[redacted]
026	Skinner Reservoir Effluent	Point of entry	G19/087-SYSTMSR	[redacted]	[redacted]
020	Weymouth Plant Effluent	Point of entry	G19/087-SYSTMWP	[redacted]	[redacted]

Table 2. Compliance Scheme

	Effective	End
1. Compliance cycle	January 1, 1993	December 31, 2001
i. Compliance period	January 1, 1993	December 31, 1995
ii. Compliance period	January 1, 1996	December 31, 1998
iii. Compliance period	January 1, 1999	December 31, 2001
2. Compliance cycle	January 1, 2002	December 31, 2010
i. Compliance period	January 1, 2002	December 31, 2004
ii. Compliance period	January 1, 2005	December 31, 2007
iii. Compliance period	January 1, 2008	December 31, 2010
3. Compliance cycle	January 1, 2011	December 31, 2019
i. Compliance period	January 1, 2011	December 31, 2013
ii. Compliance period	January 1, 2014	December 31, 2016
iii. Compliance period	January 1, 2017	December 31, 2019

Table 3. Metropolitan's Compliance Monitoring Requirements

Compound Group	Frequency
Volatile Organic Compounds	Annually
Synthetic Organic Compounds	
Pesticides	2 x /period*
Semi-volatile organics	2 x /period*
Inorganic Constituents	
Asbestos	1 x /cycle
Cyanide	Annually
Fluoride	Annually
General Minerals	Annually
Nitrate	Annually
Nitrite	1 x /period
Perchlorate	Annually
Trace Metals	Annually
Radiological	
Gross alpha	4 x/period
Gross beta	4 x/period
Radium 226/228	4 x/period
Strontium-90	1 x/period
Tritium	1 x/period
Uranium	4 x/period
Secondary Standards	
Aluminum	Annually
Chloride	Annually
Color	Annually
Copper	Annually
Foaming Agents (MBAS)	Annually
Iron	Annually
Manganese	Annually
Methyl-*tert*-butyl ether (MTBE)	Annually
Odor Threshold	Annually
Silver	Annually
Specific Conductance	Annually
Sulfate	Annually
Thiobencarb	Annually
Total Dissolved Solids (TDS)	Annually
Turbidity	Annually
Zinc	Annually

* Monitoring must occur two times in one year of a three-year period.

Table 4. Metropolitan's Compliance and Voluntary Monitoring Schedule 2011–2019

	1st Compliance Period												2nd Compliance Period												3rd Compliance Period											
	1st Qtr 2011	2nd Qtr 2011	3rd Qtr 2011	4th Qtr 2011	1st Qtr 2012	2nd Qtr 2012	3rd Qtr 2012	4th Qtr 2012	1st Qtr 2013	2nd Qtr 2013	3rd Qtr 2013	4th Qtr 2013	1st Qtr 2014	2nd Qtr 2014	3rd Qtr 2014	4th Qtr 2014	1st Qtr 2015	2nd Qtr 2015	3rd Qtr 2015	4th Qtr 2015	1st Qtr 2016	2nd Qtr 2016	3rd Qtr 2016	4th Qtr 2016	1st Qtr 2017	2nd Qtr 2017	3rd Qtr 2017	4th Qtr 2017	1st Qtr 2018	2nd Qtr 2018	3rd Qtr 2018	4th Qtr 2018	1st Qtr 2019	2nd Qtr 2019	3rd Qtr 2019	4th Qtr 2019
Volatile Organic Compounds	C					C					C					C	C					C					C					C	C			
Synthetic Organic Compounds						C		C										C		C										C		C				
Inorganic Chemicals																																				
Asbestos			C																																	
Cyanide		C				C				C				C				C				C				C				C				C		
Fluoride†		C		V		C		V		C		V		C		V		C		V		C		V		C		V		C		V		C		V
General Mineral/General Physical		C		V		C		V		C		V		C		V		C		V		C		V		C		V		C		V		C		V
Hexavalent Chromium		V				V				V				V				V				V				V				V				V		
Lead and Copper*			C												C												C									
MBAS		C				C				C				C				C				C				C				C				C		
Nitrite		C				V				V				C				V				V				C				V				V		
Nitrate		C				C				C				C				C				C				C				C				C		
Odor Threshold		C				C				C				C				C				C				C				C				C		
Perchlorate		C				C				C				C				C				C				C				C				C		
Trace Metals#		C				C				C				C				C				C				C				C				C		
Radiological • Gross Alpha • Gross Beta • Radium 226/228 • Strontium-90 • Tritium • Uranium	C	C	C	C									C	C	C	C									C	C	C	C								

C - Compliance monitoring
V –Voluntary monitoring

* Lead and copper is only performed on Metropolitan's domestic water systems – see Small Systems Monitoring Plan for details
# Aluminum will be analyzed and reported monthly for the treatment plant effluent when alum is used as the coagulant.
† Additional fluoride monitoring at the treatment plant effluents is reported under Metropolitan's Fluoride Plan.

Figure 1. Metropolitan's Service Area

Attachment K-I

Los Angeles Department of Water and Power (LADWP) Imported Water Monitoring

Presented below is the Vulnerability Assessment and Monitoring Program for imported water treated at the Los Angeles Aqueduct Filtration Plant based on the November 2012 Annual Water Quality Report Data Source (Master) Table.

Contaminants	Sampling Frequency
General Contaminants	Quarterly
Gross Beta, Ra-226/228, Strontium-90, Tritium & Uranium	Quarterly
pH, Specific Conductance, Temperature, Total Chlorine Residual – Source Water Locations	Daily, Weekly
Total Coliform, *E. Coli*, Fecal Coliform - Source Water Locations	Daily
Total Trihalomethanes and Haloacetic Acids	Monthly
Synthetic Organic Chemicals	2 Consecutive quarters / 3-yr cycle
Gross Alpha – Source Water Locations	6-yr cycle
Cryptosporidium and *Giardia*	Monthly
Asbestos	9-yr cycle
Radon	Annually
Arsenic	Weekly
Bromate	Weekly
Turbidity (Primary Standard)	On-line (continuous)
Total Coliform, E. Coli, and Fecal Coliform – Distribution Locations	Daily
Total Chlorine Residual – Same Locations as TCR Sampling	Daily
Lead and Copper (at-the-tap) – Residences	3-yr cycle
Fluoride	Daily
Total Trihalomethanes and Haloacetic Acids – 20 Locations	Monthly
Bromate (Opened Reservoir)	Weekly
Cryptosporidium and *Giardia* (Opened Reservoir)	Bi-weekly
Individual THMs and HAAs – Area-wide distributions system	Monthly
Chlorate	Daily

Attachment K-J

San Gabriel River Regional Monitoring Program (SGRRMP)

During 2009-2010, the following participants contributed staff time, laboratory analyses, and funding in a collaborative effort to implement the San Gabriel River Regional Monitoring Program (SGRRMP). As shown in the list below, participants included representatives from regulated entities, regulatory agencies, environmental groups, and research organizations. A majority of the funding was provided by SDLAC.

- SDLAC
- Council for Watershed Health
- City of Downey
- Los Angeles County Flood Control District
- LARWQCB
- Orange County Stormwater Program
- Southern California Coastal Water Research Project
- USEPA
- Participating Consultants
- Aquatic Bioassay and Consulting Laboratories
- Institute for Integrated Research in Materials, Environments, and Society California State University, Long Beach,
- Weston Solutions
- Weck Laboratories

Below is a list of parameters and their monitoring frequencies for the SGRRMP.

Freshwater Constituents

Parameter
Temperature
pH
Conductivity
Dissolved Oxygen
Salinity
Alkalinity
Hardness
Total Suspended Solids
Chlorophyll a
Ash-free dry mass
Dissolved Organic Carbon
Total Organic Carbon
Ammonia
Nitrate
Nitrite
Total Kjeldahl Nitrogen

Parameter
Total Nitrogen
Orthophosphate
Phosphorus
Chloride
Sulfate
Silica
Trace metals (total and dissolved): Arsenic, Cadmium, Chromium, Copper, Iron, Mercury, Lead, Nickel, Selenium, Zinc
Organophosphorus Pesticides
Pyrethroids Pesticides
Chronic Toxicity - Ceriodaphnia dubia (freshwater): primary test organism; Chronic Hyallela azteca (freshwater): secondary test organism if conductivity is > 2,500 µS/cm
Taxonomy: Benthic Macroinvertebrate, Qualitative Algae, Quantitative Diatom, Quantitative Algae

Table 1. Summary of the SGRRMP watershed monitoring program designed to address each of the five core management questions.

Question	Approach	Sites	Indicators	Frequency
Q1: Stream condition	Randomized design for streams in entire watershed	30 in year 1 (2005) 10 new in each following year	Triad: bioassessment (BMI & attached algae), water chemistry, toxicity, CRAM	Annually, in spring
Q2: Unique areas	Fixed sites in estuary and freshwater	12 in freshwater • 4 high[1] value wetlands • 8 target sites: 5 confluence of tribs/mainstem & 3 background	Freshwater: • Wetland habitat (CRAM) • Target sites: bioassessment (BMI), water chemistry, toxicity, CRAM	 Annually, in summer Annually, in spring
		4 in estuary	Estuary: • Full suite water quality • Sediment chemistry, toxicity, infauna	 Annually, in summer Annually, in summer
Q3: Discharges	Assess NPDES receiving water results against water quality standards	NPDES receiving water sampling locations	Water quality, chemistry, toxicity, bioassessment, bacteria	Varies
Q4: Safe to swim	Focus on high use areas	8 upper watershed river sites 5 lower watershed sentinel sites 1 estuary	• *E. coli* • *E. coli* • Total coliforms, *E. coli*, Enterococcus	5 samples/month (May to Sept) 5 samples/month (May to Sept) 2 samples/week (throughout year)
Q5: Safe to eat fish	Focus on: • Popular fishing sites • Commonly caught species • High risk chemicals	Rotate popular fishing locations: two sites per year	Commonly caught fish at each location Mercury, DDTs, PCBs, arsenic, selenium	Annually in late summer

[1] High value sites are locations of relatively isolated unique habitat.

Attachment K-K

Los Angeles River Watershed Monitoring Program (LARWMP)

During 2009-2010, the following participants contributed staff time, laboratory analyses, and funding in a collaborative effort to implement the Los Angeles River Watershed Monitoring Program (LARWMP). As shown in the list below, participants that included representatives from regulated entities, regulatory agencies, environmental groups, and research organizations. A majority of the funding was provided by the Cities of Los Angeles and Burbank and the Los Angeles County Department of Public Works (LACDPW).

- Arroyo Seco Foundation
- City of Burbank
- City of Downey
- City of Los Angeles
- Friends of the Los Angeles River
- LACDPW
- LARWQCB
- Los Angeles & San Gabriel Rivers Watershed
- Council for Watershed Health
- San Gabriel Mountains and Rivers Conservancy
- Southern California Coastal Water Research Project
- USEPA
- U.S. Forest Service
- Aquatic Bioassay and Consulting Laboratories
- Brock Bernstein Consultant

Below is a list of parameters and their monitoring frequencies for the LARWMP.

Freshwater Constituents

Parameter
Temperature
pH
Conductivity
Dissolved Oxygen
Salinity
Alkalinity
Hardness
Total Suspended Solids
Dissolved Organic Carbon
Total Organic Carbon
Ammonia
Nitrate
Nitrite
Total Kjeldahl Nitrogen

Parameter
Total Nitrogen
Orthophosphate
Phosphorus
Chloride
Sulfate
Silica
Trace metals (total and dissolved): Arsenic, Cadmium, Chromium, Copper, Iron, Mercury, Lead, Nickel, Selinium, Zinc
Organophosphorus Pesticides
Pyrethroids Pesticides
Chronic Toxicity - Ceriodaphnia dubia (freshwater): primary test organism; Chronic Hyallela azteca (freshwater): secondary test organism if conductivity is > 2,500 µS/cm
Taxonomy: Benthic Macroinvertebrate, Qualitative Algae, Quantitative Diatom, Quantitative Algae

Table 1. Monitoring design, indictors and sampling frequency.

Question	Approach	Sites	Indicators	Frequency
Q1: What is the condition of streams?	Randomized design for streams in entire watershed, except 1st and 2nd order[1] streams Streams assigned to natural, effluent dominated, urban runoff dominated subpopulations	10 randomly selected each year	Triad: bioassessment, physical habitat, CRAM, water chemistry, toxicity	Annually, in spring
Q2: What is the trend of condition at unique areas?	Fixed stations in estuary and freshwater	12 (approx.) in freshwater • 5 (approx.) high[2] value • 4 confluence of tribs/mainstem • 1 or 2 background	Freshwater • Riparian habitat using CRAM • Triad: bioassessment, water chemistry, toxicity • Riparian habitat using CRAM	 Annually, in spring Annually, in spring Annually, in spring
		1 in estuary	Estuary • Conventional water quality • Full suite water quality • Sediment chemistry, toxicity, infauna	 Not determined Annually Annually
Q3: Are receiving waters near discharges meeting objectives?	Use existing NPDES water quality data collected by LA River dischargers from receiving waters upstream and downstream of their discharge points	Sites located upstream and downstream of discharges. • Los Angeles/Glendale • City of Burbank • Tillman Water Reclamation Plant	Constituents with established water quality standards, e.g. CTR for dissolved metals, e. coli bacteria	Varies depending on permit monthly, quarterly, annual
Q4: Is it safe to swim?	Focus on high-use areas	6 – 10 in river 9 sentinel	E. coli	Weekly in swim season
		15 beach	Total & fecal coliforms, *Enterococcus*	Weekly year round
Q5: Is it safe to eat locally caught fish?	Focus on: • Popular fishing sites • Commonly caught species • High risk chemicals	3 lakes 2 river 1 estuary	Commonly caught fish at each location Mercury, Selenium, DDTs, PCBs,	Annually in summer

[1] Stream order is defined by a tributary's position in the branching network, with 1st order streams being headwater streams, 2nd order streams those with one tributary above them, and so on.

[2] High value sites are locations of relatively isolated unique habitat

Attachment K-L

LACDPW MS4 Stormwater Monitoring

Below are details on the Los Angeles County Department of Public Work's (LACDPW's) stormwater monitoring program, which is conducted in accordance with the NPDES permit for municipal separate storm sewer system (MS4) discharges for 84 cities and a majority portion of the unincorporated areas of Los Angeles County.

<u>Mass Emission Stations (MES) in the CBWCB SNMP Study Area</u>

Los Angeles River Monitoring Station (S10)

Monitoring Station S10 is located in the Los Angeles River at the existing stream gauge station (specifically, Stream Gauge F319-R) between Willow Street and Wardlow Road in the City of Long Beach and was chosen to avoid tidal influences. The Los Angeles River is a concrete-lined trapezoidal channel at this station. The total upstream tributary drainage area for the Los Angeles River is 825 square miles. This river is the largest watershed outlet to the Pacific Ocean in the Los Angeles County Flood Control District (LACFCD). This station can be found in the Thomas Guide, page 795, C-1.

Coyote Creek Monitoring Station (S13)

Monitoring Station S13 is located in Coyote Creek at the existing U.S. Army Corps of Engineers (USACE) stream gauge station (specifically, Stream Gauge F354-R) below Spring Street in the lower San Gabriel River Watershed. The station assists in determining mass loading for the San Gabriel River Watershed. The upstream tributary area is 150 square miles and extends into Orange County. The station was chosen to avoid backwater effects from the San Gabriel River to ensure that all water being sampled is from Coyote Creek only. Coyote Creek is a concrete-lined trapezoidal channel at this location. This Coyote Creek MES location has been an active stream gauging station since 1963. This station can be found in the Thomas Guide, page 796, grid H-2.

San Gabriel River Monitoring Station (S14)

Monitoring Station S14 is located in the San Gabriel River at a historic stream gauge station (specifically, Stream Gauge F263C-R) below San Gabriel River Parkway in Pico Rivera. The upstream tributary area is 450 square miles at this location. At this monitoring location, the San Gabriel River is a grouted rock concrete stabilizer along the western levee and a natural section on the eastern side. Flow measurement and water sampling are conducted in the grouted rock area along the western levee of the river. The length of the concrete stabilizer is nearly 70 ft. This San Gabriel River MES location has been an active stream gauging station since 1968. This station can be found in the Thomas Guide, page 676, J-2.

Tributary Stations within the CBWCB SNMP Study Area (that have been monitored through 2011-12)

Monitoring started in 2002

Annual Monitoring: Rio Hondo Channel

Rotating Monitoring:

- Los Angeles River Watershed: Aliso Creek, Bull Creek, Burbank Western System Channel, Verdugo Wash, Arroyo Seco Channel (2002-2003 and 2003-2004 storm seasons)
- San Gabriel River Watershed: Big Dalton\Walnut Creek, Puente Creek, Upper San Jose Creek, Maplewood Channel, North Fork Coyote, and SD 21 (Artesia-Norwalk Drain) (2006-2007 and 2007-08 storm seasons)

Constituents for the Stormwater Monitoring Program and Associated Minimum Levels [a]

PARAMETER	MINIMUM LEVEL
CONVENTIONAL POLLUTANTS	**mg/L**
Oil and Grease	5
Total Phenols	0.1
Cyanide	0.005
pH	0 - 14
Temperature	None
Dissolved Oxygen	Sensitivity to 5 mg/L
BACTERIA	
Total coliform (marine waters)	10,000 mpn/100 mL
Fecal coliform	400 mpn/100 mL
Enterococcus (marine waters and fresh waters)	104 mpn/100 mL
E. coli (fresh waters)	235 mpn/100 mL
GENERAL	**mg/L**
Dissolved Phosphorus	0.05
Total Phosphorus	0.05
Turbidity	0.1 NTU
Total Suspended Solids	2
Total Dissolved Solids	2
Volatile Suspended Solids	2
Total Organic Carbon	1
Total Petroleum Hydrocarbon	5
Biochemical Oxygen Demand	2
Chemical Oxygen Demand	20-900
Total Ammonia-Nitrogen	0.1
Total Kjeldahl Nitrogen	0.1
Nitrate-Nitrite	0.1
Alkalinity	2
Specific Conductance	1 umho/cm

PARAMETER	MINIMUM LEVEL
Total Hardness	2
Methylene Blue Active Substances	0.5
Chloride	2
Fluoride	0.1
Methyl tertiary butyl ether	1
Perchlorate	4 ug/l
METALS (Dissolved and Total)	**µg/L**
Aluminum	100
Antimony	0.5
Arsenic	1
Beryllium	0.5
Cadmium	0.25
Chromium (total)	0.5
Chromium (hexavalent)	5
Copper	0.5
Iron	100
Lead	0.5
Mercury	0.5
Nickel	1
Selenium	1
Silver	0.25
Thallium	1
Zinc	1
SEMIVOLATILE ORGANIC COMPOUNDS	**µg/L**
Acids	
2-Chlorophenol	2
2, 4-Dichlorophenol	1
2,4-Dimethylphenol	2
2, 4-Dinitrophenol	5
2-Nitrophenol	10
4-Nitrophenol	5
4-Chloro-3-methylphenol	1
Pentachlorophenol	2
Phenol	1
2,4,6-Trichlorophenol	10
BASE/NEUTRAL	**µg/L**
Acenaphthene	1
Acenaphthylene	2
Anthracene	2
Benzidine	5
1,2 Benzanthracene	5
Benzo(a)pyrene	2
Benzo(g,h,i)perylene	5
3,4 Benzoflouranthene	10
Benzo(k)flouranthene	2
Bis(2-Chloroethoxy) methane	5
Bis(2-Chloroisopropyl) ether	2

PARAMETER	MINIMUM LEVEL
Bis(2-Chloroethyl) ether	1
Bis(2-Ethylhexl) phthalate	5
4-Bromophenyl phenyl ether	5
Butyl benzyl phthalate	10
2-Chloroethyl vinyl ether	1
2-Chloronaphthalene	10
4-Chlorophenyl phenyl ether	5
Chrysene	5
Dibenzo(a,h)anthracene	0.1
1,3-Dichlorobenzene	1
1,4-Dichlorobenzene	1
1,2-Dichlorobenzene	1
3,3-Dichlorobenzidine	5
Diethyl phthalate	2
Dimethyl phthalate	2
di-n-Butyl phthalate	10
2,4-Dinitrotoluene	5
2,6-Dinitrotoluene	5
4,6 Dinitro-2-methylphenol	5
1,2-Diphenylhydrazine	1
di-n-Octyl phthalate	10
Fluoranthene	0.05
Fluorene	0.1
Hexachlorobenzene	1
Hexachlorobutadiene	1
Hexachloro-cyclopentadiene	5
Hexachloroethane	1
Indeno(1,2,3-cd)pyrene	0.05
Isophorone	1
Naphthalene	0.2
Nitrobenzene	1
N-Nitroso-dimethyl amine	5
N-Nitroso-diphenyl amine	1
N-Nitroso-di-n-propyl amine	5
Phenanthrene	0.05
Pyrene	0.05
1,2,4-Trichlorobenzene	1
CHLORINATED PESTICIDES	**µg/L**
Aldrin	0.005
alpha-hexachlorocyclohexane (BHC)	0.01
beta-BHC	0.005
delta-BHC	0.005
gamma-BHC (lindane)	0.02
alpha-chlordane	0.1
gamma-chlordane	0.1
4,4'-DDD	0.05

PARAMETER	MINIMUM LEVEL
4,4'-DDE	0.05
4,4'-DDT	0.01
Dieldrin	0.01
alpha-Endosulfan	0.02
beta-Endosulfan	0.01
Endosulfan sulfate	0.05
Endrin	0.01
Endrin aldehyde	0.01
Heptachlor	0.01
Heptachlor Epoxide	0.01
Toxaphene	0.5
Polychlorinated Biphenyls	**µg/L**
Aroclor-1016	0.5
Aroclor-1221	0.5
Aroclor-1232	0.5
Aroclor-1242	0.5
Aroclor-1248	0.5
Aroclor-1254	0.5
Aroclor-1260	0.5
ORGANOPHOSPHATE PESTICIDES	**µg/L**
Chlorpyrifos	0.05
Diazinon	0.01
Prometryn	2
Atrazine	2
Simazine	2
Cyanazine	2
Malathion	1
HERBICIDES	**µg/L**
Glyphosate	5
2,4-D	0.02
2,4,5-TP-SILVEX	0.2
All constituents for which the water body is impaired downstream of the monitoring station	

a - For Priority Pollutants, the MLs represent the lowest value listed in Appendix 4 of the State Implementation Plan: Method Detection Limits must be lower than or equal to the ML value; if a particular ML is not attainable in accordance with procedures set forth in 40 Code of Federal Regulations 136, the lowest quantifiable concentration of the lowest calibration standard analyzed by a specific analytical procedure may be used instead

MDL – method detection limit
mg/L – milligrams per liter
ML – minimum level
MPN – most probably number
NTU - Nephelometric Turbidity Unit
ug/L – micrograms per liter
umho/cm – micromhos per centimeter

Monitoring for Non-Stormwater Releases

Discharges from drinking water supplier distribution systems >100,000 gallons must monitor in the release for pollutants of concern defined as: trash and debris, including organic matter, total suspended solids, residual chlorine, pH, and any pollutant for which there is a water quality-based effluent limitation applicable to discharges from the MS4 to the receiving water. Determination of the pollutants of concern for a particular discharge shall be based on an evaluation of the potential for the constituent(s) to be present in the discharge at levels that may cause or contribute to exceedances of applicable water quality based effluent limits or receiving water limitations.

Discharge from lake dewatering must monitor in the release for pollutants of concern defined as: at a minimum, trash and debris, including organic matter, total suspended solids, and any pollutant for which there is a water quality-based effluent limitation for the lake and/or receiving water.

LARWQCB Order No. R4-2012-175 TMDL Receiving Water Compliance Points:

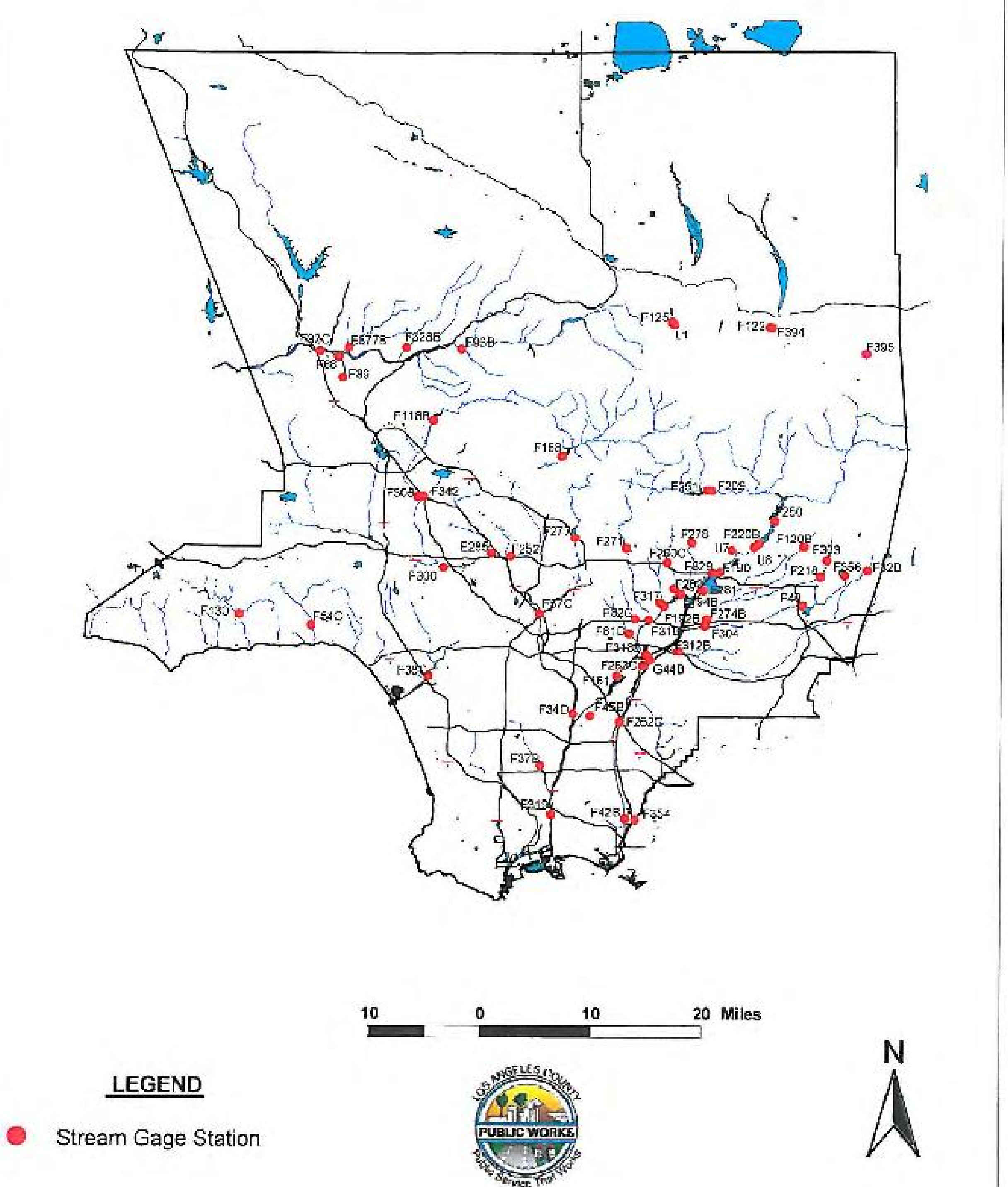
- Attachment O – TMDL Provisions for Los Angeles River Watershed Management Area: http://www.waterboards.ca.gov/rwqcb4/water_issues/programs/stormwater/municipal/la_ms4/Dec5/Order%20R4-2012-0175%20-%20Final%20Attachment%20O.pdf
- Attachment P – TMDL Provisions for San Gabriel River Watershed Management Area: http://www.waterboards.ca.gov/rwqcb4/water_issues/programs/stormwater/municipal/la_ms4/Dec5/Order%20R4-2012-0175%20-%20Final%20Attachment%20P.pdf
- Attachment Q – TMDL Provisions for Los Cerritos Channel and Alamitos Bay Watershed Management Area: http://www.waterboards.ca.gov/rwqcb4/water_issues/programs/stormwater/municipal/la_ms4/Dec5/Order%20R4-2012-0175%20-%20Final%20Attachment%20Q.pdf

Attachment K-M

LACDPW Stream Gauge Flow Monitoring

RUNOFF

STREAM GAGE STATION LOCATIONS



RUNOFF

Public Works operated 62 stream gaging stations during the 2009-10 water year. Mean daily flow and maximum instantaneous flow rates for each station are summarized and published in this volume. Annual summaries of peak flows and volumes are also provided. Additional data can be obtained by contacting the custodian of hydrologic records.

LEGEND

Stations are designated by letters and numbers which indicate ownership, operation agency, and type of station.

- Prefix **F** - Indicates a station originally owned and operated by the Los Angeles County Flood Control District and now owned and operated by Public Works.
- Prefix **E** - Indicates a station owned by the U.S. Army Corps of Engineers, but operated and maintained by the U.S. Geological Survey.
- Prefix **U** or **G** - Indicates a station originally constructed and operated by the U.S. Geological Survey, but now operated by Public Works.
- Prefix **L** - Indicates a station formerly owned by the Little Rock Water District, but now owned and operated by Public Works.
- Suffix **R** - Indicates a recorder station.
- Suffix **B, C** - Indicates that the station has been moved from its original location. B represents second location, C a third location, etc.

ALERT SYSTEM
Automated Local Evaluation in Real Time

Public Works operates and maintains the ALERT computer system to monitor meteorological conditions at 24 river stage locations in the County. Public Works' ALERT System also receives rainfall, streamflow, and reservoir data from the Corps of Engineers' Los Angeles Telemetry System.

COOPERATION

Public Works receives or has access to stream flow data from other agencies. Public Works exchanges data with the following agencies:

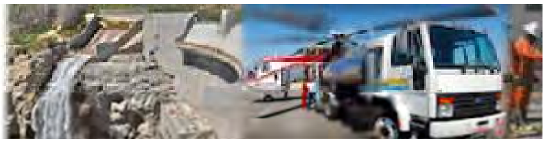
- U.S. Geological Survey, Water Resource Division
- U.S. Army Corps of Engineers
- State Department of Water Resources
- The Metropolitan Water District of Southern California
- San Gabriel River Water Committee

CUSTODIAN

Unpublished information may be obtained by contacting:

County of Los Angeles
Department of Public Works
Water Resources Division
P.O. Box 1460 Alhambra, CA 91802-1460
(626) 458-6120

Department of Public Works
dpw.lacounty.gov



Index of Stream Gaging Stations

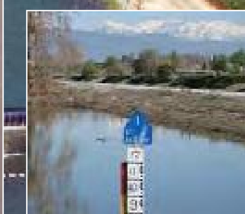
STATION LOCATION	REGULATED	DRAINAGE AREA
F81D-R ALHAMBRA WASH above Klingerman Street	N	15.2
F317-R ARCADIA WASH below Grand Avenue	Y	8.5
F277-R ARROYO SECO below Devils Gate Dam	Y	32.5
F38C-R BALLONA CREEK above Sawtelle Blvd.	Y	88.6
F120B-R BIG DALTON CREEK below Big Dalton Dam	Y	4.8
F394-R BIG ROCK CREEK upstream from Pallett Creek	N	34.3
F168-R BIG TUJUNGA CREEK below Big Tujunga Dam	Y	82.3
F377-R BOUQUET CANYON CREEK at Urbandale Ave	Y	51.9
F377B-R BOUQUET CREEK above Bouquet Canyon Road	Y	60.9
F329-R BRADBURY CHANNEL below Central Avenue	Y	3.3
F342-R BRANFORD STREET CHANNEL below Sharp Avenue	Y	5.01
E285-R BURBANK WESTERN STORM DRAIN at Riverside Dr.	Y	25.0
F37B-R COMPTON CREEK near Greenleaf Drive	N	22.6
F354-R COYOTE CREEK below Spring Street	Y	185.0
F274B-R DALTON WASH at Merced Avenue	Y	35.95
F318-R EATON WASH at Loftus Drive	Y	22.8
F271-R EATON WASH below Eaton Wash Dam	Y	12.4
U7-R FISH CREEK above mouth of canyon	N	6.36
L1-R LITTLE ROCK CREEK above Little Rock Dam	N	49.2
F356-R LIVE OAK CREEK below Live Oak Dam	Y	2.28
F319-R LOS ANGELES RIVER below Wardlow River Road	Y	815.0
F300-R LOS ANGELES RIVER at Tujunga Avenue	Y	401.0
F57C-R LOS ANGELES RIVER above Arroyo Seco	Y	511.0
F34D-R LOS ANGELES RIVER below Firestone Blvd.	Y	596.0
F130-R MALIBU CREEK below Cold Creek	Y	105.0
F395-R MESCAL CREEK at mouth of canyon	Y	5.41
F328-R MINT CANYON CREEK at Fitch Ave	N	26.9
F328B-R MINT CANYON CREEK at Sierra Highway	N	28.0
F181-R MONTEBELLO STORM DRAIN above Rio Hondo	N	9.6
F118B-R PACOIMA CREEK FLUME below Pacoima Dam	Y	28.2
F305-R PACOIMA DIVERSION at Branford Street	Y	48.8
F122-R PALLETT CREEK at Valyermo Highway	N	15.8
F45B-R RIO HONDO above Stuart and Gray Road	Y	140.0
F192B-R RIO HONDO below Lower Azusa Avenue	Y	40.9
F313B-R RIO HONDO BYPASS - Zone 1 Ditch	Y	Controlled. 445.7
F338-R RUBIO DIVERSION CHANNEL below Gooseberry Inlet	Y	2.1
F82C-R RUBIO WASH at Glendon Way	Y	10.9
F303-R SAN DIMAS CREEK below San Dimas Dam	Y	16.2
F218-R SAN DIMAS WASH below Puddingstone Diversion	Y	19.9
F250-R SAN GABRIEL - AZUSA Conduit 25 Ft. Weir Below S.G. Dam	Y	202.7
F190-R SAN GABRIEL RIVER at Foothill Blvd.	Y	230.0
F261C-R SAN GABRIEL RIVER below Valley Blvd.	Y	118.0
F262C-R SAN GABRIEL RIVER above Florence Avenue	Y	215.8
G44B-R SAN GABRIEL RIVER above Whittier Narrows Dam	Y	442
F209-R SAN GABRIEL RIVER below Cogswell Dam	Y	41.0
U8-R SAN GABRIEL RIVER below Morris Dam	Y	212.4
F263C-R SAN GABRIEL RIVER below San Gabriel River Pkwy	Y	206.3
F42B-R SAN GABRIEL RIVER above Spring Street	Y	231.0
E281-R SAN GABRIEL RIVER below Santa Fe Dam	Y	239.0
F251-R SAN GABRIEL RIVER - West Fork at toe of Cogswell Dam	Y	39.2
F312B-R SAN JOSE CHANNEL above Workman Mill Road	Y	83.4
F119-R SANTA ANITA CREEK below Santa Anita Dam	Y	10.8

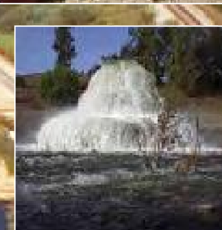
F119C-R SANTA ANITA CREEK below Santa Anita Dam	Y	10.8
F260C-R SANTA ANITA WASH below Foothill Blvd.	Y	17.2
F193B-R SANTA ANITA WASH at Longden Avenue	Y	18.8
F92-R SANTA CLARA RIVER at Old Road Bridge	Y	410.4
F93B-R SANTA CLARA RIVER above Lang Railroad Station	N	157.0
F280-R SANTA FE DIVERSION CHANNEL below Santa Fe Dam	Y	Controlled. 239.5
F125-R SANTIAGO CANYON CREEK above Little Rock Creek	N	11.2
F278-R SAWPIT CREEK below Sawpit Dam	Y	3.3
F194B-R SAWPIT WASH below Live Oak Avenue	Y	16.1
F32B-R THOMPSON CREEK below Thompson Creek Dam	Y	3.7
F54C-R TOPANGA CREEK above mouth of canyon	N	18.0
F252-R VERDUGO WASH at Estelle Avenue	Y	26.8
F304-R WALNUT CREEK above Puente Avenue	Y	57.6
F40-R WALNUT CREEK below Puddingstone Dam	Y	33.2

Attachment K-N

WRD Regional Groundwater Monitoring Program

Water Replenishment District
of Southern California





REGIONAL GROUNDWATER MONITORING PROGRAM (RGWMP) PLAN

Central Basin and West Coast Basin
Southern Los Angeles County, California

April 2014

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LIST OF ACRONYMS AND ABBREVIATIONS

REGIONAL GROUNDWATER MONITORING PROGRAM (RGWMP) PLAN
Central Basin and West Coast Basin (CBWCB)
Southern Los Angeles County, California
April 2014

AL	Action Level
AWTF	Advanced Water Treatment Facility
bgs	below ground surface
CASGEM	California Statewide Groundwater Elevation Monitoring
CBWCB	Central Basin and West Coast Basin
CDPH	SWRCB Division of Drinking Water (formerly California Department of Public Health)
DBMS	Database Management System
DTSC	California Department of Toxic Substances Control
DWR	California Department of Water Resources
EDD	Electronic Data Deliverable
EPA	United States Environmental Protection Agency
ESR	Engineering Survey and Report
GIS	Geographic Information System
GPS	Global Positioning System
LACDPH	Los Angeles County Department of Public Health (formerly Department of Health Services)
LACDPW	Los Angeles County Department of Public Works
LARWQCB	Los Angeles Regional Water Quality Control Board
MCL	Maximum Contaminant Level
mg/L	milligrams per Liter
µg/L	micrograms per Liter
MWD	Metropolitan Water District of Southern California
NDMA	n-Nitrosodimethylamine
NL	Notification Level
NTU	nephelometric turbidity units
OEHHA	Office of Environmental Health Hazard Assessment

LIST OF ACRONYMS AND ABBREVIATIONS

REGIONAL GROUNDWATER MONITORING PROGRAM (RGWMP) PLAN
Central Basin and West Coast Basin (CBWCB)
Southern Los Angeles County, California
April 2014

PCE	Perchloroethylene or Tetrachloroethylene
PHG	Public Health Goal
PPE	Personal protective equipment
QA/QC	Quality Assurance/Quality Control
RGWMP	Regional Groundwater Monitoring Program
RGWMR	Regional Groundwater Monitoring Report
RL	Response Level
SDLAC	County Sanitation Districts of Los Angeles County
SMCL	Secondary Maximum Contaminant Level
SOC	Non-Volatile Synthetic Organic Compounds
SWRCB	State Water Resources Control Board
TCE	Trichloroethylene
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
USGS	United States Geological Survey
VOC	Volatile Organic Compounds
WBMWD	West Basin Municipal Water District
WIN	Water Independence Now
WRD	Water Replenishment District of Southern California
WRP	Water Reclamation Plant
WTP	Water Treatment Plant
WY	Water Year (October 1 – September 30)

REGIONAL GROUNDWATER MONITORING PROGRAM (RGWMP) PLAN
Central Basin and West Coast Basin (CBWCB)
Southern Los Angeles County, California
April 2014

The Water Replenishment District of Southern California (WRD) manages groundwater replenishment and monitors water quality of the Central Basin and West Coast Basin (CBWCB) in southern Los Angeles County (see **Figure 1** below). Our mission is to protect and preserve high-quality groundwater in the basins through innovative, cost-effective, and environmentally sensitive management practices for the benefit of residents and businesses of the CBWCB. As part of accomplishing this mission, WRD implemented the Regional Groundwater Monitoring Program (RGWMP) to provide a comprehensive and current understanding of groundwater conditions in the CBWCB in order to predict and prepare for future conditions. This Plan describes the RGWMP.

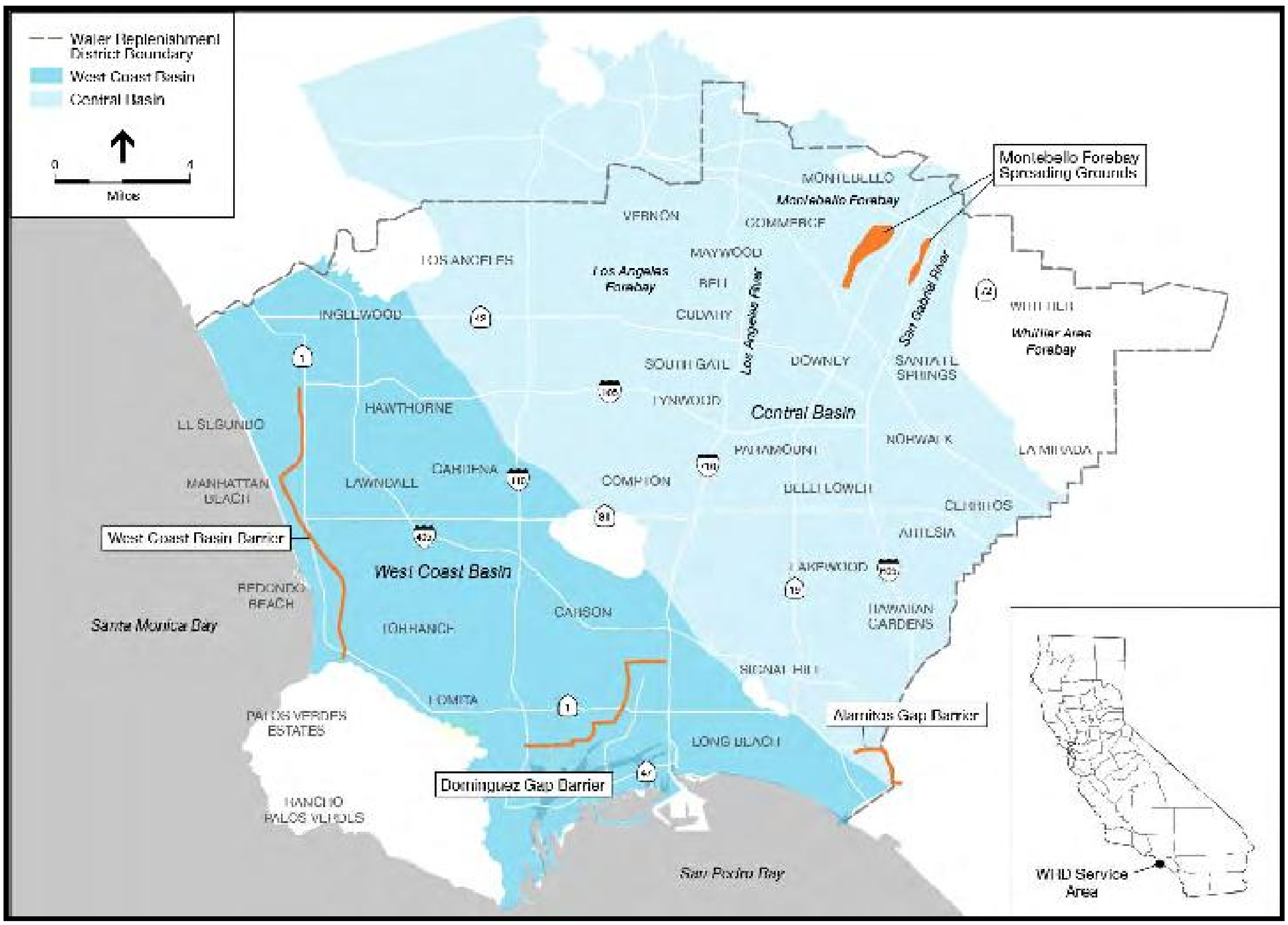


FIGURE 1
West Coast Basin and Central Basin, Southern Los Angeles County

Source: WRD

I. BACKGROUND

Between the 1900s and 1950s, groundwater was an important factor in urbanization of the CBWCB. Historical over pumping of the CBWCB caused overdraft, seawater intrusion, and other groundwater management problems related to supply and quality. To remedy these problems, the courts adjudicated the two basins in the early 1960s and set a limit on allowable groundwater production in order to control the over pumping. The California Department of Water Resources (DWR) was established as Watermaster of the CBWCB and is responsible for tracking groundwater extraction volumes.

Concurrent with the adjudication of the CBWCB, WRD was formed by a vote of the people in 1959 for the purpose of protecting the groundwater resources of the CBWCB. Since its formation, WRD has been actively involved in groundwater replenishment, water quality monitoring, contamination prevention, data management, and data publication. WRD protects the basins through groundwater replenishment, deterrence of seawater intrusion, and groundwater quality monitoring of contamination through an assessment on water pumped from the WRD service area. WRD ensures that a reliable supply of high-quality groundwater is available through its clean water projects, water supply programs, and effective management principles.

During Water Year (WY) 1994-95, WRD and the United States Geological Survey (USGS) began a cooperative study to improve the understanding of the geohydrology and geochemistry of the CBWCB. The initial study was documented in the USGS Water Resources Investigations Report 03-4065, *Geohydrology, Geochemistry and Ground-Water Simulation-Optimization of the Central Basin and West Coast Basin, Los Angeles County, California* (Reichard et al. 2003). In addition to compiling existing available data, this study recognized that the sampling of production wells did not adequately characterize the layered multiple aquifer systems of the CBWCB. The study focused on new data collection techniques including drilling and construction of nested groundwater monitoring wells and conducting depth-specific water quality monitoring. This study is the nucleus of the current and ongoing RGWMP.

1. GOALS AND OBJECTIVES

The protection and enhancement of quality groundwater in the Central and West Coast groundwater basins is a high priority for WRD. As a result, WRD established the RGWMP to improve the framework for understanding the dynamics of the groundwater system and use as a planning tool. The primary goal of the RGWMP is to track regional groundwater levels and groundwater quality in the CBWCB to ensure the continued usability of this beneficial resource. WRD staff, comprised of certified hydrogeologists and registered engineers, provides the in-house capability to collect, analyze, and report the groundwater data.

The RGWMP includes groundwater monitoring, modeling, and planning data, which are used to determine the "health" of the basins. This information in turn provides WRD, the pumpers in the basin, other interested stakeholders, and the public with the knowledge necessary for responsible water resources planning and management. Data collected from the RGWMP are evaluated and presented in annual *Regional Groundwater Monitoring Reports* (RGWMRs), as further discussed in Section VII Annual Reports.

2. GENERAL AND CURRENT GROUNDWATER QUALITY

Between 1900 and the 1950s, groundwater was an important factor in urbanization of the CBWCB. Excessive overpumping in the CBWCB caused severe overdraft and created a hydraulic gradient that resulted in seawater intrusion, which contaminated the coastal groundwater aquifers. To halt the intrusion, three seawater barriers (see Figure 1) were constructed by the Los Angeles County Department of Public Works (LACDPW): the West Coast Basin Barrier Project was initiated in the mid-1950s, the Alamitos Barrier Project in the early 1960s, and the Dominguez Gap Barrier Project in the early 1970s. LACDPW owns and operates all three barrier projects and WRD purchases all the water for injection.

Groundwater quality in the CBWCB also reflects current and historic land uses. There are localized areas of marginal to poor water quality that go untapped or may require treatment prior to use. Historic agricultural activities may have impacted groundwater locally and as an urban developed region, commercial and industrial activities (e.g., leaking aboveground and underground storage tanks, leaking sewer and oil pipelines, and illegal discharges) have contaminated groundwater with localized plumes of petroleum fuels, solvents, and other hazardous substances. In general, these plumes are limited to shallow groundwater. However, as the aquifers and confining layers in these alluvial basins are typically interfingered, the quality of groundwater in the deeper production aquifers can be threatened by the migration of pollutants from the upper aquifers. Overall, the groundwater in the CBWCB continues to be of high quality, suitable for potable and non-potable uses, and continues to meet regulatory requirements.

II. OVERVIEW OF CENTRAL BASIN AND WEST COAST BASIN

Two of the most important groundwater basins in Southern California are the Central Basin and the West Coast Basin (CBWCB), which are located in the southern portion of Los Angeles County (refer to Figure 1 above). Groundwater in the CBWCB meets approximately a third of the overall water supply needs of nearly 4 million residents and businesses in the 43 cities overlying the basins. **Figure 3** below depicts the cities in the CBWCB.

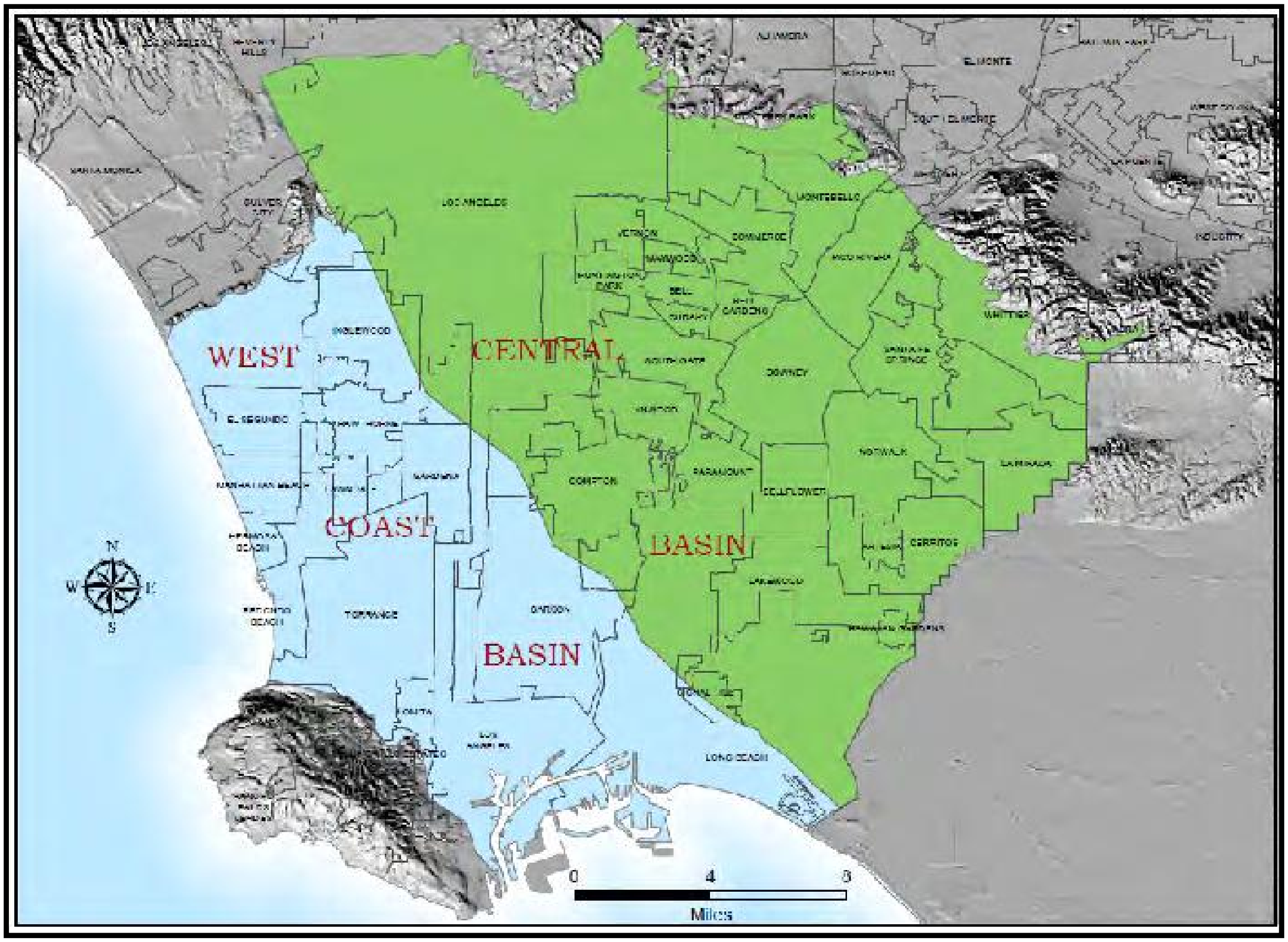


FIGURE 3
Cities in the CBWCB

Source: WRD

1. PHYSIOGRAPHIC DESCRIPTION

The Central Basin and the West Coast Basin (CBWCB) are two groundwater basins in the Coastal Plain of Los Angeles County, California (refer to Figure 1). The major land forms of the Coastal Plain consist of bordering highlands and foothills, older plains and hills, younger alluvial plains, the rivers which drain the area, and the offshore topography. Refer to **Figure 2** below for the physiographic features of the Los Angeles region.

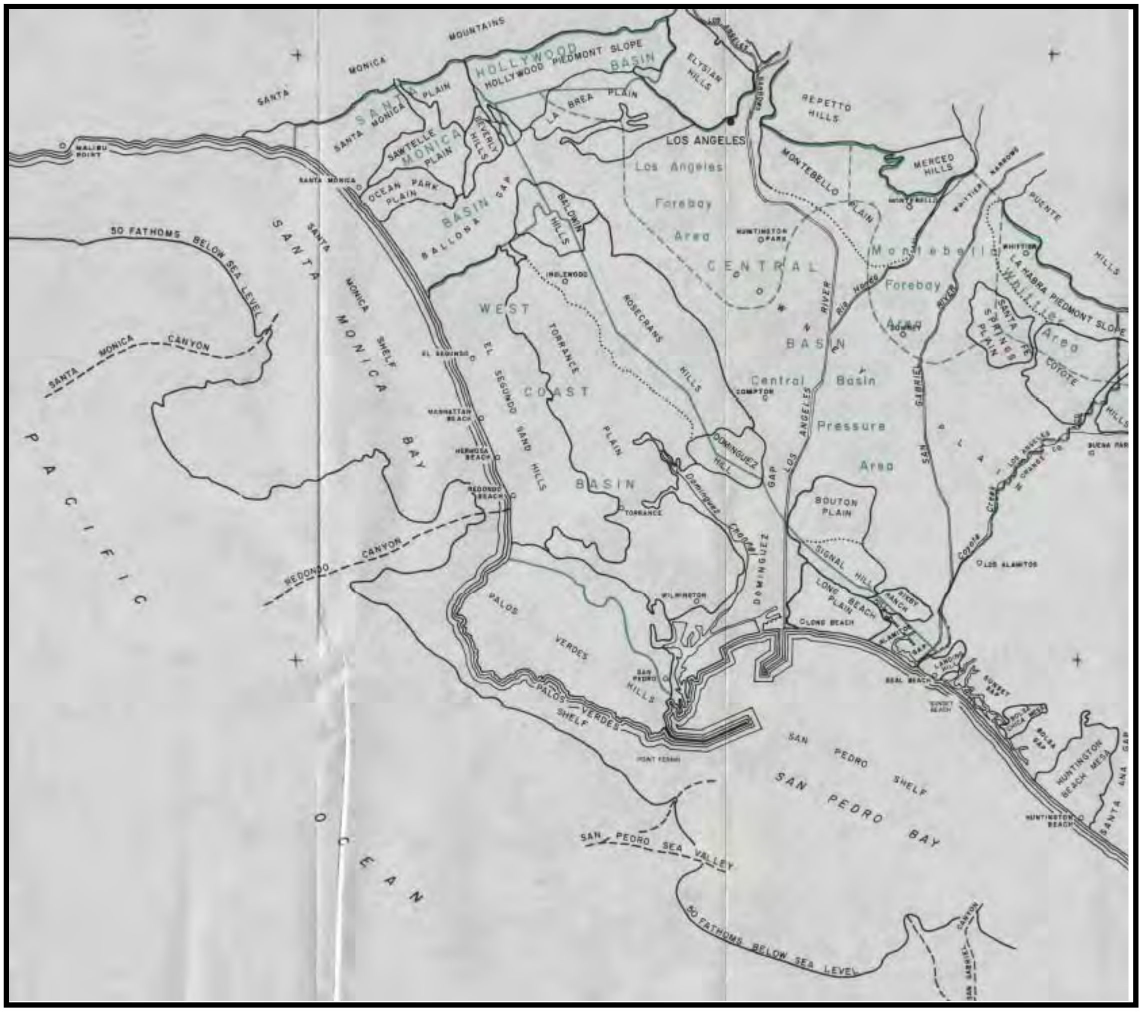


FIGURE 2
Physiographic Features of the Los Angeles Region

Source: DWR

2. GROUNDWATER BASIN BOUNDARIES

The Central Basin covers approximately 270 square miles and is bounded on the north by the Hollywood Basin and the Elysian, Repetto, Merced, and Puente Hills, to the east by the Los Angeles County/Orange County line, and to the south and west by the Newport-Inglewood Uplift, a series of discontinuous faults and folds that form a prominent line of northwest-trending hills including the Baldwin Hills, Dominguez Hills, and Signal Hill.

The West Coast Basin covers approximately 140 square miles and is bounded on the north by the Baldwin Hills and the Ballona Escarpment (a bluff just south of Ballona Creek), on the east by the Newport-Inglewood Uplift, to the south by San Pedro Bay and the Palos Verdes Hills, and to the west by Santa Monica Bay.

3. GEOLOGY

The CBWCB lies within the western portion of the Transverse Ranges Geomorphic Province. The water-bearing deposits in the CBWCB tapped for beneficial use are mostly comprised of Quaternary-age sediments (less than 1.8 million years old) of gravel, sand, silt, and clay that were deposited in layers from the erosion of nearby hills and mountains whose sediments were carried by wind and water flow, and from historic beaches and shallow ocean floors that covered the area at various times in the past. Underlying these Quaternary sediments are basement rocks of the Pliocene Pico Formation that generally do not provide sufficient quantities of groundwater to wells for economic development. Dividing the CBWCB is the Newport-Inglewood Uplift.

4. HYDROGEOLOGY/HYDROLOGY

As depicted in Figure 2, the Central Basin is divided into four sections: the Los Angeles Forebay, the Montebello Forebay, the Whittier Area, and the Pressure Area (DWR, 1961). The two forebays represent areas of unconfined (water table) aquifers that allow percolation of surface water down into the deeper production aquifers to replenish the rest of the basin. The Whittier Area and Pressure Area are confined aquifer systems that receive relatively minimal recharge from surface water, but are replenished from the upgradient forebay areas, mountainfront recharge, or other groundwater basins.

In the West Coast Basin, aquifers are generally confined and receive the majority of their natural replenishment from adjacent groundwater basins or from the Pacific Ocean (seawater intrusion). Both the Newport-Inglewood Uplift and the Charnock Fault (in the West Coast Basin) are partial barriers to groundwater flow, causing differences in water levels on opposite sides of each fault system. Groundwater flows between the Central Basin and the West Coast Basin based on the groundwater elevations on either side of the Newport-Inglewood Uplift. Most of the groundwater in the CBWCB remains at an elevation below sea level due to historic overpumping, so the importance of maintaining the seawater barrier wells to keep out the intruding saltwater is of vital importance.

5. AQUIFERS

Groundwater occurs in the pore spaces of the sediments in the CBWCB. Where these sediments are thick and transmissive enough to supply sufficient quantities of water to wells for beneficial use, they are termed "aquifers." In contrast, the name "aquitard" is given to the less permeable silt and clay layers that separate the aquifers.

The most accepted hydrogeologic description of the basin and the names of water-bearing zones were provided in California Department of Water Resources' *Bulletin No. 104: Planned Utilization of the Ground Water Basins of the Coastal Plain of Los Angeles County, Appendix A – Ground Water Geology* (DWR, 1961). WRD generally follows the naming conventions of this report (Bulletin 104), redefining certain aspects when new data become available. The major aquifers (i.e. discrete groundwater zones) and aquitards, from shallowest to deepest, in the CBWCB are identified in **Table 1** below.

TABLE 1
AQUIFER SYSTEMS IN THE CENTRAL BASIN AND WEST COAST BASIN

Age	Formation	Aquifer/Aquitard
Recent (Holocene)	Active Dune Sand	Semi-Perched Aquifer
	Alluvium	Bellflower Aquitard (mostly absent in the Montebello Forebay)
		Gaspur Aquifer
Upper Pleistocene	Older Dune Sand	Semi-Perched
	Lakewood	Exposition & Artesia Aquifers
		Gardena and Gage Aquifers (also referred to as 200-Foot Sand Aquifer)
Lower Pleistocene	Upper San Pedro	Hollydale Aquifer
		Jefferson Aquifer
		Lynwood Aquifer (also referred to as 400-Foot Gravel Aquifer)
		Silverado Aquifer
	Lower San Pedro	Sunnyside Aquifer
Upper Pliocene	Pico	

Aquifer depths can reach over 2,000 feet in the Central Basin and 1,500 feet in the West Coast Basin and are separated by aquitards. The main potable production aquifers are the deeper Lynwood, Silverado, and Sunnyside Aquifers. The shallower aquifers, including the Gage and Gardena Aquifers locally produce potable water. Also shown on the geologic sections are the aquitards separating aquifers. Many references are made to the Silverado Aquifer which is typically the main producing aquifer in the CBWCB. Substantial production can come from the Lynwood and Sunnyside Aquifers as well.

6. HYDROLOGIC AREAS TRIBUTARY TO THE GROUNDWATER BASINS

The CBWCB is located within the Los Angeles-San Gabriel Hydrologic Unit, which is a drainage area that totals approximately 1,608 square miles. Within the Los Angeles–San Gabriel Hydrologic Unit, the CBWCB is located in the Coastal Plain Hydrologic Area and the Palos Verdes, West Coast, and Central Hydrologic Subareas. Land use within these hydrologic subareas is predominantly residential, commercial, and industrial, and thus, the vast majority of the area is covered with semi-permeable or non-permeable material (e.g., paved). The Los Angeles River and the San Gabriel River, which are the major drainage systems in the Coastal

Plain Hydrologic Area, drain the coastal watersheds of the Transverse Ranges. These surface waters also provide natural recharge to large reserves of groundwater that exist in aquifers underlying the CBWCB. Groundwater in the CBWCB is also artificially recharged through the operation of the Montebello Forebay spreading grounds, the seawater intrusion barriers along the coast (West Coast Basin Barrier, Dominguez Gap Barrier, and Alamitos Barrier), and other recharge areas.

7. CLIMATE

The CBWCB is characterized by a Mediterranean climate, i.e. warm to hot, dry summers and mild to cool, wet winters, with relatively modest transitions in temperature. Most of the rainfall occurs during winter and spring (between December and March). Rainfall data will be provided in the final CBWCB SNMP.

8. LAND COVER AND LAND USE

The CBWCB covers approximately 420 square miles in southern Los Angeles County and consists of 43 cities with a population of nearly 4 million residents. Most of the CBWCB is developed as urban areas with buildings and paved surfaces. Predominant land uses include urban residential, commercial, and industrial. The economy in the CBWCB is primarily industrial, commercial, and service.

9. WATER SOURCES

Water sources in the CBWCB include groundwater, imported water, recycled water, and stormwater. Water is imported into the CBWCB from three major sources: the Sacramento-San Joaquin Delta (northern California), Colorado River, and Owens Valley/Mono Basin (eastern Sierra Nevada Mountains). Recycled water produced by various water reclamation plants in the CBWCB has many uses, including groundwater recharge, urban landscape irrigation, agricultural irrigation, industrial and commercial process water, recreational facilities, and wildlife habitat maintenance.

10. GROUNDWATER BENEFICIAL USES

The major water bodies, including inland surface waters, groundwater, coastal waters, and coastal wetlands, in the CBWCB are designated as having one or more beneficial uses, as defined in the Water Quality Control Plan (Basin Plan) that was developed by the Regional Water Quality Control Board, Los Angeles Region (LARWQCB). These beneficial uses are used by the LARWQCB to establish regulatory thresholds (i.e. water quality objectives) to protect the water supply. The current beneficial uses designated for groundwater in the CBWCB include municipal and domestic supply, agricultural supply, industrial process supply, and industrial service supply.

III. GROUNDWATER WELLS IN THE CBWCB

Prior to 1995, WRD relied heavily upon groundwater monitoring data collected, interpreted, and presented by other entities such as the LACDPW, the DWR, and the private sector for understanding basin conditions. However, these data were collected primarily from production wells, which are typically screened across multiple aquifers to maximize water inflow. The result is a mixing of waters from the different aquifers connected by a single well casing, causing an averaging of water levels and water quality. To more accurately monitor groundwater conditions, WRD established the RGWMP and installed nested groundwater monitoring wells and conducting depth-specific water quality and water level monitoring. The RGWMP changed the focus of groundwater monitoring efforts in the CBWCB to a layered multiple aquifer system with individual zones of groundwater quality and groundwater levels. WRD views each aquifer as a significant component of the groundwater system and recognizes the importance of the interrelationships between water-bearing zones.

As part of the RGWMP, WRD performs extensive collection, analysis, and reporting of groundwater data to refine the hydrogeologic conceptual model of the CBWCB, detect groundwater contamination, evaluate trends in water quality characteristics, and assure compliance with drinking water standards. Thus, the RGWMP establishes baseline regional monitoring as a first step towards detecting any degradation to the quality of the region's groundwater supply.

1. PRODUCTION WELLS

Groundwater production wells are the main source of groundwater extraction and usage in the CBWCB. There are currently over 400 active production wells in the CBWCB (refer to **Figure 4** below). Production wells are typically screened across multiple aquifers to maximize water inflow. In order to meet drinking water quality and production objectives, drinking water supply wells are typically screened in the deeper production aquifers, such as the Lynwood, Silverado, and Sunnyside Aquifers. Production well names are assigned by the well owner, but every production well in the CBWCB is assigned a 6-digit WRD ID number.

The State Water Resources Control Board (SWRCB) Division of Drinking Water (formerly California Department of Public Health) regulates all public water systems in the State to ensure the delivery of safe drinking water to all Californians. In this capacity, the SWRCB Division of Drinking Water performs field inspections of water systems, issues operating permits, reviews plans and specifications for new water infrastructure facilities, takes enforcement actions for non-compliance with laws and regulatory limits, reviews water quality monitoring results, and supports and promotes water system security. The SWRCB Division of Drinking Water also establishes the monitoring requirements for drinking water wells and all the data collected must be reported to the SWRCB Division of Drinking Water by the well owner.

Production wells that supply drinking water are regulated under Title 22 of the California Code of Regulations. Title 22 also establishes the regulatory limits, including Maximum Contaminant Levels (MCLs), Secondary Maximum Contaminant Levels (SMCLs), and Action Levels (ALs) for certain chemicals, including volatile organic compounds (VOCs), non-volatile synthetic organic compounds (SOCs), inorganic chemicals, radionuclides, disinfection byproducts, and other general physical constituents. **Appendix A** provides the current regulatory limits established by the SWRCB Division of Drinking Water for chemicals in drinking water. An MCL is the highest level of a contaminant that is allowed in drinking water and is protective of human health. MCLs not only reflect the chemicals' health risks but also factors such as their detectability and treatability, as well as the cost of treatment. SMCLs are water quality standards established to manage drinking water for aesthetic considerations, such as taste, color, and odor. An AL is defined in Title 22 as a concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a water system must follow.

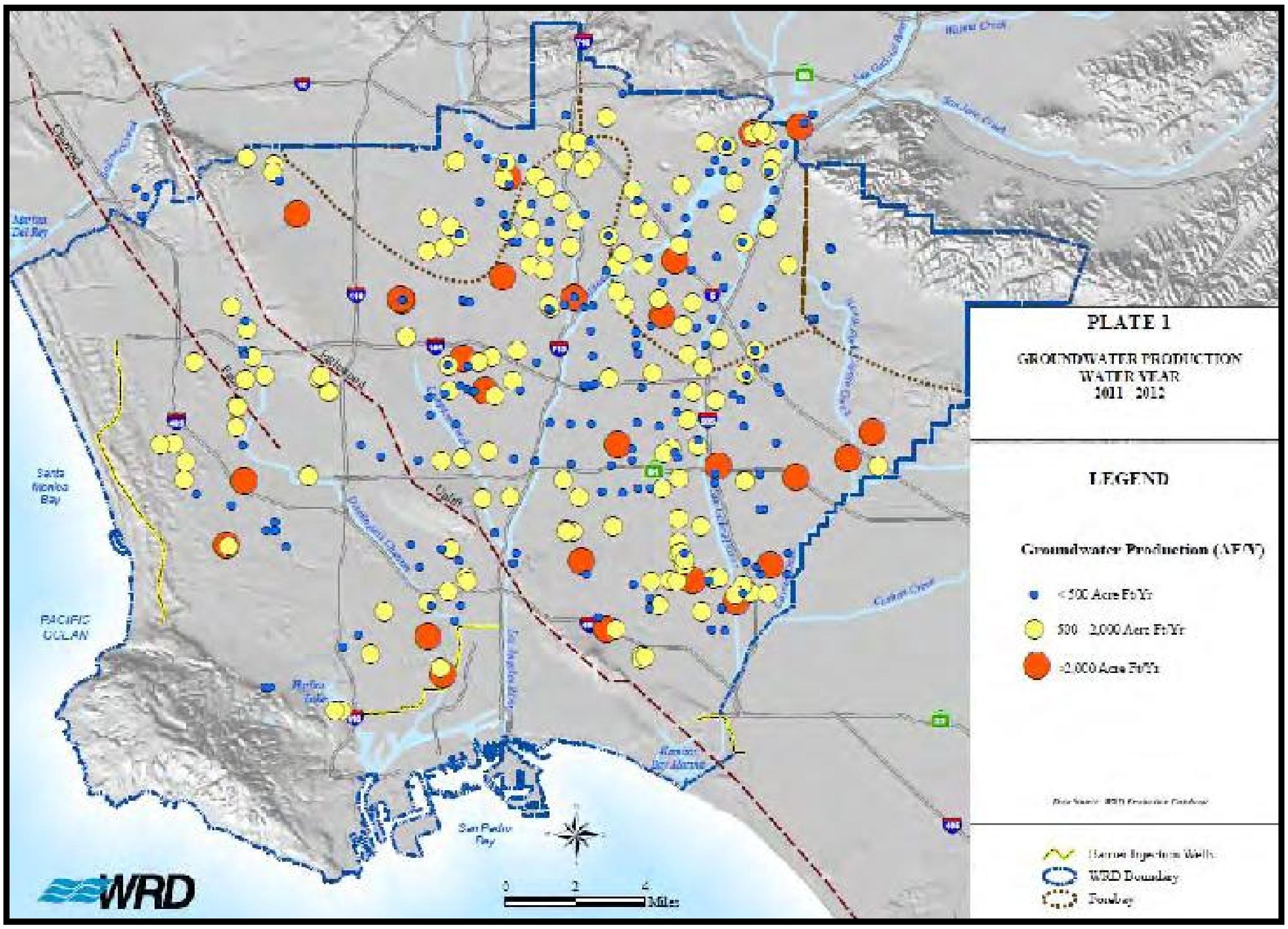


FIGURE 4
Groundwater Production Wells in the CBWCB (Water Year 2011 – 2012)

Source: WRD

2. NESTED MONITORING WELLS

The RGWMP currently consists of a network of over 300 nested monitoring wells located at 55 locations throughout the CBWCB. **Table 2** below lists the nested monitoring wells and their well construction details. WRD plans to install additional monitoring wells as needed when significant data gaps are recognized to enhance its monitoring well network and improve the understanding of the complex underground aquifer network.

TABLE 2
CONSTRUCTION DETAILS OF
NESTED GROUNDWATER MONITORING WELLS IN THE CBWCB
(As of April 2014)

Well Name	Zone	WRD Well ID	Well Depth (feet bgs)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Aquifer Designation
Bell #1	1	102041	1750	1730	1750	Pico Formation
	2	102042	1215	1195	1215	Sunnyside
	3	102043	985	965	985	Silverado
	4	102044	635	615	635	Silverado
	5	102045	440	420	440	Hollydale
	6	102046	270	250	270	Gage
Bell Gardens #1	1	101954	1795	1775	1795	Sunnyside
	2	101955	1410	1390	1410	Sunnyside
	3	101956	1110	1090	1110	Sunnyside
	4	101957	875	855	875	Silverado
	5	101958	575	555	575	Lynwood
	6	101959	390	370	390	Gage
Carson #1	1	100030	1010	990	1010	Sunnyside
	2	100031	760	740	760	Silverado
	3	100032	480	460	480	Lynwood
	4	100033	270	250	270	Gage
Carson #2	1	101787	1250	1230	1250	Sunnyside
	2	101788	870	850	870	Silverado
	3	101789	620	600	620	Silverado
	4	101790	470	450	470	Lynwood
	5	101791	250	230	250	Gage
Carson #3	1	102075	1800	1600	1620	Pico Formation
	2	102076	1240	1220	1240	Sunnyside
	3	102077	1100	1080	1100	Sunnyside
	4	102078	890	870	890	Silverado
	5	102079	640	620	640	Silverado
	6	102080	380	360	380	Lynwood

TABLE 2
CONSTRUCTION DETAILS OF
NESTED GROUNDWATER MONITORING WELLS IN THE CBWCB
(As of April 2014)

Well Name	Zone	WRD Well ID	Well Depth (feet bgs)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Aquifer Designation
Cerritos #1	1	100870	1215	1155	1175	Sunnyside
	2	100871	1020	1000	1020	Sunnyside
	3	100872	630	610	630	Lynwood
	4	100873	290	270	290	Gage
	5	100874	200	180	200	Artesia
	6	100875	135	125	135	Artesia
Cerritos #2	1	101781	1470	1350	1370	Sunnyside
	2	101782	935	915	935	Silverado
	3	101783	760	740	760	Silverado
	4	101784	510	490	510	Jefferson
	5	101785	370	350	370	Gage
	6	101786	170	150	170	Gaspur
Chandler #3B	1	100082	363	341	363	Gage/Lynwood/Silverado
Chandler #3A	2	100083	192	165	192	Gage/Lynwood/Silverado
Commerce #1	1	100881	1390	1330	1390	Pico Formation
	2	100882	960	940	960	Sunnyside
	3	100883	780	760	780	Sunnyside
	4	100884	590	570	590	Silverado
	5	100885	345	325	345	Hollydale
	6	100886	225	205	225	Exposition/Gage
Compton #1	1	101809	1410	1370	1390	Sunnyside
	2	101810	1170	1150	1170	Sunnyside
	3	101811	820	800	820	Silverado
	4	101812	480	460	480	Hollydale
	5	101813	325	305	325	Gage
Compton #2	1	101948	1495	1475	1495	Sunnyside
	2	101949	850	830	850	Sunnyside
	3	101950	605	585	605	Silverado
	4	101951	400	380	400	Hollydale
	5	101952	315	295	315	Gage
	6	101953	170	150	170	Exposition

TABLE 2
CONSTRUCTION DETAILS OF
NESTED GROUNDWATER MONITORING WELLS IN THE CBWCB
(As of April 2014)

Well Name	Zone	WRD Well ID	Well Depth (feet bgs)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Aquifer Designation
Downey #1	1	100010	1190	1170	1190	Sunnyside
	2	100011	960	940	960	Silverado
	3	100012	600	580	600	Silverado
	4	100013	390	370	390	Hollydale/Jefferson
	5	100014	270	250	270	Gage
	6	100015	110	90	110	Gaspur
Gardena #1	1	100020	990	970	990	Sunnyside
	2	100021	465	445	465	Silverado
	3	100022	365	345	365	Lynwood
	4	100023	140	120	140	Gage
Gardena #2	1	101804	1335	1275	1335	Sunnyside
	2	101805	790	770	790	Silverado
	3	101806	630	610	630	Silverado
	4	101807	360	340	360	Lynwood
	5	101808	255	235	255	Gardena
Hawthorne #1	1	100887	990	910	950	Sunnyside
	2	100888	730	710	730	Silverado
	3	100889	540	520	540	Silverado
	4	100890	420	400	420	Silverado
	5	100891	260	240	260	Lynwood
	6	100892	130	110	130	Gage
Huntington Park #1	1	100005	910	890	910	Silverado
	2	100006	710	690	710	Jefferson
	3	100007	440	420	440	Gage
	4	100008	295	275	295	Exposition
	5	100009	134	114	134	Gaspur
Inglewood #1	1	100091	1400	1380	1400	Pico Formation
	2	100092	Abandoned Well			
	3	100093	450	430	450	Silverado
	4	100094	300	280	300	Lynwood
	5	100095	170	150	170	Gage

TABLE 2
CONSTRUCTION DETAILS OF
NESTED GROUNDWATER MONITORING WELLS IN THE CBWCB
(As of April 2014)

Well Name	Zone	WRD Well ID	Well Depth (feet bgs)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Aquifer Designation
Inglewood #2	1	100824	860	800	840	Pico Formation
	2	100825	470	450	470	Sunnyside
	3	100826	350	330	350	Silverado
	4	100827	245	225	245	Lynwood
Inglewood #3	1	102138	1940	1900	1940	Pico Formation
	2	102139	1460	1440	1460	Pico Formation
	3	102140	1275	1255	1275	Pico Formation
	4	102141	910	890	910	Pico Formation
	5	102142	560	540	560	Silverado
	6	102143	390	370	390	Lynwood/Silverado
	7	102144	265	245	265	Gage/Lynwood
Lakewood #1	1	100024	1009	989	1009	Sunnyside
	2	100025	660	640	660	Silverado
	3	100026	470	450	470	Lynwood
	4	100027	300	280	300	Gage
	5	100028	160	140	160	Artesia
	6	100029	90	70	90	Bellflower
Lakewood #2	1	102151	2000	1960	2000	Not Interpreted
	2	102152	1760	1740	1760	Not Interpreted
	3	102153	1320	1300	1320	Not Interpreted
	4	102154	1015	995	1015	Silverado
	5	102155	710	690	710	Lynwood
	6	102156	575	555	575	Jefferson
	7	102157	275	255	275	Gage
	8	102158	120	110	120	Artesia
La Mirada #1	1	100876	1150	1130	1150	Sunnyside
	2	100877	985	965	985	Silverado
	3	100878	710	690	710	Lynwood
	4	100879	490	470	490	Jefferson
	5	100880	245	225	245	Gage

TABLE 2
CONSTRUCTION DETAILS OF
NESTED GROUNDWATER MONITORING WELLS IN THE CBWCB
(As of April 2014)

Well Name	Zone	WRD Well ID	Well Depth (feet bgs)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Aquifer Designation
Lomita #1	1	100818	1340	1240	1260	Sunnyside
	2	100819	720	700	720	Sunnyside
	3	100820	570	550	570	Silverado
	4	100821	420	400	420	Silverado
	5	100822	240	220	240	Gage
	6	100823	120	100	120	Gage
Long Beach #1	1	100920	1470	1430	1450	Sunnyside
	2	100921	1250	1230	1250	Sunnyside
	3	100922	990	970	990	Silverado
	4	100923	619	599	619	Lynwood
	5	100924	420	400	420	Jefferson
	6	100925	175	155	175	Gage
Long Beach #2	1	101740	1090	970	990	Sunnyside
	2	101741	740	720	740	Sunnyside
	3	101742	470	450	470	Silverado
	4	101743	300	280	300	Lynwood
	5	101744	180	160	180	Gage
	6	101745	115	95	115	Gaspur
Long Beach #3	1	101751	1390	1350	1390	Sunnyside
	2	101752	1017	997	1017	Silverado
	3	101753	690	670	690	Silverado
	4	101754	550	530	550	Silverado
	5	101755	430	410	430	Lynwood
Long Beach #4	1	101759	1380	1200	1220	Pico Formation
	2	101760	820	800	820	Sunnyside
Long Beach #6	1	101792	1530	1490	1510	Pico Formation
	2	101793	950	930	950	Sunnyside
	3	101794	760	740	760	Sunnyside
	4	101795	500	480	500	Silverado
	5	101796	400	380	400	Lynwood
	6	101797	240	220	240	Gage

TABLE 2
CONSTRUCTION DETAILS OF
NESTED GROUNDWATER MONITORING WELLS IN THE CBWCB
(As of April 2014)

Well Name	Zone	WRD Well ID	Well Depth (feet bgs)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Aquifer Designation
Long Beach #8	1	101819	1495	1435	1455	Pico Formation
	2	101820	1040	1020	1040	Sunnyside
	3	101821	800	780	800	Silverado
	4	101822	655	635	655	Silverado
	5	101823	435	415	435	Lynwood
	6	101824	185	165	185	Gage
Los Angeles #1	1	100926	1370	1350	1370	Pico Formation
	2	100927	1100	1080	1100	Sunnyside
	3	100928	940	920	940	Silverado
	4	100929	660	640	660	Lynwood
	5	100930	370	350	370	Gage
Los Angeles #2	1	102003	1370	1330	1370	Pico Formation
	2	102004	730	710	730	Sunnyside
	3	102005	525	505	525	Sunnyside
	4	102006	430	410	430	Silverado
	5	102007	265	245	265	Lynwood
	6	102008	155	135	155	Exposition
Los Angeles #3	1	102069	1570	1210	1230	Sunnyside
	2	102070	895	875	895	Silverado
	3	102071	725	705	725	Lynwood
	4	102072	570	550	570	Hollydale
	5	102073	350	330	350	Gage
	6	102074	210	190	210	Expo
Los Angeles #4	1	102131	1780	1740	1780	Pico Formation
	2	102132	1230	1190	1230	Pico Formation
	3	102133	740	720	740	Sunnyside
	4	102134	510	490	510	Silverado
	5	102135	375	355	375	Lynwood
	6	102136	255	235	255	Gage

TABLE 2
CONSTRUCTION DETAILS OF
NESTED GROUNDWATER MONITORING WELLS IN THE CBWCB
(As of April 2014)

Well Name	Zone	WRD Well ID	Well Depth (feet bgs)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Aquifer Designation
Manhattan Beach #1	1	102081	1990	1950	1990	Pico Formation
	2	102082	1590	1570	1590	Pico Formation
	3	102083	1270	1250	1270	Sunnyside
	4	102084	885	865	885	Silverado
	5	102085	660	640	660	Silverado
	6	102086	340	320	340	Lynwood
	7	102087	200	180	200	Gage
Montebello #1	1	101770	980	900	960	Pico Formation
	2	101771	710	690	710	Sunnyside
	3	101772	520	500	520	Silverado
	4	101773	390	370	390	Lynwood
	5	101774	230	210	230	Gage
	6	101775	110	90	110	Exposition
Norwalk #1	1	101814	1420	1400	1420	Sunnyside
	2	101815	1010	990	1010	Silverado
	3	101816	740	720	740	Lynwood
	4	101817	450	430	450	Jefferson
	5	101818	240	220	240	Gage
Norwalk #2	1	101942	1480	1460	1480	Sunnyside
	2	101943	1280	1260	1280	Sunnyside
	3	101944	980	960	980	Silverado
	4	101945	820	800	820	Lynwood
	5	101946	500	480	500	Gardena
	6	101947	256	236	256	Exposition
Pico #1	1	100001	900	860	900	Pico Formation
	2	100002	480	460	480	Silverado
	3	100003	400	380	400	Silverado
	4	100004	190	170	190	Gardena

TABLE 2
CONSTRUCTION DETAILS OF
NESTED GROUNDWATER MONITORING WELLS IN THE CBWCB
(As of April 2014)

Well Name	Zone	WRD Well ID	Well Depth (feet bgs)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Aquifer Designation
Pico #2	1	100085	1200	1180	1200	Sunnyside
	2	100086	850	830	850	Sunnyside
	3	100087	580	560	580	Sunnyside
	4	100088	340	320	340	Silverado
	5	100089	255	235	255	Lynwood
	6	100090	120	100	120	Gaspur
PM-1 Columbia	1	100042	605	555	595	Sunnyside
	2	100043	510	460	500	Silverado
	3	100044	290	240	280	Lynwood
	4	100045	210	160	200	Lynwood
PM-3 Madrid	1	100034	685	640	680	Sunnyside
	2	100035	525	480	520	Silverado
	3	100036	285	240	280	Lynwood
	4	100037	190	145	185	Gage
PM-4 Mariner	1	100038	720	670	710	Sunnyside
	2	100039	550	500	540	Silverado
	3	100040	390	340	380	Lynwood
	4	100041	250	200	240	Lynwood
PM-5 Columbia Park	1	102047	1480	1360	1380	Pico Formation
	2	102048	960	940	960	Pico Formation
	3	102049	790	770	790	Sunnyside
	4	102050	600	580	600	Sunnyside
	5	102051	340	320	340	Silverado
	6	102052	160	140	160	Gage
PM-6 Madrona Marsh	1	102053	1235	1195	1235	Pico Formation
	2	102054	925	905	925	Sunnyside
	3	102055	790	770	790	Sunnyside
	4	102056	550	530	550	Silverado
	5	102057	410	390	410	Lynwood
	6	102058	260	240	260	Gage

TABLE 2
CONSTRUCTION DETAILS OF
NESTED GROUNDWATER MONITORING WELLS IN THE CBWCB
(As of April 2014)

Well Name	Zone	WRD Well ID	Well Depth (feet bgs)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Aquifer Designation
Rio Hondo #1	1	100064	1150	1110	1130	Sunnyside
	2	100065	930	910	930	Sunnyside
	3	100066	730	710	730	Sunnyside
	4	100067	450	430	450	Silverado
	5	100068	300	280	300	Lynwood
	6	100069	160	140	160	Gardena
Seal Beach #1	1	102062	1485	1345	1365	Sunnyside
	2	102063	1180	1160	1180	Sunnyside
	3	102064	1040	1020	1040	Sunnyside
	4	102065	795	775	795	Silverado
	5	102066	625	605	625	Lynwood
	6	102067	235	215	235	Gage
	7	102068	70	60	70	Gaspur
South Gate #1	1	100893	1460	1440	1460	Pico Formation
	2	100894	1340	1320	1340	Sunnyside
	3	100895	930	910	930	Silverado
	4	100896	585	565	585	Lynwood
	5	100897	250	220	240	Exposition
Westchester #1	1	101776	860	740	760	Pico Formation
	2	101777	580	560	580	Sunnyside
	3	101778	475	455	475	Silverado
	4	101779	330	310	330	Lynwood
	5	101780	235	215	235	Gage
Whittier #1	1	101735	1298	1180	1200	Sunnyside
	2	101736	940	920	940	Sunnyside
	3	101737	620	600	620	Silverado
	4	101738	470	450	470	Lynwood
	5	101739	220	200	220	Gage

TABLE 2
CONSTRUCTION DETAILS OF
NESTED GROUNDWATER MONITORING WELLS IN THE CBWCB
(As of April 2014)

Well Name	Zone	WRD Well ID	Well Depth (feet bgs)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Aquifer Designation
Whittier #2	1	101936	1390	1370	1390	Sunnyside
	2	101937	1110	1090	1110	Sunnyside
	3	101938	675	655	675	Silverado
	4	101939	445	425	445	Silverado
	5	101940	335	315	335	Lynwood
	6	101941	170	150	170	Gardena
Whittier Narrows #1	1	100046	810	749	769	Sunnyside
	2	100047	810	609.5	629	Sunnyside
	3	100048	810	462.5	482.5	Sunnyside
	4	100049	810	392.5	402	Silverado
	5	100050	810	334	343.5	Silverado
	6	100051	810	272.5	282.5	Lynwood
	7	100052	810	233.5	243	Jefferson
	8	100053	810	163	173	Gardena
	9	100054	810	95	104.5	Gaspur
Whittier Narrows #2	1	100055	720	659.3	678.4	Pico Formation
	2	100056	720	579.1	598.2	Pico Formation
	3	100057	720	469.0	488.2	Pico Formation
	4	100058	720	418.6	428.2	Pico Formation
	5	100059	720	328.7	338.3	Pico Formation
	6	100060	720	263.2	273.3	Not Interpreted
	7	100061	720	213.7	223.3	Not Interpreted
	8	100062	720	135.7	145.3	Not Interpreted
	9	100063	720	90.8	100.3	Gardena
Willowbrook #1	1	100016	905	885	905	Sunnyside
	2	100017	520	500	520	Silverado
	3	100018	380	360	380	Lynwood
	4	100019	220	200	220	Gage

TABLE 2 CONSTRUCTION DETAILS OF NESTED GROUNDWATER MONITORING WELLS IN THE CBWCB (As of April 2014)						
Well Name	**Zone**	**WRD Well ID**	**Well Depth (feet bgs)**	**Top of Screen (feet bgs)**	**Bottom of Screen (feet bgs)**	**Aquifer Designation**
Wilmington #1	1	100070	1040	915	935	Sunnyside
	2	100071	800	780	800	Sunnyside
	3	100072	570	550	570	Silverado
	4	100073	245	225	245	Lynwood
	5	100074	140	120	140	Gage
Wilmington #2	1	100075	1030	950	970	Sunnyside
	2	100076	775	755	775	Silverado
	3	100077	560	540	560	Lynwood
	4	100078	410	390	410	Lynwood
	5	100079	140	120	140	Gage

A. Well Locations

Well locations are selected to provide a reasonably spaced aerial coverage and to address needs for local water quality and water level information to assess groundwater conditions and refine geologic conceptual and computer models. Additional considerations include proximity to production wells, recharge areas, and other areas of concern. **Figure 5** below depicts the locations of the existing nested monitoring wells as of April 2014.

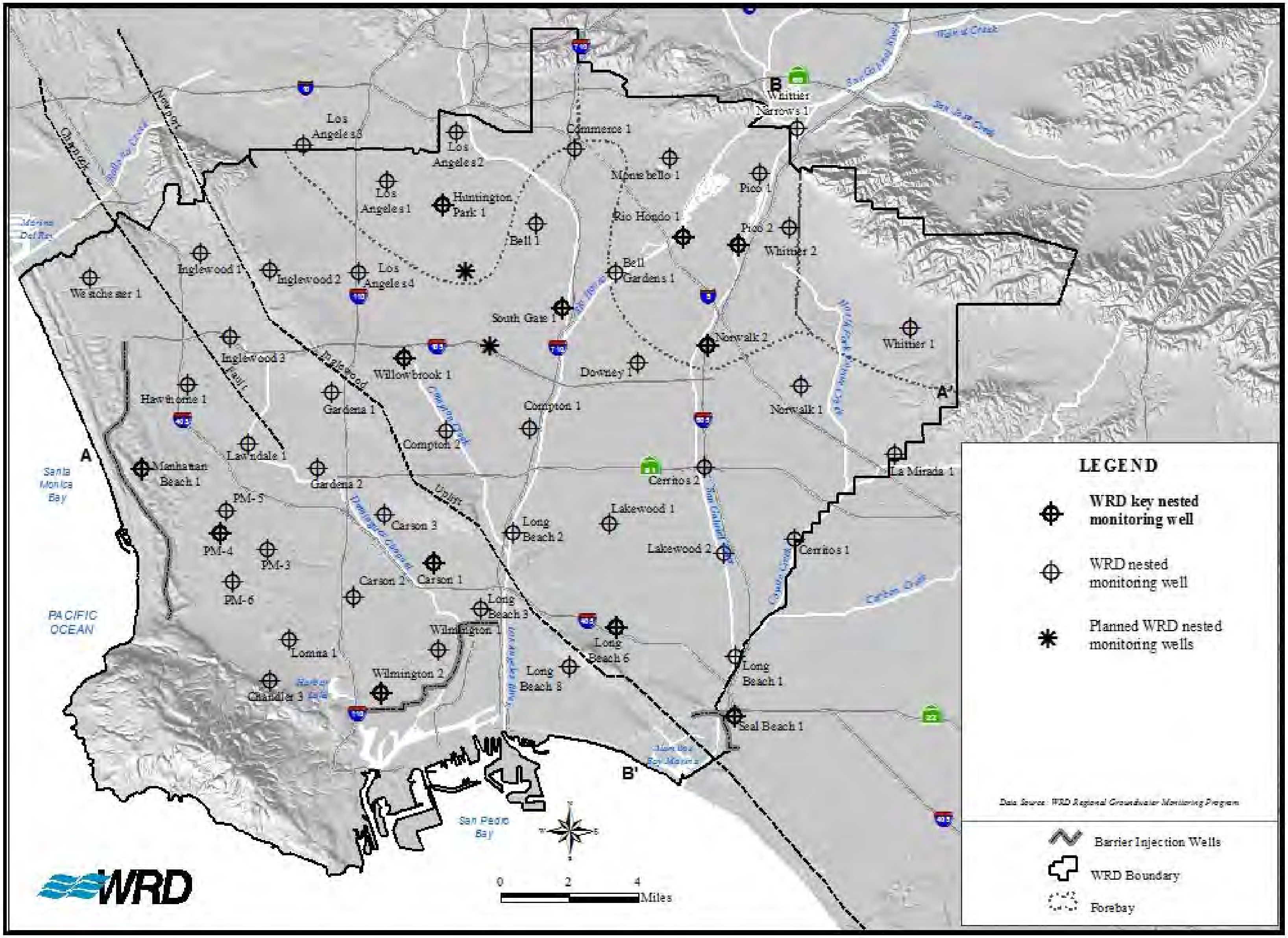
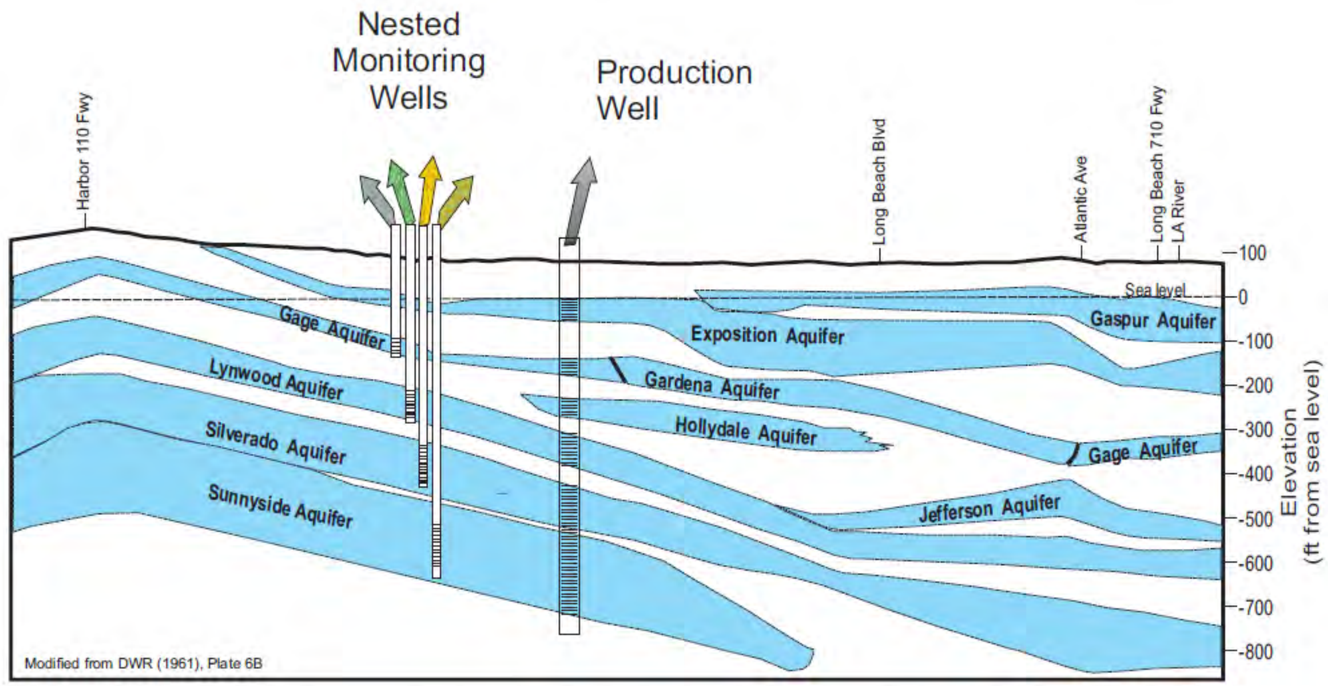


FIGURE 5
WRD's Nested Groundwater Monitoring Well Locations in the CBWCB
(as of April 2014)

Source: WRD

B. Well Construction

Depth-specific (nested) monitoring wells that tap discrete aquifer zones are necessary in order to obtain more accurate data for specific aquifers from which to infer localized water level and water quality conditions. **Figure 6** below illustrates the capabilities of nested monitoring wells to assess individual aquifers compared to typical production wells.



Production wells are typically perforated across multiple aquifers producing an average water quality. Nested monitoring wells are screened in a portion of a specific aquifer, providing water quality and water level information for the specific zone.

FIGURE 6
Nested Wells vs. Production Wells for Aquifer-Specific Data

Source: WRD

At each nested well location, a borehole is drilled through the aquifer system and into the Pico Formation to depths that typically range between 1,500 and 2,000 feet below ground surface, depending on the specific geohydrologic conditions of each site. The boring is advanced by a California-licensed drilling company using direct mud rotary drilling techniques. Generally, the nested wells are constructed by the USGS in cooperation with WRD.

The borehole is logged from soil cuttings by a USGS geologist. Standard geophysical logs of all boreholes are run and at selected well sites, advanced suites of borehole logs are collected which include porosity, permeability, and structural information. Once the well is constructed, a comprehensive well construction diagram is completed and all records are filed and maintained by WRD.

Each well nest generally consists of four to six 2-inch Schedule 80 polyvinyl (PVC) monitoring wells installed to different total depths within the same borehole. This allows for monitoring of groundwater levels, water quality, and hydraulic properties for different aquifers at the same location. Nested well screens are typically 20 feet long and consists of 0.020-inch factory-slotted PVC. The well screen depths are selected based on depths where permeable layers (aquifers) are identified using the geophysical logs, lithology (from soil cuttings), logs and hydrographs from existing wells nearby, and existing regional groundwater models.

Well construction materials are placed in the borehole using a tremie pipe. A filter pack of sand typically extends from 20 feet below to 20 feet above each nested well screen. Bentonite grout is placed between the filter packs of the nested wells and as an annular seal to ground surface. Depending on the well location, the wells are completed with either a flush-mounted well vault or a stove pipe monument. The well vaults and monuments are secured with pad lock mechanisms.

Once the wells are constructed, the latitude, longitude, top of casing elevation, and ground surface elevation of each nested well is determined by a California-licensed land surveyor or by Global Positioning System (GPS) technology. These records are filed and maintained by WRD, as further discussed in Section VI Data Management and Access.

C. Well Development

Monitoring wells are thoroughly developed by air lifting and pumping until water quality parameters (pH, electrical conductivity, temperature, and turbidity) indicate that the purged water has reached equilibrium.

D. Well Names and Aquifer Designations

Nested monitoring wells are named based on their location, i.e. the name of the city in which the well is located or other geograghic feature, and are generally followed by a sequence number based on the number of nested well locations that already exist within the area. Zone numbers are assigned consecutively for each nested well, beginning at the deepest screen upward to the shallowest at each well location. A 5-digit WRD ID number is also assigned to each nested monitoring well.

Once the wells are constructed, all available information is used by WRD to assign the aquifer names and stratigraphic unit names to each of the screened zones. Information can include the lithologic log, geophysical logs, logs from existing wells nearby, water quality and water level data, regional groundwater models, and the California Department of Water Resources' *Bulletin No. 104: Planned Utilization of the Ground Water Basins of the Coastal Plain of Los Angeles County, Appendix A – Ground Water Geology* (DWR, 1961).

IV. GROUNDWATER QUALITY MONITORNG

Groundwater samples are collected by WRD from the nested monitoring wells on a bi-annual basis, i.e. Spring and Fall of each year. Annually, as part of the RGWMP, WRD collects nearly 500 groundwater samples from its monitoring well network and analyzes them for over 100 water quality constituents to produce nearly 60,000 individual data points to help track the water quality in the basins. By analyzing and reviewing the results on a regular basis, any new or growing water quality concerns can be identified and managed effectively. The results of this monitoring and analysis include data tables, water quality maps, and graphs of trends which are presented in the annual RGWMRs.

1. NESTED MONITORING WELL PURGING AND SAMPLING

Nested monitoring wells are purged and sampled by WRD using submersible centrifugal sampling pumps (Grundfos Rediflo2) or pneumatic piston pumps (Bennett) that are permanently installed in the wells. Generally, a minimum of three casing volumes of water are pumped from the wells and samples are collected when field instruments indicate that water quality parameters (pH, ORP, specific conductance, and temperature) have stabilized and turbidity measurements are below 5 NTUs. Other industry-accepted methods may be used to sample the wells due to challenging local conditions or to evaluate new sampling technologies.

All groundwater samples are collected in laboratory supplied pre-labeled containers and include prescribed preservatives. Groundwater samples are placed in coolers with ice packs and transported to the State-certified laboratory (currently, Eurofins Eaton Analytical of Monrovia, California) following standard chain-of-custody procedures.

2. WATER QUALITY PARAMETERS

Table 3 below provides a list of the water quality parameters that are analyzed for groundwater samples collected from each nested monitoring well. Other constituents may occasionally be added to the list for certain wells or for special studies.

TABLE 3
WATER QUALITY PARAMETERS OF THE RGWMP
(As of April 2014)

Constituent	Chemical Storet No.	Laboratory Analytical Method
1,1,1,2-Tetrachloroethane	77562	EPA 524.2
1,1,1-Trichloroethane	34506	EPA 524.2
1,1,2,2-Tetrachloroethane	34516	EPA 524.2
1,1,2-Trichloroethane	34511	EPA 524.2
1,1-Dichloroethane	34496	EPA 524.2
1,1-Dichloroethylene	34501	EPA 524.2
1,1-Dichloropropene	77168	EPA 524.2

TABLE 3
WATER QUALITY PARAMETERS OF THE RGWMP
(As of April 2014)

Constituent	Chemical Storet No.	Laboratory Analytical Method
1,2,3-Trichlorobenzene	77613	EPA 524.2
1,2,3-Trichloropropane	77443	CASRL 524M-TCP / EPA 524.2
1,2,4-Trichlorobenzene	34551	EPA 524.2
1,2,4-Trimethylbenzene	77222	EPA 524.2
1,2-Dichloroethane	34531	EPA 524.2
1,2-Dichloropropane	34541	EPA 524.2
1,3,5-Trimethylbenzene	77226	EPA 524.2
1,3-Dichlorobenzene	34566	EPA 524.2
1,3-Dichloropropane	77173	EPA 524.2
1,3-Dichloropropene (Total)	34561	EPA 524.2
1,4-Dioxane	A-032	EPA 522
2,2-Dichloropropane	77170	EPA 524.2
2-Butanone (MEK)	81595	EPA 524.2
4-Methyl-2-Pentanone (MIBK)	81596	EPA 524.2
Aggressive Index (Corrosivity)	82383	SM 2330
Alkalinity	00410	SM 2320B
Aluminum	01105	EPA 200.8
Anion Sum	04208	SM 1030E
Antimony	01097	EPA 200.8
Apparent Color	00081	SM 2120B
Arsenic	01002	EPA 200.8
Barium	01007	EPA 200.8
Benzene	34030	EPA 524.2
Beryllium	01012	EPA 200.8
Bicarbonate as HCO3, Calculated	00440	SM2330B
Boron	01020	EPA 200.7
Bromobenzene	81555	EPA 524.2
Bromochloromethane	A-012	EPA 524.2
Bromodichloromethane	32101	EPA 524.2
Bromoethane	78137	EPA 524.2
Bromoform	32104	EPA 524.2
Bromomethane (Methyl Bromide)	34413	EPA 524.2
Cadmium	01027	EPA 200.8
Calcium	00916	EPA 200.7
Carbon Dioxide	77000	SM4500-CO2-D
Carbon Disulfide	77041	EPA 524.2

TABLE 3 WATER QUALITY PARAMETERS OF THE RGWMP (As of April 2014)		
Constituent	**Chemical Storet No.**	**Laboratory Analytical Method**
Carbon Tetrachloride	32102	EPA 524.2
Carbonate as CO3, Calculated	00445	SM2330B
Cation Sum	04226	SM 1030E
Chloride	00940	EPA 300.0
Chlorobenzene	34301	EPA 524.2
Chlorodibromomethane	32105	EPA 524.2
Chloroethane	34311	EPA 524.2
Chloroform (Trichloromethane)	32106	EPA 524.2
Chloromethane (Methyl Chloride)	34418	EPA 524.2
cis-1,2-Dichloroethylene	77093	EPA 524.2
cis-1,3-Dichloropropene	34704	EPA 524.2
Copper	01042	EPA 200.8
Dibromomethane	77596	EPA 524.2
Dichlorodifluoromethane (Freon 12)	34668	EPA 524.2
Di-Isopropyl Ether	A-036	EPA 524.2
Ethyl Benzene	34371	EPA 524.2
Ethyl Tertiary Butyl Ether	A-033	EPA 524.2
Fluoride	00951	SM 4500F-C
Fluorotrichloromethane (Freon11)	34488	EPA 524.2
Hardness (Total, as CaCO3)	00900	SM 2340B
Hexachlorobutadiene	34391	EPA 524.2
Hexavalent Chromium (Cr VI)	01032	EPA 218.6
Hydroxide as OH, Calculated	71830	SM2330B
Iron	01045	EPA 200.7
Isopropylbenzene	77223	EPA 524.2
Lab pH	00403	SM4500-HB
Lab Turbidity	82079	EPA 180.1
Langelier Index – 25^{o}C	71813	SM 2330B
Lead	01051	EPA 200.8
m,p-Xylenes	A-014	EPA 524.2
Magnesium	00927	EPA 200.7
Manganese	01055	EPA 200.8
Mercury	71900	EPA 245.1
Methyl Tert Butyl Ether (MTBE)	46491	EPA 524.2
Methylene Chloride	34423	EPA 524.2
Naphthalene	34696	EPA 524.2

TABLE 3 WATER QUALITY PARAMETERS OF THE RGWMP (As of April 2014)		
Constituent	**Chemical Storet No.**	**Laboratory Analytical Method**
n-Butylbenzene	A-010	EPA 524.2
Nickel	01067	EPA 200.8
Nitrate (as N)	00620	EPA 300.0
Nitrate (as NO3)	71850	EPA 300.0
Nitrite, Nitrogen by IC	00615	EPA 300.0
n-Propylbenzene	77224	EPA 524.2
o-Chlorotoluene	A-008	EPA 524.2
o-Dichlorobenzene (1,2-DCB)	34536	EPA 524.2
Odor	00086	SM 2150B
o-Xylene	77135	EPA 524.2
p-Chlorotoluene	A-009	EPA 524.2
p-Dichlorobenzene	34571	EPA 524.2
Perchlorate	A-031	EPA 314.0
pH of CaCO3 Saturation (@25^{o}C)	J-006	SM 2330B
pH of CaCO3 Saturation (@60^{o}C)	J-007	SM 2330B
p-Isopropyltoluene	A-011	EPA 524.2
Potassium	00937	EPA 200.7
sec-Butylbenzene	77350	EPA 524.2
Selenium	01147	EPA 200.8
Silver	01077	EPA 200.8
Sodium	00929	EPA 200.7
Specific Conductance	00095	SM2510B
Styrene	77128	EPA 524.2
Sulfate	00945	EPA 300.0
Surfactants	38260	SM 5540C/EPA 425.1
tert-Butylbenzene	77353	EPA 524.2
Tertiary Amyl Methyl Ether	A-034	EPA 524.2
Tetrachloroethylene (PCE)	34475	EPA 524.2
Thallium	01059	EPA 200.8
Toluene	34010	EPA 524.2
Total Chromium	01034	EPA 200.8
Total Dissolved Solids (TDS)	70300	E160.1/SM2540C
Total Nitrate, Nitrite-N, CALC	A-029	EPA 300.0
Total Organic Carbon	00680	SM5310C/E415.3
Total Trihalomethanes	82080	EPA 524.2
Total Xylenes	81551	EPA 524.2

TABLE 3 WATER QUALITY PARAMETERS OF THE RGWMP (As of April 2014)		
Constituent	**Chemical Storet No.**	**Laboratory Analytical Method**
trans-1,2-Dichloroethylene	34546	EPA 524.2
trans-1,3-Dichloropropene	34699	EPA 524.2
Trichloroethylene (TCE)	39180	EPA 524.2
Trichlorotrifluoroethane (Freon 113)	81611	EPA 524.2
Vinyl chloride (VC)	39175	EPA 524.2
Zinc	01092	EPA 200.8

3. QA/QC PROCEDURES

Quality assurance/quality control (QA/QC) of the RGWMP includes collection of field blanks and blind duplicates. Unusual analytical results are noted and compared to historical values/trends and if the result appears to be an outlier or anomaly, the result is flagged in the WRD database.

Laboratory QA/QC samples collected include method blanks, laboratory control standards (LCS), matrix spike/matrix spike duplicates (MS/MSDs), and surrogate spikes. Laboratory reports, which include sampling and QA/QC results, are posted on the password-protected laboratory website. QA/QC documentation for Eurofins Eaton Analytical is provided in **Appendix B**.

V. GROUNDWATER LEVEL MONITORING

Groundwater levels are an indication of the amount of groundwater in the basins. They reveal areas of recharge and discharge from the basins, suggest which way the groundwater is moving so that recharge water or contaminants can be tracked, are used to determine when additional replenishment water is required, and are used to calculate storage changes. Groundwater levels can also be used to demonstrate possible source areas for seawater intrusion or show the effectiveness of seawater barrier wells.

Groundwater levels in the CBWCB have been monitored and recorded since the early 1900s. Water level data going back to the 1930s and 1940s in the Montebello Forebay, Los Angeles Forebay, Central Basin Pressure Area, and West Coast Basin are presented in hydrographs, which are published in WRD's annual Engineering Survey and Report (ESR). The hydrographs illustrate the general history of groundwater conditions in the CBWCB: 1) Steep water level declines occurred in the 1930s through 1950s as a result of excessive pumping (overdraft); 2) In the mid-1950s to early 1960s, there was a sharp reversal in this downward trend due to initiation of groundwater management policies, water levels increased through the 1970s and 1980s in response to reduced pumping, artificial replenishment by WRD, and seawater barrier construction and injection; and 3) Over the past 10 to 15, years water levels have remained relatively stable as replenishment has been in closer balance to withdrawals.

WRD tracks groundwater levels throughout the year by measuring the depth to water in nested monitoring wells and production wells located throughout the CBWCB. Groundwater levels in the nested monitoring wells are manually measured by WRD at least four times per year using electronic depth-to-water indicators with marked intervals of 0.01 foot.

Additionally, in order to capture the daily and seasonal variations in water levels, WRD typically installs automatic data-logging equipment (pressure transducers and data-loggers) in nested monitoring wells to collect water levels every six hours. WRD also obtains water level data from cooperating entities such as the pumpers, DWR, and LACDPW, who collect water levels from their wells. These data are entered into WRD's database for archiving and analysis, as discussed in Section VI Data Management and Access.

Using data collected from the RGWMP, WRD tracks the changes in water levels over time in specific aquifers by preparing hydrographs for each of the nested monitoring wells. Hydrographs reveal the seasonal fluctuations of water levels caused by variations in natural and artificial recharge, and the effects of pumping and other basin discharge. Hydrographs for key nested monitoring wells are presented in the WRD's annual RGWMRs.

VI. DATA MANAGEMENT AND ACCESS

All information collected from the RGWMP is stored and managed in WRD's Database Management System (DBMS) and Geographic Information System (GIS). The GIS links spatially-related information (e.g., well locations, geologic features, cultural features, contaminated sites) to data regarding well production, water quality, water levels, and replenishment amounts. WRD uses industry standard ArcGIS® software for data analysis and preparation of spatially-related information (maps and graphics tied to data). WRD utilizes GPS technology to survey the locations of production wells, nested monitoring wells, and other geographic features for use in the GIS database.

Analytical reports from the nested monitoring well sampling events are e-mailed to WRD from the laboratory in electronic data deliverable (EDD) format and can also be downloaded from the password-protected laboratory website (www.eatonanalytical.com). EDD files are directly uploaded into the DBMS. In addition to nested well water quality data, the DBMS stores regulatory limits for various chemicals, water quality data supplied by the SWRCB Division of Drinking Water for drinking water wells, groundwater level monitoring data, well construction data, and other important information related to groundwater replenishment and production.

In early 2003, WRD implemented the internet-based GIS and Interactive Well Search Tool, which was made available to the public for access to groundwater data, including water quality data of nested monitoring wells and drinking water wells, groundwater levels, well locations, well construction details, and groundwater production. Well information can be obtained through an interactive map or text searches and the results can be displayed in both tabular and graphical formats. This online tool can be accessed through the WRD website (http://gis.wrd.org/wrdmap/login.asp) once the user sets up a username and password.

WRD is constantly updating the DBMS and GIS with new data acquired from the RGWMP and newly-acquired archived data provided by pumpers and other agencies. The GIS is a primary tool for WRD and other water-related agencies to more accurately track current and past use of groundwater, track groundwater quality, and project future water demands, thus allowing improved management of the groundwater basins.

On November 4, 2009 the State Legislature amended the Water Code with SBx7-6, mandating a statewide groundwater elevation monitoring program to track seasonal and long-term trends in California's groundwater basins. In accordance with this amendment DWR developed the California Statewide Groundwater Elevation Monitoring (CASGEM) program. In October 2011, WRD was designated the agency responsible for collecting and reporting CBWCB groundwater level data to CASGEM. Through the RGWMP, WRD continues to provide the data to the CASGEM program by collecting groundwater level data and tracking seasonal and long-term trends in the CBWCB.

VII. ANNUAL REPORTS

WRD has been monitoring groundwater quality in the CBWCB for over 50 years. An *Annual Report on the Results of Water Quality Monitoring (Annual Report)* was published by WRD each year for WYs 1972-73 through 1994-95, and was based on a basin-wide monitoring program outlined in the *Report on Program of Water Quality Monitoring* (Bookman-Edmonston Engineering, Inc., January 1973). The latter report recommended a substantial expansion of the then-existing program, particularly the development of a detailed and intensive program of monitoring the quality of groundwater in the Montebello Forebay. In response, WRD implemented the current RGWMP to serve as an expanded, more representative basin-wide monitoring program for the CBWCB. Beginning WY 1995-96, RGWMRs were published in lieu of the previous *Annual Reports*.

WRD's annual RGWMRs present the most comprehensive information to date regarding the growing network of aquifer-specific monitoring wells and in-depth water quality analyses. Each RGWMR presents groundwater data collected during the previous water year, which runs from October 1 through September 30 of each year. Hard copies of the RGWMRs are mailed to stakeholders within the CBWCB and electronic copies are posted on the WRD website (http://www.wrd.org/engineering/groundwater-engineering-reports.php) for download.

The RGWMRs includes maps and trend graphs to focus on ten key water quality constituents, including total dissolved solids (TDS), iron, manganese, nitrate, chloride, trichloroethylene (TCE), tetrachloroethylene (PCE), arsenic, perchlorate, and hexavalent chromium, to represent overall groundwater quality in the basins. TDS, where elevated, is typically present along with chloride as an indicator of historic seawater intrusion. The most prevalent water quality issue in the CBWCB is manganese, a naturally-occurring contaminant that requires treatment prior to delivery as drinking water. TCE and PCE, volatile organic contaminants that can leak into groundwater from industrial and commercial facilities, have also impacted wells in the CBWCB and are closely monitored. WRD is also currently investigating perchlorate, hexavalent chromium, and other emerging contaminants of concern.

WRD will continue to use the data generated by the RGWMP to address current and upcoming issues related to water quality and groundwater replenishment in the CBWCB.

REFERENCES

California Department of Water Resources (DWR), Southern District, 1961. Planned Utilization of the Ground Water Basins of the Coastal Plain of Los Angeles County – Appendix A: Ground Water Geology, Bulletin 104, 1961.

California Environmental Protection Agency, Regional Water Quality Control Board, Los Angeles Region (LARWQCB), 1994. Water Quality Control Plan, Los Angeles Region – Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties, Adopted by LARWQCB on June 13, 1994.

United States Department of the Interior, United States Geological Survey (USGS), 2003. Geohydrology, Geochemistry, and Ground-Water Simulation-Optimization of the Central and West Coast Basins, Los Angeles County, California, Water Resources Investigations Report 03-4065, 2003.

Water Replenishment District of Southern California (WRD), 2009. "Sequence of Events Leading to Water Replenishment District Formation." Presentation by WRD Ad Hoc History Committee to WRD Board of Directors, March 2009.

Water Replenishment District of Southern California (WRD), 2013a. Engineering Survey and Report, 2013, March 6, 2013, Updated: May 10, 2013.

Water Replenishment District of Southern California (WRD), 2013b. Regional Groundwater Monitoring Report, Water Year 2011 – 2012, March 2013.

APPENDIX A

Table of Regulatory Limits Established for Chemicals in Drinking Water

MCLs, DLRs, and PHGs for Regulated Drinking Water Contaminants

(Units are in milligrams per liter (mg/L), unless otherwise noted.)

Last Update: July 1, 2014

This table includes:

California's maximum contaminant levels (MCLs)

Detection limits for purposes of reporting (DLRs)

Public health goals (PHGs) from the Office of Environmental Health Hazard Assessment (OEHHA)

Also, PHGs for NDMA and 1,2,3-Trichloropropane (which are not yet regulated) are included at the bottom of this table.

	MCL	DLR	PHG	Date of PHG
Chemicals with MCLs in 22 CCR §64431—Inorganic Chemicals				
Aluminum	1	0.05	0.6	2001
Antimony	0.006	0.006	0.02	1997
Antimony	--	--	0.0007	2009 draft
Arsenic	0.010	0.002	0.000004	2004
Asbestos (MFL = million fibers per liter; for fibers >10 microns long)	7 MFL	0.2 MFL	7 MFL	2003
Barium	1	0.1	2	2003
Beryllium	0.004	0.001	0.001	2003
Cadmium	0.005	0.001	0.00004	2006
Chromium, Total - OEHHA withdrew the 0.0025-mg/L PHG	0.05	0.01	withdrawn Nov. 2001	1999
Chromium, Hexavalent	0.010	0.001	0.00002	2011
Cyanide	0.15	0.1	0.15	1997
Fluoride	2	0.1	1	1997
Mercury (inorganic)	0.002	0.001	0.0012	1999 (rev2005)*
Nickel	0.1	0.01	0.012	2001
Nitrate (as NO3)	45	2	45	1997
Nitrite (as N)	1 as N	0.4	1 as N	1997
Nitrate + Nitrite	10 as N	--	10 as N	1997
Perchlorate	0.006	0.004	0.006	2004
Perchlorate	--	--	0.001	2012 draft
Selenium	0.05	0.005	0.03	2010
Thallium	0.002	0.001	0.0001	1999 (rev2004)
Copper and Lead, 22 CCR §64672.3				
Values referred to as MCLs for lead and copper are not actually MCLs; instead, they are called "Action Levels" under the lead and copper rule				
Copper	1.3	0.05	0.3	2008
Lead	0.015	0.005	0.0002	2009

MCLs, DLRs, and PHGs for Regulated Drinking Water Contaminants (Units are in milligrams per liter (mg/L), unless otherwise noted.) Last Update: July 1, 2014				
This table includes: California's maximum contaminant levels (MCLs) Detection limits for purposes of reporting (DLRs) Public health goals (PHGs) from the Office of Environmental Health Hazard Assessment (OEHHA) Also, PHGs for NDMA and 1,2,3-Trichloropropane (which are not yet regulated) are included at the bottom of this table.				
	MCL	**DLR**	**PHG**	**Date of PHG**
Radionuclides with MCLs in 22 CCR §64441 and §64443—Radioactivity				
[units are picocuries per liter (pCi/L), unless otherwise stated; n/a = not applicable]				
Gross alpha particle activity - OEHHA concluded in 2003 that a PHG was not practical	15	3	none	n/a
Gross beta particle activity - OEHHA concluded in 2003 that a PHG was not practical	4 mrem/yr	4	none	n/a
Radium-226	--	1	0.05	2006
Radium-228	--	1	0.019	2006
Radium-226 + Radium-228	5	--	--	--
Strontium-90	8	2	0.35	2006
Tritium	20,000	1,000	400	2006
Uranium	20	1	0.43	2001
Chemicals with MCLs in 22 CCR §64444—Organic Chemicals				
(a) Volatile Organic Chemicals (VOCs)				
Benzene	0.001	0.0005	0.00015	2001
Carbon tetrachloride	0.0005	0.0005	0.0001	2000
1,2-Dichlorobenzene	0.6	0.0005	0.6	1997 (rev2009)
1,4-Dichlorobenzene (p-DCB)	0.005	0.0005	0.006	1997
1,1-Dichloroethane (1,1-DCA)	0.005	0.0005	0.003	2003
1,2-Dichloroethane (1,2-DCA)	0.0005	0.0005	0.0004	1999 (rev2005)
1,1-Dichloroethylene (1,1-DCE)	0.006	0.0005	0.01	1999
cis-1,2-Dichloroethylene	0.006	0.0005	0.1	2006
trans-1,2-Dichloroethylene	0.01	0.0005	0.06	2006
Dichloromethane (Methylene chloride)	0.005	0.0005	0.004	2000
1,2-Dichloropropane	0.005	0.0005	0.0005	1999
1,3-Dichloropropene	0.0005	0.0005	0.0002	1999 (rev2006)
Ethylbenzene	0.3	0.0005	0.3	1997
Methyl tertiary butyl ether (MTBE)	0.013	0.003	0.013	1999

MCLs, DLRs, and PHGs for Regulated Drinking Water Contaminants

(Units are in milligrams per liter (mg/L), unless otherwise noted.)

Last Update: July 1, 2014

This table includes:

California's maximum contaminant levels (MCLs)

Detection limits for purposes of reporting (DLRs)

Public health goals (PHGs) from the Office of Environmental Health Hazard Assessment (OEHHA)

Also, PHGs for NDMA and 1,2,3-Trichloropropane (which are not yet regulated) are included at the bottom of this table.

	MCL	DLR	PHG	Date of PHG
Monochlorobenzene	0.07	0.0005	0.07	2014
Styrene	0.1	0.0005	0.0005	2010
1,1,2,2-Tetrachloroethane	0.001	0.0005	0.0001	2003
Tetrachloroethylene (PCE)	0.005	0.0005	0.00006	2001
Toluene	0.15	0.0005	0.15	1999
1,2,4-Trichlorobenzene	0.005	0.0005	0.005	1999
1,1,1-Trichloroethane (1,1,1-TCA)	0.2	0.0005	1	2006
1,1,2-Trichloroethane (1,1,2-TCA)	0.005	0.0005	0.0003	2006
Trichloroethylene (TCE)	0.005	0.0005	0.0017	2009
Trichlorofluoromethane (Freon 11)	0.15	0.005	1.3	2014
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1.2	0.01	4	1997 (rev2011)
Vinyl chloride	0.0005	0.0005	0.00005	2000
Xylenes	1.75	0.0005	1.8	1997
(b) Non-Volatile Synthetic Organic Chemicals (SOCs)				
Alachlor	0.002	0.001	0.004	1997
Atrazine	0.001	0.0005	0.00015	1999
Bentazon	0.018	0.002	0.2	1999 (rev2009)
Benzo(a)pyrene	0.0002	0.0001	0.000007	2010
Carbofuran	0.018	0.005	0.0017	2000
Chlordane	0.0001	0.0001	0.00003	1997 (rev2006)
Dalapon	0.2	0.01	0.79	1997 (rev2009)
1,2-Dibromo-3-chloropropane (DBCP)	0.0002	0.00001	0.0000017	1999
2,4-Dichlorophenoxyacetic acid (2,4-D)	0.07	0.01	0.02	2009
Di(2-ethylhexyl)adipate	0.4	0.005	0.2	2003
Di(2-ethylhexyl)phthalate (DEHP)	0.004	0.003	0.012	1997
Dinoseb	0.007	0.002	0.014	1997 (rev2010)
Diquat	0.02	0.004	0.015	2000
Endrin	0.002	0.0001	0.0018	1999 (rev2008)
Endothal	0.1	0.045	0.094	2014

MCLs, DLRs, and PHGs for Regulated Drinking Water Contaminants

(Units are in milligrams per liter (mg/L), unless otherwise noted.)

Last Update: July 1, 2014

This table includes:

California's maximum contaminant levels (MCLs)

Detection limits for purposes of reporting (DLRs)

Public health goals (PHGs) from the Office of Environmental Health Hazard Assessment (OEHHA)

Also, PHGs for NDMA and 1,2,3-Trichloropropane (which are not yet regulated) are included at the bottom of this table.

	MCL	DLR	PHG	Date of PHG
Ethylene dibromide (EDB)	0.00005	0.00002	0.00001	2003
Glyphosate	0.7	0.025	0.9	2007
Heptachlor	0.00001	0.00001	0.000008	1999
Heptachlor epoxide	0.00001	0.00001	0.000006	1999
Hexachlorobenzene	0.001	0.0005	0.00003	2003
Hexachlorocyclopentadiene	0.05	0.001	0.002	2014
Lindane	0.0002	0.0002	0.000032	1999 (rev2005)
Methoxychlor	0.03	0.01	0.00009	2010
Molinate	0.02	0.002	0.001	2008
Oxamyl	0.05	0.02	0.026	2009
Pentachlorophenol	0.001	0.0002	0.0003	2009
Picloram	0.5	0.001	0.5	1997
Polychlorinated biphenyls (PCBs)	0.0005	0.0005	0.00009	2007
Simazine	0.004	0.001	0.004	2001
2,4,5-TP (Silvex)	0.05	0.001	0.003	2014
2,3,7,8-TCDD (dioxin)	$3x10^{-8}$	$5x10^{-9}$	$5x10^{-11}$	2010
Thiobencarb	0.07	0.001	0.07	2000
Toxaphene	0.003	0.001	0.00003	2003
Chemicals with MCLs in 22 CCR §64533—Disinfection Byproducts				
Total Trihalomethanes	0.080	--	0.0008	2010 draft
Bromodichloromethane	--	0.0010	--	--
Bromoform	--	0.0010	--	--
Chloroform	--	0.0010	--	--
Dibromochloromethane	--	0.0010	--	--
Haloacetic Acids (five) (HAA5)	0.060	--	--	--
Monochloroacetic Acid	--	0.0020	--	--
Dichloroacetic Adic	--	0.0010	--	--
Trichloroacetic Acid	--	0.0010	--	--
Monobromoacetic Acid	--	0.0010	--	--
Dibromoacetic Acid	--	0.0010	--	--
Bromate	0.010	0.0050**	0.0001	2009
Chlorite	1.0	0.020	0.05	2009

MCLs, DLRs, and PHGs for Regulated Drinking Water Contaminants				
(Units are in milligrams per liter (mg/L), unless otherwise noted.)				
Last Update: July 1, 2014				
This table includes: California's maximum contaminant levels (MCLs) Detection limits for purposes of reporting (DLRs) Public health goals (PHGs) from the Office of Environmental Health Hazard Assessment (OEHHA) Also, PHGs for NDMA and 1,2,3-Trichloropropane (which are not yet regulated) are included at the bottom of this table.				
	MCL	**DLR**	**PHG**	**Date of PHG**
Chemicals with PHGs established in response to CDPH requests. These are not currently regulated drinking water contaminants.				
N-Nitrosodimethylamine (NDMA)	--	--	0.000003	2006
1,2,3-Trichloropropane	--	--	0.0000007	2009
*OEHHA's review of this chemical during the year indicated (rev20XX) resulted in no change in the PHG.				
**The DLR for Bromate is 0.0010 mg/L for analysis performed using EPA Method 317.0 Revision 2.0, 321.8, or 326.0.				

APPENDIX B

QA/QC Documentation for
Eurofins Eaton Analytical of Monrovia, California

RON CHAPMAN, MD, MPH
Director & State Health Officer

State of California—Health and Human Services Agency

California Department of Public Health

EDMUND G. BROWN JR.
Governor

January 9, 2013

Ed Wilson
Eurofins Eaton Analytical, Inc. (former M.W.H.)
750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016

Dear Ed Wilson: Certificate No. 01114CA

This is to advise you that the laboratory named above has been accredited under National Environmental Laboratory Accreditation Program (NELAP) as an environmental testing laboratory pursuant to the provisions of the Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100825, *et seq.*

The Fields of Accreditation for which this laboratory has been accredited are enclosed. The certificate shall remain in effect until **January 31, 2014** unless revoked by California Environmental Laboratory Accreditation Program Branch (ELAPB) or withdrawn at your written request. To maintain accreditation, the laboratory shall comply with the National Environmental Laboratory Accreditation Conference (NELAC) Standards and all associated California ELAPB regulations and statutes.

The application for renewal of this certificate must be received before the expiration date of this certificate to remain in force according to the HSC 100847(a).

Please note that your laboratory is required to notify California ELAPB of any major changes in key accreditation criteria within 30 calendar days of the change. This written notification includes, but is not limited to, changes in ownership, location, key personnel, and major instrumentation (HSC 100847(b), (c), (d), and NELAC Standard Section 4.3.2). The certificate must be returned to California ELAPB upon loss of accredited status.

Your continued cooperation with the above requirements is essential for maintaining the high quality of the data produced by environmental laboratories accredited by the State of California.

If you have any questions, please contact Bill Walker at (818) 551-2012.

Sincerely,

Fred Choske for

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

Enclosure

NELAP - RECOGNIZED

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF NELAP ACCREDITATION

Is hereby granted to

Eurofins Eaton Analytical, Inc. (former M.W.H.)

750 Royal Oaks Drive, Suite 100

Monrovia, CA 91016

Scope of the Certificate is limited to the
"NELAP Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **01114CA**

Expiration Date: **1/31/2014**

Effective Date: **2/1/2013**

Richmond, California
subject to forfeiture or revocation

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH
NELAP Fields of Accreditation

NELAP RECOGNIZED

Eurofins Eaton Analytical, Inc. (former M.W.H.)

750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016
Phone: (626) 386-1100

Certificate No.: 01114CA
Renew Date: 1/31/2014

101 - Microbiology of Drinking Water

101.010	001	SM9215B	Heterotrophic Bacteria
101.020	001	SM9221A,B	Total Coliform
101.021	001	SM9221E (MTF/EC)	Fecal Coliform
101.022	001	CFR 141.21(f)(6)(i) (MTF/EC+MUG)	E. coli
101.060	002	SM9223	Total Coliform
101.060	003	SM9223	E. coli
101.070	002	Colisure	Total Coliform
101.070	003	Colisure	E. coli
101.120	001	SM9221A,B,C	Total Coliform (Enumeration)
101.130	001	SM9221E (MTF/EC)	Fecal Coliform (Enumeration)
101.160	001	SM9223	Total Coliform (Enumeration)
101.200	001	SM9223B	E. coli (Enumeration)
101.210	001	SM9221B.1/SM9221F	E. coli (Enumeration)

102 - Inorganic Chemistry of Drinking Water

102.020	001	EPA 180.1	Turbidity
102.022	001	SM2130B	Turbidity
102.030	001	EPA 300.0	Bromide
102.030	002	EPA 300.0	Chlorate
102.030	003	EPA 300.0	Chloride
102.030	004	EPA 300.0	Chlorite
102.030	005	EPA 300.0	Fluoride
102.030	006	EPA 300.0	Nitrate
102.030	007	EPA 300.0	Nitrite
102.030	010	EPA 300.0	Sulfate
102.040	001	EPA 300.1	Bromide
102.040	002	EPA 300.1	Chlorite
102.040	003	EPA 300.1	Chlorate
102.040	004	EPA 300.1	Bromate
102.045	001	EPA 314.0	Perchlorate
102.047	001	EPA 331.0	Perchlorate
102.050	001	EPA 335.4	Cyanide
102.060	001	EPA 353.2	Nitrate calc.

As of 1/9/2013 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

102.061	001	EPA 353.2	Nitrite
102.070	001	EPA 365.1	Phosphate, Ortho
102.100	001	SM2320B	Alkalinity
102.110	001	SM2330B	Corrosivity (Langlier Index)
102.120	001	SM2340B	Hardness
102.130	001	SM2510B	Conductivity
102.140	001	SM2540C	Total Dissolved Solids
102.163	001	SM4500-Cl G	Chlorine, Free and Total
102.180	001	SM4500-ClO2 D	Chlorine Dioxide
102.191	001	SM4500-CN F	Cyanide, Total
102.192	001	SM4500-CN G	Cyanide, amenable
102.200	001	SM4500-F C	Fluoride
102.210	001	SM4500-H+B	pH
102.212	001	EPA 150.1	pH
102.240	001	SM4500-P E	Phosphate, Ortho
102.262	001	SM5310C	Total Organic Carbon
102.263	001	SM5310C	DOC
102.263	002	SM5310C	TOC/DOC
102.267	001	SM5310C-QO	TOC/DOC
102.270	001	SM5540C	Surfactants
102.280	001	SM5910B	UV254
102.520	001	EPA 200.7	Calcium
102.520	002	EPA 200.7	Magnesium
102.520	003	EPA 200.7	Potassium
102.520	004	EPA 200.7	Silica
102.520	005	EPA 200.7	Sodium
102.520	006	EPA 200.7	Hardness (calc.)
102.533	002	SM4500-Si D	Silica
102.542	002	SM4500-SiO2 C	Silica
102.545	001	EPA 317.0	Bromate
102.545	003	EPA 317.0	Chlorite
102.551	002	SM4500-Cl G	Chlorine, Free, Combined, Total
102.558	001	SM4500-Cl G-QO	Chlorine, Free, Combined, Total

103 - Toxic Chemical Elements of Drinking Water

103.130	001	EPA 200.7	Aluminum
103.130	003	EPA 200.7	Barium
103.130	004	EPA 200.7	Beryllium
103.130	005	EPA 200.7	Cadmium
103.130	007	EPA 200.7	Chromium
103.130	008	EPA 200.7	Copper

103.130	009	EPA 200.7	Iron
103.130	011	EPA 200.7	Manganese
103.130	012	EPA 200.7	Nickel
103.130	015	EPA 200.7	Silver
103.130	017	EPA 200.7	Zinc
103.140	001	EPA 200.8	Aluminum
103.140	002	EPA 200.8	Antimony
103.140	003	EPA 200.8	Arsenic
103.140	004	EPA 200.8	Barium
103.140	005	EPA 200.8	Beryllium
103.140	006	EPA 200.8	Cadmium
103.140	007	EPA 200.8	Chromium
103.140	008	EPA 200.8	Copper
103.140	009	EPA 200.8	Lead
103.140	010	EPA 200.8	Manganese
103.140	012	EPA 200.8	Nickel
103.140	013	EPA 200.8	Selenium
103.140	014	EPA 200.8	Silver
103.140	015	EPA 200.8	Thallium
103.140	016	EPA 200.8	Zinc
103.160	001	EPA 245.1	Mercury
103.301	001	EPA 100.2	Asbestos
103.310	001	EPA 218.6	Chromium (VI)

104 - Volatile Organic Chemistry of Drinking Water

104.030	001	EPA 504.1	1,2-Dibromoethane
104.030	002	EPA 504.1	1,2-Dibromo-3-chloropropane
104.030	003	EPA 504.1	1,2,3-Trichloropropane
104.040	000	EPA 524.2	Volatile Organic Compounds
104.040	001	EPA 524.2	Benzene
104.040	002	EPA 524.2	Bromobenzene
104.040	003	EPA 524.2	Bromochloromethane
104.040	006	EPA 524.2	Bromomethane
104.040	007	EPA 524.2	n-Butylbenzene
104.040	008	EPA 524.2	sec-Butylbenzene
104.040	009	EPA 524.2	tert-Butylbenzene
104.040	010	EPA 524.2	Carbon Tetrachloride
104.040	011	EPA 524.2	Chlorobenzene
104.040	012	EPA 524.2	Chloroethane
104.040	014	EPA 524.2	Chloromethane
104.040	015	EPA 524.2	2-Chlorotoluene

104.040	016	EPA 524.2	4-Chlorotoluene
104.040	018	EPA 524.2	Dibromomethane
104.040	019	EPA 524.2	1,3-Dichlorobenzene
104.040	020	EPA 524.2	1,2-Dichlorobenzene
104.040	021	EPA 524.2	1,4-Dichlorobenzene
104.040	022	EPA 524.2	Dichlorodifluoromethane
104.040	023	EPA 524.2	1,1-Dichloroethane
104.040	024	EPA 524.2	1,2-Dichloroethane
104.040	025	EPA 524.2	1,1-Dichloroethene
104.040	026	EPA 524.2	cis-1,2-Dichloroethene
104.040	027	EPA 524.2	trans-1,2-Dichloroethene
104.040	028	EPA 524.2	Dichloromethane
104.040	029	EPA 524.2	1,2-Dichloropropane
104.040	030	EPA 524.2	1,3-Dichloropropane
104.040	031	EPA 524.2	2,2-Dichloropropane
104.040	032	EPA 524.2	1,1-Dichloropropene
104.040	033	EPA 524.2	cis-1,3-Dichloropropene
104.040	034	EPA 524.2	trans-1,3-Dichloropropene
104.040	035	EPA 524.2	Ethylbenzene
104.040	036	EPA 524.2	Hexachlorobutadiene
104.040	037	EPA 524.2	Isopropylbenzene
104.040	038	EPA 524.2	4-Isopropyltoluene
104.040	039	EPA 524.2	Naphthalene
104.040	040	EPA 524.2	Nitrobenzene
104.040	041	EPA 524.2	N-propylbenzene
104.040	042	EPA 524.2	Styrene
104.040	043	EPA 524.2	1,1,1,2-Tetrachloroethane
104.040	044	EPA 524.2	1,1,2,2-Tetrachloroethane
104.040	045	EPA 524.2	Tetrachloroethene
104.040	046	EPA 524.2	Toluene
104.040	047	EPA 524.2	1,2,3-Trichlorobenzene
104.040	048	EPA 524.2	1,2,4-Trichlorobenzene
104.040	049	EPA 524.2	1,1,1-Trichloroethane
104.040	050	EPA 524.2	1,1,2-Trichloroethane
104.040	051	EPA 524.2	Trichloroethene
104.040	052	EPA 524.2	Trichlorofluoromethane
104.040	053	EPA 524.2	1,2,3-Trichloropropane
104.040	054	EPA 524.2	1,2,4-Trimethylbenzene
104.040	055	EPA 524.2	1,3,5-Trimethylbenzene
104.040	056	EPA 524.2	Vinyl Chloride

104.040	057	EPA 524.2	Xylenes, Total
104.040	058	EPA 524.2	Hexachloroethane
104.045	001	EPA 524.2	Bromodichloromethane
104.045	002	EPA 524.2	Bromoform
104.045	003	EPA 524.2	Chloroform
104.045	004	EPA 524.2	Dibromochloromethane
104.045	005	EPA 524.2	Trihalomethanes
104.050	002	EPA 524.2	Methyl tert-butyl Ether (MTBE)
104.050	004	EPA 524.2	tert-Amyl Methyl Ether (TAME)
104.050	005	EPA 524.2	Ethyl tert-butyl Ether (ETBE)
104.050	006	EPA 524.2	Trichlorotrifluoroethane
104.050	011	EPA 524.2	Oxygenates
104.055	001	EPA 524.3	Benzene
104.055	002	EPA 524.3	Carbon Tetrachloride
104.055	003	EPA 524.3	Chlorobenzene
104.055	004	EPA 524.3	1,2-Dichlorobenzene
104.055	005	EPA 524.3	1,4-Dichlorobenzene
104.055	006	EPA 524.3	1,2-Dichloroethane
104.055	007	EPA 524.3	cis-1,2-Dichloroethene
104.055	008	EPA 524.3	trans-1,2-Dichloroethene
104.055	009	EPA 524.3	Dichloromethane
104.055	010	EPA 524.3	1,2-Dichloropropane
104.055	011	EPA 524.3	Ethylbenzene
104.055	012	EPA 524.3	Styrene
104.055	013	EPA 524.3	Tetrachloroethene
104.055	014	EPA 524.3	1,1,1-Trichloroethane
104.055	015	EPA 524.3	Trichloroethene
104.055	016	EPA 524.3	Toluene
104.055	017	EPA 524.3	1,2,4-Trichlorobenzene
104.055	018	EPA 524.3	1,1-Dichloroethene
104.055	019	EPA 524.3	1,1,2-Trichloroethane
104.055	020	EPA 524.3	Vinyl Chloride
104.055	021	EPA 524.3	Xylenes, Total
104.055	022	EPA 524.3	1,2-Dibromo-3-chloropropane
104.055	023	EPA 524.3	1,2-Dibromoethane
104.055	024	EPA 524.3	Trihalomethanes, Total

105 - Semi-volatile Organic Chemistry of Drinking Water

105.010	001	EPA 505	Aldrin
105.010	002	EPA 505	Alachlor
105.010	004	EPA 505	Chlordane

105.010	005	EPA 505	Dieldrin
105.010	006	EPA 505	Endrin
105.010	007	EPA 505	Heptachlor
105.010	008	EPA 505	Heptachlor Epoxide
105.010	011	EPA 505	Lindane
105.010	012	EPA 505	Methoxychlor
105.010	014	EPA 505	Toxaphene
105.010	015	EPA 505	PCBs as Aroclors (screen)
105.010	016	EPA 505	PCB-1016
105.010	017	EPA 505	PCB-1221
105.010	018	EPA 505	PCB-1232
105.010	019	EPA 505	PCB-1242
105.010	020	EPA 505	PCB-1248
105.010	021	EPA 505	PCB-1254
105.010	022	EPA 505	PCB-1260
105.083	001	EPA 515.4	2,4-D
105.083	002	EPA 515.4	Dinoseb
105.083	003	EPA 515.4	Pentachlorophenol
105.083	004	EPA 515.4	Picloram
105.083	005	EPA 515.4	2,4,5-TP
105.083	006	EPA 515.4	Dalapon
105.083	007	EPA 515.4	Bentazon
105.083	008	EPA 515.4	Dicamba
105.083	009	EPA 515.4	Chlorinated Acids
105.090	001	EPA 525.2	Alachlor
105.090	002	EPA 525.2	Aldrin
105.090	003	EPA 525.2	Atrazine
105.090	004	EPA 525.2	Benzo(a)pyrene
105.090	005	EPA 525.2	Butachlor
105.090	006	EPA 525.2	Chlordane
105.090	007	EPA 525.2	Dieldrin
105.090	008	EPA 525.2	Di(2-ethylhexyl) Adipate
105.090	009	EPA 525.2	Di(2-ethylhexyl) Phthalate
105.090	010	EPA 525.2	4,4'-DDD
105.090	011	EPA 525.2	4,4'-DDE
105.090	012	EPA 525.2	4,4'-DDT
105.090	013	EPA 525.2	Endrin
105.090	014	EPA 525.2	Heptachlor
105.090	015	EPA 525.2	Heptachlor Epoxide
105.090	016	EPA 525.2	Hexachlorobenzene

105.090	017	EPA 525.2	Hexachlorocyclopentadiene
105.090	018	EPA 525.2	Lindane
105.090	019	EPA 525.2	Methoxychlor
105.090	020	EPA 525.2	Metolachlor
105.090	021	EPA 525.2	Metribuzin
105.090	022	EPA 525.2	Molinate
105.090	023	EPA 525.2	Pentachlorophenol
105.090	024	EPA 525.2	Propachlor
105.090	025	EPA 525.2	Simazine
105.090	030	EPA 525.2	Adipates
105.090	031	EPA 525.2	Phthalates
105.090	034	EPA 525.2	Pesticides
105.101	001	EPA 531.2	Carbofuran
105.101	002	EPA 531.2	Oxamyl
105.101	003	EPA 531.2	Aldicarb
105.101	004	EPA 531.2	Aldicarb Sulfone
105.101	005	EPA 531.2	Aldicarb Sulfoxide
105.101	006	EPA 531.2	Carbaryl
105.101	007	EPA 531.2	3-Hydroxycarbofuran
105.101	008	EPA 531.2	Methomyl
105.120	001	EPA 547	Glyphosate
105.140	001	EPA 548.1	Endothall
105.150	001	EPA 549.2	Diquat
105.170	001	EPA 551.1	Bromochloroacetonitrile
105.170	005	EPA 551.1	Chloral Hydrate
105.170	007	EPA 551.1	Chloropicrin
105.170	008	EPA 551.1	Dibromoacetonitrile
105.170	010	EPA 551.1	1,2-Dibromo-3-chloropropane
105.170	011	EPA 551.1	1,2-Dibromoethane
105.170	012	EPA 551.1	Dichloroacetonitrile
105.170	013	EPA 551.1	1,1-Dichloro-2-propanone
105.170	015	EPA 551.1	Trichloroacetonitrile
105.170	016	EPA 551.1	1,1,1-Trichloro-2-propanone
105.175	001	EPA 551.1	Bromodichloromethane
105.175	002	EPA 551.1	Bromoform
105.175	003	EPA 551.1	Chloroform
105.175	004	EPA 551.1	Dibromochloromethane
105.175	005	EPA 551.1	Trihalomethanes
105.190	001	SM6251B	Bromoacetic Acid
105.190	002	SM6251B	Bromochloroacetic Acid

105.190	003	SM6251B	Chloroacetic Acid
105.190	005	SM6251B	Dibromoacetic Acid
105.190	006	SM6251B	Dichloroacetic Acid
105.190	007	SM6251B	Trichloroacetic Acid
105.190	008	SM6251B	Haloacetic Acids (HAA5)
105.191	001	SM6251B (20th)	Haloacetic Acids (HAA5)
105.201	001	EPA 552.3	Haloacetic Acids (HAA5)
105.201	002	EPA 552.3	Dalapon
105.230	001	EPA 1613	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

106 - Radiochemistry of Drinking Water

106.010	001	EPA 900.0	Gross Alpha
106.010	002	EPA 900.0	Gross Beta
106.060	001	EPA 904.0	Radium-228
106.092	001	EPA 200.8	Uranium
106.270	001	SM7110C	Gross Alpha
106.610	001	SM7500-Rn	Radon-222
106.651	001	Georgia Inst. of Tech. rev 1.2	Radium-226
106.651	002	Georgia Inst. of Tech. rev 1.2	Radium-228

107 - Microbiology of Wastewater

107.010	001	SM9215B	Heterotrophic Bacteria
107.020	001	SM9221B	Total Coliform
107.030	001	SM9221B	Total Coliform with Chlorine Present
107.040	001	SM9221C,E (MTF/EC)	Fecal Coliform
107.050	001	SM9221E	Fecal Coliform with Chlorine Present
107.100	001	SM9230B	Fecal Streptococci
107.100	002	SM9230B	Enterococci
107.245	001	SM9223	E. coli

108 - Inorganic Chemistry of Wastewater

108.020	001	EPA 120.1	Conductivity
108.090	001	EPA 160.4	Residue, Volatile
108.110	001	EPA 180.1	Turbidity
108.112	001	EPA 200.7	Boron
108.112	002	EPA 200.7	Calcium
108.112	003	EPA 200.7	Hardness (calc.)
108.112	004	EPA 200.7	Magnesium
108.112	005	EPA 200.7	Potassium
108.112	006	EPA 200.7	Silica
108.112	007	EPA 200.7	Sodium
108.120	001	EPA 300.0	Bromide

108.120	002	EPA 300.0	Chloride
108.120	003	EPA 300.0	Fluoride
108.120	004	EPA 300.0	Nitrate
108.120	005	EPA 300.0	Nitrite
108.120	006	EPA 300.0	Nitrate-nitrite
108.120	008	EPA 300.0	Sulfate
108.183	001	EPA 335.4	Cyanide, Total
108.200	001	EPA 350.1	Ammonia
108.211	001	EPA 351.2	Kjeldahl Nitrogen
108.232	001	EPA 353.2	Nitrate nitrite
108.232	002	EPA 353.2	Nitrite
108.260	001	EPA 365.1	Phosphate, Ortho
108.261	001	EPA 365.1	Phosphorus, Total
108.323	001	EPA 410.4	Chemical Oxygen Demand
108.360	001	EPA 420.1	Phenols, Total
108.362	001	EPA 420.4	Phenols, Total
108.385	001	SM2120B	Color
108.390	001	SM2130B	Turbidity
108.410	001	SM2320B	Alkalinity
108.420	001	SM2340B	Hardness (calc.)
108.430	001	SM2510B	Conductivity
108.440	001	SM2540B	Residue, Total
108.441	001	SM2540C	Residue, Filterable
108.442	001	SM2540D	Residue, Non-filterable
108.443	001	SM2540F	Residue, Settleable
108.465	001	SM4500-Cl G	Chlorine
108.473	001	SM4500-CN G	Cyanide, amenable
108.474	001	SM4500-CN F	Cyanide, Total
108.480	001	SM4500-F C	Fluoride
108.483	001	SM4500-F B	Fluoride
108.490	001	SM4500-H+ B	pH
108.493	001	SM4500-NH3 D or E (19th/20th)	Ammonia
108.498	001	SM4500-NH3 H (18th)	Ammonia
108.531	001	SM4500-O G	Dissolved Oxygen
108.540	001	SM4500-P E	Phosphate, Ortho
108.541	001	SM4500-P E	Phosphorus, Total
108.550	001	SM4500-Si D (18th/19th)	Dissolved Silica
108.551	001	SM4500-SiO2 C (20th)	Silica
108.580	001	SM4500-S= D	Sulfide
108.590	001	SM5210B	Biochemical Oxygen Demand

108.591	001	SM5210B	Carbonaceous BOD
108.602	001	SM5220D	Chemical Oxygen Demand
108.611	001	SM5310C	Total Organic Carbon
108.620	001	SM5320B	Total Organic Halides
108.640	001	SM5540C	Surfactants

109 - Toxic Chemical Elements of Wastewater

109.002	001	EPA 100.2	Asbestos
109.010	001	EPA 200.7	Aluminum
109.010	002	EPA 200.7	Antimony
109.010	004	EPA 200.7	Barium
109.010	005	EPA 200.7	Beryllium
109.010	007	EPA 200.7	Cadmium
109.010	009	EPA 200.7	Chromium
109.010	010	EPA 200.7	Cobalt
109.010	011	EPA 200.7	Copper
109.010	012	EPA 200.7	Iron
109.010	013	EPA 200.7	Lead
109.010	015	EPA 200.7	Manganese
109.010	016	EPA 200.7	Molybdenum
109.010	017	EPA 200.7	Nickel
109.010	021	EPA 200.7	Silver
109.010	024	EPA 200.7	Tin
109.010	026	EPA 200.7	Vanadium
109.010	027	EPA 200.7	Zinc
109.020	001	EPA 200.8	Aluminum
109.020	002	EPA 200.8	Antimony
109.020	003	EPA 200.8	Arsenic
109.020	004	EPA 200.8	Barium
109.020	005	EPA 200.8	Beryllium
109.020	006	EPA 200.8	Cadmium
109.020	007	EPA 200.8	Chromium
109.020	008	EPA 200.8	Cobalt
109.020	009	EPA 200.8	Copper
109.020	010	EPA 200.8	Lead
109.020	011	EPA 200.8	Manganese
109.020	012	EPA 200.8	Molybdenum
109.020	013	EPA 200.8	Nickel
109.020	014	EPA 200.8	Selenium
109.020	015	EPA 200.8	Silver
109.020	016	EPA 200.8	Thallium

109.020	017	EPA 200.8	Vanadium
109.020	018	EPA 200.8	Zinc
109.020	022	EPA 200.8	Tin
109.020	023	EPA 200.8	Titanium
109.104	001	EPA 218.6	Chromium (VI)
109.190	001	EPA 245.1	Mercury
109.809	002	SM3500-Cr B (20th)	Chromium (VI)
109.812	001	SM3500-Cr C (20th)	Chromium (VI)

110 - Volatile Organic Chemistry of Wastewater

110.040	001	EPA 624	Benzene
110.040	002	EPA 624	Bromodichloromethane
110.040	003	EPA 624	Bromoform
110.040	004	EPA 624	Bromomethane
110.040	005	EPA 624	Carbon Tetrachloride
110.040	006	EPA 624	Chlorobenzene
110.040	007	EPA 624	Chloroethane
110.040	008	EPA 624	2-Chloroethyl Vinyl Ether
110.040	009	EPA 624	Chloroform
110.040	010	EPA 624	Chloromethane
110.040	011	EPA 624	Dibromochloromethane
110.040	012	EPA 624	1,2-Dichlorobenzene
110.040	013	EPA 624	1,3-Dichlorobenzene
110.040	014	EPA 624	1,4-Dichlorobenzene
110.040	015	EPA 624	1,1-Dichloroethane
110.040	016	EPA 624	1,2-Dichloroethane
110.040	017	EPA 624	1,1-Dichloroethene
110.040	018	EPA 624	trans-1,2-Dichloroethene
110.040	019	EPA 624	1,2-Dichloropropane
110.040	020	EPA 624	cis-1,3-Dichloropropene
110.040	021	EPA 624	trans-1,3-Dichloropropene
110.040	022	EPA 624	Ethylbenzene
110.040	023	EPA 624	Methylene Chloride
110.040	024	EPA 624	1,1,2,2-Tetrachloroethane
110.040	025	EPA 624	Tetrachloroethene
110.040	026	EPA 624	Toluene
110.040	027	EPA 624	1,1,1-Trichloroethane
110.040	028	EPA 624	1,1,2-Trichloroethane
110.040	029	EPA 624	Trichloroethene
110.040	030	EPA 624	Trichlorofluoromethane
110.040	031	EPA 624	Vinyl Chloride

110.040	043	EPA 624	Other Volatile Organics

111 - Semi-volatile Organic Chemistry of Wastewater

111.100	001	EPA 625	Acenaphthene
111.100	002	EPA 625	Acenaphthylene
111.100	003	EPA 625	Anthracene
111.100	004	EPA 625	Benzidine
111.100	005	EPA 625	Benz(a)anthracene
111.100	006	EPA 625	Benzo(b)fluoranthene
111.100	007	EPA 625	Benzo(k)fluoranthene
111.100	008	EPA 625	Benzo(g,h,i)perylene
111.100	009	EPA 625	Benzo(a)pyrene
111.100	010	EPA 625	Benzyl Butyl Phthalate
111.100	011	EPA 625	bis(2-chloroethoxy)methane
111.100	012	EPA 625	bis(2-chloroethyl) Ether
111.100	013	EPA 625	Bis(2-chloroisopropyl) Ether
111.100	014	EPA 625	Di(2-ethylhexyl) Phthalate
111.100	015	EPA 625	4-Bromophenyl Phenyl Ether
111.100	016	EPA 625	4-Chloro-3-methylphenol
111.100	017	EPA 625	2-Chloronaphthalene
111.100	018	EPA 625	2-Chlorophenol
111.100	019	EPA 625	4-Chlorophenyl Phenyl Ether
111.100	020	EPA 625	Chrysene
111.100	021	EPA 625	Dibenz(a,h)anthracene
111.100	025	EPA 625	3,3'-Dichlorobenzidine
111.100	026	EPA 625	2,4-Dichlorophenol
111.100	027	EPA 625	Diethyl Phthalate
111.100	028	EPA 625	2,4-Dimethylphenol
111.100	029	EPA 625	Dimethyl Phthalate
111.100	030	EPA 625	Di-n-butyl phthalate
111.100	031	EPA 625	Di-n-octyl phthalate
111.100	032	EPA 625	2,4-Dinitrophenol
111.100	033	EPA 625	2,4-Dinitrotoluene
111.100	034	EPA 625	2,6-Dinitrotoluene
111.100	035	EPA 625	Fluoranthene
111.100	036	EPA 625	Fluorene
111.100	037	EPA 625	Hexachlorobenzene
111.100	038	EPA 625	Hexachlorobutadiene
111.100	039	EPA 625	Hexachlorocyclopentadiene
111.100	040	EPA 625	Hexachloroethane
111.100	041	EPA 625	Indeno(1,2,3-c,d)pyrene

111.100	042	EPA 625	Isophorone
111.100	043	EPA 625	2-Methyl-4,6-dinitrophenol
111.100	044	EPA 625	Naphthalene
111.100	045	EPA 625	Nitrobenzene
111.100	046	EPA 625	2-Nitrophenol
111.100	047	EPA 625	4-Nitrophenol
111.100	048	EPA 625	N-nitrosodimethylamine
111.100	049	EPA 625	N-nitroso-di-n-propylamine
111.100	050	EPA 625	N-nitrosodiphenylamine
111.100	051	EPA 625	Pentachlorophenol
111.100	052	EPA 625	Phenanthrene
111.100	053	EPA 625	Phenol
111.100	054	EPA 625	Pyrene
111.100	055	EPA 625	1,2,4-Trichlorobenzene
111.100	056	EPA 625	2,4,6-Trichlorophenol

112 - Radiochemistry of Wastewater

112.010	001	EPA 900.0	Gross Alpha
112.010	002	EPA 900.0	Gross Beta

RON CHAPMAN, MD, MPH
Director & State Health Officer

State of California—Health and Human Services Agency

California Department of Public Health

EDMUND G. BROWN JR.
Governor

September 13, 2013

Ed Wilson
Eurofins Eaton Analytical, Inc.
750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016

Dear Ed Wilson: Certificate No. 2813

This is to advise you that the laboratory named above has been certified as an environmental testing laboratory pursuant to the provisions of the Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100825, *et seq.*

The Fields of Testing for which this laboratory has been certified are indicated on the enclosed "Fields of Testing." The certificate shall remain in effect until **January 31, 2015** unless it is revoked. This certificate is subject to an annual fee as prescribed by HSC 100860.1(a).

The application for renewal of this certificate must be received before the expiration date of this certificate to remain in force according to the HSC 100845(a).

Any changes in laboratory location or structural alterations, which may affect adversely the quality of analysis in the Fields of Testing for which this laboratory has been granted a certificate, require prior notification. Notification is also required for changes in ownership or laboratory director within 30 days after the change (HSC, Section 100845(b) and (d)).

Your continued cooperation with the above requirements is essential for maintaining the high quality of the data produced by environmental laboratories certified by the State of California.

If you have any questions, please contact Rosalinda Lomboy at (818) 551-2014.

Sincerely,

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

Enclosure

CDPH
California Department of Public Health

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF ENVIRONMENTAL ACCREDITATION

Is hereby granted to

Eurofins Eaton Analytical, Inc.

750 Royal Oaks Drive, Suite 100

Monrovia, CA 91016

Scope of the certificate is limited to the
"Fields of Testing"
which accompany this Certificate.

Continued accredited status depends on successful completion of on-site, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **2813**

Expiration Date: **1/31/2015**

Effective Date: **2/1/2013**

Richmond, California
subject to forfeiture or revocation

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

Eurofins Eaton Analytical, Inc.
750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016
Phone: (626) 386-1100

Certificate No.: 2813
Renew Date: 1/31/2015

Field of Testing: 101 - Microbiology of Drinking Water

101.010	001	Heterotrophic Bacteria	SM9215B
101.020	001	Total Coliform	SM9221A,B
101.021	001	Fecal Coliform	SM9221E (MTF/EC)
101.022	001	E. coli	CFR 141.21(f)(6)(i) (MTF/EC-MUG)
101.060	002	Total Coliform	SM9223
101.060	003	E. coli	SM9223
101.070	002	Total Coliform	Colisure
101.070	003	E. coli	Colisure
101.120	001	Total Coliform (Enumeration)	SM9221A,B,C
101.130	001	Fecal Coliform (Enumeration)	SM9221E (MTF/EC)
101.160	001	Total Coliform (Enumeration)	SM9223
101.200	001	E. coli (Enumeration)	SM9223B
101.210	001	E. coli (Enumeration)	SM9221B.1/SM9221F

Field of Testing: 103 - Toxic Chemical Elements of Drinking Water

103.130	018	Boron	EPA 200.7
103.140	018	Vanadium	EPA 200.8
103.310	001	Chromium (VI)	EPA 218.6

Field of Testing: 104 - Volatile Organic Chemistry of Drinking Water

104.035	001	1,2,3-Trichloropropane	SRL 524M-TCP
104.050	007	tert-Butyl Alcohol (TBA)	EPA 524.2
104.050	008	Carbon Disulfide	EPA 524.2
104.050	009	Methyl Isobutyl Ketone	EPA 524.2
104.055	001	Benzene	EPA 524.3
104.055	002	Carbon Tetrachloride	EPA 524.3
104.055	003	Chlorobenzene	EPA 524.3
104.055	004	1,2-Dichlorobenzene	EPA 524.3
104.055	005	1,4 Dichlorobenzene	EPA 524.3
104.055	006	1,2-Dichloroethane	EPA 524.3
104.055	007	cis-1,2-Dichloroethene	EPA 524.3
104.055	008	trans-1,2-Dichloroethene	EPA 524.3
104.055	009	Dichloromethane	EPA 524.3
104.055	010	1,2-Dichloropropane	EPA 524.3
104.055	011	Ethylbenzene	EPA 524.3

As of 9/13/2013 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

104.055	012	Styrene	EPA 524.3	
104.055	013	Tetrachloroethene	EPA 524.3	
104.055	014	1,1,1-Trichloroethane	EPA 524.3	
104.055	015	Trichloroethene	EPA 524.3	
104.055	016	Toluene	EPA 524.3	
104.055	017	1,2,4-Trichlorobenzene	EPA 524.3	
104.055	018	1,1-Dichloroethene	EPA 524.3	
104.055	019	1,1,2-Trichloroethane	EPA 524.3	
104.055	020	Vinyl Chloride	EPA 524.3	
104.055	021	Xylenes, Total	EPA 524.3	
104.055	022	1,2-Dibromo-3-chloropropane	EPA 524.3	
104.055	023	1,2-Dibromoethane	EPA 524.3	
104.055	024	Trihalomethanes, Total	EPA 524.3	
104.055	025	Methyl Isobutyl Ketone	EPA 524.3	
104.055	026	Trichlorotrifluoroethane	EPA 524.3	
104.055	027	Nitrobenzene	EPA 524.3	
Field of Testing: 105 - Semi-volatile Organic Chemistry of Drinking Water				
105.090	028	Thiobencarb	EPA 525.2	
105.201	001	Haloacetic Acids (HAA5)	EPA 552.3	
105.201	002	Dalapon	EPA 552.3	
105.230	001	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	EPA 1613	
Field of Testing: 108 - Inorganic Chemistry of Wastewater				
108.210	002	Kjeldahl Nitrogen, Total (as N)	EPA 351.1	
Field of Testing: 114 - Inorganic Chemistry of Hazardous Waste				
114.010	001	Antimony	EPA 6010B	Aqueous Only
114.010	003	Barium	EPA 6010B	Aqueous Only
114.010	004	Beryllium	EPA 6010B	Aqueous Only
114.010	005	Cadmium	EPA 6010B	Aqueous Only
114.010	006	Chromium	EPA 6010B	Aqueous Only
114.010	007	Cobalt	EPA 6010B	Aqueous Only
114.010	008	Copper	EPA 6010B	Aqueous Only
114.010	009	Lead	EPA 6010B	Aqueous Only
114.010	010	Molybdenum	EPA 6010B	Aqueous Only
114.010	011	Nickel	EPA 6010B	Aqueous Only
114.010	013	Silver	EPA 6010B	Aqueous Only
114.010	014	Thallium	EPA 6010B	Aqueous Only
114.010	015	Vanadium	EPA 6010B	Aqueous Only
114.010	016	Zinc	EPA 6010B	Aqueous Only
114.020	001	Antimony	EPA 6020	Aqueous Only
114.020	002	Arsenic	EPA 6020	Aqueous Only

114.020	003	Barium	EPA 6020	Aqueous Only
114.020	004	Beryllium	EPA 6020	Aqueous Only
114.020	005	Cadmium	EPA 6020	Aqueous Only
114.020	006	Chromium	EPA 6020	Aqueous Only
114.020	007	Cobalt	EPA 6020	Aqueous Only
114.020	008	Copper	EPA 6020	Aqueous Only
114.020	009	Lead	EPA 6020	Aqueous Only
114.020	010	Molybdenum	EPA 6020	Aqueous Only
114.020	011	Nickel	EPA 6020	Aqueous Only
114.020	012	Selenium	EPA 6020	Aqueous Only
114.020	013	Silver	EPA 6020	Aqueous Only
114.020	014	Thallium	EPA 6020	Aqueous Only
114.020	015	Vanadium	EPA 6020	Aqueous Only
114.020	016	Zinc	EPA 6020	Aqueous Only
114.103	001	Chromium (VI)	EPA 7196A	Aqueous Only
114.106	001	Chromium (VI)	EPA 7199	Aqueous Only
114.140	001	Mercury	EPA 7470A	Aqueous Only
114.240	001	Corrosivity - pH Determination	EPA 9040B	Aqueous Only
114.250	001	Fluoride	EPA 9056	Aqueous Only
114.270	001	Fluoride	EPA 9214	Aqueous Only

Field of Testing: 116 - Volatile Organic Chemistry of Hazardous Waste

116.010	000	EDB and DBCP	EPA 8011	Aqueous Only
116.080	000	Volatile Organic Compounds	EPA 8260B	Aqueous Only
116.080	120	Oxygenates	EPA 8260B	Aqueous Only

Field of Testing: 117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.110	000	Extractable Organics	EPA 8270C	Aqueous Only

As of 9/13/2013 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

NELAP - RECOGNIZED

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF NELAP ACCREDITATION

Is hereby granted to

Eurofins Lancaster Laboratories, Inc.

2425 New Holland Pike

Lancaster, PA 17601-5994

Scope of the Certificate is limited to the
"NELAP Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **10276CA**

Expiration Date: **7/31/2014**

Effective Date: **8/1/2013**

Richmond, California
subject to forfeiture or revocation

Fred Choske for

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

NELAP Fields of Accreditation

NELAP RECOGNIZED

Eurofins Lancaster Laboratories, Inc.

2425 New Holland Pike
Lancaster, PA 17601-5994
Phone: (717) 656-2300

Primary AA: PA 36-00037

Certificate No. 10276CA
Renew Date: 7/31/2014

105 - Semi-volatile Organic Chemistry of Drinking Water			
105.230	001	EPA 1613	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
111 - Semi-volatile Organic Chemistry of Wastewater			
111.111	001	EPA 1613B	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
111.111	002	EPA 1613B	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)
111.111	003	EPA 1613B	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
111.111	004	EPA 1613B	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
111.111	005	EPA 1613B	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)
111.111	006	EPA 1613B	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)
111.111	007	EPA 1613B	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)
111.111	008	EPA 1613B	2,3,7,8-Tetrachlorodibenzofuran (TCDF)
111.111	009	EPA 1613B	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)
111.111	010	EPA 1613B	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)
111.111	011	EPA 1613B	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)
111.111	012	EPA 1613B	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)
111.111	013	EPA 1613B	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)
111.111	014	EPA 1613B	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)
111.111	015	EPA 1613B	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)
111.111	016	EPA 1613B	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)
111.111	017	EPA 1613B	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)
111.111	018	EPA 1613B	Total TCDD
111.111	019	EPA 1613B	Total PeCDD
111.111	020	EPA 1613B	Total HxCDD
111.111	021	EPA 1613B	Total HpCDD
111.111	022	EPA 1613B	Total TCDF
111.111	023	EPA 1613B	Total PeCDF
111.111	024	EPA 1613B	Total HxCDF
111.111	025	EPA 1613B	Total HpCDF
111.120	048	EPA 1625	N-nitrosodimethylamine
117 - Semi-volatile Organic Chemistry of Hazardous Waste			
117.130	001	EPA 8290	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
117.130	002	EPA 8290	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)
117.130	003	EPA 8290	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	004	EPA 8290	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)

As of 7/17/2013 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

117.130	005	EPA 8290	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	006	EPA 8290	2,3,7,8-Tetrachlorodibenzofuran (TCDF)
117.130	007	EPA 8290	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)
117.130	008	EPA 8290	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)
117.130	009	EPA 8290	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	010	EPA 8290	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	011	EPA 8290	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)
117.130	012	EPA 8290	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	013	EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)
117.130	014	EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)
117.130	015	EPA 8290	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)
117.130	016	EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)
117.130	017	EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF ENVIRONMENTAL ACCREDITATION

Is hereby granted to

APPL, Inc. (Agriculture & Priority Pollutants Laboratories, Inc.)

908 North Temperance Avenue

Clovis, CA 93611

Scope of the certificate is limited to the
"Fields of Testing"
which accompany this Certificate.

Continued accredited status depends on successful completion of on-site, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **1312**

Expiration Date: **09/30/2014**

Effective Date: **10/01/2012**

Richmond, California
subject to forfeiture or revocation

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

APPL, Inc. (Agriculture & Priority Pollutants Laboratories, Inc.)
908 North Temperance Avenue
Clovis, CA 93611
Phone: (559) 275-2175

Certificate No.: 1312
Renew Date: 9/30/2014

Field of Testing: 102 - Inorganic Chemistry of Drinking Water

102.030	001	Bromide	EPA 300.0
102.030	003	Chloride	EPA 300.0
102.030	005	Fluoride	EPA 300.0
102.030	006	Nitrate	EPA 300.0
102.030	007	Nitrite	EPA 300.0
102.030	008	Phosphate, Ortho	EPA 300.0
102.030	010	Sulfate	EPA 300.0
102.060	001	Nitrate calc.	EPA 353.2
102.061	001	Nitrite	EPA 353.2
102.100	001	Alkalinity	SM2320B
102.120	001	Hardness	SM2340B
102.130	001	Conductivity	SM2510B
102.140	001	Total Dissolved Solids	SM2540C
102.145	001	Total Dissolved Solids	EPA 160.1
102.190	001	Cyanide, Total	SM4500-CN E
102.192	001	Cyanide, amenable	SM4500-CN G
102.240	001	Phosphate, Ortho	SM4500-P E
102.260	001	Total Organic Carbon	SM5310B
102.261	001	DOC	SM5310B
102.261	002	TOC/DOC	SM5310B
102.270	001	Surfactants	SM5540C
102.520	001	Calcium	EPA 200.7
102.520	002	Magnesium	EPA 200.7
102.520	003	Potassium	EPA 200.7
102.520	005	Sodium	EPA 200.7
102.520	006	Hardness (calculation)	EPA 200.7
102.533	002	Silica	SM4500-SI D

Field of Testing: 103 - Toxic Chemical Elements of Drinking Water

103.130	001	Aluminum	EPA 200.7
103.130	003	Barium	EPA 200.7
103.130	004	Beryllium	EPA 200.7
103.130	005	Cadmium	EPA 200.7
103.130	007	Chromium	EPA 200.7
103.130	008	Copper	EPA 200.7
103.130	009	Iron	EPA 200.7

103.130	011	Manganese	EPA 200.7
103.130	012	Nickel	EPA 200.7
103.130	015	Silver	EPA 200.7
103.130	018	Boron	EPA 200.7
103.140	001	Aluminum	EPA 200.8
103.140	002	Antimony	EPA 200.8
103.140	003	Arsenic	EPA 200.8
103.140	004	Barium	EPA 200.8
103.140	005	Beryllium	EPA 200.8
103.140	006	Cadmium	EPA 200.8
103.140	007	Chromium	EPA 200.8
103.140	008	Copper	EPA 200.8
103.140	009	Lead	EPA 200.8
103.140	010	Manganese	EPA 200.8
103.140	012	Nickel	EPA 200.8
103.140	013	Selenium	EPA 200.8
103.140	014	Silver	EPA 200.8
103.140	015	Thallium	EPA 200.8
103.140	016	Zinc	EPA 200.8
103.140	017	Boron	EPA 200.8
103.140	018	Vanadium	EPA 200.8
103.160	001	Mercury	EPA 245.1
103.310	001	Chromium (VI)	EPA 218.6

Field of Testing: 104 - Volatile Organic Chemistry of Drinking Water

104.030	001	1,2-Dibromoethane	EPA 504.1
104.030	002	1,2-Dibromo-3-chloropropane	EPA 504.1
104.030	003	1,2,3-Trichloropropane	EPA 504.1
104.040	000	Volatile Organic Compounds	EPA 524.2
104.040	001	Benzene	EPA 524.2
104.040	007	n-Butylbenzene	EPA 524.2
104.040	008	sec-Butylbenzene	EPA 524.2
104.040	009	tert-Butylbenzene	EPA 524.2
104.040	010	Carbon Tetrachloride	EPA 524.2
104.040	011	Chlorobenzene	EPA 524.2
104.040	015	2-Chlorotoluene	EPA 524.2
104.040	016	4-Chlorotoluene	EPA 524.2
104.040	019	1,3-Dichlorobenzene	EPA 524.2
104.040	020	1,2-Dichlorobenzene	EPA 524.2
104.040	021	1,4-Dichlorobenzene	EPA 524.2
104.040	022	Dichlorodifluoromethane	EPA 524.2
104.040	023	1,1-Dichloroethane	EPA 524.2
104.040	024	1,2-Dichloroethane	EPA 524.2
104.040	025	1,1-Dichloroethene	EPA 524.2

104.040	026	cis-1,2-Dichloroethene	EPA 524.2
104.040	027	trans-1,2-Dichloroethene	EPA 524.2
104.040	028	Dichloromethane	EPA 524.2
104.040	029	1,2-Dichloropropane	EPA 524.2
104.040	033	cis-1,3-Dichloropropene	EPA 524.2
104.040	034	trans-1,3-Dichloropropene	EPA 524.2
104.040	035	Ethylbenzene	EPA 524.2
104.040	037	Isopropylbenzene	EPA 524.2
104.040	039	Naphthalene	EPA 524.2
104.040	041	N-propylbenzene	EPA 524.2
104.040	042	Styrene	EPA 524.2
104.040	044	1,1,2,2-Tetrachloroethane	EPA 524.2
104.040	045	Tetrachloroethene	EPA 524.2
104.040	046	Toluene	EPA 524.2
104.040	048	1,2,4-Trichlorobenzene	EPA 524.2
104.040	049	1,1,1-Trichloroethane	EPA 524.2
104.040	050	1,1,2-Trichloroethane	EPA 524.2
104.040	051	Trichloroethene	EPA 524.2
104.040	052	Trichlorofluoromethane	EPA 524.2
104.040	054	1,2,4-Trimethylbenzene	EPA 524.2
104.040	055	1,3,5-Trimethylbenzene	EPA 524.2
104.040	056	Vinyl Chloride	EPA 524.2
104.040	057	Xylenes, Total	EPA 524.2
104.045	001	Bromodichloromethane	EPA 524.2
104.045	002	Bromoform	EPA 524.2
104.045	003	Chloroform	EPA 524.2
104.045	004	Dibromochloromethane	EPA 524.2
104.045	005	Trihalomethanes	EPA 524.2
104.050	002	Methyl tert-butyl Ether (MTBE)	EPA 524.2
104.050	004	tert-Amyl Methyl Ether (TAME)	EPA 524.2
104.050	005	Ethyl tert-butyl Ether (ETBE)	EPA 524.2
104.050	006	Trichlorotrifluoroethane	EPA 524.2
104.050	007	tert-Butyl Alcohol (TBA)	EPA 524.2
104.050	008	Carbon Disulfide	EPA 524.2
104.050	009	Methyl Isobutyl Ketone	EPA 524.2

Field of Testing: 105 - Semi-volatile Organic Chemistry of Drinking Water

105.030	000	N-, P- Pesticides	EPA 507
105.030	001	Alachlor	EPA 507
105.030	002	Atrazine	EPA 507
105.030	007	Molinate	EPA 507
105.030	009	Simazine	EPA 507
105.030	010	Thiobencarb	EPA 507
105.040	007	Endrin	EPA 508

105.040	008	Heptachlor	EPA 508
105.040	009	Heptachlor Epoxide	EPA 508
105.040	010	Hexachlorobenzene	EPA 508
105.040	012	Lindane	EPA 508
105.040	013	Methoxychlor	EPA 508
105.040	015	Toxaphene	EPA 508
105.040	016	PCBs as Aroclors (screen)	EPA 508
105.070	001	Bentazon	EPA 515.1
105.070	002	2,4-D	EPA 515.1
105.070	003	Dalapon	EPA 515.1
105.070	005	Dinoseb	EPA 515.1
105.070	006	Pentachlorophenol	EPA 515.1
105.070	007	Picloram	EPA 515.1
105.070	008	2,4,5-TP	EPA 515.1
105.070	009	Chlorinated Acids	EPA 515.1
105.090	004	Benzo(a)pyrene	EPA 525.2
105.090	008	Di(2-ethylhexyl) Adipate	EPA 525.2
105.090	009	Di(2-ethylhexyl) Phthalate	EPA 525.2
105.090	016	Hexachlorobenzene	EPA 525.2
105.090	017	Hexachlorocyclopentadiene	EPA 525.2
105.090	029	Polynuclear Aromatic Hydrocarbons	EPA 525.2
105.090	030	Adipates	EPA 525.2
105.090	031	Phthalates	EPA 525.2
105.090	032	Other Extractables	EPA 525.2

Field of Testing: 108 - Inorganic Chemistry of Wastewater

108.020	001	Conductivity	EPA 120.1
108.110	001	Turbidity	EPA 180.1
108.112	001	Boron	EPA 200.7
108.112	002	Calcium	EPA 200.7
108.112	003	Hardness (calculation)	EPA 200.7
108.112	004	Magnesium	EPA 200.7
108.112	005	Potassium	EPA 200.7
108.112	006	Silica	EPA 200.7
108.112	007	Sodium	EPA 200.7
108.113	001	Boron	EPA 200.8
108.113	002	Calcium	EPA 200.8
108.113	003	Magnesium	EPA 200.8
108.113	004	Potassium	EPA 200.8
108.113	005	Silica	EPA 200.8
108.113	006	Sodium	EPA 200.8
108.120	001	Bromide	EPA 300.0
108.120	002	Chloride	EPA 300.0
108.120	003	Fluoride	EPA 300.0

108.120	004	Nitrate	EPA 300.0
108.120	005	Nitrite	EPA 300.0
108.120	006	Nitrate-nitrite	EPA 300.0
108.120	007	Phosphate, Ortho	EPA 300.0
108.120	008	Sulfate	EPA 300.0
108.200	001	Ammonia	EPA 350.1
108.211	001	Kjeldahl Nitrogen	EPA 351.2
108.232	001	Nitrate-nitrite	EPA 353.2
108.232	002	Nitrite	EPA 353.2
108.381	001	Oil and Grease	EPA 1664A
108.390	001	Turbidity	SM2130B
108.410	001	Alkalinity	SM2320B
108.420	001	Hardness (calculation)	SM2340B
108.421	001	Hardness	SM2340C
108.430	001	Conductivity	SM2510B
108.440	001	Residue, Total	SM2540B
108.441	001	Residue, Filterable	SM2540C
108.442	001	Residue, Non-filterable	SM2540D
108.443	001	Residue, Settleable	SM2540F
108.470	001	Cyanide, Manual Distillation	SM4500-CN C
108.472	001	Cyanide, Total	SM4500-CN E
108.473	001	Cyanide, amenable	SM4500-CN G
108.490	001	pH	SM4500-H+B
108.540	001	Phosphate, Ortho	SM4500-P E
108.541	001	Phosphorus, Total	SM4500-P E
108.550	001	Dissolved Silica	SM4500-SI D (18th/19th)
108.551	001	Silica	SM4500-SiO2 C (20th)
108.582	001	Sulfide	SM4500-S= F (19th/20th)
108.610	001	Total Organic Carbon	SM5310B
108.630	001	Oil and Grease	SM5520B (20th)
108.640	001	Surfactants	SM5540C

Field of Testing: 109 - Toxic Chemical Elements of Wastewater

109.010	001	Aluminum	EPA 200.7
109.010	002	Antimony	EPA 200.7
109.010	003	Arsenic	EPA 200.7
109.010	004	Barium	EPA 200.7
109.010	005	Beryllium	EPA 200.7
109.010	007	Cadmium	EPA 200.7
109.010	009	Chromium	EPA 200.7
109.010	010	Cobalt	EPA 200.7
109.010	011	Copper	EPA 200.7
109.010	012	Iron	EPA 200.7
109.010	013	Lead	EPA 200.7

109.010	015	Manganese	EPA 200.7
109.010	016	Molybdenum	EPA 200.7
109.010	017	Nickel	EPA 200.7
109.010	019	Selenium	EPA 200.7
109.010	021	Silver	EPA 200.7
109.010	023	Thallium	EPA 200.7
109.010	024	Tin	EPA 200.7
109.010	026	Vanadium	EPA 200.7
109.010	027	Zinc	EPA 200.7
109.020	001	Aluminum	EPA 200.8
109.020	002	Antimony	EPA 200.8
109.020	003	Arsenic	EPA 200.8
109.020	004	Barium	EPA 200.8
109.020	005	Beryllium	EPA 200.8
109.020	006	Cadmium	EPA 200.8
109.020	007	Chromium	EPA 200.8
109.020	008	Cobalt	EPA 200.8
109.020	009	Copper	EPA 200.8
109.020	010	Lead	EPA 200.8
109.020	011	Manganese	EPA 200.8
109.020	012	Molybdenum	EPA 200.8
109.020	013	Nickel	EPA 200.8
109.020	014	Selenium	EPA 200.8
109.020	015	Silver	EPA 200.8
109.020	016	Thallium	EPA 200.8
109.020	017	Vanadium	EPA 200.8
109.020	018	Zinc	EPA 200.8
109.020	020	Gold	EPA 200.8
109.020	021	Iron	EPA 200.8
109.020	022	Tin	EPA 200.8
109.020	023	Titanium	EPA 200.8
109.104	001	Chromium (VI)	EPA 218.6
109.190	001	Mercury	EPA 245.1
109.824	001	Iron	SM3500-Fe B (20th)
109.825	001	Iron	SM3500-Fe D (18th/19th)

Field of Testing: 110 - Volatile Organic Chemistry of Wastewater

110.040	040	Halogenated Hydrocarbons	EPA 624
110.040	041	Aromatic Compounds	EPA 624
110.040	042	Oxygenates	EPA 624
110.040	043	Other Volatile Organics	EPA 624

Field of Testing: 111 - Semi-volatile Organic Chemistry of Wastewater

111.101	032	Polynuclear Aromatic Hydrocarbons	EPA 625
111.101	033	Adipates	EPA 625

111.101	034	Phthalates	EPA 625
111.101	036	Other Extractables	EPA 625
111.170	030	Organochlorine Pesticides	EPA 608
111.170	031	PCBs	EPA 608
111.272	001	Oil and Grease	SM5520B (20th)
111.273	001	Oil and Grease	EPA 1664A

NELAP - RECOGNIZED

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF NELAP ACCREDITATION

Is hereby granted to

APPL, Inc. (Agriculture & Priority Pollutants Laboratories, Inc.)

908 North Temperance Avenue

Clovis, CA 93611

Scope of the Certificate is limited to the
"NELAP Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **05233CA**

Expiration Date: **1/31/2014**

Effective Date: **2/1/2013**

Richmond, California
subject to forfeiture or revocation

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

NELAP RECOGNIZED

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

NELAP Fields of Accreditation

APPL, Inc. (Agriculture & Priority Pollutants Laboratories, Inc.)

908 North Temperance Avenue
Clovis, CA 93611
Phone: (559) 275-2175

Certificate No.: 05233CA
Renew Date: 1/31/2014

114 - Inorganic Chemistry of Hazardous Waste

114.010	001	EPA 6010B	Antimony
114.010	002	EPA 6010B	Arsenic
114.010	003	EPA 6010B	Barium
114.010	004	EPA 6010B	Beryllium
114.010	005	EPA 6010B	Cadmium
114.010	006	EPA 6010B	Chromium
114.010	007	EPA 6010B	Cobalt
114.010	008	EPA 6010B	Copper
114.010	009	EPA 6010B	Lead
114.010	010	EPA 6010B	Molybdenum
114.010	011	EPA 6010B	Nickel
114.010	012	EPA 6010B	Selenium
114.010	013	EPA 6010B	Silver
114.010	014	EPA 6010B	Thallium
114.010	015	EPA 6010B	Vanadium
114.010	016	EPA 6010B	Zinc
114.020	001	EPA 6020	Antimony
114.020	002	EPA 6020	Arsenic
114.020	003	EPA 6020	Barium
114.020	004	EPA 6020	Beryllium
114.020	005	EPA 6020	Cadmium
114.020	006	EPA 6020	Chromium
114.020	007	EPA 6020	Cobalt
114.020	008	EPA 6020	Copper
114.020	009	EPA 6020	Lead
114.020	010	EPA 6020	Molybdenum
114.020	011	EPA 6020	Nickel
114.020	012	EPA 6020	Selenium
114.020	013	EPA 6020	Silver
114.020	014	EPA 6020	Thallium
114.020	015	EPA 6020	Vanadium
114.020	016	EPA 6020	Zinc
114.103	001	EPA 7196A	Chromium (VI)

As of 8/12/2013, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

114.106	001	EPA 7199	Chromium (VI)
114.140	001	EPA 7470A	Mercury
114.141	001	EPA 7471A	Mercury
114.222	001	EPA 9014	Cyanide
114.240	001	EPA 9040B	Corrosivity - pH Determination
114.241	001	EPA 9045C	Corrosivity - pH Determination
114.250	001	EPA 9056	Fluoride

115 - Extraction Test of Hazardous Waste

115.020	001	EPA 1311	Toxicity Characteristic Leaching Procedure (TCLP)
115.021	001	EPA 1311	TCLP Inorganics
115.022	001	EPA 1311	TCLP Extractables
115.023	001	EPA 1311	TCLP Volatiles
115.030	001	CCR Chapter11, Article 5, Appendix II	Waste Extraction Test (WET)
115.040	001	EPA 1312	Synthetic Precipitation Leaching Procedure (SPLP)

116 - Volatile Organic Chemistry of Hazardous Waste

116.010	000	EPA 8011	EDB and DBCP
116.010	001	EPA 8011	1,2-Dibromoethane
116.010	002	EPA 8011	Dibromochloropropane
116.030	001	EPA 8015B	Gasoline-range Organics
116.080	000	EPA 8260B	Volatile Organic Compounds
116.080	001	EPA 8260B	Acetone
116.080	002	EPA 8260B	Acetonitrile
116.080	003	EPA 8260B	Acrolein
116.080	004	EPA 8260B	Acrylonitrile
116.080	007	EPA 8260B	Benzene
116.080	008	EPA 8260B	Benzyl Chloride
116.080	010	EPA 8260B	Bromochloromethane
116.080	011	EPA 8260B	Bromodichloromethane
116.080	012	EPA 8260B	Bromoform
116.080	013	EPA 8260B	Bromomethane
116.080	015	EPA 8260B	Carbon Disulfide
116.080	016	EPA 8260B	Carbon Tetrachloride
116.080	018	EPA 8260B	Chlorobenzene
116.080	019	EPA 8260B	Chloroethane
116.080	020	EPA 8260B	2-Chloroethyl Vinyl Ether
116.080	021	EPA 8260B	Chloroform
116.080	022	EPA 8260B	Chloromethane
116.080	026	EPA 8260B	Dibromochloromethane
116.080	027	EPA 8260B	Dibromochloropropane
116.080	028	EPA 8260B	1,2-Dibromoethane
116.080	029	EPA 8260B	Dibromofluoromethane

116.080	030	EPA 8260B	Dibromomethane
116.080	031	EPA 8260B	1,2-Dichlorobenzene
116.080	032	EPA 8260B	1,3-Dichlorobenzene
116.080	033	EPA 8260B	1,4-Dichlorobenzene
116.080	035	EPA 8260B	trans-1,4-Dichloro-2-butene
116.080	036	EPA 8260B	Dichlorodifluoromethane
116.080	037	EPA 8260B	1,1-Dichloroethane
116.080	038	EPA 8260B	1,2-Dichloroethane
116.080	039	EPA 8260B	1,1-Dichloroethene
116.080	040	EPA 8260B	trans-1,2-Dichloroethene
116.080	041	EPA 8260B	cis-1,2-Dichloroethene
116.080	042	EPA 8260B	1,2-Dichloropropane
116.080	043	EPA 8260B	1,3-Dichloropropane
116.080	044	EPA 8260B	2,2-Dichloropropane
116.080	045	EPA 8260B	1,1-Dichloropropene
116.080	046	EPA 8260B	cis-1,3-Dichloropropene
116.080	047	EPA 8260B	trans-1,3-Dichloropropene
116.080	053	EPA 8260B	Ethylbenzene
116.080	056	EPA 8260B	Hexachlorobutadiene
116.080	057	EPA 8260B	Hexachloroethane
116.080	058	EPA 8260B	2-Hexanone (MBK)
116.080	059	EPA 8260B	Iodomethane
116.080	064	EPA 8260B	Methyl tert-butyl Ether (MTBE)
116.080	065	EPA 8260B	Methylene Chloride
116.080	066	EPA 8260B	Methyl Ethyl Ketone
116.080	068	EPA 8260B	4-Methyl-2-pentanone (MIBK)
116.080	069	EPA 8260B	Naphthalene
116.080	081	EPA 8260B	1,1,1,2-Tetrachloroethane
116.080	082	EPA 8260B	1,1,2,2-Tetrachloroethane
116.080	083	EPA 8260B	Tetrachloroethene
116.080	084	EPA 8260B	Toluene
116.080	086	EPA 8260B	1,2,3-Trichlorobenzene
116.080	087	EPA 8260B	1,2,4-Trichlorobenzene
116.080	088	EPA 8260B	1,1,1-Trichloroethane
116.080	089	EPA 8260B	1,1,2-Trichloroethane
116.080	090	EPA 8260B	Trichloroethene
116.080	091	EPA 8260B	Trichlorofluoromethane
116.080	092	EPA 8260B	1,2,3-Trichloropropane
116.080	093	EPA 8260B	Vinyl Acetate
116.080	094	EPA 8260B	Vinyl Chloride
116.080	095	EPA 8260B	Xylenes, Total

116.080	096	EPA 8260B	tert-Amyl Methyl Ether (TAME)
116.080	097	EPA 8260B	tert-Butyl Alcohol (TBA)
116.080	098	EPA 8260B	Ethyl tert-butyl Ether (ETBE)
116.080	099	EPA 8260B	Bromobenzene
116.080	100	EPA 8260B	n-Butylbenzene
116.080	101	EPA 8260B	sec-Butylbenzene
116.080	102	EPA 8260B	tert-Butylbenzene
116.080	103	EPA 8260B	2-Chlorotoluene
116.080	104	EPA 8260B	4-Chlorotoluene
116.080	105	EPA 8260B	Isopropylbenzene
116.080	106	EPA 8260B	N-propylbenzene
116.080	107	EPA 8260B	Styrene
116.080	108	EPA 8260B	1,2,4-Trimethylbenzene
116.080	109	EPA 8260B	1,3,5-Trimethylbenzene
116.080	120	EPA 8260B	Oxygenates

117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	EPA 8015B	Diesel-range Total Petroleum Hydrocarbons
117.110	001	EPA 8270C	Acenaphthene
117.110	002	EPA 8270C	Acenaphthylene
117.110	007	EPA 8270C	Aniline
117.110	008	EPA 8270C	Anthracene
117.110	010	EPA 8270C	Benzidine
117.110	011	EPA 8270C	Benz(a)anthracene
117.110	012	EPA 8270C	Benzo(b)fluoranthene
117.110	013	EPA 8270C	Benzo(k)fluoranthene
117.110	014	EPA 8270C	Benzo(g,h,i)perylene
117.110	015	EPA 8270C	Benzo(a)pyrene
117.110	016	EPA 8270C	Benzoic Acid
117.110	018	EPA 8270C	Benzyl Alcohol
117.110	019	EPA 8270C	Benzyl Butyl Phthalate
117.110	020	EPA 8270C	bis(2-chloroethoxy)methane
117.110	021	EPA 8270C	bis(2-chloroethyl) Ether
117.110	022	EPA 8270C	Bis(2-chloroisopropyl) Ether
117.110	023	EPA 8270C	Di(2-ethylhexyl) Phthalate
117.110	024	EPA 8270C	4-Bromophenyl Phenyl Ether
117.110	025	EPA 8270C	Carbazole
117.110	026	EPA 8270C	4-Chloroaniline
117.110	027	EPA 8270C	4-Chloro-3-methylphenol
117.110	029	EPA 8270C	2-Chloronaphthalene
117.110	030	EPA 8270C	2-Chlorophenol
117.110	031	EPA 8270C	4-Chlorophenyl Phenyl Ether

117.110	032	EPA 8270C	Chrysene
117.110	036	EPA 8270C	Dibenz(a,h)anthracene
117.110	037	EPA 8270C	Dibenzofuran
117.110	039	EPA 8270C	1,2-Dichlorobenzene
117.110	040	EPA 8270C	1,3-Dichlorobenzene
117.110	041	EPA 8270C	1,4-Dichlorobenzene
117.110	042	EPA 8270C	3,3'-Dichlorobenzidine
117.110	043	EPA 8270C	2,4-Dichlorophenol
117.110	044	EPA 8270C	2,6-Dichlorophenol
117.110	045	EPA 8270C	Diethyl Phthalate
117.110	053	EPA 8270C	2,4-Dimethylphenol
117.110	054	EPA 8270C	Dimethyl Phthalate
117.110	055	EPA 8270C	Di-n-butyl phthalate
117.110	056	EPA 8270C	Di-n-octyl phthalate
117.110	060	EPA 8270C	2,4-Dinitrophenol
117.110	061	EPA 8270C	2,4-Dinitrotoluene
117.110	062	EPA 8270C	2,6-Dinitrotoluene
117.110	067	EPA 8270C	Fluoranthene
117.110	068	EPA 8270C	Fluorene
117.110	069	EPA 8270C	Hexachlorobenzene
117.110	070	EPA 8270C	Hexachlorobutadiene
117.110	071	EPA 8270C	Hexachlorocyclopentadiene
117.110	072	EPA 8270C	Hexachloroethane
117.110	075	EPA 8270C	Indeno(1,2,3-c,d)pyrene
117.110	076	EPA 8270C	Isophorone
117.110	080	EPA 8270C	2-Methyl-4,6-dinitrophenol
117.110	083	EPA 8270C	2-Methylnaphthalene
117.110	084	EPA 8270C	2-Methylphenol
117.110	085	EPA 8270C	3-Methylphenol
117.110	086	EPA 8270C	4-Methylphenol
117.110	087	EPA 8270C	Naphthalene
117.110	092	EPA 8270C	2-Nitroaniline
117.110	093	EPA 8270C	3-Nitroaniline
117.110	094	EPA 8270C	4-Nitroaniline
117.110	095	EPA 8270C	Nitrobenzene
117.110	096	EPA 8270C	2-Nitrophenol
117.110	097	EPA 8270C	4-Nitrophenol
117.110	099	EPA 8270C	N-nitrosodiethylamine
117.110	100	EPA 8270C	N-nitrosodimethylamine
117.110	101	EPA 8270C	N-nitroso-di-n-propylamine
117.110	102	EPA 8270C	N-nitrosodiphenylamine

As of 8/12/2013 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

117.110	110	EPA 8270C	Pentachlorophenol
117.110	112	EPA 8270C	Phenanthrene
117.110	113	EPA 8270C	Phenol
117.110	119	EPA 8270C	Pyrene
117.110	120	EPA 8270C	Pyridine
117.110	125	EPA 8270C	2,3,4,6-Tetrachlorophenol
117.110	129	EPA 8270C	1,2,4-Trichlorobenzene
117.110	130	EPA 8270C	2,4,5-Trichlorophenol
117.110	131	EPA 8270C	2,4,6-Trichlorophenol
117.111	073	EPA 8270C	Polynuclear Aromatic Hydrocarbons
117.111	074	EPA 8270C	Adipates
117.111	075	EPA 8270C	Phthalates
117.111	076	EPA 8270C	Other Extractables
117.130	000	EPA 8290	Dioxins and Dibenzofurans
117.130	001	EPA 8290	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
117.130	002	EPA 8290	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)
117.130	003	EPA 8290	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	004	EPA 8290	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	005	EPA 8290	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	006	EPA 8290	2,3,7,8-Tetrachlorodibenzofuran (TCDF)
117.130	007	EPA 8290	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)
117.130	008	EPA 8290	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)
117.130	009	EPA 8290	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	010	EPA 8290	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	011	EPA 8290	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)
117.130	012	EPA 8290	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	013	EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)
117.130	014	EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)
117.130	015	EPA 8290	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)
117.130	016	EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)
117.130	017	EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)
117.171	000	EPA 8330A	Nitroaromatics and Nitramines
117.171	001	EPA 8330A	4-Amino-2,6-dinitrotoluene
117.171	002	EPA 8330A	2-Amino-4,6-dinitrotoluene
117.171	003	EPA 8330A	1,3-Dinitrobenzene
117.171	004	EPA 8330A	2,4-Dinitrotoluene
117.171	005	EPA 8330A	2,6-Dinitrotoluene
117.171	006	EPA 8330A	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
117.171	007	EPA 8330A	Methyl-2,4,6-trinitrophenylnitramine
117.171	008	EPA 8330A	Nitrobenzene
117.171	009	EPA 8330A	2-Nitrotoluene

117.171	010	EPA 8330A	3-Nitrotoluene
117.171	011	EPA 8330A	4-Nitrotoluene
117.171	012	EPA 8330A	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
117.171	013	EPA 8330A	1,3,5-Trinitrobenzene
117.171	014	EPA 8330A	2,4,6-Trinitrotoluene
117.210	001	EPA 8081A	Aldrin
117.210	002	EPA 8081A	a-BHC
117.210	003	EPA 8081A	b-BHC
117.210	004	EPA 8081A	d-BHC
117.210	005	EPA 8081A	g-BHC (Lindane)
117.210	007	EPA 8081A	a-Chlordane
117.210	008	EPA 8081A	g-Chlordane
117.210	009	EPA 8081A	Chlordane (tech.)
117.210	013	EPA 8081A	4,4'-DDD
117.210	014	EPA 8081A	4,4'-DDE
117.210	015	EPA 8081A	4,4'-DDT
117.210	020	EPA 8081A	Dieldrin
117.210	021	EPA 8081A	Endosulfan I
117.210	022	EPA 8081A	Endosulfan II
117.210	023	EPA 8081A	Endosulfan Sulfate
117.210	024	EPA 8081A	Endrin
117.210	025	EPA 8081A	Endrin Aldehyde
117.210	026	EPA 8081A	Endrin Ketone
117.210	027	EPA 8081A	Heptachlor
117.210	028	EPA 8081A	Heptachlor Epoxide
117.210	033	EPA 8081A	Methoxychlor
117.210	039	EPA 8081A	Toxaphene
117.220	000	EPA 8082	PCBs
117.220	001	EPA 8082	PCB-1016
117.220	002	EPA 8082	PCB-1221
117.220	003	EPA 8082	PCB-1232
117.220	004	EPA 8082	PCB-1242
117.220	005	EPA 8082	PCB-1248
117.220	006	EPA 8082	PCB-1254
117.220	007	EPA 8082	PCB-1260
117.220	008	EPA 8082	2-Chlorobiphenyl
117.220	009	EPA 8082	2,3-Dichlorobiphenyl
117.220	010	EPA 8082	2,2',5-Trichlorobiphenyl
117.220	011	EPA 8082	2,4',5-Trichlorobiphenyl
117.220	012	EPA 8082	2,2',3,5'-Tetrachlorobiphenyl
117.220	013	EPA 8082	2,2',5,5'-Tetrachlorobiphenyl

117.220	014	EPA 8082	2,3',4,4'-Tetrachlorobiphenyl
117.220	015	EPA 8082	2,2',3,4,5'-Pentachlorobiphenyl
117.220	016	EPA 8082	2,2',4,5,5'-Pentachlorobiphenyl
117.220	017	EPA 8082	2,3,3',4',6-Pentachlorobiphenyl
117.220	018	EPA 8082	2,2',3,4,4',5'-Hexachlorobiphenyl
117.220	019	EPA 8082	2,2',3,4,5,5'-Hexachlorobiphenyl
117.220	020	EPA 8082	2,2',3,5,5',6-Hexachlorobiphenyl
117.220	021	EPA 8082	2,2',4,4',5,5'-Hexachlorobiphenyl
117.220	022	EPA 8082	2,2',3,3',4,4',5-Heptachlorobiphenyl
117.220	023	EPA 8082	2,2',3,4,4',5,5'-Heptachlorobiphenyl
117.220	024	EPA 8082	2,2',3,4,4',5',6-Heptachlorobiphenyl
117.220	025	EPA 8082	2,2',3,4',5,5',6-Heptachlorobiphenyl
117.220	026	EPA 8082	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl
117.240	001	EPA 8141A	Atrazine
117.240	002	EPA 8141A	Azinphos Methyl
117.240	005	EPA 8141A	Chlorpyrifos
117.240	007	EPA 8141A	Demeton-O
117.240	008	EPA 8141A	Demeton-S
117.240	009	EPA 8141A	Diazinon
117.240	010	EPA 8141A	Dimethoate
117.240	011	EPA 8141A	Disulfoton
117.240	012	EPA 8141A	EPN
117.240	013	EPA 8141A	Ethion
117.240	014	EPA 8141A	Famphur
117.240	015	EPA 8141A	Malathion
117.240	016	EPA 8141A	Mevinphos
117.240	017	EPA 8141A	Naled
117.240	018	EPA 8141A	Parathion Ethyl
117.240	019	EPA 8141A	Parathion Methyl
117.240	020	EPA 8141A	Phorate
117.240	022	EPA 8141A	Ronnel
117.240	023	EPA 8141A	Simazine
117.240	024	EPA 8141A	Sulfotepp
117.250	001	EPA 8151A	2,4-D
117.250	002	EPA 8151A	2,4-DB
117.250	003	EPA 8151A	2,4,5-T
117.250	004	EPA 8151A	2,4,5-TP
117.250	006	EPA 8151A	Dalapon
117.250	007	EPA 8151A	Dichlorprop
117.250	008	EPA 8151A	Dinoseb
117.250	009	EPA 8151A	MCPA

117.250	010	EPA 8151A	MCPP
117.250	011	EPA 8151A	4-Nitrophenol
117.250	012	EPA 8151A	Pentachlorophenol
117.250	013	EPA 8151A	Picloram
117.250	014	EPA 8151A	Dicamba
117.250	015	EPA 8151A	3,5-Dichlorobenzoic Acid
117.250	016	EPA 8151A	Acifluorfen
117.250	017	EPA 8151A	Bentazon
117.250	019	EPA 8151A	DCPA
117.280	001	EPA 8321A	Aldicarb
117.280	002	EPA 8321A	Aldicarb Sulfone
117.280	004	EPA 8321A	Barban
117.280	005	EPA 8321A	Bromacil
117.280	006	EPA 8321A	Carbaryl
117.280	008	EPA 8321A	Carbofuran
117.280	009	EPA 8321A	Chloroxuron
117.280	010	EPA 8321A	Diuron
117.280	011	EPA 8321A	Linuron
117.280	012	EPA 8321A	Methiocarb
117.280	013	EPA 8321A	Methomyl

NELAP - RECOGNIZED

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF NELAP ACCREDITATION

Is hereby granted to

APPL, Inc. (Agriculture & Priority Pollutants Laboratories, Inc.)

908 North Temperance Avenue

Clovis, CA 93611

Scope of the Certificate is limited to the
"NELAP Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **05233CA**

Expiration Date: **1/31/2013**

Effective Date: **2/1/2012**

Richmond, California
subject to forfeiture or revocation

George C. Kulasingam, Ph.D., Chief
Environmental Laboratory Accreditation Program Branch

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM - NELAP RECOGNIZED

NELAP Fields of Accreditation

APPL, Inc. (Agriculture & Priority Pollutants Laboratories, Inc.)

908 North Temperance Avenue
Clovis, CA 93611
Phone: (559) 275-2175

Certificate No.: 05233CA
Renew Date: 1/31/2013

114 - Inorganic Chemistry of Hazardous Waste

114.010	001	EPA 6010B	Antimony
114.010	002	EPA 6010B	Arsenic
114.010	003	EPA 6010B	Barium
114.010	004	EPA 6010B	Beryllium
114.010	005	EPA 6010B	Cadmium
114.010	006	EPA 6010B	Chromium
114.010	007	EPA 6010B	Cobalt
114.010	008	EPA 6010B	Copper
114.010	009	EPA 6010B	Lead
114.010	010	EPA 6010B	Molybdenum
114.010	011	EPA 6010B	Nickel
114.010	012	EPA 6010B	Selenium
114.010	013	EPA 6010B	Silver
114.010	014	EPA 6010B	Thallium
114.010	015	EPA 6010B	Vanadium
114.010	016	EPA 6010B	Zinc
114.020	001	EPA 6020	Antimony
114.020	002	EPA 6020	Arsenic
114.020	003	EPA 6020	Barium
114.020	004	EPA 6020	Beryllium
114.020	005	EPA 6020	Cadmium
114.020	006	EPA 6020	Chromium
114.020	007	EPA 6020	Cobalt
114.020	008	EPA 6020	Copper
114.020	009	EPA 6020	Lead
114.020	010	EPA 6020	Molybdenum
114.020	011	EPA 6020	Nickel
114.020	012	EPA 6020	Selenium
114.020	013	EPA 6020	Silver
114.020	014	EPA 6020	Thallium
114.020	015	EPA 6020	Vanadium
114.020	016	EPA 6020	Zinc
114.103	001	EPA 7196A	Chromium (VI)

114.106	001	EPA 7199	Chromium (VI)
114.140	001	EPA 7470A	Mercury
114.141	001	EPA 7471A	Mercury
114.222	001	EPA 9014	Cyanide
114.240	001	EPA 9040B	Corrosivity - pH Determination
114.241	001	EPA 9045C	Corrosivity - pH Determination
114.250	001	EPA 9056	Fluoride
114.270	001	EPA 9214	Fluoride

115 - Extraction Test of Hazardous Waste

115.020	001	EPA 1311	Toxicity Characteristic Leaching Procedure (TCLP)
115.030	001	CCR Chapter11, Article 5, Appendix II	Waste Extraction Test (WET)
115.040	001	EPA 1312	Synthetic Precipitation Leaching Procedure (SPLP)

116 - Volatile Organic Chemistry of Hazardous Waste

116.010	000	EPA 8011	EDB and DBCP
116.010	001	EPA 8011	1,2-Dibromoethane
116.010	002	EPA 8011	Dibromochloropropane
116.030	001	EPA 8015B	Gasoline-range Organics
116.040	002	EPA 8021B	Benzene
116.040	039	EPA 8021B	Ethylbenzene
116.040	041	EPA 8021B	Methyl tert-butyl Ether (MTBE)
116.040	047	EPA 8021B	Toluene
116.040	056	EPA 8021B	Xylenes, Total
116.040	062	EPA 8021B	BTEX
116.080	001	EPA 8260B	Acetone
116.080	003	EPA 8260B	Acrolein
116.080	004	EPA 8260B	Acrylonitrile
116.080	007	EPA 8260B	Benzene
116.080	010	EPA 8260B	Bromochloromethane
116.080	011	EPA 8260B	Bromodichloromethane
116.080	012	EPA 8260B	Bromoform
116.080	013	EPA 8260B	Bromomethane
116.080	015	EPA 8260B	Carbon Disulfide
116.080	016	EPA 8260B	Carbon Tetrachloride
116.080	018	EPA 8260B	Chlorobenzene
116.080	019	EPA 8260B	Chloroethane
116.080	020	EPA 8260B	2-Chloroethyl Vinyl Ether
116.080	021	EPA 8260B	Chloroform
116.080	022	EPA 8260B	Chloromethane
116.080	026	EPA 8260B	Dibromochloromethane
116.080	027	EPA 8260B	Dibromochloropropane
116.080	028	EPA 8260B	1,2-Dibromoethane

116.080	030	EPA 8260B	Dibromomethane
116.080	031	EPA 8260B	1,2-Dichlorobenzene
116.080	032	EPA 8260B	1,3-Dichlorobenzene
116.080	033	EPA 8260B	1,4-Dichlorobenzene
116.080	036	EPA 8260B	Dichlorodifluoromethane
116.080	037	EPA 8260B	1,1-Dichloroethane
116.080	038	EPA 8260B	1,2-Dichloroethane
116.080	039	EPA 8260B	1,1-Dichloroethene
116.080	040	EPA 8260B	trans-1,2-Dichloroethene
116.080	041	EPA 8260B	cis-1,2-Dichloroethene
116.080	042	EPA 8260B	1,2-Dichloropropane
116.080	043	EPA 8260B	1,3-Dichloropropane
116.080	044	EPA 8260B	2,2-Dichloropropane
116.080	045	EPA 8260B	1,1-Dichloropropene
116.080	046	EPA 8260B	cis-1,3-Dichloropropene
116.080	047	EPA 8260B	trans-1,3-Dichloropropene
116.080	053	EPA 8260B	Ethylbenzene
116.080	056	EPA 8260B	Hexachlorobutadiene
116.080	057	EPA 8260B	Hexachloroethane
116.080	058	EPA 8260B	2-Hexanone (MBK)
116.080	064	EPA 8260B	Methyl tert-butyl Ether (MTBE)
116.080	065	EPA 8260B	Methylene Chloride
116.080	066	EPA 8260B	Methyl Ethyl Ketone
116.080	068	EPA 8260B	4-Methyl-2-pentanone (MIBK)
116.080	069	EPA 8260B	Naphthalene
116.080	081	EPA 8260B	1,1,1,2-Tetrachloroethane
116.080	082	EPA 8260B	1,1,2,2-Tetrachloroethane
116.080	083	EPA 8260B	Tetrachloroethene
116.080	084	EPA 8260B	Toluene
116.080	086	EPA 8260B	1,2,3-Trichlorobenzene
116.080	087	EPA 8260B	1,2,4-Trichlorobenzene
116.080	088	EPA 8260B	1,1,1-Trichloroethane
116.080	089	EPA 8260B	1,1,2-Trichloroethane
116.080	090	EPA 8260B	Trichloroethene
116.080	091	EPA 8260B	Trichlorofluoromethane
116.080	092	EPA 8260B	1,2,3-Trichloropropane
116.080	093	EPA 8260B	Vinyl Acetate
116.080	094	EPA 8260B	Vinyl Chloride
116.080	095	EPA 8260B	Xylenes, Total
116.080	096	EPA 8260B	tert-Amyl Methyl Ether (TAME)
116.080	097	EPA 8260B	tert-Butyl Alcohol (TBA)

116.080	098	EPA 8260B	Ethyl tert-butyl Ether (ETBE)
116.080	099	EPA 8260B	Bromobenzene
116.080	100	EPA 8260B	n-Butylbenzene
116.080	101	EPA 8260B	sec-Butylbenzene
116.080	102	EPA 8260B	tert-Butylbenzene
116.080	103	EPA 8260B	2-Chlorotoluene
116.080	104	EPA 8260B	4-Chlorotoluene
116.080	105	EPA 8260B	Isopropylbenzene
116.080	106	EPA 8260B	N-propylbenzene
116.080	107	EPA 8260B	Styrene
116.080	108	EPA 8260B	1,2,4-Trimethylbenzene
116.080	109	EPA 8260B	1,3,5-Trimethylbenzene
116.080	120	EPA 8260B	Oxygenates

117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	EPA 8015B	Diesel-range Total Petroleum Hydrocarbons
117.110	001	EPA 8270C	Acenaphthene
117.110	002	EPA 8270C	Acenaphthylene
117.110	007	EPA 8270C	Aniline
117.110	008	EPA 8270C	Anthracene
117.110	010	EPA 8270C	Benzidine
117.110	011	EPA 8270C	Benz(a)anthracene
117.110	012	EPA 8270C	Benzo(b)fluoranthene
117.110	013	EPA 8270C	Benzo(k)fluoranthene
117.110	014	EPA 8270C	Benzo(g,h,i)perylene
117.110	015	EPA 8270C	Benzo(a)pyrene
117.110	016	EPA 8270C	Benzoic Acid
117.110	018	EPA 8270C	Benzyl Alcohol
117.110	019	EPA 8270C	Benzyl Butyl Phthalate
117.110	020	EPA 8270C	bis(2-chloroethoxy)methane
117.110	021	EPA 8270C	bis(2-chloroethyl) Ether
117.110	022	EPA 8270C	Bis(2-chloroisopropyl) Ether
117.110	023	EPA 8270C	Di(2-ethylhexyl) Phthalate
117.110	024	EPA 8270C	4-Bromophenyl Phenyl Ether
117.110	025	EPA 8270C	Carbazole
117.110	026	EPA 8270C	4-Chloroaniline
117.110	027	EPA 8270C	4-Chloro-3-methylphenol
117.110	029	EPA 8270C	2-Chloronaphthalene
117.110	030	EPA 8270C	2-Chlorophenol
117.110	031	EPA 8270C	4-Chlorophenyl Phenyl Ether
117.110	032	EPA 8270C	Chrysene
117.110	036	EPA 8270C	Dibenz(a,h)anthracene

117.110	037	EPA 8270C	Dibenzofuran
117.110	039	EPA 8270C	1,2-Dichlorobenzene
117.110	040	EPA 8270C	1,3-Dichlorobenzene
117.110	041	EPA 8270C	1,4-Dichlorobenzene
117.110	042	EPA 8270C	3,3'-Dichlorobenzidine
117.110	043	EPA 8270C	2,4-Dichlorophenol
117.110	044	EPA 8270C	2,6-Dichlorophenol
117.110	045	EPA 8270C	Diethyl Phthalate
117.110	053	EPA 8270C	2,4-Dimethylphenol
117.110	054	EPA 8270C	Dimethyl Phthalate
117.110	055	EPA 8270C	Di-n-butyl phthalate
117.110	056	EPA 8270C	Di-n-octyl phthalate
117.110	060	EPA 8270C	2,4-Dinitrophenol
117.110	061	EPA 8270C	2,4-Dinitrotoluene
117.110	062	EPA 8270C	2,6-Dinitrotoluene
117.110	067	EPA 8270C	Fluoranthene
117.110	068	EPA 8270C	Fluorene
117.110	069	EPA 8270C	Hexachlorobenzene
117.110	070	EPA 8270C	Hexachlorobutadiene
117.110	071	EPA 8270C	Hexachlorocyclopentadiene
117.110	072	EPA 8270C	Hexachloroethane
117.110	075	EPA 8270C	Indeno(1,2,3-c,d)pyrene
117.110	076	EPA 8270C	Isophorone
117.110	080	EPA 8270C	2-Methyl-4,6-dinitrophenol
117.110	083	EPA 8270C	2-Methylnaphthalene
117.110	084	EPA 8270C	2-Methylphenol
117.110	085	EPA 8270C	3-Methylphenol
117.110	086	EPA 8270C	4-Methylphenol
117.110	087	EPA 8270C	Naphthalene
117.110	092	EPA 8270C	2-Nitroaniline
117.110	093	EPA 8270C	3-Nitroaniline
117.110	094	EPA 8270C	4-Nitroaniline
117.110	095	EPA 8270C	Nitrobenzene
117.110	096	EPA 8270C	2-Nitrophenol
117.110	097	EPA 8270C	4-Nitrophenol
117.110	100	EPA 8270C	N-nitrosodimethylamine
117.110	101	EPA 8270C	N-nitroso-di-n-propylamine
117.110	102	EPA 8270C	N-nitrosodiphenylamine
117.110	110	EPA 8270C	Pentachlorophenol
117.110	112	EPA 8270C	Phenanthrene
117.110	113	EPA 8270C	Phenol

117.110	119	EPA 8270C	Pyrene
117.110	120	EPA 8270C	Pyridine
117.110	125	EPA 8270C	2,3,4,6-Tetrachlorophenol
117.110	129	EPA 8270C	1,2,4-Trichlorobenzene
117.110	130	EPA 8270C	2,4,5-Trichlorophenol
117.110	131	EPA 8270C	2,4,6-Trichlorophenol
117.111	073	EPA 8270C	Polynuclear Aromatic Hydrocarbons
117.111	074	EPA 8270C	Adipates
117.111	075	EPA 8270C	Phthalates
117.111	076	EPA 8270C	Other Extractables
117.130	000	EPA 8290	Dioxins and Dibenzofurans
117.130	001	EPA 8290	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
117.130	002	EPA 8290	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)
117.130	003	EPA 8290	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	004	EPA 8290	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	005	EPA 8290	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	006	EPA 8290	2,3,7,8-Tetrachlorodibenzofuran (TCDF)
117.130	007	EPA 8290	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)
117.130	008	EPA 8290	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)
117.130	009	EPA 8290	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	010	EPA 8290	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	011	EPA 8290	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)
117.130	012	EPA 8290	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	013	EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)
117.130	014	EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)
117.130	015	EPA 8290	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)
117.130	016	EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)
117.130	017	EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)
117.171	000	EPA 8330A	Nitroaromatics and Nitramines
117.171	001	EPA 8330A	4-Amino-2,6-dinitrotoluene
117.171	002	EPA 8330A	2-Amino-4,6-dinitrotoluene
117.171	003	EPA 8330A	1,3-Dinitrobenzene
117.171	004	EPA 8330A	2,4-Dinitrotoluene
117.171	005	EPA 8330A	2,6-Dinitrotoluene
117.171	006	EPA 8330A	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
117.171	007	EPA 8330A	Methyl-2,4,6-trinitrophenylnitramine
117.171	008	EPA 8330A	Nitrobenzene
117.171	009	EPA 8330A	2-Nitrotoluene
117.171	010	EPA 8330A	3-Nitrotoluene
117.171	011	EPA 8330A	4-Nitrotoluene
117.171	012	EPA 8330A	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

117.171	013	EPA 8330A	1,3,5-Trinitrobenzene
117.171	014	EPA 8330A	2,4,6-Trinitrotoluene
117.210	001	EPA 8081A	Aldrin
117.210	002	EPA 8081A	a-BHC
117.210	003	EPA 8081A	b-BHC
117.210	004	EPA 8081A	d-BHC
117.210	005	EPA 8081A	g-BHC (Lindane)
117.210	007	EPA 8081A	a-Chlordane
117.210	008	EPA 8081A	g-Chlordane
117.210	009	EPA 8081A	Chlordane (tech.)
117.210	013	EPA 8081A	4,4'-DDD
117.210	014	EPA 8081A	4,4'-DDE
117.210	015	EPA 8081A	4,4'-DDT
117.210	020	EPA 8081A	Dieldrin
117.210	021	EPA 8081A	Endosulfan I
117.210	022	EPA 8081A	Endosulfan II
117.210	023	EPA 8081A	Endosulfan Sulfate
117.210	024	EPA 8081A	Endrin
117.210	025	EPA 8081A	Endrin Aldehyde
117.210	026	EPA 8081A	Endrin Ketone
117.210	027	EPA 8081A	Heptachlor
117.210	028	EPA 8081A	Heptachlor Epoxide
117.210	033	EPA 8081A	Methoxychlor
117.210	039	EPA 8081A	Toxaphene
117.220	000	EPA 8082	PCBs
117.220	001	EPA 8082	PCB-1016
117.220	002	EPA 8082	PCB-1221
117.220	003	EPA 8082	PCB-1232
117.220	004	EPA 8082	PCB-1242
117.220	005	EPA 8082	PCB-1248
117.220	006	EPA 8082	PCB-1254
117.220	007	EPA 8082	PCB-1260
117.240	002	EPA 8141A	Azinphos Methyl
117.240	005	EPA 8141A	Chlorpyrifos
117.240	007	EPA 8141A	Demeton-O
117.240	008	EPA 8141A	Demeton-S
117.240	009	EPA 8141A	Diazinon
117.240	010	EPA 8141A	Dimethoate
117.240	011	EPA 8141A	Disulfoton
117.240	012	EPA 8141A	EPN
117.240	013	EPA 8141A	Ethion

117.240	014	EPA 8141A	Famphur
117.240	015	EPA 8141A	Malathion
117.240	016	EPA 8141A	Mevinphos
117.240	017	EPA 8141A	Naled
117.240	018	EPA 8141A	Parathion Ethyl
117.240	019	EPA 8141A	Parathion Methyl
117.240	020	EPA 8141A	Phorate
117.240	022	EPA 8141A	Ronnel
117.240	023	EPA 8141A	Simazine
117.240	024	EPA 8141A	Sulfotepp
117.250	001	EPA 8151A	2,4-D
117.250	002	EPA 8151A	2,4-DB
117.250	003	EPA 8151A	2,4,5-T
117.250	004	EPA 8151A	2,4,5-TP
117.250	006	EPA 8151A	Dalapon
117.250	007	EPA 8151A	Dichlorprop
117.250	008	EPA 8151A	Dinoseb
117.250	009	EPA 8151A	MCPA
117.250	010	EPA 8151A	MCPP
117.250	011	EPA 8151A	4-Nitrophenol
117.250	012	EPA 8151A	Pentachlorophenol
117.250	013	EPA 8151A	Picloram
117.250	014	EPA 8151A	Dicamba
117.250	015	EPA 8151A	3,5-Dichlorobenzoic Acid
117.250	016	EPA 8151A	Acifluorfen
117.250	017	EPA 8151A	Bentazon
117.250	019	EPA 8151A	DCPA
117.280	001	EPA 8321A	Aldicarb
117.280	002	EPA 8321A	Aldicarb Sulfone
117.280	004	EPA 8321A	Barban
117.280	005	EPA 8321A	Bromacil
117.280	006	EPA 8321A	Carbaryl
117.280	008	EPA 8321A	Carbofuran
117.280	009	EPA 8321A	Chloroxuron
117.280	010	EPA 8321A	Diuron
117.280	011	EPA 8321A	Linuron
117.280	012	EPA 8321A	Methiocarb
117.280	013	EPA 8321A	Methomyl
117.290	008	EPA 8321A	Dinoseb

RON CHAPMAN, MD, MPH
Director & State Health Officer

State of California—Health and Human Services Agency

California Department of Public Health

EDMUND G. BROWN JR.
Governor

July 6, 2012

Tu Nisamaneepong, Ph.D.
EMAX Laboratories, Inc.
1835 West 205th Street
Torrance, CA 90501

Dear Tu Nisamaneepong, Ph.D.: Certificate No. 02116CA

This is to advise you that the laboratory named above has been accredited under National Environmental Laboratory Accreditation Program (NELAP) as an environmental testing laboratory pursuant to the provisions of the Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100825, *et seq.*

The Fields of Accreditation for which this laboratory has been accredited are enclosed. The certificate shall remain in effect until **August 31, 2013** unless revoked by California Environmental Laboratory Accreditation Program Branch (ELAPB) or withdrawn at your written request. To maintain accreditation, the laboratory shall comply with the National Environmental Laboratory Accreditation Conference (NELAC) Standards and all associated California ELAPB regulations and statutes.

The application for renewal of this certificate must be received before the expiration date of this certificate to remain in force according to the HSC 100847(a).

Please note that your laboratory is required to notify California ELAPB of any major changes in key accreditation criteria within 30 calendar days of the change. This written notification includes, but is not limited to, changes in ownership, location, key personnel, and major instrumentation (HSC 100847(b), (c), (d), and NELAC Standard Section 4.3.2). The certificate must be returned to California ELAPB upon loss of accredited status.

Your continued cooperation with the above requirements is essential for maintaining the high quality of the data produced by environmental laboratories accredited by the State of California.

If you have any questions, please contact at .

Sincerely,

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

Enclosure

NELAP - RECOGNIZED

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF NELAP ACCREDITATION

is hereby granted to

EMAX Laboratories, Inc.

1835 West 205th Street

Torrance, CA 90501

Scope of the Certificate is limited to the
"NELAP Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **02116CA**

Expiration Date: **8/31/2013**

Effective Date: **9/1/2012**

Richmond, California
subject to forfeiture or revocation

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

NELAP RECOGNIZED

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

NELAP Fields of Accreditation

EMAX Laboratories, Inc.

1835 West 205th Street
Torrance, CA 90501
Phone: (310) 618-8889

Certificate No.: 02116CA
Renew Date: 8/31/2013

102 - Inorganic Chemistry of Drinking Water

102.020	001	EPA 180.1	Turbidity
102.022	001	SM2130B	Turbidity
102.030	001	EPA 300.0	Bromide
102.030	003	EPA 300.0	Chloride
102.030	005	EPA 300.0	Fluoride
102.030	006	EPA 300.0	Nitrate
102.030	007	EPA 300.0	Nitrite
102.030	008	EPA 300.0	Phosphate, Ortho
102.030	010	EPA 300.0	Sulfate
102.045	001	EPA 314.0	Perchlorate
102.100	001	SM2320B	Alkalinity
102.120	001	SM2340B	Hardness
102.121	001	SM2340C	Hardness
102.130	001	SM2510B	Conductivity
102.140	001	SM2540C	Total Dissolved Solids
102.145	001	EPA 160.1	Total Dissolved Solids
102.150	001	SM4110B	Chloride
102.150	002	SM4110B	Fluoride
102.150	003	SM4110B	Nitrate
102.150	004	SM4110B	Nitrite
102.150	005	SM4110B	Phosphate, Ortho
102.150	006	SM4110B	Sulfate
102.170	001	SM4500-Cl-B	Chloride
102.190	001	SM4500-CN E	Cyanide, Total
102.200	001	SM4500-F C	Fluoride
102.210	001	SM4500-H+B	pH
102.212	001	EPA 150.1	pH
102.220	001	SM4500-NO2 B	Nitrite
102.232	002	SM4500 NO3 E	Nitrate
102.240	001	SM4500-P E	Phosphate, Ortho
102.260	001	SM5310B	Total Organic Carbon
102.520	001	EPA 200.7	Calcium
102.520	002	EPA 200.7	Magnesium
102.520	003	EPA 200.7	Potassium

As of 7/6/2012 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

102.520	005	EPA 200.7	Sodium
102.520	006	EPA 200.7	Hardness (calc.)

103 - Toxic Chemical Elements of Drinking Water

103.130	001	EPA 200.7	Aluminum
103.130	003	EPA 200.7	Barium
103.130	004	EPA 200.7	Beryllium
103.130	005	EPA 200.7	Cadmium
103.130	007	EPA 200.7	Chromium
103.130	008	EPA 200.7	Copper
103.130	009	EPA 200.7	Iron
103.130	011	EPA 200.7	Manganese
103.130	012	EPA 200.7	Nickel
103.130	015	EPA 200.7	Silver
103.130	017	EPA 200.7	Zinc
103.140	001	EPA 200.8	Aluminum
103.140	002	EPA 200.8	Antimony
103.140	003	EPA 200.8	Arsenic
103.140	004	EPA 200.8	Barium
103.140	005	EPA 200.8	Beryllium
103.140	006	EPA 200.8	Cadmium
103.140	007	EPA 200.8	Chromium
103.140	008	EPA 200.8	Copper
103.140	009	EPA 200.8	Lead
103.140	010	EPA 200.8	Manganese
103.140	012	EPA 200.8	Nickel
103.140	013	EPA 200.8	Selenium
103.140	014	EPA 200.8	Silver
103.140	015	EPA 200.8	Thallium
103.140	016	EPA 200.8	Zinc
103.160	001	EPA 245.1	Mercury
103.310	001	EPA 218.6	Chromium (VI)

104 - Volatile Organic Chemistry of Drinking Water

104.030	001	EPA 504.1	1,2-Dibromoethane
104.030	002	EPA 504.1	1,2-Dibromo-3-chloropropane
104.030	004	EPA 504.1	EDB and DBCP
104.040	000	EPA 524.2	Volatile Organic Compounds
104.040	001	EPA 524.2	Benzene
104.040	002	EPA 524.2	Bromobenzene
104.040	003	EPA 524.2	Bromochloromethane
104.040	006	EPA 524.2	Bromomethane
104.040	007	EPA 524.2	n-Butylbenzene
104.040	008	EPA 524.2	sec-Butylbenzene

104.040	009	EPA 524.2	tert-Butylbenzene
104.040	010	EPA 524.2	Carbon Tetrachloride
104.040	011	EPA 524.2	Chlorobenzene
104.040	012	EPA 524.2	Chloroethane
104.040	014	EPA 524.2	Chloromethane
104.040	015	EPA 524.2	2-Chlorotoluene
104.040	016	EPA 524.2	4-Chlorotoluene
104.040	018	EPA 524.2	Dibromomethane
104.040	019	EPA 524.2	1,3-Dichlorobenzene
104.040	020	EPA 524.2	1,2-Dichlorobenzene
104.040	021	EPA 524.2	1,4-Dichlorobenzene
104.040	022	EPA 524.2	Dichlorodifluoromethane
104.040	023	EPA 524.2	1,1-Dichloroethane
104.040	024	EPA 524.2	1,2-Dichloroethane
104.040	025	EPA 524.2	1,1-Dichloroethene
104.040	026	EPA 524.2	cis-1,2-Dichloroethene
104.040	027	EPA 524.2	trans-1,2-Dichloroethene
104.040	028	EPA 524.2	Dichloromethane
104.040	029	EPA 524.2	1,2-Dichloropropane
104.040	030	EPA 524.2	1,3-Dichloropropane
104.040	031	EPA 524.2	2,2-Dichloropropane
104.040	032	EPA 524.2	1,1-Dichloropropene
104.040	033	EPA 524.2	cis-1,3-Dichloropropene
104.040	034	EPA 524.2	trans-1,3-Dichloropropene
104.040	035	EPA 524.2	Ethylbenzene
104.040	036	EPA 524.2	Hexachlorobutadiene
104.040	037	EPA 524.2	Isopropylbenzene
104.040	038	EPA 524.2	4-Isopropyltoluene
104.040	039	EPA 524.2	Naphthalene
104.040	040	EPA 524.2	Nitrobenzene
104.040	041	EPA 524.2	N-propylbenzene
104.040	042	EPA 524.2	Styrene
104.040	043	EPA 524.2	1,1,1,2-Tetrachloroethane
104.040	044	EPA 524.2	1,1,2,2-Tetrachloroethane
104.040	045	EPA 524.2	Tetrachloroethene
104.040	046	EPA 524.2	Toluene
104.040	047	EPA 524.2	1,2,3-Trichlorobenzene
104.040	048	EPA 524.2	1,2,4-Trichlorobenzene
104.040	049	EPA 524.2	1,1,1-Trichloroethane
104.040	050	EPA 524.2	1,1,2-Trichloroethane
104.040	051	EPA 524.2	Trichloroethene
104.040	052	EPA 524.2	Trichlorofluoromethane

104.040	053	EPA 524.2	1,2,3-Trichloropropane
104.040	054	EPA 524.2	1,2,4-Trimethylbenzene
104.040	055	EPA 524.2	1,3,5-Trimethylbenzene
104.040	056	EPA 524.2	Vinyl Chloride
104.040	057	EPA 524.2	Xylenes, Total
104.040	059	EPA 524.2	Federal regulated VOCs excluding vinyl chloride
104.040	060	EPA 524.2	Federal unregulated VOCs
104.045	001	EPA 524.2	Bromodichloromethane
104.045	002	EPA 524.2	Bromoform
104.045	003	EPA 524.2	Chloroform
104.045	004	EPA 524.2	Dibromochloromethane
104.045	005	EPA 524.2	Trihalomethanes
104.050	002	EPA 524.2	Methyl tert-butyl Ether (MTBE)
104.050	004	EPA 524.2	tert-Amyl Methyl Ether (TAME)
104.050	005	EPA 524.2	Ethyl tert-butyl Ether (ETBE)
104.050	006	EPA 524.2	Trichlorotrifluoroethane
104.050	011	EPA 524.2	Oxygenates

108 - Inorganic Chemistry of Wastewater

108.020	001	EPA 120.1	Conductivity
108.110	001	EPA 180.1	Turbidity
108.112	001	EPA 200.7	Boron
108.112	002	EPA 200.7	Calcium
108.112	003	EPA 200.7	Hardness (calc.)
108.112	004	EPA 200.7	Magnesium
108.112	005	EPA 200.7	Potassium
108.112	007	EPA 200.7	Sodium
108.113	001	EPA 200.8	Boron
108.113	002	EPA 200.8	Calcium
108.113	003	EPA 200.8	Magnesium
108.113	004	EPA 200.8	Potassium
108.113	006	EPA 200.8	Sodium
108.120	001	EPA 300.0	Bromide
108.120	002	EPA 300.0	Chloride
108.120	003	EPA 300.0	Fluoride
108.120	004	EPA 300.0	Nitrate
108.120	005	EPA 300.0	Nitrite
108.120	006	EPA 300.0	Nitrate-nitrite, Total
108.120	007	EPA 300.0	Phosphate, Ortho
108.120	008	EPA 300.0	Sulfate
108.323	001	EPA 410.4	Chemical Oxygen Demand
108.360	001	EPA 420.1	Phenols, Total
108.381	001	EPA 1664A	Oil and Grease

108.385	001	SM2120B	Color
108.390	001	SM2130B	Turbidity
108.400	001	SM2310B	Acidity
108.410	001	SM2320B	Alkalinity
108.420	001	SM2340B	Hardness (calc.)
108.421	001	SM2340C	Hardness
108.430	001	SM2510B	Conductivity
108.440	001	SM2540B	Residue, Total
108.441	001	SM2540C	Residue, Filterable
108.442	001	SM2540D	Residue, Non-filterable
108.443	001	SM2540F	Residue, Settleable
108.448	001	SM4110B	Bromide
108.448	002	SM4110B	Chloride
108.448	003	SM4110B	Fluoride
108.448	004	SM4110B	Nitrate
108.448	005	SM4110B	Nitrite
108.448	006	SM4110B	Nitrate-nitrite
108.448	007	SM4110B	Phosphate, Ortho
108.448	008	SM4110B	Sulfate
108.450	001	SM4500-Cl- B	Chloride
108.460	001	SM4500-Cl B	Chlorine
108.472	001	SM4500-CN E	Cyanide, Total
108.473	001	SM4500-CN G	Cyanide, amenable
108.480	001	SM4500-F C	Fluoride
108.490	001	SM4500 H+ B	pH
108.491	001	SM4500-NH3 C (18th)	Ammonia
108.491	002	SM4500-NH3 C (18th)	Kjeldahl Nitrogen
108.510	001	SM4500-NO2 B	Nitrite
108.520	001	SM4500-NO3 E	Nitrate-nitrite
108.520	002	SM4500-NO3 E	Nitrite
108.551	001	SM4500-SiO2 C (20th)	Silica
108.580	001	SM4500-S= D	Sulfide
108.582	001	SM4500-S= F (19th/20th)	Sulfide
108.590	001	SM5210B	Biochemical Oxygen Demand
108.602	001	SM5220D	Chemical Oxygen Demand
108.610	001	SM5310B	Total Organic Carbon
108.630	001	SM5520B (20th)	Oil and Grease
108.640	001	SM5540C	Surfactants

109 - Toxic Chemical Elements of Wastewater

109.010	001	EPA 200.7	Aluminum
109.010	002	EPA 200.7	Antimony
109.010	003	EPA 200.7	Arsenic

109.010	004	EPA 200.7	Barium
109.010	005	EPA 200.7	Beryllium
109.010	007	EPA 200.7	Cadmium
109.010	009	EPA 200.7	Chromium
109.010	010	EPA 200.7	Cobalt
109.010	011	EPA 200.7	Copper
109.010	012	EPA 200.7	Iron
109.010	013	EPA 200.7	Lead
109.010	015	EPA 200.7	Manganese
109.010	016	EPA 200.7	Molybdenum
109.010	017	EPA 200.7	Nickel
109.010	019	EPA 200.7	Selenium
109.010	021	EPA 200.7	Silver
109.010	023	EPA 200.7	Thallium
109.010	024	EPA 200.7	Tin
109.010	026	EPA 200.7	Vanadium
109.010	027	EPA 200.7	Zinc
109.020	001	EPA 200.8	Aluminum
109.020	002	EPA 200.8	Antimony
109.020	003	EPA 200.8	Arsenic
109.020	004	EPA 200.8	Barium
109.020	005	EPA 200.8	Beryllium
109.020	006	EPA 200.8	Cadmium
109.020	007	EPA 200.8	Chromium
109.020	008	EPA 200.8	Cobalt
109.020	009	EPA 200.8	Copper
109.020	010	EPA 200.8	Lead
109.020	011	EPA 200.8	Manganese
109.020	012	EPA 200.8	Molybdenum
109.020	013	EPA 200.8	Nickel
109.020	014	EPA 200.8	Selenium
109.020	015	EPA 200.8	Silver
109.020	016	EPA 200.8	Thallium
109.020	017	EPA 200.8	Vanadium
109.020	018	EPA 200.8	Zinc
109.020	021	EPA 200.8	Iron
109.020	022	EPA 200.8	Tin
109.020	023	EPA 200.8	Titanium
109.104	001	EPA 218.6	Chromium (VI)
109.190	001	EPA 245.1	Mercury
109.624	001	SM3500-Fe B (20th)	Iron

110 - Volatile Organic Chemistry of Wastewater

110.040	001	EPA 624	Benzene
110.040	002	EPA 624	Bromodichloromethane
110.040	003	EPA 624	Bromoform
110.040	004	EPA 624	Bromomethane
110.040	005	EPA 624	Carbon Tetrachloride
110.040	006	EPA 624	Chlorobenzene
110.040	007	EPA 624	Chloroethane
110.040	008	EPA 624	2-Chloroethyl Vinyl Ether
110.040	009	EPA 624	Chloroform
110.040	010	EPA 624	Chloromethane
110.040	011	EPA 624	Dibromochloromethane
110.040	012	EPA 624	1,2-Dichlorobenzene
110.040	013	EPA 624	1,3-Dichlorobenzene
110.040	014	EPA 624	1,4-Dichlorobenzene
110.040	015	EPA 624	1,1-Dichloroethane
110.040	016	EPA 624	1,2-Dichloroethane
110.040	017	EPA 624	1,1-Dichloroethene
110.040	018	EPA 624	trans-1,2-Dichloroethene
110.040	019	EPA 624	1,2-Dichloropropane
110.040	020	EPA 624	cis-1,3-Dichloropropene
110.040	021	EPA 624	trans-1,3-Dichloropropene
110.040	022	EPA 624	Ethylbenzene
110.040	023	EPA 624	Methylene Chloride
110.040	024	EPA 624	1,1,2,2-Tetrachloroethane
110.040	025	EPA 624	Tetrachloroethene
110.040	025	EPA 624	Toluene
110.040	027	EPA 624	1,1,1-Trichloroethane
110.040	028	EPA 624	1,1,2-Trichloroethane
110.040	029	EPA 624	Trichloroethene
110.040	030	EPA 624	Trichlorofluoromethane
110.040	031	EPA 624	Vinyl Chloride
110.040	042	EPA 624	Oxygenates
110.040	043	EPA 624	Other Volatile Organics

111 - Semi-volatile Organic Chemistry of Wastewater

111.100	001	EPA 625	Acenaphthene
111.100	002	EPA 625	Acenaphthylene
111.100	003	EPA 625	Anthracene
111.100	004	EPA 625	Benzidine
111.100	005	EPA 625	Benz(a)anthracene
111.100	006	EPA 625	Benzo(b)fluoranthene
111.100	007	EPA 625	Benzo(k)fluoranthene
111.100	008	EPA 625	Benzo(g,h,i)perylene

111.100	009	EPA 625	Benzo(a)pyrene
111.100	010	EPA 625	Benzyl Butyl Phthalate
111.100	011	EPA 625	bis(2-chloroethoxy)methane
111.100	012	EPA 625	bis(2-chloroethyl) Ether
111.100	013	EPA 625	Bis(2-chloroisopropyl) Ether
111.100	014	EPA 625	Di(2-ethylhexyl) Phthalate
111.100	015	EPA 625	4-Bromophenyl Phenyl Ether
111.100	016	EPA 625	4-Chloro-3-methylphenol
111.100	017	EPA 625	2-Chloronaphthalene
111.100	018	EPA 625	2-Chlorophenol
111.100	019	EPA 625	4-Chlorophenyl Phenyl Ether
111.100	020	EPA 625	Chrysene
111.100	021	EPA 625	Dibenz(a,h)anthracene
111.100	025	EPA 625	3,3'-Dichlorobenzidine
111.100	026	EPA 625	2,4-Dichlorophenol
111.100	027	EPA 625	Diethyl Phthalate
111.100	028	EPA 625	2,4-Dimethylphenol
111.100	029	EPA 625	Dimethyl Phthalate
111.100	030	EPA 625	Di-n-butyl phthalate
111.100	031	EPA 625	Di-n-octyl phthalate
111.100	032	EPA 625	2,4-Dinitrophenol
111.100	033	EPA 625	2,4-Dinitrotoluene
111.100	034	EPA 625	2,6-Dinitrotoluene
111.100	035	EPA 625	Fluoranthene
111.100	036	EPA 625	Fluorene
111.100	037	EPA 625	Hexachlorobenzene
111.100	038	EPA 625	Hexachlorobutadiene
111.100	039	EPA 625	Hexachlorocyclopentadiene
111.100	040	EPA 625	Hexachloroethane
111.100	041	EPA 625	Indeno(1,2,3-c,d)pyrene
111.100	042	EPA 625	Isophorone
111.100	043	EPA 625	2-Methyl-4,6-dinitrophenol
111.100	044	EPA 625	Naphthalene
111.100	045	EPA 625	Nitrobenzene
111.100	046	EPA 625	2-Nitrophenol
111.100	047	EPA 625	4-Nitrophenol
111.100	048	EPA 625	N-nitrosodimethylamine
111.100	049	EPA 625	N-nitroso-di-n-propylamine
111.100	050	EPA 625	N-nitrosodiphenylamine
111.100	051	EPA 625	Pentachlorophenol
111.100	052	EPA 625	Phenanthrene
111.100	053	EPA 625	Phenol

111.100	054	EPA 625	Pyrene
111.100	055	EPA 625	1,2,4-Trichlorobenzene
111.100	056	EPA 625	2,4,6-Trichlorophenol
111.101	032	EPA 625	Polynuclear Aromatic Hydrocarbons
111.101	034	EPA 625	Phthalates
111.101	036	EPA 625	Other Extractables
111.170	001	EPA 608	Aldrin
111.170	002	EPA 608	a-BHC
111.170	003	EPA 608	b-BHC
111.170	004	EPA 608	d-BHC
111.170	005	EPA 608	g-BHC (Lindane)
111.170	006	EPA 608	Chlordane
111.170	007	EPA 608	4,4'-DDD
111.170	008	EPA 608	4,4'-DDE
111.170	009	EPA 608	4,4'-DDT
111.170	010	EPA 608	Dieldrin
111.170	011	EPA 608	Endosulfan I
111.170	012	EPA 608	Endosulfan II
111.170	013	EPA 608	Endosulfan Sulfate
111.170	014	EPA 608	Endrin
111.170	015	EPA 608	Endrin Aldehyde
111.170	016	EPA 608	Heptachlor
111.170	017	EPA 608	Heptachlor Epoxide
111.170	018	EPA 608	Toxaphene
111.170	019	EPA 608	PCB-1016
111.170	020	EPA 608	PCB-1221
111.170	021	EPA 608	PCB-1232
111.170	022	EPA 608	PCB-1242
111.170	023	EPA 608	PCB-1248
111.170	024	EPA 608	PCB-1254
111.170	025	EPA 608	PCB-1260
111.170	030	EPA 608	Organochlorine Pesticides
111.170	031	EPA 608	PCBs
111.272	001	SM5520B (20th)	Oil and Grease
111.273	001	EPA 1664A	Oil and Grease

114 - Inorganic Chemistry of Hazardous Waste

114.010	001	EPA 6010B	Antimony
114.010	002	EPA 6010B	Arsenic
114.010	003	EPA 6010B	Barium
114.010	004	EPA 6010B	Beryllium
114.010	005	EPA 6010B	Cadmium
114.010	006	EPA 6010B	Chromium

114.010	007	EPA 6010B	Cobalt
114.010	008	EPA 6010B	Copper
114.010	009	EPA 6010B	Lead
114.010	010	EPA 6010B	Molybdenum
114.010	011	EPA 6010B	Nickel
114.010	012	EPA 6010B	Selenium
114.010	013	EPA 6010B	Silver
114.010	014	EPA 6010B	Thallium
114.010	015	EPA 6010B	Vanadium
114.010	016	EPA 6010B	Zinc
114.020	001	EPA 6020	Antimony
114.020	002	EPA 6020	Arsenic
114.020	003	EPA 6020	Barium
114.020	004	EPA 6020	Beryllium
114.020	005	EPA 6020	Cadmium
114.020	006	EPA 6020	Chromium
114.020	007	EPA 6020	Cobalt
114.020	008	EPA 6020	Copper
114.020	009	EPA 6020	Lead
114.020	010	EPA 6020	Molybdenum
114.020	011	EPA 6020	Nickel
114.020	012	EPA 6020	Selenium
114.020	013	EPA 6020	Silver
114.020	014	EPA 6020	Thallium
114.020	015	EPA 6020	Vanadium
114.020	016	EPA 6020	Zinc
114.103	001	EPA 7196A	Chromium (VI)
114.106	001	EPA 7199	Chromium (VI)
114.140	001	EPA 7470A	Mercury
114.141	001	EPA 7471A	Mercury
114.222	001	EPA 9014	Cyanide
114.230	001	EPA 9034	Sulfides, Total
114.240	001	EPA 9040B	Corrosivity - pH Determination
114.241	001	EPA 9045C	Corrosivity - pH Determination
114.250	001	EPA 9056	Fluoride

115 - Extraction Test of Hazardous Waste

115.020	001	EPA 1311	Toxicity Characteristic Leaching Procedure (TCLP)
115.030	001	CCR Chapter11, Article 5, Appendix II	Waste Extraction Test (WET)
115.040	001	EPA 1312	Synthetic Precipitation Leaching Procedure (SPLP)

116 - Volatile Organic Chemistry of Hazardous Waste

116.010	000	EPA 8011	EDB and DBCP
116.010	001	EPA 8011	1,2-Dibromoethane

116.010	002	EPA 8011	Dibromochloropropane
116.020	011	EPA 8015B	Ethylene Glycol
116.020	031	EPA 8015B	Ethanol and Methanol
116.030	001	EPA 8015B	Gasoline-range Organics
116.040	002	EPA 8021B	Benzene
116.040	039	EPA 8021B	Ethylbenzene
116.040	041	EPA 8021B	Methyl tert-butyl Ether (MTBE)
116.040	047	EPA 8021B	Toluene
116.040	056	EPA 8021B	Xylenes, Total
116.040	062	EPA 8021B	BTEX
116.080	000	EPA 8260B	Volatile Organic Compounds
116.080	001	EPA 8260B	Acetone
116.080	002	EPA 8260B	Acetonitrile
116.080	003	EPA 8260B	Acrolein
116.080	004	EPA 8260B	Acrylonitrile
116.080	005	EPA 8260B	Allyl Alcohol
116.080	006	EPA 8260B	Allyl Chloride
116.080	007	EPA 8260B	Benzene
116.080	009	EPA 8260B	Bromoacetone
116.080	010	EPA 8260B	Bromochloromethane
116.080	011	EPA 8260B	Bromodichloromethane
116.080	012	EPA 8260B	Bromoform
116.080	013	EPA 8260B	Bromomethane
116.080	014	EPA 8260B	n-Butyl Alcohol
116.080	015	EPA 8260B	Carbon Disulfide
116.080	016	EPA 8260B	Carbon Tetrachloride
116.080	018	EPA 8260B	Chlorobenzene
116.080	019	EPA 8260B	Chloroethane
116.080	020	EPA 8260B	2-Chloroethyl Vinyl Ether
116.080	021	EPA 8260B	Chloroform
116.080	022	EPA 8260B	Chloromethane
116.080	023	EPA 8260B	Chloroprene
116.080	024	EPA 8260B	3-Chloropropionitrile
116.080	025	EPA 8260B	Crotonaldehyde
116.080	026	EPA 8260B	Dibromochloromethane
116.080	027	EPA 8260B	Dibromochloropropane
116.080	028	EPA 8260B	1,2-Dibromoethane
116.080	030	EPA 8260B	Dibromomethane
116.080	031	EPA 8260B	1,2-Dichlorobenzene
116.080	032	EPA 8260B	1,3-Dichlorobenzene
116.080	033	EPA 8260B	1,4-Dichlorobenzene
116.080	034	EPA 8260B	cis-1,4-Dichloro-2-butene

116.080	035	EPA 8260B	trans-1,4-Dichloro-2-butene
116.080	036	EPA 8260B	Dichlorodifluoromethane
116.080	037	EPA 8260B	1,1-Dichloroethane
116.080	038	EPA 8260B	1,2-Dichloroethane
116.080	039	EPA 8260B	1,1-Dichloroethene
116.080	040	EPA 8260B	trans-1,2-Dichloroethene
116.080	041	EPA 8260B	cis-1,2-Dichloroethene
116.080	042	EPA 8260B	1,2-Dichloropropane
116.080	043	EPA 8260B	1,3-Dichloropropane
116.080	044	EPA 8260B	2,2-Dichloropropane
116.080	045	EPA 8260B	1,1-Dichloropropene
116.080	046	EPA 8260B	cis-1,3-Dichloropropene
116.080	047	EPA 8260B	trans-1,3-Dichloropropene
116.080	048	EPA 8260B	1,3-Dichloro-2-propanol
116.080	049	EPA 8260B	1,2,3,4-Diepoxybutane
116.080	050	EPA 8260B	1,4-Dioxane
116.080	053	EPA 8260B	Ethylbenzene
116.080	055	EPA 8260B	Ethyl Methacrylate
116.080	056	EPA 8260B	Hexachlorobutadiene
116.080	057	EPA 8260B	Hexachloroethane
116.080	058	EPA 8260B	2-Hexanone (MBK)
116.080	059	EPA 8260B	Iodomethane
116.080	060	EPA 8260B	Isobutyl Alcohol
116.080	061	EPA 8260B	Malononitrile
116.080	062	EPA 8260B	Methacrylonitrile
116.080	064	EPA 8260B	Methyl tert-butyl Ether (MTBE)
116.080	065	EPA 8260B	Methylene Chloride
116.080	066	EPA 8260B	Methyl Ethyl Ketone
116.080	067	EPA 8260B	Methyl Methacrylate
116.080	068	EPA 8260B	4-Methyl-2-pentanone (MIBK)
116.080	069	EPA 8260B	Naphthalene
116.080	070	EPA 8260B	Nitrobenzene
116.080	072	EPA 8260B	N-nitroso-di-n-butylamine
116.080	074	EPA 8260B	Pentachloroethane
116.080	075	EPA 8260B	Pentafluorobenzene
116.080	076	EPA 8260B	2-Picoline
116.080	078	EPA 8260B	Propionitrile
116.080	079	EPA 8260B	N-propylamine
116.080	080	EPA 8260B	Pyridine
116.080	081	EPA 8260B	1,1,1,2-Tetrachloroethane
116.080	082	EPA 8260B	1,1,2,2-Tetrachloroethane
116.080	083	EPA 8260B	Tetrachloroethene

116.080	084	EPA 8260B	Toluene
116.080	086	EPA 8260B	1,2,3-Trichlorobenzene
116.080	087	EPA 8260B	1,2,4-Trichlorobenzene
116.080	088	EPA 8260B	1,1,1-Trichloroethane
116.080	089	EPA 8260B	1,1,2-Trichloroethane
116.080	090	EPA 8260B	Trichloroethene
116.080	091	EPA 8260B	Trichlorofluoromethane
116.080	092	EPA 8260B	1,2,3-Trichloropropane
116.080	093	EPA 8260B	Vinyl Acetate
116.080	094	EPA 8260B	Vinyl Chloride
116.080	095	EPA 8260B	Xylenes, Total
116.080	096	EPA 8260B	tert-Amyl Methyl Ether (TAME)
116.080	097	EPA 8260B	tert Butyl Alcohol (TBA)
116.080	098	EPA 8260B	Ethyl tert-butyl Ether (ETBE)
116.080	099	EPA 8260B	Bromobenzene
116.080	100	EPA 8260B	n-Butylbenzene
116.080	101	EPA 8260B	sec-Butylbenzene
116.080	102	EPA 8260B	tert-Butylbenzene
116.080	103	EPA 8260B	2-Chlorotoluene
116.080	104	EPA 8260B	4-Chlorotoluene
116.080	105	EPA 8260B	Isopropylbenzene
116.080	106	EPA 8260B	N-propylbenzene
116.080	107	EPA 8260B	Styrene
116.080	108	EPA 8260B	1,2,4-Trimethylbenzene
116.080	109	EPA 8260B	1,3,5-Trimethylbenzene
116.080	120	EPA 8260B	Oxygenates
116.100	002	LUFT GC/MS	Benzene
116.100	003	LUFT GC/MS	Toluene
116.100	004	LUFT GC/MS	Xylenes
116.100	005	LUFT GC/MS	Methyl tert-butyl Ether (MTBE)
116.100	010	LUFT GC/MS	BTEX and MTBE
116.110	001	LUFT	Total Petroleum Hydrocarbons - Gasoline

117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	EPA 8015B	Diesel-range Total Petroleum Hydrocarbons
117.015	001	LUFT GC/MS	Diesel-range Total Petroleum Hydrocarbons
117.016	001	LUFT	Diesel-range Total Petroleum Hydrocarbons
117.017	001	EPA 418.1	TRPH Screening
117.110	000	EPA 8270C	Extractable Organics
117.110	001	EPA 8270C	Acenaphthene
117.110	002	EPA 8270C	Acenaphthylene
117.110	003	EPA 8270C	Acetophenone
117.110	004	EPA 8270C	2-Acetylaminofluorene

117.110	005	EPA 8270C	1-Acetyl-2-thiourea
117.110	006	EPA 8270C	4-Aminobiphenyl
117.110	007	EPA 8270C	Aniline
117.110	008	EPA 8270C	Anthracene
117.110	009	EPA 8270C	Aramite
117.110	010	EPA 8270C	Benzidine
117.110	011	EPA 8270C	Benz(a)anthracene
117.110	012	EPA 8270C	Benzo(b)fluoranthene
117.110	013	EPA 8270C	Benzo(k)fluoranthene
117.110	014	EPA 8270C	Benzo(g,h,i)perylene
117.110	015	EPA 8270C	Benzo(a)pyrene
117.110	016	EPA 8270C	Benzoic Acid
117.110	017	EPA 8270C	p-Benzoquinone
117.110	018	EPA 8270C	Benzyl Alcohol
117.110	019	EPA 8270C	Benzyl Butyl Phthalate
117.110	020	EPA 8270C	bis(2-chloroethoxy)methane
117.110	021	EPA 8270C	bis(2-chloroethyl) Ether
117.110	022	EPA 8270C	Bis(2-chloroisopropyl) Ether
117.110	023	EPA 8270C	Di(2-ethylhexyl) Phthalate
117.110	024	EPA 8270C	4-Bromophenyl Phenyl Ether
117.110	025	EPA 8270C	Carbazole
117.110	026	EPA 8270C	4-Chloroaniline
117.110	027	EPA 8270C	4-Chloro-3-methylphenol
117.110	029	EPA 8270C	2-Chloronaphthalene
117.110	030	EPA 8270C	2-Chlorophenol
117.110	031	EPA 8270C	4-Chlorophenyl Phenyl Ether
117.110	032	EPA 8270C	Chrysene
117.110	033	EPA 8270C	2-Cyclohexyl-4,6-dinitrophenol
117.110	034	EPA 8270C	2,4-Diaminotoluene
117.110	036	EPA 8270C	Dibenz(a,h)anthracene
117.110	037	EPA 8270C	Dibenzofuran
117.110	038	EPA 8270C	Dibenzo(a,e)pyrene
117.110	039	EPA 8270C	1,2-Dichlorobenzene
117.110	040	EPA 8270C	1,3-Dichlorobenzene
117.110	041	EPA 8270C	1,4-Dichlorobenzene
117.110	042	EPA 8270C	3,3'-Dichlorobenzidine
117.110	043	EPA 8270C	2,4-Dichlorophenol
117.110	044	EPA 8270C	2,6-Dichlorophenol
117.110	045	EPA 8270C	Diethyl Phthalate
117.110	050	EPA 8270C	p-Dimethylaminoazobenzene
117.110	051	EPA 8270C	7,12-Dimethylbenz(a)anthracene
117.110	052	EPA 8270C	a,a-Dimethylphenethylamine

117.110	053	EPA 8270C	2,4-Dimethylphenol
117.110	054	EPA 8270C	Dimethyl Phthalate
117.110	055	EPA 8270C	Di-n-butyl phthalate
117.110	056	EPA 8270C	Di-n-octyl phthalate
117.110	058	EPA 8270C	1,3-Dinitrobenzene
117.110	060	EPA 8270C	2,4-Dinitrophenol
117.110	061	EPA 8270C	2,4-Dinitrotoluene
117.110	062	EPA 8270C	2,6-Dinitrotoluene
117.110	063	EPA 8270C	Diphenylamine
117.110	064	EPA 8270C	1,2-Diphenylhydrazine
117.110	065	EPA 8270C	Ethyl Carbamate
117.110	066	EPA 8270C	Ethyl Methanesulfonate
117.110	067	EPA 8270C	Fluoranthene
117.110	068	EPA 8270C	Fluorene
117.110	069	EPA 8270C	Hexachlorobenzene
117.110	070	EPA 8270C	Hexachlorobutadiene
117.110	071	EPA 8270C	Hexachlorocyclopentadiene
117.110	072	EPA 8270C	Hexachloroethane
117.110	073	EPA 8270C	Hexachlorophene
117.110	074	EPA 8270C	Hexachloropropene
117.110	075	EPA 8270C	Indeno(1,2,3-c,d)pyrene
117.110	076	EPA 8270C	Isophorone
117.110	077	EPA 8270C	Isosafrole
117.110	078	EPA 8270C	Maleic Anhydride
117.110	079	EPA 8270C	3-Methylcholanthrene
117.110	080	EPA 8270C	2-Methyl-4,6-dinitrophenol
117.110	082	EPA 8270C	Methyl Methanesulfonate
117.110	083	EPA 8270C	2-Methylnaphthalene
117.110	084	EPA 8270C	2-Methylphenol
117.110	085	EPA 8270C	3-Methylphenol
117.110	086	EPA 8270C	4-Methylphenol
117.110	087	EPA 8270C	Naphthalene
117.110	088	EPA 8270C	1,4-Naphthoquinone
117.110	089	EPA 8270C	1-Naphthylamine
117.110	090	EPA 8270C	2-Naphthylamine
117.110	091	EPA 8270C	Nicotine
117.110	092	EPA 8270C	2-Nitroaniline
117.110	093	EPA 8270C	3-Nitroaniline
117.110	094	EPA 8270C	4-Nitroaniline
117.110	095	EPA 8270C	Nitrobenzene
117.110	096	EPA 8270C	2-Nitrophenol
117.110	097	EPA 8270C	4-Nitrophenol

As of 7/6/2012 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State

117.110	098	EPA 8270C	N-nitroso-di-n-butylamine
117.110	099	EPA 8270C	N-nitrosodiethylamine
117.110	100	EPA 8270C	N-nitrosodimethylamine
117.110	101	EPA 8270C	N-nitroso-di-n-propylamine
117.110	102	EPA 8270C	N-nitrosodiphenylamine
117.110	103	EPA 8270C	N-nitrosomethylethylamine
117.110	104	EPA 8270C	N-nitrosomorpholine
117.110	105	EPA 8270C	N-nitrosopiperidine
117.110	106	EPA 8270C	N-nitrosopyrrolidine
117.110	107	EPA 8270C	5-Nitro-o-toluidine
117.110	108	EPA 8270C	Pentachlorobenzene
117.110	109	EPA 8270C	Pentachloronitrobenzene
117.110	110	EPA 8270C	Pentachlorophenol
117.110	111	EPA 8270C	Phenacetin
117.110	112	EPA 8270C	Phenanthrene
117.110	113	EPA 8270C	Phenol
117.110	114	EPA 8270C	1,4-Phenylenediamine
117.110	116	EPA 8270C	2-Picoline
117.110	117	EPA 8270C	Pronamide
117.110	119	EPA 8270C	Pyrene
117.110	120	EPA 8270C	Pyridine
117.110	122	EPA 8270C	Safrole
117.110	124	EPA 8270C	1,2,4,5-Tetrachlorobenzene
117.110	125	EPA 8270C	2,3,4,6-Tetrachlorophenol
117.110	128	EPA 8270C	o-Toluidine
117.110	129	EPA 8270C	1,2,4-Trichlorobenzene
117.110	130	EPA 8270C	2,4,5-Trichlorophenol
117.110	131	EPA 8270C	2,4,6-Trichlorophenol
117.110	132	EPA 8270C	1,3,5-Trinitrobenzene
117.111	025	EPA 8270C	Dimethoate
117.111	026	EPA 8270C	Dinoseb
117.111	036	EPA 8270C	Famphur
117.111	039	EPA 8270C	Isodrin
117.111	040	EPA 8270C	Kepone
117.111	054	EPA 8270C	Parathion Ethyl
117.111	055	EPA 8270C	Parathion Methyl
117.111	056	EPA 8270C	Phorate
117.111	058	EPA 8270C	Sulfotepp
117.111	061	EPA 8270C	O,O,O-triethyl Phosphorothioate
117.111	073	EPA 8270C	Polynuclear Aromatic Hydrocarbons
117.111	075	EPA 8270C	Phthalates
117.111	076	EPA 8270C	Other Extractables

117.140	000	EPA 8310	Polynuclear Aromatic Hydrocarbons
117.140	001	EPA 8310	Acenaphthene
117.140	002	EPA 8310	Acenaphthylene
117.140	003	EPA 8310	Anthracene
117.140	004	EPA 8310	Benz(a)anthracene
117.140	005	EPA 8310	Benzo(a)pyrene
117.140	006	EPA 8310	Benzo(b)fluoranthene
117.140	007	EPA 8310	Benzo(k)fluoranthene
117.140	008	EPA 8310	Benzo(g,h,i)perylene
117.140	009	EPA 8310	Chrysene
117.140	010	EPA 8310	Dibenz(a,h)anthracene
117.140	011	EPA 8310	Fluoranthene
117.140	012	EPA 8310	Fluorene
117.140	013	EPA 8310	Indeno(1,2,3 c,d)pyrene
117.140	014	EPA 8310	Naphthalene
117.140	015	EPA 8310	Phenanthrene
117.140	016	EPA 8310	Pyrene
117.170	000	EPA 8330	Nitroaromatics and Nitramines
117.170	001	EPA 8330	4-Amino-2,6-dinitrotoluene
117.170	002	EPA 8330	2-Amino-4,6-dinitrotoluene
117.170	003	EPA 8330	1,3-Dinitrobenzene
117.170	004	EPA 8330	2,4-Dinitrotoluene
117.170	005	EPA 8330	2,6-Dinitrotoluene
117.170	006	EPA 8330	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
117.170	007	EPA 8330	Methyl-2,4,6-trinitrophenylnitramine
117.170	008	EPA 8330	Nitrobenzene
117.170	009	EPA 8330	2-Nitrotoluene
117.170	010	EPA 8330	3-Nitrotoluene
117.170	011	EPA 8330	4-Nitrotoluene
117.170	012	EPA 8330	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
117.170	013	EPA 8330	1,3,5-Trinitrobenzene
117.170	014	EPA 8330	2,4,6-Trinitrotoluene
117.171	000	EPA 8330A	Nitroaromatics and Nitramines
117.171	001	EPA 8330A	4-Amino-2,6-dinitrotoluene
117.171	002	EPA 8330A	2-Amino-4,6-dinitrotoluene
117.171	003	EPA 8330A	1,3-Dinitrobenzene
117.171	004	EPA 8330A	2,4-Dinitrotoluene
117.171	005	EPA 8330A	2,6-Dinitrotoluene
117.171	006	EPA 8330A	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
117.171	007	EPA 8330A	Methyl-2,4,6-trinitrophenylnitramine
117.171	008	EPA 8330A	Nitrobenzene
117.171	009	EPA 8330A	2-Nitrotoluene

117.171	010	EPA 8330A	3-Nitrotoluene
117.171	011	EPA 8330A	4-Nitrotoluene
117.171	013	EPA 8330A	1,3,5-Trinitrobenzene
117.171	014	EPA 8330A	2,4,6-Trinitrotoluene
117.190	001	EPA 8332	Nitroglycerine
117.210	000	EPA 8081A	Organochlorine Pesticides
117.210	001	EPA 8081A	Aldrin
117.210	002	EPA 8081A	a-BHC
117.210	003	EPA 8081A	b-BHC
117.210	004	EPA 8081A	d-BHC
117.210	005	EPA 8081A	g-BHC (Lindane)
117.210	007	EPA 8081A	a-Chlordane
117.210	008	EPA 8081A	g-Chlordane
117.210	009	EPA 8081A	Chlordane (tech.)
117.210	010	EPA 8081A	Chlorobenzilate
117.210	011	EPA 8081A	Chloroneb
117.210	012	EPA 8081A	Chlorothalonil
117.210	013	EPA 8081A	4,4'-DDD
117.210	014	EPA 8081A	4,4'-DDE
117.210	015	EPA 8081A	4,4'-DDT
117.210	020	EPA 8081A	Dieldrin
117.210	021	EPA 8081A	Endosulfan I
117.210	022	EPA 8081A	Endosulfan II
117.210	023	EPA 8081A	Endosulfan Sulfate
117.210	024	EPA 8081A	Endrin
117.210	025	EPA 8081A	Endrin Aldehyde
117.210	026	EPA 8081A	Endrin Ketone
117.210	027	EPA 8081A	Heptachlor
117.210	028	EPA 8081A	Heptachlor Epoxide
117.210	029	EPA 8081A	Hexachlorobenzene
117.210	033	EPA 8081A	Methoxychlor
117.210	039	EPA 8081A	Toxaphene
117.220	000	EPA 8082	PCBs
117.220	001	EPA 8082	PCB-1016
117.220	002	EPA 8082	PCB-1221
117.220	003	EPA 8082	PCB-1232
117.220	004	EPA 8082	PCB-1242
117.220	005	EPA 8082	PCB-1248
117.220	006	EPA 8082	PCB-1254
117.220	007	EPA 8082	PCB-1260
117.220	008	EPA 8082	2-Chlorobiphenyl
117.220	009	EPA 8082	2,3-Dichlorobiphenyl

117.220	010	EPA 8082	2,2',5-Trichlorobiphenyl
117.220	011	EPA 8082	2,4',5-Trichlorobiphenyl
117.220	012	EPA 8082	2,2',3,5'-Tetrachlorobiphenyl
117.220	013	EPA 8082	2,2',5,5'-Tetrachlorobiphenyl
117.220	014	EPA 8082	2,3',4,4'-Tetrachlorobiphenyl
117.220	015	EPA 8082	2,2',3,4,5'-Pentachlorobiphenyl
117.220	016	EPA 8082	2,2',4,5,5'-Pentachlorobiphenyl
117.220	017	EPA 8082	2,3,3',4',6-Pentachlorobiphenyl
117.220	018	EPA 8082	2,2',3,4,4',5'-Hexachlorobiphenyl
117.220	019	EPA 8082	2,2',3,4,5,5'-Hexachlorobiphenyl
117.220	020	EPA 8082	2,2',3,5,5',6-Hexachlorobiphenyl
117.220	021	EPA 8082	2,2',4,4',5,5'-Hexachlorobiphenyl
117.220	022	EPA 8082	2,2',3,3',4,4',5-Heptachlorobiphenyl
117.220	023	EPA 8082	2,2',3,4,4',5,5'-Heptachlorobiphenyl
117.220	024	EPA 8082	2,2',3,4,4',5',6-Heptachlorobiphenyl
117.220	025	EPA 8082	2,2',3,4',5,5',6-Heptachlorobiphenyl
117.220	026	EPA 8082	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl
117.240	000	EPA 8141A	Organophosphorus Pesticides
117.240	001	EPA 8141A	Atrazine
117.240	002	EPA 8141A	Azinphos Methyl
117.240	004	EPA 8141A	Chlorfenvinphos
117.240	005	EPA 8141A	Chlorpyrifos
117.240	006	EPA 8141A	Chlorpyrifos Methyl
117.240	007	EPA 8141A	Demeton-O
117.240	008	EPA 8141A	Demeton-S
117.240	009	EPA 8141A	Diazinon
117.240	010	EPA 8141A	Dimethoate
117.240	011	EPA 8141A	Disulfoton
117.240	012	EPA 8141A	EPN
117.240	013	EPA 8141A	Ethion
117.240	014	EPA 8141A	Famphur
117.240	015	EPA 8141A	Malathion
117.240	016	EPA 8141A	Mevinphos
117.240	017	EPA 8141A	Naled
117.240	018	EPA 8141A	Parathion Ethyl
117.240	019	EPA 8141A	Parathion Methyl
117.240	020	EPA 8141A	Phorate
117.240	022	EPA 8141A	Ronnel
117.240	024	EPA 8141A	Sulfotepp
117.240	025	EPA 8141A	Thionazin
117.250	000	EPA 8151A	Chlorinated Herbicides
117.250	001	EPA 8151A	2,4-D

117.250	002	EPA 8151A	2,4-DB
117.250	003	EPA 8151A	2,4,5-T
117.250	004	EPA 8151A	2,4,5-TP
117.250	006	EPA 8151A	Dalapon
117.250	007	EPA 8151A	Dichlorprop
117.250	008	EPA 8151A	Dinoseb
117.250	009	EPA 8151A	MCPA
117.250	010	EPA 8151A	MCPP
117.250	011	EPA 8151A	4-Nitrophenol
117.250	012	EPA 8151A	Pentachlorophenol
117.250	013	EPA 8151A	Picloram
117.250	014	EPA 8151A	Dicamba
117.250	015	EPA 8151A	3,5-Dichlorobenzoic Acid
117.250	016	EPA 8151A	Acifluorfen
117.250	017	EPA 8151A	Bentazon
117.250	018	EPA 8151A	Chloramben
117.250	019	EPA 8151A	DCPA
120 - Physical Properties of Hazardous Waste			
120.010	001	EPA 1010	Ignitability
120.040	001	Section 7.3 SW-846	Reactive Cyanide
120.050	001	Section 7.3 SW-846	Reactive Sulfide
120.070	001	EPA 9040B	Corrosivity - pH Determination
120.080	001	EPA 9045C	Corrosivity - pH Determination

NELAP - RECOGNIZED

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF NELAP ACCREDITATION

Is hereby granted to

EMAX Laboratories, Inc.

1835 West 205th Street

Torrance, CA 90501

Scope of the Certificate is limited to the
"NELAP Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **02116CA**

Expiration Date: **8/31/2014**

Effective Date: **9/1/2013**

Richmond, California
subject to forfeiture or revocation

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

NELAP RECOGNIZED

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH
NELAP Fields of Accreditation

EMAX Laboratories, Inc.
1835 West 205th Street
Torrance, CA 90501
Phone: (310) 618-8889

Certificate No. 02116CA
Renew Date. 8/31/2014

102 - Inorganic Chemistry of Drinking Water

102.020	001	EPA 180.1	Turbidity
102.022	001	SM2130B	Turbidity
102.030	001	EPA 300.0	Bromide
102.030	003	EPA 300.0	Chloride
102.030	005	EPA 300.0	Fluoride
102.030	006	EPA 300.0	Nitrate
102.030	007	EPA 300.0	Nitrite
102.030	008	EPA 300.0	Phosphate, Ortho
102.030	010	EPA 300.0	Sulfate
102.045	001	EPA 314.0	Perchlorate
102.100	001	SM2320B	Alkalinity
102.120	001	SM2340B	Hardness
102.121	001	SM2340C	Hardness
102.130	001	SM2510B	Conductivity
102.140	001	SM2540C	Total Dissolved Solids
102.145	001	EPA 160.1	Total Dissolved Solids
102.150	001	SM4110B	Chloride
102.150	002	SM4110B	Fluoride
102.150	003	SM4110B	Nitrate
102.150	004	SM4110B	Nitrite
102.150	005	SM4110B	Phosphate, Ortho
102.150	006	SM4110B	Sulfate
102.170	001	SM4500-Cl-B	Chloride
102.190	001	SM4500 CN E	Cyanide, Total
102.200	001	SM4500-F C	Fluoride
102.210	001	SM4500-H+ B	pH
102.212	001	EPA 150.1	pH
102.220	001	SM4500-NO2 B	Nitrite
102.232	002	SM4500 NO3 E	Nitrate
102.240	001	SM4500-P E	Phosphate, Ortho
102.260	001	SM5310B-2000	Total Organic Carbon
102.520	001	EPA 200.7	Calcium

102.520	002	EPA 200.7	Magnesium
102.520	003	EPA 200.7	Potassium
102.520	005	EPA 200.7	Sodium
102.520	006	EPA 200.7	Hardness (calc.)
102.564	001	Quickchem 10-204-00-1-X	Cyanide

103 - Toxic Chemical Elements of Drinking Water

103.130	001	EPA 200.7	Aluminum
103.130	003	EPA 200.7	Barium
103.130	004	EPA 200.7	Beryllium
103.130	005	EPA 200.7	Cadmium
103.130	007	EPA 200.7	Chromium
103.130	008	EPA 200.7	Copper
103.130	009	EPA 200.7	Iron
103.130	011	EPA 200.7	Manganese
103.130	012	EPA 200.7	Nickel
103.130	015	EPA 200.7	Silver
103.130	017	EPA 200.7	Zinc
103.140	001	EPA 200.8	Aluminum
103.140	002	EPA 200.8	Antimony
103.140	003	EPA 200.8	Arsenic
103.140	004	EPA 200.8	Barium
103.140	005	EPA 200.8	Beryllium
103.140	006	EPA 200.8	Cadmium
103.140	007	EPA 200.8	Chromium
103.140	008	EPA 200.8	Copper
103.140	009	EPA 200.8	Lead
103.140	010	EPA 200.8	Manganese
103.140	012	EPA 200.8	Nickel
103.140	013	EPA 200.8	Selenium
103.140	014	EPA 200.8	Silver
103.140	015	EPA 200.8	Thallium
103.140	016	EPA 200.8	Zinc
103.160	001	EPA 245.1	Mercury
103.310	001	EPA 218.6	Chromium (VI)

104 - Volatile Organic Chemistry of Drinking Water

104.030	001	EPA 504.1	1,2-Dibromoethane
104.030	002	EPA 504.1	1,2-Dibromo-3-chloropropane
104.030	004	EPA 504.1	EDB and DBCP
104.040	000	EPA 524.2	Volatile Organic Compounds

104.040	001	EPA 524.2	Benzene
104.040	002	EPA 524.2	Bromobenzene
104.040	003	EPA 524.2	Bromochloromethane
104.040	006	EPA 524.2	Bromomethane
104.040	007	EPA 524.2	n-Butylbenzene
104.040	008	EPA 524.2	sec-Butylbenzene
104.040	009	EPA 524.2	tert Butylbenzene
104.040	010	EPA 524.2	Carbon Tetrachloride
104.040	011	EPA 524.2	Chlorobenzene
104.040	012	EPA 524.2	Chloroethane
104.040	014	EPA 524.2	Chloromethane
104.040	015	EPA 524.2	2-Chlorotoluene
104.040	016	EPA 524.2	4-Chlorotoluene
104.040	018	EPA 524.2	Dibromomethane
104.040	019	EPA 524.2	1,3-Dichlorobenzene
104.040	020	EPA 524.2	1,2-Dichlorobenzene
104.040	021	EPA 524.2	1,4-Dichlorobenzene
104.040	022	EPA 524.2	Dichlorodifluoromethane
104.040	023	EPA 524.2	1,1-Dichloroethane
104.040	024	EPA 524.2	1,2-Dichloroethane
104.040	025	EPA 524.2	1,1-Dichloroethene
104.040	026	EPA 524.2	cis-1,2-Dichloroethene
104.040	027	EPA 524.2	trans-1,2-Dichloroethene
104.040	028	EPA 524.2	Dichloromethane
104.040	029	EPA 524.2	1,2-Dichloropropane
104.040	030	EPA 524.2	1,3-Dichloropropane
104.040	031	EPA 524.2	2,2-Dichloropropane
104.040	032	EPA 524.2	1,1-Dichloropropene
104.040	033	EPA 524.2	cis-1,3-Dichloropropene
104.040	034	EPA 524.2	trans-1,3-Dichloropropene
104.040	035	EPA 524.2	Ethylbenzene
104.040	036	EPA 524.2	Hexachlorobutadiene
104.040	037	EPA 524.2	Isopropylbenzene
104.040	038	EPA 524.2	4-Isopropyltoluene
104.040	039	EPA 524.2	Naphthalene
104.040	040	EPA 524.2	Nitrobenzene
104.040	041	EPA 524.2	N-propylbenzene
104.040	042	EPA 524.2	Styrene
104.040	043	EPA 524.2	1,1,1,2-Tetrachloroethane
104.040	044	EPA 524.2	1,1,2,2-Tetrachloroethane

104.040	045	EPA 524.2	Tetrachloroethene
104.040	046	EPA 524.2	Toluene
104.040	047	EPA 524.2	1,2,3-Trichlorobenzene
104.040	048	EPA 524.2	1,2,4-Trichlorobenzene
104.040	049	EPA 524.2	1,1,1-Trichloroethane
104.040	050	EPA 524.2	1,1,2-Trichloroethane
104.040	051	EPA 524.2	Trichloroethene
104.040	052	EPA 524.2	Trichlorofluoromethane
104.040	053	EPA 524.2	1,2,3-Trichloropropane
104.040	054	EPA 524.2	1,2,4-Trimethylbenzene
104.040	055	EPA 524.2	1,3,5-Trimethylbenzene
104.040	056	EPA 524.2	Vinyl Chloride
104.040	057	EPA 524.2	Xylenes, Total
104.040	059	EPA 524.2	Federal regulated VOCs, excluding vinyl chloride
104.040	060	EPA 524.2	Federal unregulated VOCs
104.045	001	EPA 524.2	Bromodichloromethane
104.045	002	EPA 524.2	Bromoform
104.045	003	EPA 524.2	Chloroform
104.045	004	EPA 524.2	Dibromochloromethane
104.045	005	EPA 524.2	Trihalomethanes
104.050	002	EPA 524.2	Methyl tert-butyl Ether (MTBE)
104.050	004	EPA 524.2	tert-Amyl Methyl Ether (TAME)
104.050	005	EPA 524.2	Ethyl tert butyl Ether (ETBE)
104.050	006	EPA 524.2	Trichlorotrifluoroethane
104.050	011	EPA 524.2	Oxygenates

108 - Inorganic Chemistry of Wastewater

108.020	001	EPA 120.1	Conductivity
108.110	001	EPA 180.1	Turbidity
108.112	001	EPA 200.7	Boron
108.112	002	EPA 200.7	Calcium
108.112	003	EPA 200.7	Hardness (calc.)
108.112	004	EPA 200.7	Magnesium
108.112	005	EPA 200.7	Potassium
108.112	007	EPA 200.7	Sodium
108.113	001	EPA 200.8	Boron
108.113	002	EPA 200.8	Calcium
108.113	003	EPA 200.8	Magnesium
108.113	004	EPA 200.8	Potassium
108.113	005	EPA 200.8	Sodium
108.120	001	EPA 300.0	Bromide

108.120	002	EPA 300.0	Chloride
108.120	003	EPA 300.0	Fluoride
108.120	004	EPA 300.0	Nitrate
108.120	005	EPA 300.0	Nitrite
108.120	006	EPA 300.0	Nitrate-nitrite, Total
108.120	007	EPA 300.0	Phosphate, Ortho
108.120	008	EPA 300.0	Sulfate
108.323	001	EPA 410.4	Chemical Oxygen Demand
108.360	001	EPA 420.1	Phenols, Total
108.381	002	EPA 1664 Rev. A	Oil & Grease Total
108.385	001	SM2120B	Color
108.390	001	SM2130B	Turbidity
108.400	001	SM2310B	Acidity
108.410	001	SM2320B	Alkalinity
108.420	001	SM2340B	Hardness (calc.)
108.421	001	SM2340C	Hardness
108.430	001	SM2510B	Conductivity
108.440	001	SM2540B	Residue, Total
108.441	001	SM2540C	Residue, Filterable
108.442	001	SM2540D	Residue, Non-filterable
108.443	001	SM2540F	Residue, Settleable
108.448	001	SM4110B	Bromide
108.448	002	SM4110B	Chloride
108.448	003	SM4110B	Fluoride
108.448	004	SM4110B	Nitrate
108.448	005	SM4110B	Nitrite
108.448	006	SM4110B	Nitrate-nitrite
108.448	007	SM4110B	Phosphate, Ortho
108.448	008	SM4110B	Sulfate
108.450	001	SM4500-Cl- B	Chloride
108.460	001	SM4500-Cl B	Chlorine, Total
108.472	001	SM4500 CN E	Cyanide, Total
108.473	001	SM4500-CN G	Cyanide, amenable
108.480	001	SM4500-F C	Fluoride
108.490	001	SM4500-H+B	pH
108.491	001	SM4500-NH3 C (18th)	Ammonia
108.491	002	SM4500 NH3 C (18th)	Kjeldahl Nitrogen
108.510	001	SM4500-NO2 B	Nitrite
108.520	001	SM4500-NO3 E	Nitrate-nitrite
108.520	002	SM4500-NO3 E	Nitrite

108.540	001	SM4500-P E-1999	Phosphate, Ortho
108.541	001	SM4500-P E-1999	Phosphorus, Total
108.551	001	SM4500-SiO2 C (20th)	Silica
108.580	001	SM4500-S= D	Sulfide
108.582	001	SM4500-S= F (19th/20th)	Sulfide
108.590	001	SM5210B	Biochemical Oxygen Demand
108.602	001	SM5220D	Chemical Oxygen Demand
108.610	001	SM5310B-2000	Total Organic Carbon
108.630	001	SM5520B (20th)	Oil and Grease
108.540	001	SM5540C	Surfactants
108.920	001	Quikchem 10-204-00-1-X	Cyanide

109 - Toxic Chemical Elements of Wastewater

109.010	001	EPA 200.7	Aluminum
109.010	002	EPA 200.7	Antimony
109.010	003	EPA 200.7	Arsenic
109.010	004	EPA 200.7	Barium
109.010	005	EPA 200.7	Beryllium
109.010	007	EPA 200.7	Cadmium
109.010	009	EPA 200.7	Chromium
109.010	010	EPA 200.7	Cobalt
109.010	011	EPA 200.7	Copper
109.010	012	EPA 200.7	Iron
109.010	013	EPA 200.7	Lead
109.010	015	EPA 200.7	Manganese
109.010	016	EPA 200.7	Molybdenum
109.010	017	EPA 200.7	Nickel
109.010	019	EPA 200.7	Selenium
109.010	021	EPA 200.7	Silver
109.010	023	EPA 200.7	Thallium
109.010	024	EPA 200.7	Tin
109.010	026	EPA 200.7	Vanadium
109.010	027	EPA 200.7	Zinc
109.020	001	EPA 200.8	Aluminum
109.020	002	EPA 200.8	Antimony
109.020	003	EPA 200.8	Arsenic
109.020	004	EPA 200.8	Barium
109.020	005	EPA 200.8	Beryllium
109.020	006	EPA 200.8	Cadmium
109.020	007	EPA 200.8	Chromium
109.020	008	EPA 200.8	Cobalt

109.020	009	EPA 200.8	Copper
109.020	010	EPA 200.8	Lead
109.020	011	EPA 200.8	Manganese
109.020	012	EPA 200.8	Molybdenum
109.020	013	EPA 200.8	Nickel
109.020	014	EPA 200.8	Selenium
109.020	015	EPA 200.8	Silver
109.020	016	EPA 200.8	Thallium
109.020	017	EPA 200.8	Vanadium
109.020	018	EPA 200.8	Zinc
109.020	021	EPA 200.8	Iron
109.020	022	EPA 200.8	Tin
109.020	023	EPA 200.8	Titanium
109.104	001	EPA 218.6	Chromium (VI)
109.190	001	EPA 245.1	Mercury
109.824	001	SM3500-Fe B (20th)	Iron

110 - Volatile Organic Chemistry of Wastewater

110.040	001	EPA 624	Benzene
110.040	002	EPA 624	Bromodichloromethane
110.040	003	EPA 624	Bromoform
110.040	004	EPA 624	Bromomethane
110.040	005	EPA 624	Carbon Tetrachloride
110.040	006	EPA 624	Chlorobenzene
110.040	007	EPA 624	Chloroethane
110.040	008	EPA 624	2-Chloroethyl Vinyl Ether
110.040	009	EPA 624	Chloroform
110.040	010	EPA 624	Chloromethane
110.040	011	EPA 624	Dibromochloromethane
110.040	012	EPA 624	1,2-Dichlorobenzene
110.040	013	EPA 624	1,3-Dichlorobenzene
110.040	014	EPA 624	1,4-Dichlorobenzene
110.040	015	EPA 624	1,1-Dichloroethane
110.040	016	EPA 624	1,2-Dichloroethane
110.040	017	EPA 624	1,1-Dichloroethene
110.040	018	EPA 624	trans-1,2-Dichloroethene
110.040	019	EPA 624	1,2-Dichloropropane
110.040	020	EPA 624	cis-1,3-Dichloropropene
110.040	021	EPA 624	trans-1,3-Dichloropropene
110.040	022	EPA 624	Ethylbenzene
110.040	023	EPA 624	Methylene Chloride

110.040	024	EPA 624	1,1,2,2-Tetrachloroethane
110.040	025	EPA 624	Tetrachloroethene
110.040	026	EPA 624	Toluene
110.040	027	EPA 624	1,1,1-Trichloroethane
110.040	028	EPA 624	1,1,2-Trichloroethane
110.040	029	EPA 624	Trichloroethene
110.040	030	EPA 624	Trichlorofluoromethane
110.040	031	EPA 624	Vinyl Chloride
110.040	042	EPA 624	Oxygenates
110.040	043	EPA 624	Other Volatile Organics

111 - Semi-volatile Organic Chemistry of Wastewater

111.100	001	EPA 625	Acenaphthene
111.100	002	EPA 625	Acenaphthylene
111.100	003	EPA 625	Anthracene
111.100	004	EPA 625	Benzidine
111.100	005	EPA 625	Benz(a)anthracene
111.100	006	EPA 625	Benzo(b)fluoranthene
111.100	007	EPA 625	Benzo(k)fluoranthene
111.100	008	EPA 625	Benzo(g,h,i)perylene
111.100	009	EPA 625	Benzo(a)pyrene
111.100	010	EPA 625	Benzyl Butyl Phthalate
111.100	011	EPA 625	bis(2-chloroethoxy)methane
111.100	012	EPA 625	bis(2-chloroethyl) Ether
111.100	013	EPA 625	Bis(2-chloroisopropyl) Ether
111.100	014	EPA 625	Di(2-ethylhexyl) Phthalate
111.100	015	EPA 625	4-Bromophenyl Phenyl Ether
111.100	016	EPA 625	4-Chloro-3-methylphenol
111.100	017	EPA 625	2-Chloronaphthalene
111.100	018	EPA 625	2-Chlorophenol
111.100	019	EPA 625	4-Chlorophenyl Phenyl Ether
111.100	020	EPA 625	Chrysene
111.100	021	EPA 625	Dibenz(a,h)anthracene
111.100	025	EPA 625	3,3'-Dichlorobenzidine
111.100	026	EPA 625	2,4-Dichlorophenol
111.100	027	EPA 625	Diethyl Phthalate
111.100	028	EPA 625	2,4-Dimethylphenol
111.100	029	EPA 625	Dimethyl Phthalate
111.100	030	EPA 625	Di-n-butyl phthalate
111.100	031	EPA 625	Di-n-octyl phthalate
111.100	032	EPA 625	2,4-Dinitrophenol

111.100	033	EPA 625	2,4-Dinitrotoluene
111.100	034	EPA 625	2,6-Dinitrotoluene
111.100	035	EPA 625	Fluoranthene
111.100	036	EPA 625	Fluorene
111.100	037	EPA 625	Hexachlorobenzene
111.100	038	EPA 625	Hexachlorobutadiene
111.100	039	EPA 625	Hexachlorocyclopentadiene
111.100	040	EPA 625	Hexachloroethane
111.100	041	EPA 625	Indeno(1,2,3-c,d)pyrene
111.100	042	EPA 625	Isophorone
111.100	043	EPA 625	2-Methyl-4,6-dinitrophenol
111.100	044	EPA 625	Naphthalene
111.100	045	EPA 625	Nitrobenzene
111.100	046	EPA 625	2-Nitrophenol
111.100	047	EPA 625	4-Nitrophenol
111.100	048	EPA 625	N-nitrosodimethylamine
111.100	049	EPA 625	N-nitroso-di-n-propylamine
111.100	050	EPA 625	N-nitrosodiphenylamine
111.100	051	EPA 625	Pentachlorophenol
111.100	052	EPA 625	Phenanthrene
111.100	053	EPA 625	Phenol
111.100	054	EPA 625	Pyrene
111.100	055	EPA 625	1,2,4-Trichlorobenzene
111.100	056	EPA 625	2,4,6-Trichlorophenol
111.101	032	EPA 625	Polynuclear Aromatic Hydrocarbons
111.101	034	EPA 625	Phthalates
111.101	035	EPA 625	Other Extractables
111.170	001	EPA 608	Aldrin
111.170	002	EPA 608	a-BHC
111.170	003	EPA 608	b-BHC
111.170	004	EPA 608	d-BHC
111.170	005	EPA 608	g-BHC (Lindane)
111.170	006	EPA 608	Chlordane
111.170	007	EPA 608	4,4'-DDD
111.170	008	EPA 608	4,4'-DDE
111.170	009	EPA 608	4,4'-DDT
111.170	010	EPA 608	Dieldrin
111.170	011	EPA 608	Endosulfan I
111.170	012	EPA 608	Endosulfan II
111.170	013	EPA 608	Endosulfan Sulfate

111.170	014	EPA 608	Endrin
111.170	015	EPA 608	Endrin Aldehyde
111.170	016	EPA 608	Heptachlor
111.170	017	EPA 608	Heptachlor Epoxide
111.170	018	EPA 608	Toxaphene
111.170	019	EPA 608	PCB-1016
111.170	020	EPA 608	PCB-1221
111.170	021	EPA 608	PCB-1232
111.170	022	EPA 608	PCB 1242
111.170	023	EPA 608	PCB 1248
111.170	024	EPA 608	PCB-1254
111.170	025	EPA 608	PCB-1260
111.170	030	EPA 608	Organochlorine Pesticides
111.170	031	EPA 608	PCBs
111.272	001	SM5520B (20th)	Oil and Grease
111.273	001	EPA 1664A	Oil and Grease

114 - Inorganic Chemistry of Hazardous Waste

114.010	001	EPA 6010B	Antimony
114.010	002	EPA 6010B	Arsenic
114.010	003	EPA 6010B	Barium
114.010	004	EPA 6010B	Beryllium
114.010	005	EPA 6010B	Cadmium
114.010	006	EPA 6010B	Chromium
114.010	007	EPA 6010B	Cobalt
114.010	008	EPA 6010B	Copper
114.010	009	EPA 6010B	Lead
114.010	010	EPA 6010B	Molybdenum
114.010	011	EPA 6010B	Nickel
114.010	012	EPA 6010B	Selenium
114.010	013	EPA 6010B	Silver
114.010	014	EPA 6010B	Thallium
114.010	015	EPA 6010B	Vanadium
114.010	016	EPA 6010B	Zinc
114.020	001	EPA 6020	Antimony
114.020	002	EPA 6020	Arsenic
114.020	003	EPA 6020	Barium
114.020	004	EPA 6020	Beryllium
114.020	005	EPA 6020	Cadmium
114.020	006	EPA 6020	Chromium
114.020	007	EPA 6020	Cobalt

114.020	008	EPA 6020	Copper
114.020	009	EPA 6020	Lead
114.020	010	EPA 6020	Molybdenum
114.020	011	EPA 6020	Nickel
114.020	012	EPA 6020	Selenium
114.020	013	EPA 6020	Silver
114.020	014	EPA 6020	Thallium
114.020	015	EPA 6020	Vanadium
114.020	016	EPA 6020	Zinc
114.103	001	EPA 7196A	Chromium (VI)
114.106	001	EPA 7199	Chromium (VI)
114.140	001	EPA 7470A	Mercury
114.141	001	EPA 7471A	Mercury
114.222	001	EPA 9014	Cyanide
114.230	001	EPA 9034	Sulfides, Total
114.240	001	EPA 9040B	Corrosivity - pH Determination
114.241	001	EPA 9045C	Corrosivity - pH Determination
114.250	001	EPA 9056	Fluoride
114.270	001	EPA 9214	Fluoride

115 - Extraction Test of Hazardous Waste

115.020	001	EPA 1311	Toxicity Characteristic Leaching Procedure (TCLP)
115.030	001	CCR Chapter11, Article 5, Appendix II	Waste Extraction Test (WET)
115.040	001	EPA 1312	Synthetic Precipitation Leaching Procedure (SPLP)

116 - Volatile Organic Chemistry of Hazardous Waste

116.010	000	EPA 8011	EDB and DBCP
116.010	001	EPA 8011	1,2-Dibromoethane
116.010	002	EPA 8011	Dibromochloropropane
116.020	011	EPA 8015B	Ethylene Glycol
116.020	031	EPA 8015B	Ethanol and Methanol
116.030	001	EPA 8015B	Gasoline-range Organics
116.080	000	EPA 8260B	Volatile Organic Compounds
116.080	001	EPA 8260B	Acetone
116.080	002	EPA 8260B	Acetonitrile
116.080	003	EPA 8260B	Acrolein
116.080	004	EPA 8260B	Acrylonitrile
116.080	005	EPA 8260B	Allyl Alcohol
116.080	006	EPA 8260B	Allyl Chloride
116.080	007	EPA 8260B	Benzene
116.080	008	EPA 8260B	Bromoacetone

116.080	010	EPA 8260B	Bromochloromethane
116.080	011	EPA 8260B	Bromodichloromethane
116.080	012	EPA 8260B	Bromoform
116.080	013	EPA 8260B	Bromomethane
116.080	014	EPA 8260B	n-Butyl Alcohol
116.080	015	EPA 8260B	Carbon Disulfide
116.080	016	EPA 8260B	Carbon Tetrachloride
116.080	018	EPA 8260B	Chlorobenzene
116.080	019	EPA 8260B	Chloroethane
116.080	020	EPA 8260B	2-Chloroethyl Vinyl Ether
116.080	021	EPA 8260B	Chloroform
116.080	022	EPA 8260B	Chloromethane
116.080	023	EPA 8260B	Chloroprene
116.080	024	EPA 8260B	3-Chloropropionitrile
116.080	025	EPA 8260B	Crotonaldehyde
116.080	026	EPA 8260B	Dibromochloromethane
116.080	027	EPA 8260B	Dibromochloropropane
116.080	028	EPA 8260B	1,2-Dibromoethane
116.080	030	EPA 8260B	Dibromomethane
116.080	031	EPA 8260B	1,2-Dichlorobenzene
116.080	032	EPA 8260B	1,3-Dichlorobenzene
116.080	033	EPA 8260B	1,4-Dichlorobenzene
116.080	034	EPA 8260B	cis-1,4-Dichloro-2-butene
116.080	035	EPA 8260B	trans-1,4-Dichloro-2-butene
116.080	036	EPA 8260B	Dichlorodifluoromethane
116.080	037	EPA 8260B	1,1-Dichloroethane
116.080	038	EPA 8260B	1,2-Dichloroethane
116.080	039	EPA 8260B	1,1-Dichloroethene
116.080	040	EPA 8260B	trans-1,2-Dichloroethene
116.080	041	EPA 8260B	cis-1,2-Dichloroethene
116.080	042	EPA 8260B	1,2-Dichloropropane
116.080	043	EPA 8260B	1,3-Dichloropropane
116.080	044	EPA 8260B	2,2-Dichloropropane
116.080	045	EPA 8260B	1,1-Dichloropropene
116.080	046	EPA 8260B	cis-1,3-Dichloropropene
116.080	047	EPA 8260B	trans-1,3-Dichloropropene
116.080	048	EPA 8260B	1,3-Dichloro-2-propanol
116.080	049	EPA 8260B	1,2,3,4-Diepoxybutane
116.080	050	EPA 8260B	1,4-Dioxane
116.080	053	EPA 8260B	Ethylbenzene

116.080	055	EPA 8260B	Ethyl Methacrylate
116.080	056	EPA 8260B	Hexachlorobutadiene
116.080	057	EPA 8260B	Hexachloroethane
116.080	058	EPA 8260B	2-Hexanone (MBK)
116.080	059	EPA 8260B	Iodomethane
116.080	060	EPA 8260B	Isobutyl Alcohol
116.080	061	EPA 8260B	Malononitrile
116.080	062	EPA 8260B	Methacrylonitrile
116.080	064	EPA 8260B	Methyl tert-butyl Ether (MTBE)
116.080	065	EPA 8260B	Methylene Chloride
116.080	066	EPA 8260B	Methyl Ethyl Ketone
116.080	067	EPA 8260B	Methyl Methacrylate
116.080	068	EPA 8260B	4-Methyl-2-pentanone (MIBK)
116.080	069	EPA 8260B	Naphthalene
116.080	070	EPA 8260B	Nitrobenzene
116.080	072	EPA 8260B	N-nitroso-di-n-butylamine
116.080	074	EPA 8260B	Pentachloroethane
116.080	075	EPA 8260B	Pentafluorobenzene
116.080	076	EPA 8260B	2-Picoline
116.080	078	EPA 8260B	Propionitrile
116.080	079	EPA 8260B	N-propylamine
116.080	080	EPA 8260B	Pyridine
116.080	081	EPA 8260B	1,1,1,2-Tetrachloroethane
116.080	082	EPA 8260B	1,1,2,2-Tetrachloroethane
116.080	083	EPA 8260B	Tetrachloroethene
116.080	084	EPA 8260B	Toluene
116.080	086	EPA 8260B	1,2,3-Trichlorobenzene
116.080	087	EPA 8260B	1,2,4-Trichlorobenzene
116.080	088	EPA 8260B	1,1,1-Trichloroethane
116.080	089	EPA 8260B	1,1,2-Trichloroethane
116.080	090	EPA 8260B	Trichloroethene
116.080	091	EPA 8260B	Trichlorofluoromethane
116.080	092	EPA 8260B	1,2,3-Trichloropropane
116.080	093	EPA 8260B	Vinyl Acetate
116.080	094	EPA 8260B	Vinyl Chloride
116.080	095	EPA 8260B	Xylenes, Total
116.080	096	EPA 8260B	tert-Amyl Methyl Ether (TAME)
116.080	097	EPA 8260B	tert-Butyl Alcohol (TBA)
116.080	098	EPA 8260B	Ethyl tert-butyl Ether (ETBE)
116.080	099	EPA 8260B	Bromobenzene

116.080	100	EPA 8260B	n-Butylbenzene
116.080	101	EPA 8260B	sec-Butylbenzene
116.080	102	EPA 8260B	tert-Butylbenzene
116.080	103	EPA 8260B	2 Chlorotoluene
116.080	104	EPA 8260B	4 Chlorotoluene
116.080	105	EPA 8260B	Isopropylbenzene
116.080	106	EPA 8260B	N-propylbenzene
116.080	107	EPA 8260B	Styrene
116.080	108	EPA 8260B	1,2,4-Trimethylbenzene
116.080	109	EPA 8260B	1,3,5-Trimethylbenzene
116.080	120	EPA 8260B	Oxygenates
116.100	002	LUFT GC/MS	Benzene
116.100	003	LUFT GC/MS	Toluene
116.100	004	LUFT GC/MS	Xylenes
116.100	005	LUFT GC/MS	Methyl tert-butyl Ether (MTBE)
116.100	010	LUFT GC/MS	BTEX and MTBE
116.110	001	LUFT	Total Petroleum Hydrocarbons - Gasoline

117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	EPA 8015B	Diesel-range Total Petroleum Hydrocarbons
117.015	001	LUFT GC/MS	Diesel-range Total Petroleum Hydrocarbons
117.016	001	LUFT	Diesel-range Total Petroleum Hydrocarbons
117.017	001	EPA 418.1	TRPH Screening
117.110	000	EPA 8270C	Extractable Organics
117.110	001	EPA 8270C	Acenaphthene
117.110	002	EPA 8270C	Acenaphthylene
117.110	003	EPA 8270C	Acetophenone
117.110	004	EPA 8270C	2-Acetylaminofluorene
117.110	005	EPA 8270C	1-Acetyl-2-thiourea
117.110	006	EPA 8270C	4-Aminobiphenyl
117.110	007	EPA 8270C	Aniline
117.110	008	EPA 8270C	Anthracene
117.110	009	EPA 8270C	Aramite
117.110	010	EPA 8270C	Benzidine
117.110	011	EPA 8270C	Benz(a)anthracene
117.110	012	EPA 8270C	Benzo(b)fluoranthene
117.110	013	EPA 8270C	Benzo(k)fluoranthene
117.110	014	EPA 8270C	Benzo(g,h,i)perylene
117.110	015	EPA 8270C	Benzo(a)pyrene
117.110	016	EPA 8270C	Benzoic Acid
117.110	017	EPA 8270C	p-Benzoquinone

117.110	018	EPA 8270C	Benzyl Alcohol
117.110	019	EPA 8270C	Benzyl Butyl Phthalate
117.110	020	EPA 8270C	bis(2-chloroethoxy)methane
117.110	021	EPA 8270C	bis(2-chloroethyl) Ether
117.110	022	EPA 8270C	Bis(2-chloroisopropyl) Ether
117.110	023	EPA 8270C	Di(2-ethylhexyl) Phthalate
117.110	024	EPA 8270C	4-Bromophenyl Phenyl Ether
117.110	025	EPA 8270C	Carbazole
117.110	026	EPA 8270C	4-Chloroaniline
117.110	027	EPA 8270C	4-Chloro-3-methylphenol
117.110	029	EPA 8270C	2-Chloronaphthalene
117.110	030	EPA 8270C	2-Chlorophenol
117.110	031	EPA 8270C	4-Chlorophenyl Phenyl Ether
117.110	032	EPA 8270C	Chrysene
117.110	033	EPA 8270C	2-Cyclohexyl-4,6-dinitrophenol
117.110	034	EPA 8270C	2,4-Diaminotoluene
117.110	036	EPA 8270C	Dibenz(a,h)anthracene
117.110	037	EPA 8270C	Dibenzofuran
117.110	038	EPA 8270C	Dibenzo(a,e)pyrene
117.110	039	EPA 8270C	1,2-Dichlorobenzene
117.110	040	EPA 8270C	1,3-Dichlorobenzene
117.110	041	EPA 8270C	1,4-Dichlorobenzene
117.110	042	EPA 8270C	3,3'-Dichlorobenzidine
117.110	043	EPA 8270C	2,4-Dichlorophenol
117.110	044	EPA 8270C	2,6-Dichlorophenol
117.110	046	EPA 8270C	Diethyl Phthalate
117.110	050	EPA 8270C	p-Dimethylaminoazobenzene
117.110	051	EPA 8270C	7,12-Dimethylbenz(a)anthracene
117.110	052	EPA 8270C	a,a-Dimethylphenethylamine
117.110	053	EPA 8270C	2,4-Dimethylphenol
117.110	054	EPA 8270C	Dimethyl Phthalate
117.110	055	EPA 8270C	Di-n-butyl phthalate
117.110	056	EPA 8270C	Di-n-octyl phthalate
117.110	058	EPA 8270C	1,3-Dinitrobenzene
117.110	060	EPA 8270C	2,4-Dinitrophenol
117.110	061	EPA 8270C	2,4-Dinitrotoluene
117.110	062	EPA 8270C	2,6-Dinitrotoluene
117.110	063	EPA 8270C	Diphenylamine
117.110	064	EPA 8270C	1,2-Diphenylhydrazine
117.110	065	EPA 8270C	Ethyl Carbamate

117.110	066	EPA 8270C	Ethyl Methanesulfonate
117.110	067	EPA 8270C	Fluoranthene
117.110	068	EPA 8270C	Fluorene
117.110	069	EPA 8270C	Hexachlorobenzene
117.110	070	EPA 8270C	Hexachlorobutadiene
117.110	071	EPA 8270C	Hexachlorocyclopentadiene
117.110	072	EPA 8270C	Hexachloroethane
117.110	073	EPA 8270C	Hexachlorophene
117.110	074	EPA 8270C	Hexachloropropene
117.110	075	EPA 8270C	Indeno(1,2,3-c,d)pyrene
117.110	076	EPA 8270C	Isophorone
117.110	077	EPA 8270C	Isosafrole
117.110	078	EPA 8270C	Maleic Anhydride
117.110	079	EPA 8270C	3-Methylcholanthrene
117.110	080	EPA 8270C	2-Methyl-4,6-dinitrophenol
117.110	082	EPA 8270C	Methyl Methanesulfonate
117.110	083	EPA 8270C	2-Methylnaphthalene
117.110	084	EPA 8270C	2-Methylphenol
117.110	085	EPA 8270C	3-Methylphenol
117.110	086	EPA 8270C	4-Methylphenol
117.110	087	EPA 8270C	Naphthalene
117.110	088	EPA 8270C	1,4-Naphthoquinone
117.110	089	EPA 8270C	1-Naphthylamine
117.110	090	EPA 8270C	2-Naphthylamine
117.110	091	EPA 8270C	Nicotine
117.110	092	EPA 8270C	2-Nitroaniline
117.110	093	EPA 8270C	3-Nitroaniline
117.110	094	EPA 8270C	4-Nitroaniline
117.110	095	EPA 8270C	Nitrobenzene
117.110	096	EPA 8270C	2-Nitrophenol
117.110	097	EPA 8270C	4-Nitrophenol
117.110	098	EPA 8270C	N-nitroso-di-n-butylamine
117.110	099	EPA 8270C	N-nitrosodiethylamine
117.110	100	EPA 8270C	N-nitrosodimethylamine
117.110	101	EPA 8270C	N-nitroso-di-n-propylamine
117.110	102	EPA 8270C	N-nitrosodiphenylamine
117.110	103	EPA 8270C	N-nitrosomethylethylamine
117.110	104	EPA 8270C	N-nitrosomorpholine
117.110	105	EPA 8270C	N-nitrosopiperidine
117.110	106	EPA 8270C	N-nitrosopyrrolidine

117.110	107	EPA 8270C	5-Nitro-o-toluidine
117.110	108	EPA 8270C	Pentachlorobenzene
117.110	109	EPA 8270C	Pentachloronitrobenzene
117.110	110	EPA 8270C	Pentachlorophenol
117.110	111	EPA 8270C	Phenacetin
117.110	112	EPA 8270C	Phenanthrene
117.110	113	EPA 8270C	Phenol
117.110	114	EPA 8270C	1,4-Phenylenediamine
117.110	116	EPA 8270C	2-Picoline
117.110	117	EPA 8270C	Pronamide
117.110	119	EPA 8270C	Pyrene
117.110	120	EPA 8270C	Pyridine
117.110	122	EPA 8270C	Safrole
117.110	124	EPA 8270C	1,2,4,5-Tetrachlorobenzene
117.110	126	EPA 8270C	2,3,4,6-Tetrachlorophenol
117.110	128	EPA 8270C	o-Toluidine
117.110	129	EPA 8270C	1,2,4-Trichlorobenzene
117.110	130	EPA 8270C	2,4,5-Trichlorophenol
117.110	131	EPA 8270C	2,4,6-Trichlorophenol
117.110	132	EPA 8270C	1,3,5-Trinitrobenzene
117.111	025	EPA 8270C	Dimethoate
117.111	026	EPA 8270C	Dinoseb
117.111	036	EPA 8270C	Famphur
117.111	039	EPA 8270C	Isodrin
117.111	040	EPA 8270C	Kepone
117.111	054	EPA 8270C	Parathion Ethyl
117.111	055	EPA 8270C	Parathion Methyl
117.111	056	EPA 8270C	Phorate
117.111	058	EPA 8270C	Sulfotepp
117.111	061	EPA 8270C	O,O,O-Triethyl Phosphorothioate
117.111	073	EPA 8270C	Polynuclear Aromatic Hydrocarbons
117.111	075	EPA 8270C	Phthalates
117.111	076	EPA 8270C	Other Extractables
117.140	000	EPA 8310	Polynuclear Aromatic Hydrocarbons
117.140	001	EPA 8310	Acenaphthene
117.140	002	EPA 8310	Acenaphthylene
117.140	003	EPA 8310	Anthracene
117.140	004	EPA 8310	Benz(a)anthracene
117.140	005	EPA 8310	Benzo(a)pyrene
117.140	006	EPA 8310	Benzo(b)fluoranthene

117.140	007	EPA 8310	Benzo(k)fluoranthene
117.140	008	EPA 8310	Benzo(g,h,i)perylene
117.140	009	EPA 8310	Chrysene
117.140	010	EPA 8310	Dibenz(a,h)anthracene
117.140	011	EPA 8310	Fluoranthene
117.140	012	EPA 8310	Fluorene
117.140	013	EPA 8310	Indeno(1,2,3-c,d)pyrene
117.140	014	EPA 8310	Naphthalene
117.140	015	EPA 8310	Phenanthrene
117.140	016	EPA 8310	Pyrene
117.171	000	EPA 8330A	Nitroaromatics and Nitramines
117.171	001	EPA 8330A	4-Amino-2,6-dinitrotoluene
117.171	002	EPA 8330A	2-Amino-4,6-dinitrotoluene
117.171	003	EPA 8330A	1,3-Dinitrobenzene
117.171	004	EPA 8330A	2,4-Dinitrotoluene
117.171	005	EPA 8330A	2,6-Dinitrotoluene
117.171	006	EPA 8330A	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
117.171	007	EPA 8330A	Methyl-2,4,6-trinitrophenylnitramine
117.171	008	EPA 8330A	Nitrobenzene
117.171	009	EPA 8330A	2-Nitrotoluene
117.171	010	EPA 8330A	3-Nitrotoluene
117.171	011	EPA 8330A	4-Nitrotoluene
117.171	013	EPA 8330A	1,3,5-Trinitrobenzene
117.171	014	EPA 8330A	2,4,6-Trinitrotoluene
117.190	001	EPA 8332	Nitroglycerine
117.210	000	EPA 8081A	Organochlorine Pesticides
117.210	001	EPA 8081A	Aldrin
117.210	002	EPA 8081A	a-BHC
117.210	003	EPA 8081A	b-BHC
117.210	004	EPA 8081A	d-BHC
117.210	005	EPA 8081A	g-BHC (Lindane)
117.210	007	EPA 8081A	a-Chlordane
117.210	008	EPA 8081A	g-Chlordane
117.210	009	EPA 8081A	Chlordane (tech.)
117.210	010	EPA 8081A	Chlorobenzilate
117.210	011	EPA 8081A	Chloroneb
117.210	012	EPA 8081A	Chlorothalonil
117.210	013	EPA 8081A	4,4'-DDD
117.210	014	EPA 8081A	4,4'-DDE
117.210	015	EPA 8081A	4,4'-DDT

117.210	020	EPA 8081A	Dieldrin
117.210	021	EPA 8081A	Endosulfan I
117.210	022	EPA 8081A	Endosulfan II
117.210	023	EPA 8081A	Endosulfan Sulfate
117.210	024	EPA 8081A	Endrin
117.210	025	EPA 8081A	Endrin Aldehyde
117.210	026	EPA 8081A	Endrin Ketone
117.210	027	EPA 8081A	Heptachlor
117.210	028	EPA 8081A	Heptachlor Epoxide
117.210	029	EPA 8081A	Hexachlorobenzene
117.210	033	EPA 8081A	Methoxychlor
117.210	039	EPA 8081A	Toxaphene
117.220	000	EPA 8082	PCBs
117.220	001	EPA 8082	PCB-1016
117.220	002	EPA 8082	PCB-1221
117.220	003	EPA 8082	PCB-1232
117.220	004	EPA 8082	PCB-1242
117.220	005	EPA 8082	PCB-1248
117.220	006	EPA 8082	PCB-1254
117.220	007	EPA 8082	PCB-1260
117.220	008	EPA 8082	2-Chlorobiphenyl
117.220	009	EPA 8082	2,3-Dichlorobiphenyl
117.220	010	EPA 8082	2,2',5-Trichlorobiphenyl
117.220	011	EPA 8082	2,4',5-Trichlorobiphenyl
117.220	012	EPA 8082	2,2',3,5'-Tetrachlorobiphenyl
117.220	013	EPA 8082	2,2',5,5'-Tetrachlorobiphenyl
117.220	014	EPA 8082	2,3',4,4'-Tetrachlorobiphenyl
117.220	015	EPA 8082	2,2',3,4,5'-Pentachlorobiphenyl
117.220	016	EPA 8082	2,2',4,5,5'-Pentachlorobiphenyl
117.220	017	EPA 8082	2,3,3',4',6-Pentachlorobiphenyl
117.220	018	EPA 8082	2,2',3,4,4',5'-Hexachlorobiphenyl
117.220	019	EPA 8082	2,2',3,4,5,5'-Hexachlorobiphenyl
117.220	020	EPA 8082	2,2',3,5,5',6-Hexachlorobiphenyl
117.220	021	EPA 8082	2,2',4,4',5,5'-Hexachlorobiphenyl
117.220	022	EPA 8082	2,2',3,3',4,4',5-Heptachlorobiphenyl
117.220	023	EPA 8082	2,2',3,4,4',5,5'-Heptachlorobiphenyl
117.220	024	EPA 8082	2,2',3,4,4',5',6-Heptachlorobiphenyl
117.220	025	EPA 8082	2,2',3,4',5,5',6-Heptachlorobiphenyl
117.220	026	EPA 8082	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl
117.240	000	EPA 8141A	Organophosphorus Pesticides

117.240	001	EPA 8141A	Atrazine
117.240	002	EPA 8141A	Azinphos Methyl
117.240	004	EPA 8141A	Chlorfenvinphos
117.240	005	EPA 8141A	Chlorpyrifos
117.240	006	EPA 8141A	Chlorpyrifos Methyl
117.240	007	EPA 8141A	Demeton-O
117.240	008	EPA 8141A	Demeton-S
117.240	009	EPA 8141A	Diazinon
117.240	010	EPA 8141A	Dimethoate
117.240	011	EPA 8141A	Disulfoton
117.240	012	EPA 8141A	EPN
117.240	013	EPA 8141A	Ethion
117.240	014	EPA 8141A	Famphur
117.240	015	EPA 8141A	Malathion
117.240	016	EPA 8141A	Mevinphos
117.240	017	EPA 8141A	Naled
117.240	018	EPA 8141A	Parathion Ethyl
117.240	019	EPA 8141A	Parathion Methyl
117.240	020	EPA 8141A	Phorate
117.240	022	EPA 8141A	Ronnel
117.240	024	EPA 8141A	Sulfotepp
117.240	026	EPA 8141A	Thionazin
117.250	000	EPA 8151A	Chlorinated Herbicides
117.250	001	EPA 8151A	2,4-D
117.250	002	EPA 8151A	2,4-DB
117.250	003	EPA 8151A	2,4,5-T
117.250	004	EPA 8151A	2,4,5-TP
117.250	006	EPA 8151A	Dalapon
117.250	007	EPA 8151A	Dichlorprop
117.250	008	EPA 8151A	Dinoseb
117.250	009	EPA 8151A	MCPA
117.250	010	EPA 8151A	MCPP
117.250	011	EPA 8151A	4-Nitrophenol
117.250	012	EPA 8151A	Pentachlorophenol
117.250	013	EPA 8151A	Picloram
117.250	014	EPA 8151A	Dicamba
117.250	015	EPA 8151A	3,5-Dichlorobenzoic Acid
117.250	016	EPA 8151A	Acifluorfen
117.250	017	EPA 8151A	Bentazon
117.250	018	EPA 8151A	Chloramben

117.250	019	EPA 8151A	DCPA

120 - Physical Properties of Hazardous Waste

120.010	001	EPA 1010	Ignitability
120.040	001	Section 7.3 SW-846	Reactive Cyanide
120.050	001	Section 7.3 SW-846	Reactive Sulfide
120.070	001	EPA 9040B	Corrosivity - pH Determination
120.080	001	EPA 9045C	Corrosivity - pH Determination

CDPH
Howard Backer, MD, MPH
Interim Director

State of California—Health and Human Services Agency

California Department of Public Health

EDMUND G. BROWN JR.
Governor

June 6, 2011

Curtis Desilets
Enviro-Chem, Inc.
1214 East Lexington Avenue
Pomona, CA 91766

Dear Curtis Desilets: Certificate No. 1555

This is to advise you that the laboratory named above continues to be certified as an environmental testing laboratory pursuant to the provisions of the Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100825, et seq. Certification for all currently certified Fields of Testing that the laboratory has applied for renewal shall remain in effect until **06/30/2013** unless it is revoked.

Please note that the renewal application for certification is subject to an on-site process, and the continued use of this certificate is contingent upon:

* **successful completion of the on-site process;**
* **acceptable performance in the required proficiency testing (PT) studies;**
* **timely payment of all fees, including an annual fee due before June 30, 2012;**
* **compliance with Environmental Laboratory Accreditation Program Branch (ELAP) statutes (HSC, Section 100825, et seq.) and Regulations (California Code of Regulations (CCR),Title 22, Division 4, Chapter 19).**

An updated certificate of the "Fields of Testing" will be issued to the laboratory upon successful completion of the on-site process.

The application for the renewal of this certificate must be received before the expiration date to remain in force according to the HSC100845(a).

Please note that the laboratory is required to notify ELAP of any major changes in the laboratory such as the transfer of ownership, change of laboratory director, change in location, or structural alterations which may affect adversely the quality of analyses (HSC, Section 100845(b)(d)). Please include the above certificate number in all your correspondence with ELAP.

If you have any questions, please contact ELAP at (510) 620-3155.

Sincerely,

George C. Kulasingam, Ph.D., Chief
Environmental Laboratory Accreditation Program Branch

CDPH
California Department of
PublicHealth

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF ENVIRONMENTAL ACCREDITATION

Is hereby granted to

Enviro-Chem, Inc.

1214 East Lexington Avenue

Pomona, CA 91766

Scope of the certificate is limited to the
"Fields of Testing"
which accompany this Certificate.

Continued accredited status depends on successful completion of on-site, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **1555**

Expiration Date: **06/30/2013**

Effective Date: **07/01/2011**

Richmond, California
subject to forfeiture or revocation

George C. Kulasingam

George C. Kulasingam, Ph.D., Chief
Environmental Laboratory Accreditation Program Branch

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

ENVIRO-CHEM, INC. **Lab Phone** (909) 590-5905

1214 EAST LEXINGTON AVENUE
POMONA, CA 91766

Certificate No: 1555 **Renew Date: 6/30/2009**

Field of Testing: 103 - Toxic Chemical Elements of Drinking Water

103.130	001	Aluminum	EPA 200.7
103.130	003	Barium	EPA 200.7
103.130	004	Beryllium	EPA 200.7
103.130	005	Cadmium	EPA 200.7
103.130	007	Chromium	EPA 200.7
103.130	008	Copper	EPA 200.7
103.130	009	Iron	EPA 200.7
103.130	011	Manganese	EPA 200.7
103.130	012	Nickel	EPA 200.7
103.130	015	Silver	EPA 200.7
103.130	017	Zinc	EPA 200.7
103.130	018	Boron	EPA 200.7
103.160	001	Mercury	EPA 245.1
103.310	001	Chromium (VI)	EPA 218.6

Field of Testing: 104 - Volatile Organic Chemistry of Drinking Water

104.040	000	Volatile Organic Compounds	EPA 524.2

Field of Testing: 108 - Inorganic Chemistry of Wastewater

108.020	001	Conductivity	EPA 120.1
108.110	001	Turbidity	EPA 180.1
108.112	001	Boron	EPA 200.7
108.112	002	Calcium	EPA 200.7
108.112	003	Hardness (calc.)	EPA 200.7
108.112	004	Magnesium	EPA 200.7
108.112	006	Silica	EPA 200.7
108.112	007	Sodium	EPA 200.7
108.141	001	Alkalinity	EPA 310.2
108.183	001	Cyanide, Total	EPA 335.4
108.200	001	Ammonia	EPA 350.1
108.323	001	Chemical Oxygen Demand	EPA 410.4
108.350	001	Total Recoverable Petroleum Hydrocarbons	EPA 418.1
108.360	001	Phenols, Total	EPA 420.1
108.381	001	Oil and Grease	EPA 1664A
108.390	001	Turbidity	SM2130B
108.400	001	Acidity	SM2310B
108.410	001	Alkalinity	SM2320B

As of 11/14/2008, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

108.430	001	Conductivity	SM2510B
108.440	001	Residue, Total	SM2540B
108.441	001	Residue, Filterable	SM2540C
108.442	001	Residue, Non-filterable	SM2540D
108.443	001	Residue, Settleable	SM2540F
108.447	001	Boron	SM3120B
108.447	002	Calcium	SM3120B
108.447	003	Hardness (calc.)	SM3120B
108.447	004	Magnesium	SM3120B
108.447	006	Silica	SM3120B
108.447	007	Sodium	SM3120B
108.451	001	Chloride	SM4500-Cl- C
108.461	001	Chlorine	SM4500-Cl C
108.470	001	Cyanide, Manual Distillation	SM4500-CN C
108.472	001	Cyanide, Total	SM4500-CN E
108.473	001	Cyanide, amenable	SM4500-CN G
108.480	001	Fluoride	SM4500-F C
108.490	001	pH	SM4500-H+ B
108.493	001	Ammonia	SM4500-NH3 D or E (19th/20th)
108.494	001	Ammonia	SM4500-NH3 F or G (18th)
108.520	001	Nitrate-nitrite	SM4500-NO3 E
108.520	002	Nitrite	SM4500-NO3 E
108.571	001	Sulfate	SM4500-SO4 D
108.580	001	Sulfide	SM4500-S= D
108.602	001	Chemical Oxygen Demand	SM5220D
108.630	001	Oil and Grease	SM5520B (20th)
108.640	001	Surfactants	SM5540C

Field of Testing: 109 - Toxic Chemical Elements of Wastewater

109.010	001	Aluminum	EPA 200.7
109.010	002	Antimony	EPA 200.7
109.010	003	Arsenic	EPA 200.7
109.010	004	Barium	EPA 200.7
109.010	005	Beryllium	EPA 200.7
109.010	007	Cadmium	EPA 200.7
109.010	009	Chromium	EPA 200.7
109.010	010	Cobalt	EPA 200.7
109.010	011	Copper	EPA 200.7
109.010	012	Iron	EPA 200.7
109.010	013	Lead	EPA 200.7
109.010	015	Manganese	EPA 200.7
109.010	016	Molybdenum	EPA 200.7
109.010	017	Nickel	EPA 200.7
109.010	019	Selenium	EPA 200.7

109.010	021	Silver	EPA 200.7
109.010	023	Thallium	EPA 200.7
109.010	024	Tin	EPA 200.7
109.010	026	Vanadium	EPA 200.7
109.010	027	Zinc	EPA 200.7
109.104	001	Chromium (VI)	EPA 218.6
109.190	001	Mercury	EPA 245.1
109.430	001	Aluminum	SM3120B
109.430	002	Antimony	SM3120B
109.430	003	Arsenic	SM3120B
109.430	004	Barium	SM3120B
109.430	005	Beryllium	SM3120B
109.430	007	Cadmium	SM3120B
109.430	009	Chromium	SM3120B
109.430	010	Cobalt	SM3120B
109.430	011	Copper	SM3120B
109.430	012	Iron	SM3120B
109.430	013	Lead	SM3120B
109.430	015	Manganese	SM3120B
109.430	016	Molybdenum	SM3120B
109.430	017	Nickel	SM3120B
109.430	019	Selenium	SM3120B
109.430	021	Silver	SM3120B
109.430	023	Thallium	SM3120B
109.430	024	Vanadium	SM3120B
109.430	025	Zinc	SM3120B

Field of Testing: 110 - Volatile Organic Chemistry of Wastewater

110.040	040	Halogenated Hydrocarbons	EPA 624
110.040	041	Aromatic Compounds	EPA 624
110.040	042	Oxygenates	EPA 624
110.040	043	Other Volatile Organics	EPA 624

Field of Testing: 111 - Semi-volatile Organic Chemistry of Wastewater

111.101	032	Polynuclear Aromatic Hydrocarbons	EPA 625
111.101	033	Adipates	EPA 625
111.101	034	Phthalates	EPA 625
111.101	036	Other Extractables	EPA 625
111.170	030	Organochlorine Pesticides	EPA 608
111.170	031	PCBs	EPA 608

Field of Testing: 114 - Inorganic Chemistry of Hazardous Waste

114.010	001	Antimony	EPA 6010B
114.010	002	Arsenic	EPA 6010B
114.010	003	Barium	EPA 6010B
114.010	004	Beryllium	EPA 6010B

ENVIRO-CHEM, INC.

Certificate No: 1555
Renew Date: 6/30/2009

114.010	005	Cadmium	EPA 6010B
114.010	006	Chromium	EPA 6010B
114.010	007	Cobalt	EPA 6010B
114.010	008	Copper	EPA 6010B
114.010	009	Lead	EPA 6010B
114.010	010	Molybdenum	EPA 6010B
114.010	011	Nickel	EPA 6010B
114.010	012	Selenium	EPA 6010B
114.010	013	Silver	EPA 6010B
114.010	014	Thallium	EPA 6010B
114.010	015	Vanadium	EPA 6010B
114.010	016	Zinc	EPA 6010B
114.103	001	Chromium (VI)	EPA 7196A
114.106	001	Chromium (VI)	EPA 7199
114.130	001	Lead	EPA 7420
114.140	001	Mercury	EPA 7470A
114.141	001	Mercury	EPA 7471A
114.221	001	Cyanide, Total	EPA 9012A
114.230	001	Sulfides, Total	EPA 9034
114.240	001	Corrosivity - pH Determination	EPA 9040B
114.241	001	Corrosivity - pH Determination	EPA 9045C

Field of Testing: 115 - Extraction Test of Hazardous Waste

115.020	001	Toxicity Characteristic Leaching Procedure (TCLP)	EPA 1311
115.030	001	Waste Extraction Test (WET)	CCR Chapter11, Article 5, Appendix II
115.040	001	Synthetic Precipitation Leaching Procedure (SPLP)	EPA 1312

Field of Testing: 116 - Volatile Organic Chemistry of Hazardous Waste

116.020	031	Ethanol and Methanol	EPA 8015B
116.030	001	Gasoline-range Organics	EPA 8015B
116.040	041	Methyl tert-butyl Ether (MTBE)	EPA 8021B
116.040	062	BTEX	EPA 8021B
116.080	000	Volatile Organic Compounds	EPA 8260B
116.080	120	Oxygenates	EPA 8260B
116.100	001	Total Petroleum Hydrocarbons - Gasoline	LUFT GC/MS
116.100	010	BTEX and MTBE	LUFT GC/MS
116.110	001	Total Petroleum Hydrocarbons - Gasoline	LUFT

Field of Testing: 117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	Diesel-range Total Petroleum Hydrocarbons	EPA 8015B
117.015	001	Diesel-range Total Petroleum Hydrocarbons	LUFT GC/MS
117.016	001	Diesel-range Total Petroleum Hydrocarbons	LUFT
117.017	001	TRPH Screening	EPA 418.1
117.110	000	Extractable Organics	EPA 8270C
117.210	000	Organochlorine Pesticides	EPA 8081A
117.220	000	PCBs	EPA 8082

As of 11/14/2008 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

CDPH
California Department of
PublicHealth

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF ENVIRONMENTAL LABORATORY ACCREDITATION

Is hereby granted to

Enviro-Chem, Inc.

1214 East Lexington Avenue

Pomona, CA 91766

Scope of the certificate is limited to the
"Fields of Testing"
which accompany this Certificate.

Continued accredited status depends on successful completion of on-site, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **1555**

Expiration Date: **06/30/2015**

Effective Date: **07/01/2013**

Richmond, California
subject to forfeiture or revocation

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

State of California—Health and Human Services Agency
California Department of Public Health

RON CHAPMAN, MD, MPH
Director & State Health Officer

EDMUND G. BROWN JR.
Governor

June 6, 2013

Curtis B. Desilets
Enviro-Chem, Inc.
1214 East Lexington Avenue
Pomona, CA 91766

Dear Curtis B. Desilets: Certificate No. 1555

This is to advise you that the laboratory named above continues to be certified as an environmental testing laboratory pursuant to the provisions of the Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100825, et seq. Certification for all currently certified Fields of Testing that the laboratory has applied for renewal shall remain in effect until **06/30/2015** unless it is revoked.

Please note that the renewal application for certification is subject to an on-site process, and the continued use of this certificate is contingent upon:

- **successful completion of the on-site process;**
- **acceptable performance in the required proficiency testing (PT) studies;**
- **timely payment of all fees, including an annual fee due before June 30, 2014;**
- **compliance with Environmental Laboratory Accreditation Program Branch (ELAPB); statutes (HSC, Section 100825, et seq.) and Regulations (California Code of Regulations (CCR),Title 22, Division 4, Chapter 19).**

An updated certificate of the "Fields of Testing" will be issued to the laboratory upon successful completion of the on-site process.

The application for the renewal of this certificate must be received before the expiration date to remain in force according to the HSC100845(a).

Please note that the laboratory is required to notify ELAPB of any major changes in the laboratory such as the transfer of ownership, change of laboratory director, change in location, or structural alterations which may affect adversely the quality of analyses (HSC, Section 100845(b)(d)). Please include the above certificate number in all your correspondence with ELAPB.

If you have any questions, please contact ELAPB at (510) 620-3155.

Sincerely,

Fred Choske for

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

Enviro-Chem, Inc.
1214 East Lexington Avenue
Pomona, CA 91766
Phone: (909) 590-5905

Certificate No.: 1555
Renew Date: 6/30/2013

Field of Testing: 103 - Toxic Chemical Elements of Drinking Water

103.160	001	Mercury	EPA 245.1
103.310	001	Chromium (VI)	EPA 218.6

Field of Testing: 108 - Inorganic Chemistry of Wastewater

108.020	001	Conductivity	EPA 120.1
108.110	001	Turbidity	EPA 180.1
108.112	001	Boron	EPA 200.7
108.112	002	Calcium	EPA 200.7
108.112	003	Hardness (calc.)	EPA 200.7
108.112	004	Magnesium	EPA 200.7
108.112	006	Silica	EPA 200.7
108.112	007	Sodium	EPA 200.7
108.120	002	Chloride	EPA 300.0
108.120	003	Fluoride	EPA 300.0
108.120	004	Nitrate	EPA 300.0
108.120	005	Nitrite	EPA 300.0
108.120	006	Nitrate-nitrite	EPA 300.0
108.120	007	Phosphate, Ortho	EPA 300.0
108.120	008	Sulfate	EPA 300.0
108.141	001	Alkalinity	EPA 310.2
108.183	001	Cyanide, Total	EPA 335.4
108.200	001	Ammonia	EPA 350.1
108.323	001	Chemical Oxygen Demand	EPA 410.4
108.350	001	Total Recoverable Petroleum Hydrocarbons	EPA 418.1
108.360	001	Phenols, Total	EPA 420.1
108.381	001	Oil and Grease	EPA 1664A
108.390	001	Turbidity	SM2130B
108.400	001	Acidity	SM2310B
108.410	001	Alkalinity	SM2320B
108.430	001	Conductivity	SM2510B
108.440	001	Residue, Total	SM2540B
108.441	001	Residue, Filterable	SM2540C
108.442	001	Residue, Non-filterable	SM2540D
108.443	001	Residue, Settleable	SM2540F

108.447	001	Boron	SM3120B
108.447	002	Calcium	SM3120B
108.447	003	Hardness (calc.)	SM3120B
108.447	004	Magnesium	SM3120B
108.447	006	Silica	SM3120B
108.447	007	Sodium	SM3120B
108.451	001	Chloride	SM4500-Cl- C
108.460	001	Chlorine, Total	SM4500-Cl B
108.470	001	Cyanide, Manual Distillation	SM4500-CN C
108.472	001	Cyanide, Total	SM4500-CN E
108.473	001	Cyanide, amenable	SM4500-CN G
108.490	001	pH	SM4500-H+ B
108.493	001	Ammonia	SM4500-NH3 D or E (19th/20th)
108.494	001	Ammonia	SM4500-NH3 F or G (18th)
108.520	001	Nitrate-nitrite	SM4500-NO3 E
108.520	002	Nitrite	SM4500-NO3 E
108.580	001	Sulfide	SM4500-S= D
108.602	001	Chemical Oxygen Demand	SM5220D
108.640	001	Surfactants	SM5540C

Field of Testing: 109 - Toxic Chemical Elements of Wastewater

109.010	001	Aluminum	EPA 200.7
109.010	002	Antimony	EPA 200.7
109.010	003	Arsenic	EPA 200.7
109.010	004	Barium	EPA 200.7
109.010	005	Beryllium	EPA 200.7
109.010	007	Cadmium	EPA 200.7
109.010	009	Chromium	EPA 200.7
109.010	010	Cobalt	EPA 200.7
109.010	011	Copper	EPA 200.7
109.010	012	Iron	EPA 200.7
109.010	013	Lead	EPA 200.7
109.010	015	Manganese	EPA 200.7
109.010	016	Molybdenum	EPA 200.7
109.010	017	Nickel	EPA 200.7
109.010	019	Selenium	EPA 200.7
109.010	021	Silver	EPA 200.7
109.010	023	Thallium	EPA 200.7
109.010	024	Tin	EPA 200.7
109.010	026	Vanadium	EPA 200.7
109.010	027	Zinc	EPA 200.7
109.104	001	Chromium (VI)	EPA 218.6

As of 8/22/2013 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

109.190	001	Mercury	EPA 245.1
109.430	001	Aluminum	SM3120B
109.430	002	Antimony	SM3120B
109.430	003	Arsenic	SM3120B
109.430	004	Barium	SM3120B
109.430	005	Beryllium	SM3120B
109.430	007	Cadmium	SM3120B
109.430	009	Chromium	SM3120B
109.430	010	Cobalt	SM3120B
109.430	011	Copper	SM3120B
109.430	012	Iron	SM3120B
109.430	013	Lead	SM3120B
109.430	015	Manganese	SM3120B
109.430	016	Molybdenum	SM3120B
109.430	017	Nickel	SM3120B
109.430	019	Selenium	SM3120B
109.430	021	Silver	SM3120B
109.430	023	Thallium	SM3120B
109.430	024	Vanadium	SM3120B
109.430	025	Zinc	SM3120B

Field of Testing: 110 - Volatile Organic Chemistry of Wastewater

110.040	040	Halogenated Hydrocarbons	EPA 624
110.040	041	Aromatic Compounds	EPA 624
110.040	042	Oxygenates	EPA 624
110.040	043	Other Volatile Organics	EPA 624

Field of Testing: 111 - Semi-volatile Organic Chemistry of Wastewater

111.101	032	Polynuclear Aromatic Hydrocarbons	EPA 625
111.101	033	Adipates	EPA 625
111.101	034	Phthalates	EPA 625
111.101	036	Other Extractables	EPA 625
111.170	030	Organochlorine Pesticides	EPA 608
111.170	031	PCBs	EPA 608

Field of Testing: 114 - Inorganic Chemistry of Hazardous Waste

114.010	001	Antimony	EPA 6010B
114.010	002	Arsenic	EPA 6010B
114.010	003	Barium	EPA 6010B
114.010	004	Beryllium	EPA 6010B
114.010	005	Cadmium	EPA 6010B
114.010	006	Chromium	EPA 6010B
114.010	007	Cobalt	EPA 6010B

114.010	008	Copper	EPA 6010B
114.010	009	Lead	EPA 6010B
114.010	010	Molybdenum	EPA 6010B
114.010	011	Nickel	EPA 6010B
114.010	012	Selenium	EPA 6010B
114.010	013	Silver	EPA 6010B
114.010	014	Thallium	EPA 6010B
114.010	015	Vanadium	EPA 6010B
114.010	016	Zinc	EPA 6010B
114.103	001	Chromium (VI)	EPA 7196A
114.106	001	Chromium (VI)	EPA 7199
114.130	001	Lead	EPA 7420
114.140	001	Mercury	EPA 7470A
114.141	001	Mercury	EPA 7471A
114.221	001	Cyanide, Total	EPA 9012A
114.230	001	Sulfides, Total	EPA 9034
114.240	001	Corrosivity - pH Determination	EPA 9040B
114.241	001	Corrosivity - pH Determination	EPA 9045C

Field of Testing: 115 - Extraction Test of Hazardous Waste

115.020	001	Toxicity Characteristic Leaching Procedure (TCLP)	EPA 1311
115.030	001	Waste Extraction Test (WET)	CCR Chapter11, Article 5, Appendix II

Field of Testing: 116 - Volatile Organic Chemistry of Hazardous Waste

116.020	031	Ethanol and Methanol	EPA 8015B
116.030	001	Gasoline-range Organics	EPA 8015B
116.080	000	Volatile Organic Compounds	EPA 8260B
116.080	120	Oxygenates	EPA 8260B
116.100	001	Total Petroleum Hydrocarbons - Gasoline	LUFT GC/MS
116.100	010	BTEX and MTBE	LUFT GC/MS
116.110	001	Total Petroleum Hydrocarbons - Gasoline	LUFT

Field of Testing: 117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	Diesel-range Total Petroleum Hydrocarbons	EPA 8015B
117.015	001	Diesel-range Total Petroleum Hydrocarbons	LUFT GC/MS
117.016	001	Diesel-range Total Petroleum Hydrocarbons	LUFT
117.017	001	TRPH Screening	EPA 418.1
117.110	000	Extractable Organics	EPA 8270C
117.210	000	Organochlorine Pesticides	EPA 8081A
117.220	000	PCBs	EPA 8082
117.240	000	Organophosphorus Pesticides	EPA 8141A
117.250	000	Chlorinated Herbicides	EPA 8151A

Field of Testing: 120 - Physical Properties of Hazardous Waste

120.010	001	Ignitability	EPA 1010
120.070	001	Corrosivity - pH Determination	EPA 9040B
120.080	001	Corrosivity - pH Determination	EPA 9045C

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
Phone: (717) 656-2300

Certificate No.: 2792
Renew Date: 1/31/2014

Field of Testing: 102 - Inorganic Chemistry of Drinking Water

102.045	001	Perchlorate	EPA 314.0

Field of Testing: 104 - Volatile Organic Chemistry of Drinking Water

104.040	000	Volatile Organic Compounds	EPA 524.2
104.040	001	Benzene	EPA 524.2
104.040	007	n-Butylbenzene	EPA 524.2
104.040	008	sec-Butylbenzene	EPA 524.2
104.040	009	tert-Butylbenzene	EPA 524.2
104.040	010	Carbon Tetrachloride	EPA 524.2
104.040	011	Chlorobenzene	EPA 524.2
104.040	015	2-Chlorotoluene	EPA 524.2
104.040	016	4-Chlorotoluene	EPA 524.2
104.040	019	1,3-Dichlorobenzene	EPA 524.2
104.040	020	1,2-Dichlorobenzene	EPA 524.2
104.040	021	1,4-Dichlorobenzene	EPA 524.2
104.040	022	Dichlorodifluoromethane	EPA 524.2
104.040	023	1,1-Dichloroethane	EPA 524.2
104.040	024	1,2-Dichloroethane	EPA 524.2
104.040	025	1,1-Dichloroethene	EPA 524.2
104.040	026	cis-1,2-Dichloroethene	EPA 524.2
104.040	027	trans-1,2-Dichloroethene	EPA 524.2
104.040	028	Dichloromethane	EPA 524.2
104.040	029	1,2-Dichloropropane	EPA 524.2
104.040	033	cis-1,3-Dichloropropene	EPA 524.2
104.040	034	trans-1,3-Dichloropropene	EPA 524.2
104.040	035	Ethylbenzene	EPA 524.2
104.040	037	Isopropylbenzene	EPA 524.2
104.040	039	Naphthalene	EPA 524.2
104.040	041	N-propylbenzene	EPA 524.2
104.040	042	Styrene	EPA 524.2
104.040	044	1,1,2,2-Tetrachloroethane	EPA 524.2
104.040	045	Tetrachloroethene	EPA 524.2
104.040	046	Toluene	EPA 524.2
104.040	048	1,2,4-Trichlorobenzene	EPA 524.2
104.040	049	1,1,1-Trichloroethane	EPA 524.2
104.040	050	1,1,2-Trichloroethane	EPA 524.2

As of 2/17/2012 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

104.040	051	Trichloroethene	EPA 524.2
104.040	052	Trichlorofluoromethane	EPA 524.2
104.040	054	1,2,4-Trimethylbenzene	EPA 524.2
104.040	055	1,3,5-Trimethylbenzene	EPA 524.2
104.040	056	Vinyl Chloride	EPA 524.2
104.040	057	Xylenes, Total	EPA 524.2
104.045	001	Bromodichloromethane	EPA 524.2
104.045	002	Bromoform	EPA 524.2
104.045	003	Chloroform	EPA 524.2
104.045	004	Dibromochloromethane	EPA 524.2
104.045	005	Trihalomethanes	EPA 524.2
104.050	002	Methyl tert-butyl Ether (MTBE)	EPA 524.2
104.050	004	tert-Amyl Methyl Ether (TAME)	EPA 524.2
104.050	005	Ethyl tert-butyl Ether (ETBE)	EPA 524.2
104.050	006	Trichlorotrifluoroethane	EPA 524.2
104.050	007	tert-Butyl Alcohol (TBA)	EPA 524.2
104.050	008	Carbon Disulfide	EPA 524.2
104.050	009	Methyl Isobutyl Ketone	EPA 524.2

Field of Testing: 105 - Semi-volatile Organic Chemistry of Drinking Water

105.030	001	Alachlor	EPA 507
105.030	002	Atrazine	EPA 507
105.030	009	Simazine	EPA 507
105.030	010	Thiobencarb	EPA 507
105.040	003	Chlordane (total)	EPA 508
105.040	007	Endrin	EPA 508
105.040	008	Heptachlor	EPA 508
105.040	009	Heptachlor Epoxide	EPA 508
105.040	010	Hexachlorobenzene	EPA 508
105.040	011	Hexachlorocyclopentadiene	EPA 508
105.040	012	Lindane	EPA 508
105.040	013	Methoxychlor	EPA 508
105.070	002	2,4-D	EPA 515.1
105.070	003	Dalapon	EPA 515.1
105.070	005	Dinoseb	EPA 515.1
105.070	006	Pentachlorophenol	EPA 515.1
105.070	007	Picloram	EPA 515.1
105.070	008	2,4,5-TP	EPA 515.1
105.070	009	Chlorinated Acids	EPA 515.1
105.090	001	Alachlor	EPA 525.2
105.090	003	Atrazine	EPA 525.2
105.090	004	Benzo(a)pyrene	EPA 525.2
105.090	008	Di(2-ethylhexyl) Adipate	EPA 525.2
105.090	009	Di(2-ethylhexyl) Phthalate	EPA 525.2

105.090	013	Endrin	EPA 525.2
105.090	014	Heptachlor	EPA 525.2
105.090	015	Heptachlor Epoxide	EPA 525.2
105.090	016	Hexachlorobenzene	EPA 525.2
105.090	017	Hexachlorocyclopentadiene	EPA 525.2
105.090	018	Lindane	EPA 525.2
105.090	019	Methoxychlor	EPA 525.2
105.090	023	Pentachlorophenol	EPA 525.2
105.090	025	Simazine	EPA 525.2
105.090	029	Polynuclear Aromatic Hydrocarbons	EPA 525.2
105.090	030	Adipates	EPA 525.2
105.090	031	Phthalates	EPA 525.2
105.100	000	Carbamates	EPA 531.1
105.100	005	Carbofuran	EPA 531.1
105.100	008	Oxamyl	EPA 531.1

Field of Testing: 108 - Inorganic Chemistry of Wastewater

108.020	001	Conductivity	EPA 120.1
108.090	001	Residue, Volatile	EPA 160.4
108.110	001	Turbidity	EPA 180.1
108.112	001	Boron	EPA 200.7
108.112	002	Calcium	EPA 200.7
108.112	004	Magnesium	EPA 200.7
108.112	005	Potassium	EPA 200.7
108.112	007	Sodium	EPA 200.7
108.113	002	Calcium	EPA 200.8
108.113	003	Magnesium	EPA 200.8
108.113	004	Potassium	EPA 200.8
108.113	006	Sodium	EPA 200.8
108.120	001	Bromide	EPA 300.0
108.120	002	Chloride	EPA 300.0
108.120	003	Fluoride	EPA 300.0
108.120	004	Nitrate	EPA 300.0
108.120	005	Nitrite	EPA 300.0
108.120	007	Phosphate, Ortho	EPA 300.0
108.120	008	Sulfate	EPA 300.0
108.183	001	Cyanide, Total	EPA 335.4
108.211	001	Kjeldahl Nitrogen	EPA 351.2
108.232	001	Nitrate-nitrite	EPA 353.2
108.232	002	Nitrite	EPA 353.2
108.261	001	Phosphorus, Total	EPA 365.1
108.264	001	Phosphate, Ortho	EPA 365.3
108.323	001	Chemical Oxygen Demand	EPA 410.4
108.362	001	Phenols, Total	EPA 420.4

108.381	001	Oil and Grease	EPA 1664A
108.400	001	Acidity	SM2310B
108.410	001	Alkalinity	SM2320B
108.420	001	Hardness (calc.)	SM2340B
108.430	001	Conductivity	SM2510B
108.440	001	Residue, Total	SM2540B
108.441	001	Residue, Filterable	SM2540C
108.442	001	Residue, Non-filterable	SM2540D
108.443	001	Residue, Settleable	SM2540F
108.451	001	Chloride	SM4500-Cl- C
108.464	001	Chlorine	SM4500-Cl F
108.480	001	Fluoride	SM4500-F C
108.490	001	pH	SM4500-H+ B
108.492	001	Ammonia	SM4500-NH3 C (19th/20th)
108.492	002	Kjeldahl Nitrogen	SM4500-NH3 C (19th/20th)
108.493	001	Ammonia	SM4500-NH3 D or E (19th/20th)
108.531	001	Dissolved Oxygen	SM4500-O G
108.551	001	Silica	SM4500-SiO2 C (20th)
108.560	001	Sulfite	SM4500-SO3 B
108.580	001	Sulfide	SM4500-S= D
108.582	001	Sulfide	SM4500-S= F (19th/20th)
108.590	001	Biochemical Oxygen Demand	SM5210B
108.591	001	Carbonaceous BOD	SM5210B
108.611	001	Total Organic Carbon	SM5310C
108.640	001	Surfactants	SM5540C

Field of Testing: 109 - Toxic Chemical Elements of Wastewater

109.010	001	Aluminum	EPA 200.7
109.010	002	Antimony	EPA 200.7
109.010	003	Arsenic	EPA 200.7
109.010	004	Barium	EPA 200.7
109.010	005	Beryllium	EPA 200.7
109.010	007	Cadmium	EPA 200.7
109.010	009	Chromium	EPA 200.7
109.010	010	Cobalt	EPA 200.7
109.010	011	Copper	EPA 200.7
109.010	012	Iron	EPA 200.7
109.010	013	Lead	EPA 200.7
109.010	015	Manganese	EPA 200.7
109.010	016	Molybdenum	EPA 200.7
109.010	017	Nickel	EPA 200.7
109.010	019	Selenium	EPA 200.7
109.010	021	Silver	EPA 200.7
109.010	023	Thallium	EPA 200.7

109.010	024	Tin	EPA 200.7
109.010	026	Vanadium	EPA 200.7
109.010	027	Zinc	EPA 200.7
109.020	001	Aluminum	EPA 200.8
109.020	002	Antimony	EPA 200.8
109.020	003	Arsenic	EPA 200.8
109.020	004	Barium	EPA 200.8
109.020	005	Beryllium	EPA 200.8
109.020	006	Cadmium	EPA 200.8
109.020	007	Chromium	EPA 200.8
109.020	009	Copper	EPA 200.8
109.020	010	Lead	EPA 200.8
109.020	011	Manganese	EPA 200.8
109.020	012	Molybdenum	EPA 200.8
109.020	013	Nickel	EPA 200.8
109.020	014	Selenium	EPA 200.8
109.020	016	Thallium	EPA 200.8
109.020	017	Vanadium	EPA 200.8
109.020	018	Zinc	EPA 200.8
109.020	021.	Iron	EPA 200.8
109.020	022	Tin	EPA 200.8
109.020	023	Titanium	EPA 200.8
109.104	001	Chromium (VI)	EPA 218.6
109.190	001	Mercury	EPA 245.1
109.361	001	Mercury	EPA 1631E
109.809	002	Chromium (VI)	SM3500-Cr B (20th)
Field of Testing: 110 - Volatile Organic Chemistry of Wastewater			
110.020	000	Aromatic Volatiles	EPA 602
110.040	040	Halogenated Hydrocarbons	EPA 624
110.040	041	Aromatic Compounds	EPA 624
110.040	042	Oxygenates	EPA 624
110.040	043	Other Volatile Organics	EPA 624
Field of Testing: 111 - Semi-volatile Organic Chemistry of Wastewater			
111.060	000	Polynuclear Aromatics	EPA 610
111.101	032	Polynuclear Aromatic Hydrocarbons	EPA 625
111.101	033	Adipates	EPA 625
111.101	034	Phthalates	EPA 625
111.101	036	Other Extractables	EPA 625
111.170	030	Organochlorine Pesticides	EPA 608
111.170	031	PCBs	EPA 608
Field of Testing: 114 - Inorganic Chemistry of Hazardous Waste			
114.010	001	Antimony	EPA 6010B
114.010	002	Arsenic	EPA 6010B

114.010	003	Barium	EPA 6010B	
114.010	004	Beryllium	EPA 6010B	
114.010	005	Cadmium	EPA 6010B	
114.010	006	Chromium	EPA 6010B	
114.010	007	Cobalt	EPA 6010B	
114.010	008	Copper	EPA 6010B	
114.010	009	Lead	EPA 6010B	
114.010	010	Molybdenum	EPA 6010B	
114.010	011	Nickel	EPA 6010B	
114.010	012	Selenium	EPA 6010B	
114.010	013	Silver	EPA 6010B	
114.010	014	Thallium	EPA 6010B	
114.010	015	Vanadium	EPA 6010B	
114.010	016	Zinc	EPA 6010B	
114.020	001	Antimony	EPA 6020	
114.020	002	Arsenic	EPA 6020	
114.020	003	Barium	EPA 6020	
114.020	004	Beryllium	EPA 6020	
114.020	005	Cadmium	EPA 6020	
114.020	006	Chromium	EPA 6020	
114.020	007	Cobalt	EPA 6020	
114.020	008	Copper	EPA 6020	
114.020	009	Lead	EPA 6020	
114.020	010	Molybdenum	EPA 6020	
114.020	011	Nickel	EPA 6020	
114.020	012	Selenium	EPA 6020	
114.020	013	Silver	EPA 6020	
114.020	014	Thallium	EPA 6020	
114.020	015	Vanadium	EPA 6020	
114.020	016	Zinc	EPA 6020	
114.103	001	Chromium (VI)	EPA 7196A	
114.106	001	Chromium (VI)	EPA 7199	
114.140	001	Mercury	EPA 7470A	Aqueous Only
114.141	001	Mercury	EPA 7471A	
114.221	001	Cyanide, Total	EPA 9012A	

Field of Testing: 115 - Extraction Test of Hazardous Waste

115.020	001	Toxicity Characteristic Leaching Procedure (TCLP)	EPA 1311	
115.030	001	Waste Extraction Test (WET)	CCR Chapter11, Article 5, Appendix II	
115.040	001	Synthetic Precipitation Leaching Procedure (SPLP)	EPA 1312	

Field of Testing: 116 - Volatile Organic Chemistry of Hazardous Waste

116.010	000	EDB and DBCP	EPA 8011	Aqueous Only
116.020	030	Nonhalogenated Volatiles	EPA 8015B	
116.020	031	Ethanol and Methanol	EPA 8015B	

116.030	001	Gasoline-range Organics	EPA 8015B
116.040	041	Methyl tert-butyl Ether (MTBE)	EPA 8021B
116.040	062	BTEX	EPA 8021B
116.080	000	Volatile Organic Compounds	EPA 8260B
116.080	120	Oxygenates	EPA 8260B
116.100	001	Total Petroleum Hydrocarbons - Gasoline	LUFT GC/MS
116.100	010	BTEX and MTBE	LUFT GC/MS

Field of Testing: 117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	Diesel-range Total Petroleum Hydrocarbons	EPA 8015B
117.110	000	Extractable Organics	EPA 8270C
117.140	000	Polynuclear Aromatic Hydrocarbons	EPA 8310
117.150	000	Carbonyl Compounds	EPA 8315A
117.170	000	Nitroaromatics and Nitramines	EPA 8330
117.171	000	Nitroaromatics and Nitramines	EPA 8330A
117.210	000	Organochlorine Pesticides	EPA 8081A
117.220	000	PCBs	EPA 8082
117.240	000	Organophosphorus Pesticides	EPA 8141A
117.250	000	Chlorinated Herbicides	EPA 8151A
117.270	000	Carbamates, N-methylcarbamates	EPA 8318

Field of Testing: 120 - Physical Properties of Hazardous Waste

120.010	001	Ignitability	EPA 1010
120.040	001	Reactive Cyanide	Section 7.3 SW-846
120.050	001	Reactive Sulfide	Section 7.3 SW-846
120.070	001	Corrosivity - pH Determination	EPA 9040B
120.080	001	Corrosivity - pH Determination	EPA 9045C

NELAP - RECOGNIZED

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF NELAP ACCREDITATION

Is hereby granted to

Lancaster Laboratories, Inc.

2425 New Holland Pike

Lancaster, PA 17601-5994

Scope of the Certificate is limited to the
"NELAP Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **10276CA**

Expiration Date: **7/31/2012**

Effective Date: **8/1/2012**

Richmond, California
subject to forfeiture or revocation

Fred Chooke for
David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

NELAP RECOGNIZED

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

NELAP Fields of Accreditation

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
Phone: (717) 656-2300

Certificate No. 10276CA
Renew Date: 7/31/2013

Primary AA: PA 36-00037

105 - Semi-volatile Organic Chemistry of Drinking Water			
105.230	001	EPA 1613	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
111 - Semi-volatile Organic Chemistry of Wastewater			
111.111	000	EPA 1613B	Dioxins
111.111	001	EPA 1613B	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
111.111	002	EPA 1613B	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)
111.111	003	EPA 1613B	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
111.111	004	EPA 1613B	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
111.111	005	EPA 1613B	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)
111.111	006	EPA 1613B	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)
111.111	007	EPA 1613B	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)
111.111	008	EPA 1613B	2,3,7,8-Tetrachlorodibenzofuran (TCDF)
111.111	009	EPA 1613B	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)
111.111	010	EPA 1613B	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)
111.111	011	EPA 1613B	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)
111.111	012	EPA 1613B	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)
111.111	013	EPA 1613B	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)
111.111	014	EPA 1613B	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)
111.111	015	EPA 1613B	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)
111.111	016	EPA 1613B	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)
111.111	017	EPA 1613B	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)
111.111	018	EPA 1613B	Total TCDD
111.111	019	EPA 1613B	Total PeCDD
111.111	020	EPA 1613B	Total HxCDD
111.111	021	EPA 1613B	Total HpCDD
111.111	022	EPA 1613B	Total TCDF
111.111	023	EPA 1613B	Total PeCDF
111.111	024	EPA 1613B	Total HxCDF
111.111	025	EPA 1613B	Total HpCDF
111.120	048	EPA 1625	N-nitrosodimethylamine
117 - Semi-volatile Organic Chemistry of Hazardous Waste			
117.130	000	EPA 8290	Dioxins and Dibenzofurans
117.130	001	EPA 8290	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
117.130	002	EPA 8290	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)

As of 10/31/2012, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

117.130	003	EPA 8290	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	004	EPA 8290	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	005	EPA 8290	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	006	EPA 8290	2,3,7,8-Tetrachlorodibenzofuran (TCDF)
117.130	007	EPA 8290	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)
117.130	008	EPA 8290	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)
117.130	009	EPA 8290	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	010	EPA 8290	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	011	EPA 8290	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)
117.130	012	EPA 8290	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	013	EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)
117.130	014	EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)
117.130	015	EPA 8290	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)
117.130	016	EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)
117.130	017	EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)

NELAP - RECOGNIZED

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF NELAP ACCREDITATION

Is hereby granted to

Pace Analytical Services, Inc. - Pittsburgh, PA

1638 Roseytown Road, Suites 2, 3, & 4

Greensburg, PA 15601

Scope of the Certificate is limited to the
"NELAP Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **04222CA**

Expiration Date: **1/31/2014**

Effective Date: **2/1/2013**

Richmond, California
subject to forfeiture or revocation

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

NELAP RECOGNIZED

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

NELAP Fields of Accreditation

Pace Analytical Services, Inc. - Pittsburgh, PA

1638 Roseytown Road, Suites 2, 3, & 4
Greensburg, PA 15601
Phone: (724) 850-5600

Primary AA: PA PA01457

Certificate No.: 04222CA
Renew Date: 1/31/2014

106 - Radiochemistry of Drinking Water

106.010	001	EPA 900.0	Gross Alpha
106.010	002	EPA 900.0	Gross Beta
106.030	003	EPA 901.1	Gamma Emitters
106.050	001	EPA 903.0	Total Alpha Radium
106.051	001	EPA 903.1	Radium-226
106.060	001	EPA 904.0	Radium-228
106.070	003	EPA 905.0	Strontium-90
106.080	001	EPA 906.0	Tritium
106.090	001	EPA 908.0	Uranium
106.270	001	SM7110C	Gross Alpha
106.480	001	ASTM D5174-97	Uranium
106.610	001	SM7500-Rn	Radon-222

118 - Radiochemistry of Hazardous Waste

118.010	001	EPA 9310	Gross Alpha
118.010	002	EPA 9310	Gross Beta
118.020	001	EPA 9315	Radium, Total
118.030	001	EPA 9320	Radium-228

As of 12/28/2012, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

State of California—Health and Human Services Agency
California Department of Public Health

RON CHAPMAN, MD, MPH
Director & State Health Officer

EDMUND G. BROWN JR.
Governor

December 28, 2012

Dennis J. Leeke
Pace Analytical Services, Inc. - Pittsburgh, PA
1638 Roseytown Road, Suites 2, 3, & 4
Greensburg, PA 15601

Dear Dennis J. Leeke:

Certificate No. 04222CA

This is to advise you that the laboratory named above has been accredited under National Environmental Laboratory Accreditation Program (NELAP) as an environmental testing laboratory pursuant to the provisions of the Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100825, *et seq.*

The Fields of Accreditation for which this laboratory has been accredited are enclosed. Recognition of accreditation is subject to maintaining accreditation with the primary Accreditation Body. In addition, the laboratory shall comply with the National Environmental Laboratory Accreditation Conference (NELAC) Standards and all associated California Environmental Laboratory Accreditation Program Branch (ELAPB) regulations and statutes.

Please note that your laboratory is required to notify California ELAPB of any major changes in key accreditation criteria within 30 calendar days of the change. This written notification includes, but is not limited to, changes in ownership, location, key personnel, and major instrumentation (HSC 100847(b), (c), (d), and NELAC Standard Section 4.3.2). The certificate must be returned to California ELAPB upon loss of accredited status.

Your continued cooperation with the above requirements is essential for maintaining the high quality of the data produced by environmental laboratories accredited by the State of California.

If you have any questions, please contact Linda Louie at (510) 620-3155.

Sincerely,

Fred Choate for

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

Enclosure

NELAP - RECOGNIZED

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF NELAP ACCREDITATION

Is hereby granted to

Pace Analytical Services, Inc. - Pittsburgh, PA

1638 Roseytown Road, Suites 2, 3, & 4
Greensburg, PA 15601

Scope of the Certificate is limited to the
"NELAP Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **04222CA**

Expiration Date: **1/31/2015**

Effective Date: **2/1/2014**

Richmond, California
subject to forfeiture or revocation

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

NELAP RECOGNIZED

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

NELAP Fields of Accreditation

Pace Analytical Services, Inc. - Pittsburgh, PA

1638 Roseytown Road, Suites 2, 3, & 4
Greensburg, PA 15601
Phone: (724) 850-5600

Primary AA: PA PA01457

Certificate No. 04222CA
Renew Date: 1/31/2015

106 - Radiochemistry of Drinking Water

106.010	001	EPA 900.0	Gross Alpha
106.010	002	EPA 900.0	Gross Beta
106.030	003	EPA 901.1	Gamma Emitters
106.050	001	EPA 903.0	Total Alpha Radium
106.050	002	EPA 903.0	Radium-226
106.051	001	EPA 903.1	Radium-226
106.060	001	EPA 904.0	Radium-228
106.070	003	EPA 905.0	Strontium-90
106.080	001	EPA 906.0	Tritium
106.090	001	EPA 908.0	Uranium
106.270	001	SM7110C	Gross Alpha
106.480	001	ASTM D5174-97	Uranium
106.610	001	SM7500-Rn	Radon-222

118 - Radiochemistry of Hazardous Waste

118.010	001	EPA 9310	Gross Alpha
118.010	002	EPA 9310	Gross Beta
118.020	001	EPA 9315	Radium, Total
118.030	001	EPA 9320	Radium-228
118.200	001	DOE 4.5.2.3	Gamma

As of 12/10/2013, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

State of California—Health and Human Services Agency
California Department of Public Health

RON CHAPMAN, MD, MPH
Director & State Health Officer

EDMUND G. BROWN JR.
Governor

September 13, 2013

Sarah Cherney
Pace Analytical Services, Inc.- Minneapolis
1700 Elm Street, SE, Suite 200
Minneapolis, MN 55414

Dear Sarah Cherney: Certificate No 01155CA

Enclosed is an updated copy of your certificate.

If you have any questions, please contact our office at (510) 620-3155.

Sincerely,

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

Enclosure

Environmental Laboratory Accreditation Program Branch
MS 0511, Building P, 1st Floor, 850 Marina Bay Parkway, Richmond, CA 94804
(510) 620-3155. (510) 620-3165 Fax
www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

NELAP Fields of Accreditation

NELAP RECOGNIZED

Pace Analytical Services, Inc.- Minneapolis
Minnesota Laboratory
1700 Elm Street SE, Suite 200
Minneapolis, MN 55414
Phone: (612) 607-1700

Certificate No. 01155CA
Renew Date: 8/31/2014

Primary AA: MN 027053137

102 - Inorganic Chemistry of Drinking Water

102.020	001	EPA 180.1	Turbidity
102.030	003	EPA 300.0	Chloride
102.030	005	EPA 300.0	Fluoride
102.030	006	EPA 300.0	Nitrate
102.030	007	EPA 300.0	Nitrite
102.030	010	EPA 300.0	Sulfate
102.060	001	EPA 353.2	Nitrate calc.
102.061	001	EPA 353.2	Nitrite
102.100	001	SM2320B	Alkalinity
102.120	001	SM2340B	Hardness
102.130	001	SM2510B	Conductivity
102.140	001	SM2540C	Total Dissolved Solids
102.163	001	SM4500-Cl G	Chlorine, Free and Total
102.190	001	SM4500-CN E	Cyanide, Total
102.200	001	SM4500-F C	Fluoride
102.210	001	SM4500-H+ B	pH
102.220	001	SM4500-NO2 B	Nitrite
102.240	001	SM4500-P E	Phosphate, Ortho

103 - Toxic Chemical Elements of Drinking Water

103.140	001	EPA 200.8	Aluminum
103.140	002	EPA 200.8	Antimony
103.140	003	EPA 200.8	Arsenic
103.140	004	EPA 200.8	Barium
103.140	005	EPA 200.8	Beryllium
103.140	006	EPA 200.8	Cadmium
103.140	007	EPA 200.8	Chromium
103.140	008	EPA 200.8	Copper
103.140	009	EPA 200.8	Lead
103.140	010	EPA 200.8	Manganese
103.140	011	EPA 200.8	Mercury
103.140	012	EPA 200.8	Nickel
103.140	013	EPA 200.8	Selenium
103.140	014	EPA 200.8	Silver

103.140	015	EPA 200.8	Thallium
103.140	016	EPA 200.8	Zinc
103.160	001	EPA 245.1	Mercury

104 - Volatile Organic Chemistry of Drinking Water

104.040	001	EPA 524.2	Benzene
104.040	002	EPA 524.2	Bromobenzene
104.040	003	EPA 524.2	Bromochloromethane
104.040	006	EPA 524.2	Bromomethane
104.040	007	EPA 524.2	n-Butylbenzene
104.040	008	EPA 524.2	sec-Butylbenzene
104.040	009	EPA 524.2	tert-Butylbenzene
104.040	010	EPA 524.2	Carbon Tetrachloride
104.040	011	EPA 524.2	Chlorobenzene
104.040	012	EPA 524.2	Chloroethane
104.040	014	EPA 524.2	Chloromethane
104.040	015	EPA 524.2	2-Chlorotoluene
104.040	016	EPA 524.2	4-Chlorotoluene
104.040	018	EPA 524.2	Dibromomethane
104.040	019	EPA 524.2	1,3-Dichlorobenzene
104.040	020	EPA 524.2	1,2-Dichlorobenzene
104.040	021	EPA 524.2	1,4-Dichlorobenzene
104.040	022	EPA 524.2	Dichlorodifluoromethane
104.040	023	EPA 524.2	1,1-Dichloroethane
104.040	024	EPA 524.2	1,2-Dichloroethane
104.040	025	EPA 524.2	1,1-Dichloroethene
104.040	026	EPA 524.2	cis-1,2-Dichloroethene
104.040	027	EPA 524.2	trans-1,2-Dichloroethene
104.040	028	EPA 524.2	Dichloromethane
104.040	029	EPA 524.2	1,2-Dichloropropane
104.040	031	EPA 524.2	2,2-Dichloropropane
104.040	032	EPA 524.2	1,1-Dichloropropene
104.040	033	EPA 524.2	cis-1,3-Dichloropropene
104.040	034	EPA 524.2	trans-1,3-Dichloropropene
104.040	035	EPA 524.2	Ethylbenzene
104.040	036	EPA 524.2	Hexachlorobutadiene
104.040	037	EPA 524.2	Isopropylbenzene
104.040	039	EPA 524.2	Naphthalene
104.040	041	EPA 524.2	N-propylbenzene
104.040	042	EPA 524.2	Styrene
104.040	043	EPA 524.2	1,1,1,2-Tetrachloroethane
104.040	044	EPA 524.2	1,1,2,2-Tetrachloroethane

104.040	045	EPA 524.2	Tetrachloroethene
104.040	046	EPA 524.2	Toluene
104.040	047	EPA 524.2	1,2,3-Trichlorobenzene
104.040	048	EPA 524.2	1,2,4-Trichlorobenzene
104.040	049	EPA 524.2	1,1,1-Trichloroethane
104.040	050	EPA 524.2	1,1,2-Trichloroethane
104.040	051	EPA 524.2	Trichloroethene
104.040	052	EPA 524.2	Trichlorofluoromethane
104.040	053	EPA 524.2	1,2,3-Trichloropropane
104.040	054	EPA 524.2	1,2,4-Trimethylbenzene
104.040	055	EPA 524.2	1,3,5-Trimethylbenzene
104.040	056	EPA 524.2	Vinyl Chloride
104.040	057	EPA 524.2	Xylenes, Total
104.045	001	EPA 524.2	Bromodichloromethane
104.045	002	EPA 524.2	Bromoform
104.045	003	EPA 524.2	Chloroform
104.045	004	EPA 524.2	Dibromochloromethane
104.045	005	EPA 524.2	Trihalomethanes
104.050	002	EPA 524.2	Methyl tert-butyl Ether (MTBE)

105 - Semi-volatile Organic Chemistry of Drinking Water

105.230	001	EPA 1613	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

108 - Inorganic Chemistry of Wastewater

108.020	001	EPA 120.1	Conductivity
108.090	001	EPA 160.4	Residue, Volatile
108.110	001	EPA 180.1	Turbidity
108.112	001	EPA 200.7	Boron
108.112	002	EPA 200.7	Calcium
108.112	003	EPA 200.7	Hardness (calculation)
108.112	004	EPA 200.7	Magnesium
108.112	005	EPA 200.7	Potassium
108.112	007	EPA 200.7	Sodium
108.113	001	EPA 200.8	Boron
108.113	002	EPA 200.8	Calcium
108.113	003	EPA 200.8	Magnesium
108.113	004	EPA 200.8	Potassium
108.113	006	EPA 200.8	Sodium
108.120	001	EPA 300.0	Bromide
108.120	002	EPA 300.0	Chloride
108.120	003	EPA 300.0	Fluoride
108.120	004	EPA 300.0	Nitrate
108.120	006	EPA 300.0	Sulfate

108.200	001	EPA 350.1	Ammonia
108.232	001	EPA 353.2	Nitrate-nitrite
108.232	002	EPA 353.2	Nitrite
108.323	001	EPA 410.4	Chemical Oxygen Demand
108.360	001	EPA 420.1	Phenols, Total
108.362	001	EPA 420.4	Phenols, Total
108.381	001	EPA 1664A	Oil and Grease
108.410	001	SM2320B	Alkalinity
108.420	001	SM2340B	Hardness (calculation)
108.430	001	SM2510B	Conductivity
108.440	001	SM2540B	Residue, Total
108.441	001	SM2540C	Residue, Filterable
108.442	001	SM2540D	Residue, Non-filterable
108.443	001	SM2540F	Residue, Settleable
108.452	001	SM4500-Cl- E	Chloride
108.472	001	SM4500-CN E	Cyanide, Total
108.473	001	SM4500-CN G	Cyanide, amenable
108.480	001	SM4500-F C	Fluoride
108.490	001	SM4500-H+ B	pH
108.510	001	SM4500-NO2 B	Nitrite
108.525	001	SM4500-NO3 H	Nitrate-nitrite
108.540	001	SM4500-P E-1999	Phosphate, Ortho
108.541	001	SM4500-P E-1999	Phosphorus, Total
108.602	001	SM5220D	Chemical Oxygen Demand
108.700	001	ASTM D516-90	Sulfate

109 - Toxic Chemical Elements of Wastewater

109.010	001	EPA 200.7	Aluminum
109.010	002	EPA 200.7	Antimony
109.010	003	EPA 200.7	Arsenic
109.010	004	EPA 200.7	Barium
109.010	005	EPA 200.7	Beryllium
109.010	007	EPA 200.7	Cadmium
109.010	009	EPA 200.7	Chromium
109.010	010	EPA 200.7	Cobalt
109.010	011	EPA 200.7	Copper
109.010	012	EPA 200.7	Iron
109.010	013	EPA 200.7	Lead
109.010	015	EPA 200.7	Manganese
109.010	016	EPA 200.7	Molybdenum
109.010	017	EPA 200.7	Nickel
109.010	019	EPA 200.7	Selenium

109.010	021	EPA 200.7	Silver
109.010	023	EPA 200.7	Thallium
109.010	024	EPA 200.7	Tin
109.010	026	EPA 200.7	Vanadium
109.010	027	EPA 200.7	Zinc
109.020	001	EPA 200.8	Aluminum
109.020	002	EPA 200.8	Antimony
109.020	003	EPA 200.8	Arsenic
109.020	004	EPA 200.8	Barium
109.020	005	EPA 200.8	Beryllium
109.020	006	EPA 200.8	Cadmium
109.020	007	EPA 200.8	Chromium
109.020	008	EPA 200.8	Cobalt
109.020	009	EPA 200.8	Copper
109.020	010	EPA 200.8	Lead
109.020	011	EPA 200.8	Manganese
109.020	012	EPA 200.8	Molybdenum
109.020	013	EPA 200.8	Nickel
109.020	014	EPA 200.8	Selenium
109.020	015	EPA 200.8	Silver
109.020	016	EPA 200.8	Thallium
109.020	017	EPA 200.8	Vanadium
109.020	018	EPA 200.8	Zinc
109.020	022	EPA 200.8	Tin
109.020	023	EPA 200.8	Titanium
109.190	001	EPA 245.1	Mercury
109.809	002	SM3500-Cr B (20th)	Chromium (VI)

110 - Volatile Organic Chemistry of Wastewater

110.040	001	EPA 624	Benzene
110.040	002	EPA 624	Bromodichloromethane
110.040	003	EPA 624	Bromoform
110.040	004	EPA 624	Bromomethane
110.040	005	EPA 624	Carbon Tetrachloride
110.040	006	EPA 624	Chlorobenzene
110.040	007	EPA 624	Chloroethane
110.040	008	EPA 624	2-Chloroethyl Vinyl Ether
110.040	009	EPA 624	Chloroform
110.040	010	EPA 624	Chloromethane
110.040	011	EPA 624	Dibromochloromethane
110.040	012	EPA 624	1,2-Dichlorobenzene
110.040	013	EPA 624	1,3-Dichlorobenzene

110.040	014	EPA 624	1,4-Dichlorobenzene
110.040	015	EPA 624	1,1-Dichloroethane
110.040	016	EPA 624	1,2-Dichloroethane
110.040	017	EPA 624	1,1-Dichloroethene
110.040	018	EPA 624	trans-1,2-Dichloroethene
110.040	019	EPA 624	1,2-Dichloropropane
110.040	020	EPA 624	cis-1,3-Dichloropropene
110.040	021	EPA 624	trans-1,3-Dichloropropene
110.040	022	EPA 624	Ethylbenzene
110.040	023	EPA 624	Methylene Chloride
110.040	024	EPA 624	1,1,2,2-Tetrachloroethane
110.040	025	EPA 624	Tetrachloroethene
110.040	026	EPA 624	Toluene
110.040	027	EPA 624	1,1,1-Trichloroethane
110.040	028	EPA 624	1,1,2-Trichloroethane
110.040	029	EPA 624	Trichloroethene
110.040	030	EPA 624	Trichlorofluoromethane
110.040	031	EPA 624	Vinyl Chloride

111 - Semi-volatile Organic Chemistry of Wastewater

111.100	001	EPA 625	Acenaphthene
111.100	002	EPA 625	Acenaphthylene
111.100	003	EPA 625	Anthracene
111.100	004	EPA 625	Benzidine
111.100	005	EPA 625	Benz(a)anthracene
111.100	006	EPA 625	Benzo(b)fluoranthene
111.100	007	EPA 625	Benzo(k)fluoranthene
111.100	008	EPA 625	Benzo(g,h,i)perylene
111.100	009	EPA 625	Benzo(a)pyrene
111.100	010	EPA 625	Benzyl Butyl Phthalate
111.100	011	EPA 625	bis(2-chloroethoxy)methane
111.100	012	EPA 625	bis(2-chloroethyl) Ether
111.100	013	EPA 625	Bis(2-chloroisopropyl) Ether
111.100	014	EPA 625	Di(2-ethylhexyl) Phthalate
111.100	015	EPA 625	4-Bromophenyl Phenyl Ether
111.100	016	EPA 625	4-Chloro-3-methylphenol
111.100	017	EPA 625	2-Chloronaphthalene
111.100	018	EPA 625	2-Chlorophenol
111.100	019	EPA 625	4-Chlorophenyl Phenyl Ether
111.100	020	EPA 625	Chrysene
111.100	021	EPA 625	Dibenz(a,h)anthracene
111.100	025	EPA 625	3,3'-Dichlorobenzidine

111.100	026	EPA 625	2,4-Dichlorophenol
111.100	027	EPA 625	Diethyl Phthalate
111.100	028	EPA 625	2,4-Dimethylphenol
111.100	029	EPA 625	Dimethyl Phthalate
111.100	030	EPA 625	Di-n-butyl phthalate
111.100	031	EPA 625	Di-n-octyl phthalate
111.100	032	EPA 625	2,4-Dinitrophenol
111.100	033	EPA 625	2,4-Dinitrotoluene
111.100	034	EPA 625	2,6-Dinitrotoluene
111.100	035	EPA 625	Fluoranthene
111.100	036	EPA 625	Fluorene
111.100	037	EPA 625	Hexachlorobenzene
111.100	038	EPA 625	Hexachlorobutadiene
111.100	039	EPA 625	Hexachlorocyclopentadiene
111.100	040	EPA 625	Hexachloroethane
111.100	041	EPA 625	Indeno(1,2,3-c,d)pyrene
111.100	042	EPA 625	Isophorone
111.100	043	EPA 625	2-Methyl-4,6-dinitrophenol
111.100	044	EPA 625	Naphthalene
111.100	045	EPA 625	Nitrobenzene
111.100	046	EPA 625	2-Nitrophenol
111.100	047	EPA 625	4-Nitrophenol
111.100	048	EPA 625	N-nitrosodimethylamine
111.100	049	EPA 625	N-nitroso-di-n-propylamine
111.100	050	EPA 625	N-nitrosodiphenylamine
111.100	051	EPA 625	Pentachlorophenol
111.100	052	EPA 625	Phenanthrene
111.100	053	EPA 625	Phenol
111.100	054	EPA 625	Pyrene
111.100	055	EPA 625	1,2,4-Trichlorobenzene
111.100	056	EPA 625	2,4,6-Trichlorophenol
111.111	001	EPA 1613B	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
111.111	002	EPA 1613B	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)
111.111	003	EPA 1613B	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
111.111	004	EPA 1613B	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
111.111	005	EPA 1613B	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)
111.111	006	EPA 1613B	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)
111.111	007	EPA 1613B	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)
111.111	008	EPA 1613B	2,3,7,8-Tetrachlorodibenzofuran (TCDF)
111.111	009	EPA 1613B	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)
111.111	010	EPA 1613B	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)

111.111	011	EPA 1613B	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)
111.111	012	EPA 1613B	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)
111.111	013	EPA 1613B	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)
111.111	014	EPA 1613B	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)
111.111	015	EPA 1613B	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)
111.111	016	EPA 1613B	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)
111.111	017	EPA 1613B	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)
111.111	018	EPA 1613B	Total TCDD
111.111	019	EPA 1613B	Total PeCDD
111.111	020	EPA 1613B	Total HxCDD
111.111	021	EPA 1613B	Total HpCDD
111.111	022	EPA 1613B	Total TCDF
111.111	023	EPA 1613B	Total PeCDF
111.111	024	EPA 1613B	Total HxCDF
111.111	025	EPA 1613B	Total HpCDF
111.273	001	EPA 1664A	Oil and Grease

114 - Inorganic Chemistry of Hazardous Waste

114.010	001	EPA 6010B	Antimony
114.010	002	EPA 6010B	Arsenic
114.010	003	EPA 6010B	Barium
114.010	004	EPA 6010B	Beryllium
114.010	005	EPA 6010B	Cadmium
114.010	006	EPA 6010B	Chromium
114.010	007	EPA 6010B	Cobalt
114.010	008	EPA 6010B	Copper
114.010	009	EPA 6010B	Lead
114.010	010	EPA 6010B	Molybdenum
114.010	011	EPA 6010B	Nickel
114.010	012	EPA 6010B	Selenium
114.010	013	EPA 6010B	Silver
114.010	014	EPA 6010B	Thallium
114.010	015	EPA 6010B	Vanadium
114.010	016	EPA 6010B	Zinc
114.020	001	EPA 6020	Antimony
114.020	002	EPA 6020	Arsenic
114.020	003	EPA 6020	Barium
114.020	004	EPA 6020	Beryllium
114.020	005	EPA 6020	Cadmium
114.020	006	EPA 6020	Chromium
114.020	007	EPA 6020	Cobalt
114.020	008	EPA 6020	Copper

114.020	009	EPA 6020	Lead	
114.020	010	EPA 6020	Molybdenum	
114.020	011	EPA 6020	Nickel	
114.020	012	EPA 6020	Selenium	
114.020	013	EPA 6020	Silver	
114.020	014	EPA 6020	Thallium	
114.020	015	EPA 6020	Vanadium	
114.020	016	EPA 6020	Zinc	
114.140	001	EPA 7470A	Mercury	Aqueous Only
114.141	001	EPA 7471A	Mercury	

115 - Extraction Test of Hazardous Waste

115.020	001	EPA 1311	Toxicity Characteristic Leaching Procedure (TCLP)	
115.021	001	EPA 1311	TCLP Inorganics	
115.022	001	EPA 1311	TCLP Extractables	
115.023	001	EPA 1311	TCLP Volatiles	
115.040	001	EPA 1312	Synthetic Precipitation Leaching Procedure (SPLP)	

116 - Volatile Organic Chemistry of Hazardous Waste

116.010	001	EPA 8011	1,2-Dibromoethane	Aqueous Only
116.010	002	EPA 8011	Dibromochloropropane	Aqueous Only
116.030	001	EPA 8015B	Gasoline-range Organics	
116.040	002	EPA 8021B	Benzene	
116.040	039	EPA 8021B	Ethylbenzene	
116.040	041	EPA 8021B	Methyl tert-butyl Ether (MTBE)	
116.040	047	EPA 8021B	Toluene	
116.040	056	EPA 8021B	Xylenes, Total	
116.080	001	EPA 8260B	Acetone	
116.080	002	EPA 8260B	Acetonitrile	
116.080	003	EPA 8260B	Acrolein	
116.080	004	EPA 8260B	Acrylonitrile	
116.080	006	EPA 8260B	Allyl Chloride	
116.080	007	EPA 8260B	Benzene	
116.080	010	EPA 8260B	Bromochloromethane	
116.080	011	EPA 8260B	Bromodichloromethane	
116.080	012	EPA 8260B	Bromoform	
116.080	013	EPA 8260B	Bromomethane	
116.080	015	EPA 8260B	Carbon Disulfide	
116.080	016	EPA 8260B	Carbon Tetrachloride	
116.080	018	EPA 8260B	Chlorobenzene	
116.080	019	EPA 8260B	Chloroethane	
116.080	020	EPA 8260B	2-Chloroethyl Vinyl Ether	
116.080	021	EPA 8260B	Chloroform	

116.080	022	EPA 8260B	Chloromethane	
116.080	023	EPA 8260B	Chloroprene	
116.080	026	EPA 8260B	Dibromochloromethane	
116.080	027	EPA 8260B	Dibromochloropropane	
116.080	028	EPA 8260B	1,2-Dibromoethane	
116.080	030	EPA 8260B	Dibromomethane	
116.080	031	EPA 8260B	1,2-Dichlorobenzene	
116.080	032	EPA 8260B	1,3-Dichlorobenzene	
116.080	033	EPA 8260B	1,4-Dichlorobenzene	
116.080	034	EPA 8260B	cis-1,4-Dichloro-2-butene	
116.080	035	EPA 8260B	trans-1,4-Dichloro-2-butene	
116.080	036	EPA 8260B	Dichlorodifluoromethane	
116.080	037	EPA 8260B	1,1-Dichloroethane	
116.080	038	EPA 8260B	1,2-Dichloroethane	
116.080	039	EPA 8260B	1,1-Dichloroethene	
116.080	040	EPA 8260B	trans-1,2-Dichloroethene	
116.080	041	EPA 8260B	cis-1,2-Dichloroethene	
116.080	042	EPA 8260B	1,2-Dichloropropane	
116.080	043	EPA 8260B	1,3-Dichloropropane	
116.080	044	EPA 8260B	2,2-Dichloropropane	
116.080	045	EPA 8260B	1,1-Dichloropropene	
116.080	046	EPA 8260B	cis-1,3-Dichloropropene	
116.080	047	EPA 8260B	trans-1,3-Dichloropropene	
116.080	050	EPA 8260B	1,4-Dioxane	
116.080	052	EPA 8260B	Ethyl Acetate	
116.080	053	EPA 8260B	Ethylbenzene	
116.080	055	EPA 8260B	Ethyl Methacrylate	
116.080	056	EPA 8260B	Hexachlorobutadiene	
116.080	058	EPA 8260B	2-Hexanone (MBK)	
116.080	059	EPA 8260B	Iodomethane	
116.080	060	EPA 8260B	Isobutyl Alcohol	
116.080	062	EPA 8260B	Methacrylonitrile	
116.080	064	EPA 8260B	Methyl tert-butyl Ether (MTBE)	
116.080	065	EPA 8260B	Methylene Chloride	
116.080	066	EPA 8260B	Methyl Ethyl Ketone	
116.080	067	EPA 8260B	Methyl Methacrylate	
116.080	068	EPA 8260B	4-Methyl-2-pentanone (MIBK)	
116.080	069	EPA 8260B	Naphthalene	
116.080	071	EPA 8260B	2-Nitropropane	
116.080	078	EPA 8260B	Propionitrile	Aqueous Only
116.080	081	EPA 8260B	1,1,1,2-Tetrachloroethane	

116.080	082	EPA 8260B	1,1,2,2-Tetrachloroethane
116.080	083	EPA 8260B	Tetrachloroethene
116.080	084	EPA 8260B	Toluene
116.080	086	EPA 8260B	1,2,3-Trichlorobenzene
116.080	087	EPA 8260B	1,2,4-Trichlorobenzene
116.080	088	EPA 8260B	1,1,1-Trichloroethane
116.080	089	EPA 8260B	1,1,2-Trichloroethane
116.080	090	EPA 8260B	Trichloroethene
116.080	091	EPA 8260B	Trichlorofluoromethane
116.080	092	EPA 8260B	1,2,3-Trichloropropane
116.080	093	EPA 8260B	Vinyl Acetate
116.080	094	EPA 8260B	Vinyl Chloride
116.080	095	EPA 8260B	Xylenes, Total
116.080	096	EPA 8260B	tert-Amyl Methyl Ether (TAME)
116.080	097	EPA 8260B	tert-Butyl Alcohol (TBA)
116.080	098	EPA 8260B	Ethyl tert-butyl Ether (ETBE)
116.080	099	EPA 8260B	Bromobenzene
116.080	100	EPA 8260B	n-Butylbenzene
116.080	101	EPA 8260B	sec-Butylbenzene
116.080	102	EPA 8260B	tert-Butylbenzene
116.080	103	EPA 8260B	2-Chlorotoluene
116.080	104	EPA 8260B	4-Chlorotoluene
116.080	105	EPA 8260B	Isopropylbenzene
116.080	106	EPA 8260B	N-propylbenzene
116.080	107	EPA 8260B	Styrene
116.080	108	EPA 8260B	1,2,4-Trimethylbenzene
116.080	109	EPA 8260B	1,3,5-Trimethylbenzene

117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	EPA 8015B	Diesel-range Total Petroleum Hydrocarbons
117.110	001	EPA 8270C	Acenaphthene
117.110	002	EPA 8270C	Acenaphthylene
117.110	008	EPA 8270C	Anthracene
117.110	010	EPA 8270C	Benzidine
117.110	011	EPA 8270C	Benz(a)anthracene
117.110	012	EPA 8270C	Benzo(b)fluoranthene
117.110	013	EPA 8270C	Benzo(k)fluoranthene
117.110	014	EPA 8270C	Benzo(g,h,i)perylene
117.110	015	EPA 8270C	Benzo(a)pyrene
117.110	016	EPA 8270C	Benzoic Acid
117.110	018	EPA 8270C	Benzyl Alcohol
117.110	019	EPA 8270C	Benzyl Butyl Phthalate

117.110	020	EPA 8270C	bis(2-chloroethoxy)methane
117.110	021	EPA 8270C	bis(2-chloroethyl) Ether
117.110	022	EPA 8270C	Bis(2-chloroisopropyl) Ether
117.110	023	EPA 8270C	Di(2-ethylhexyl) Phthalate
117.110	024	EPA 8270C	4-Bromophenyl Phenyl Ether
117.110	026	EPA 8270C	4-Chloroaniline
117.110	027	EPA 8270C	4-Chloro-3-methylphenol
117.110	029	EPA 8270C	2-Chloronaphthalene
117.110	030	EPA 8270C	2-Chlorophenol
117.110	031	EPA 8270C	4-Chlorophenyl Phenyl Ether
117.110	032	EPA 8270C	Chrysene
117.110	036	EPA 8270C	Dibenz(a,h)anthracene
117.110	037	EPA 8270C	Dibenzofuran
117.110	039	EPA 8270C	1,2-Dichlorobenzene
117.110	040	EPA 8270C	1,3-Dichlorobenzene
117.110	041	EPA 8270C	1,4-Dichlorobenzene
117.110	042	EPA 8270C	3,3'-Dichlorobenzidine
117.110	043	EPA 8270C	2,4-Dichlorophenol
117.110	045	EPA 8270C	Diethyl Phthalate
117.110	053	EPA 8270C	2,4-Dimethylphenol
117.110	054	EPA 8270C	Dimethyl Phthalate
117.110	055	EPA 8270C	Di-n-butyl phthalate
117.110	060	EPA 8270C	2,4-Dinitrophenol
117.110	061	EPA 8270C	2,4-Dinitrotoluene
117.110	062	EPA 8270C	2,6-Dinitrotoluene
117.110	064	EPA 8270C	1,2-Diphenylhydrazine
117.110	067	EPA 8270C	Fluoranthene
117.110	068	EPA 8270C	Fluorene
117.110	069	EPA 8270C	Hexachlorobenzene
117.110	070	EPA 8270C	Hexachlorobutadiene
117.110	071	EPA 8270C	Hexachlorocyclopentadiene
117.110	072	EPA 8270C	Hexachloroethane
117.110	075	EPA 8270C	Indeno(1,2,3-c,d)pyrene
117.110	076	EPA 8270C	Isophorone
117.110	080	EPA 8270C	2-Methyl-4,6-dinitrophenol
117.110	083	EPA 8270C	2-Methylnaphthalene
117.110	084	EPA 8270C	2-Methylphenol
117.110	085	EPA 8270C	3-Methylphenol
117.110	086	EPA 8270C	4-Methylphenol
117.110	087	EPA 8270C	Naphthalene
117.110	092	EPA 8270C	2-Nitroaniline

117.110	093	EPA 8270C	3-Nitroaniline
117.110	094	EPA 8270C	4-Nitroaniline
117.110	095	EPA 8270C	Nitrobenzene
117.110	096	EPA 8270C	2-Nitrophenol
117.110	097	EPA 8270C	4-Nitrophenol
117.110	100	EPA 8270C	N-nitrosodimethylamine
117.110	101	EPA 8270C	N-nitroso-di-n-propylamine
117.110	102	EPA 8270C	N-nitrosodiphenylamine
117.110	110	EPA 8270C	Pentachlorophenol
117.110	112	EPA 8270C	Phenanthrene
117.110	113	EPA 8270C	Phenol
117.110	119	EPA 8270C	Pyrene
117.110	120	EPA 8270C	Pyridine
117.110	129	EPA 8270C	1,2,4-Trichlorobenzene
117.110	130	EPA 8270C	2,4,5-Trichlorophenol
117.110	131	EPA 8270C	2,4,6-Trichlorophenol
117.130	001	EPA 8290	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
117.130	002	EPA 8290	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)
117.130	003	EPA 8290	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	004	EPA 8290	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	005	EPA 8290	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	006	EPA 8290	2,3,7,8-Tetrachlorodibenzofuran (TCDF)
117.130	007	EPA 8290	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)
117.130	008	EPA 8290	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)
117.130	009	EPA 8290	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	010	EPA 8290	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	011	EPA 8290	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)
117.130	012	EPA 8290	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	013	EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)
117.130	014	EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)
117.130	015	EPA 8290	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)
117.130	016	EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)
117.130	017	EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)
117.210	001	EPA 8081A	Aldrin
117.210	002	EPA 8081A	a-BHC
117.210	003	EPA 8081A	b-BHC
117.210	004	EPA 8081A	d-BHC
117.210	005	EPA 8081A	g-BHC (Lindane)
117.210	007	EPA 8081A	a-Chlordane
117.210	008	EPA 8081A	g-Chlordane
117.210	009	EPA 8081A	Chlordane (tech.)

117.210	013	EPA 8081A	4,4'-DDD
117.210	014	EPA 8081A	4,4'-DDE
117.210	015	EPA 8081A	4,4'-DDT
117.210	021	EPA 8081A	Endosulfan I
117.210	022	EPA 8081A	Endosulfan II
117.210	023	EPA 8081A	Endosulfan Sulfate
117.210	024	EPA 8081A	Endrin
117.210	025	EPA 8081A	Endrin Aldehyde
117.210	026	EPA 8081A	Endrin Ketone
117.210	027	EPA 8081A	Heptachlor
117.210	028	EPA 8081A	Heptachlor Epoxide
117.210	031	EPA 8081A	Isodrin
117.210	033	EPA 8081A	Methoxychlor
117.210	039	EPA 8081A	Toxaphene
117.220	000	EPA 8082	PCBs
117.220	001	EPA 8082	PCB-1016
117.220	002	EPA 8082	PCB-1221
117.220	003	EPA 8082	PCB-1232
117.220	004	EPA 8082	PCB-1242
117.220	005	EPA 8082	PCB-1248
117.220	006	EPA 8082	PCB-1254
117.220	007	EPA 8082	PCB-1260

RON CHAPMAN, MD, MPH
Director & State Health Officer

State of California—Health and Human Services Agency
California Department of Public Health

EDMUND G. BROWN JR.
Governor

December 7, 2012

Sarah Cherney
Pace Analytical Services, Inc.- Minneapolis
1700 Elm Street, SE, Suite 200
Minneapolis, MN 55414

Dear Sarah Cherney: Certificate No 01155CA

Enclosed is an amended copy of your certificate.

If you have any questions, please contact our office at (510) 620-3155.

Sincerely,

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

Enclosure

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

NELAP Fields of Accreditation

NELAP RECOGNIZED

Pace Analytical Services, Inc.- Minneapolis
Minnesota Laboratory
1700 Elm Street SE, Suite 200
Minneapolis, MN 55414
Phone: (612) 607-1700

Primary AA: MN 027053137

Certificate No.: 01155CA
Renew Date: 8/31/2013

102 - Inorganic Chemistry of Drinking Water

102.020	001	EPA 180.1	Turbidity
102.030	003	EPA 300.0	Chloride
102.030	005	EPA 300.0	Fluoride
102.030	006	EPA 300.0	Nitrate
102.030	007	EPA 300.0	Nitrite
102.030	010	EPA 300.0	Sulfate
102.060	001	EPA 353.2	Nitrate calc.
102.061	001	EPA 353.2	Nitrite
102.100	001	SM2320B	Alkalinity
102.120	001	SM2340B	Hardness
102.130	001	SM2510B	Conductivity
102.140	001	SM2540C	Total Dissolved Solids
102.163	001	SM4500-Cl G	Chlorine, Free and Total
102.190	001	SM4500-CN E	Cyanide, Total
102.200	001	SM4500-F C	Fluoride
102.210	001	SM4500-H+ B	pH
102.220	001	SM4500-NO2 B	Nitrite
102.240	001	SM4500-P E	Phosphate, Ortho

103 - Toxic Chemical Elements of Drinking Water

103.140	001	EPA 200.8	Aluminum
103.140	002	EPA 200.8	Antimony
103.140	003	EPA 200.8	Arsenic
103.140	004	EPA 200.8	Barium
103.140	005	EPA 200.8	Beryllium
103.140	006	EPA 200.8	Cadmium
103.140	007	EPA 200.8	Chromium
103.140	008	EPA 200.8	Copper
103.140	009	EPA 200.8	Lead
103.140	010	EPA 200.8	Manganese
103.140	011	EPA 200.8	Mercury
103.140	012	EPA 200.8	Nickel
103.140	013	EPA 200.8	Selenium
103.140	014	EPA 200.8	Silver

As of 12/7/2012 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

103.140	015	EPA 200.8	Thallium
103.140	016	EPA 200.8	Zinc
103.160	001	EPA 245.1	Mercury

104 - Volatile Organic Chemistry of Drinking Water

104.040	000	EPA 524.2	Volatile Organic Compounds
104.040	001	EPA 524.2	Benzene
104.040	002	EPA 524.2	Bromobenzene
104.040	003	EPA 524.2	Bromochloromethane
104.040	006	EPA 524.2	Bromomethane
104.040	007	EPA 524.2	n-Butylbenzene
104.040	008	EPA 524.2	sec-Butylbenzene
104.040	009	EPA 524.2	tert-Butylbenzene
104.040	010	EPA 524.2	Carbon Tetrachloride
104.040	011	EPA 524.2	Chlorobenzene
104.040	012	EPA 524.2	Chloroethane
104.040	014	EPA 524.2	Chloromethane
104.040	015	EPA 524.2	2-Chlorotoluene
104.040	016	EPA 524.2	4-Chlorotoluene
104.040	018	EPA 524.2	Dibromomethane
104.040	019	EPA 524.2	1,3-Dichlorobenzene
104.040	020	EPA 524.2	1,2-Dichlorobenzene
104.040	021	EPA 524.2	1,4-Dichlorobenzene
104.040	022	EPA 524.2	Dichlorodifluoromethane
104.040	023	EPA 524.2	1,1-Dichloroethane
104.040	024	EPA 524.2	1,2-Dichloroethane
104.040	025	EPA 524.2	1,1-Dichloroethene
104.040	026	EPA 524.2	cis-1,2-Dichloroethene
104.040	027	EPA 524.2	trans-1,2-Dichloroethene
104.040	028	EPA 524.2	Dichloromethane
104.040	029	EPA 524.2	1,2-Dichloropropane
104.040	030	EPA 524.2	1,3-Dichloropropane
104.040	031	EPA 524.2	2,2-Dichloropropane
104.040	032	EPA 524.2	1,1-Dichloropropene
104.040	033	EPA 524.2	cis-1,3-Dichloropropene
104.040	034	EPA 524.2	trans-1,3-Dichloropropene
104.040	035	EPA 524.2	Ethylbenzene
104.040	036	EPA 524.2	Hexachlorobutadiene
104.040	037	EPA 524.2	Isopropylbenzene
104.040	039	EPA 524.2	Naphthalene
104.040	041	EPA 524.2	N-propylbenzene
104.040	042	EPA 524.2	Styrene

104.040	043	EPA 524.2	1,1,1,2-Tetrachloroethane
104.040	044	EPA 524.2	1,1,2,2-Tetrachloroethane
104.040	045	EPA 524.2	Tetrachloroethene
104.040	046	EPA 524.2	Toluene
104.040	047	EPA 524.2	1,2,3-Trichlorobenzene
104.040	048	EPA 524.2	1,2,4-Trichlorobenzene
104.040	049	EPA 524.2	1,1,1-Trichloroethane
104.040	050	EPA 524.2	1,1,2-Trichloroethane
104.040	051	EPA 524.2	Trichloroethene
104.040	052	EPA 524.2	Trichlorofluoromethane
104.040	053	EPA 524.2	1,2,3-Trichloropropane
104.040	054	EPA 524.2	1,2,4-Trimethylbenzene
104.040	055	EPA 524.2	1,3,5-Trimethylbenzene
104.040	056	EPA 524.2	Vinyl Chloride
104.040	057	EPA 524.2	Xylenes, Total
104.040	059	EPA 524.2	Federal regulated VOCs, excluding vinyl chloride
104.040	060	EPA 524.2	Federal unregulated VOCs
104.045	001	EPA 524.2	Bromodichloromethane
104.045	002	EPA 524.2	Bromoform
104.045	003	EPA 524.2	Chloroform
104.045	004	EPA 524.2	Dibromochloromethane
104.045	005	EPA 524.2	Trihalomethanes
104.050	002	EPA 524.2	Methyl tert-butyl Ether (MTBE)

105 - Semi-volatile Organic Chemistry of Drinking Water

105.230	001	EPA 1613	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

108 - Inorganic Chemistry of Wastewater

108.020	001	EPA 120.1	Conductivity
108.090	001	EPA 160.4	Residue, Volatile
108.110	001	EPA 180.1	Turbidity
108.112	001	EPA 200.7	Boron
108.112	002	EPA 200.7	Calcium
108.112	003	EPA 200.7	Hardness (calc.)
108.112	004	EPA 200.7	Magnesium
108.112	005	EPA 200.7	Potassium
108.112	007	EPA 200.7	Sodium
108.120	001	EPA 300.0	Bromide
108.120	002	EPA 300.0	Chloride
108.120	003	EPA 300.0	Fluoride
108.120	004	EPA 300.0	Nitrate
108.120	008	EPA 300.0	Sulfate
108.200	001	EPA 350.1	Ammonia

108.232	001	EPA 353.2	Nitrate-nitrite
108.232	002	EPA 353.2	Nitrite
108.323	001	EPA 410.4	Chemical Oxygen Demand
108.360	001	EPA 420.1	Phenols, Total
108.362	001	EPA 420.4	Phenols, Total
108.381	001	EPA 1664A	Oil and Grease
108.410	001	SM2320B	Alkalinity
108.420	001	SM2340B	Hardness (calc.)
108.430	001	SM2510B	Conductivity
108.440	001	SM2540B	Residue, Total
108.441	001	SM2540C	Residue, Filterable
108.442	001	SM2540D	Residue, Non-filterable
108.443	001	SM2540F	Residue, Settleable
108.452	001	SM4500-Cl- E	Chloride
108.472	001	SM4500-CN E	Cyanide, Total
108.473	001	SM4500-CN G	Cyanide, amenable
108.480	001	SM4500-F C	Fluoride
108.490	001	SM4500-H+ B	pH
108.510	001	SM4500-NO2 B	Nitrite
108.525	001	SM4500-NO3 H	Nitrate-nitrite
108.531	001	SM4500-O G	Dissolved Oxygen
108.540	001	SM4500-P E	Phosphate, Ortho
108.541	001	SM4500-P E	Phosphorus, Total
108.602	001	SM5220D	Chemical Oxygen Demand

109 - Toxic Chemical Elements of Wastewater

109.010	001	EPA 200.7	Aluminum
109.010	002	EPA 200.7	Antimony
109.010	003	EPA 200.7	Arsenic
109.010	004	EPA 200.7	Barium
109.010	005	EPA 200.7	Beryllium
109.010	007	EPA 200.7	Cadmium
109.010	009	EPA 200.7	Chromium
109.010	010	EPA 200.7	Cobalt
109.010	011	EPA 200.7	Copper
109.010	012	EPA 200.7	Iron
109.010	013	EPA 200.7	Lead
109.010	015	EPA 200.7	Manganese
109.010	016	EPA 200.7	Molybdenum
109.010	017	EPA 200.7	Nickel
109.010	019	EPA 200.7	Selenium
109.010	021	EPA 200.7	Silver

109.010	023	EPA 200.7	Thallium
109.010	024	EPA 200.7	Tin
109.010	026	EPA 200.7	Vanadium
109.010	027	EPA 200.7	Zinc
109.020	001	EPA 200.8	Aluminum
109.020	002	EPA 200.8	Antimony
109.020	003	EPA 200.8	Arsenic
109.020	004	EPA 200.8	Barium
109.020	005	EPA 200.8	Beryllium
109.020	006	EPA 200.8	Cadmium
109.020	007	EPA 200.8	Chromium
109.020	008	EPA 200.8	Cobalt
109.020	009	EPA 200.8	Copper
109.020	010	EPA 200.8	Lead
109.020	011	EPA 200.8	Manganese
109.020	012	EPA 200.8	Molybdenum
109.020	013	EPA 200.8	Nickel
109.020	014	EPA 200.8	Selenium
109.020	015	EPA 200.8	Silver
109.020	016	EPA 200.8	Thallium
109.020	017	EPA 200.8	Vanadium
109.020	018	EPA 200.8	Zinc
109.190	001	EPA 245.1	Mercury
109.809	002	SM3500-Cr B (20th)	Chromium (VI)

110 - Volatile Organic Chemistry of Wastewater

110.040	001	EPA 624	Benzene
110.040	002	EPA 624	Bromodichloromethane
110.040	003	EPA 624	Bromoform
110.040	004	EPA 624	Bromomethane
110.040	005	EPA 624	Carbon Tetrachloride
110.040	006	EPA 624	Chlorobenzene
110.040	007	EPA 624	Chloroethane
110.040	008	EPA 624	2-Chloroethyl Vinyl Ether
110.040	009	EPA 624	Chloroform
110.040	010	EPA 624	Chloromethane
110.040	011	EPA 624	Dibromochloromethane
110.040	012	EPA 624	1,2-Dichlorobenzene
110.040	013	EPA 624	1,3-Dichlorobenzene
110.040	014	EPA 624	1,4-Dichlorobenzene
110.040	015	EPA 624	1,1-Dichloroethane
110.040	016	EPA 624	1,2-Dichloroethane

110.040	017	EPA 624	1,1-Dichloroethene
110.040	018	EPA 624	trans-1,2-Dichloroethene
110.040	019	EPA 624	1,2-Dichloropropane
110.040	020	EPA 624	cis-1,3-Dichloropropene
110.040	021	EPA 624	trans-1,3-Dichloropropene
110.040	022	EPA 624	Ethylbenzene
110.040	023	EPA 624	Methylene Chloride
110.040	024	EPA 624	1,1,2,2-Tetrachloroethane
110.040	025	EPA 624	Tetrachloroethene
110.040	026	EPA 624	Toluene
110.040	027	EPA 624	1,1,1-Trichloroethane
110.040	028	EPA 624	1,1,2-Trichloroethane
110.040	029	EPA 624	Trichloroethene
110.040	030	EPA 624	Trichlorofluoromethane
110.040	031	EPA 624	Vinyl Chloride
110.040	043	EPA 624	Other Volatile Organics

111 - Semi-volatile Organic Chemistry of Wastewater

111.100	001	EPA 625	Acenaphthene
111.100	002	EPA 625	Acenaphthylene
111.100	003	EPA 625	Anthracene
111.100	004	EPA 625	Benzidine
111.100	005	EPA 625	Benz(a)anthracene
111.100	006	EPA 625	Benzo(b)fluoranthene
111.100	007	EPA 625	Benzo(k)fluoranthene
111.100	008	EPA 625	Benzo(g,h,i)perylene
111.100	009	EPA 625	Benzo(a)pyrene
111.100	010	EPA 625	Benzyl Butyl Phthalate
111.100	011	EPA 625	bis(2-chloroethoxy)methane
111.100	012	EPA 625	bis(2-chloroethyl) Ether
111.100	013	EPA 625	Bis(2-chloroisopropyl) Ether
111.100	014	EPA 625	Di(2-ethylhexyl) Phthalate
111.100	015	EPA 625	4-Bromophenyl Phenyl Ether
111.100	016	EPA 625	4-Chloro-3-methylphenol
111.100	017	EPA 625	2-Chloronaphthalene
111.100	018	EPA 625	2-Chlorophenol
111.100	019	EPA 625	4-Chlorophenyl Phenyl Ether
111.100	020	EPA 625	Chrysene
111.100	021	EPA 625	Dibenz(a,h)anthrecene
111.100	025	EPA 625	3,3'-Dichlorobenzidine
111.100	026	EPA 625	2,4-Dichlorophenol
111.100	027	EPA 625	Diethyl Phthalate

111.100	028	EPA 625	2,4-Dimethylphenol
111.100	029	EPA 625	Dimethyl Phthalate
111.100	030	EPA 625	Di-n-butyl phthalate
111.100	031	EPA 625	Di-n-octyl phthalate
111.100	032	EPA 625	2,4-Dinitrophenol
111.100	033	EPA 625	2,4-Dinitrotoluene
111.100	034	EPA 625	2,6-Dinitrotoluene
111.100	035	EPA 625	Fluoranthene
111.100	036	EPA 625	Fluorene
111.100	037	EPA 625	Hexachlorobenzene
111.100	038	EPA 625	Hexachlorobutadiene
111.100	039	EPA 625	Hexachlorocyclopentadiene
111.100	040	EPA 625	Hexachloroethane
111.100	041	EPA 625	Indeno(1,2,3-c,d)pyrene
111.100	042	EPA 625	Isophorone
111.100	043	EPA 625	2-Methyl-4,6-dinitrophenol
111.100	044	EPA 625	Naphthalene
111.100	045	EPA 625	Nitrobenzene
111.100	046	EPA 625	2-Nitrophenol
111.100	047	EPA 625	4-Nitrophenol
111.100	048	EPA 625	N-nitrosodimethylamine
111.100	049	EPA 625	N-nitroso-di-n-propylamine
111.100	050	EPA 625	N-nitrosodiphenylamine
111.100	051	EPA 625	Pentachlorophenol
111.100	052	EPA 625	Phenanthrene
111.100	053	EPA 625	Phenol
111.100	054	EPA 625	Pyrene
111.100	055	EPA 625	1,2,4-Trichlorobenzene
111.100	056	EPA 625	2,4,6-Trichlorophenol
111.111	001	EPA 1613B	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
111.111	002	EPA 1613B	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)
111.111	003	EPA 1613B	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
111.111	004	EPA 1613B	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
111.111	005	EPA 1613B	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)
111.111	006	EPA 1613B	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)
111.111	007	EPA 1613B	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)
111.111	008	EPA 1613B	2,3,7,8-Tetrachlorodibenzofuran (TCDF)
111.111	009	EPA 1613B	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)
111.111	010	EPA 1613B	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)
111.111	011	EPA 1613B	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)
111.111	012	EPA 1613B	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)

111.111	013	EPA 1613B	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)
111.111	014	EPA 1613B	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)
111.111	015	EPA 1613B	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)
111.111	016	EPA 1613B	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)
111.111	017	EPA 1613B	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)
111.111	018	EPA 1613B	Total TCDD
111.111	019	EPA 1613B	Total PeCDD
111.111	020	EPA 1613B	Total HxCDD
111.111	021	EPA 1613B	Total HpCDD
111.111	022	EPA 1613B	Total TCDF
111.111	023	EPA 1613B	Total PeCDF
111.111	024	EPA 1613B	Total HxCDF
111.111	025	EPA 1613B	Total HpCDF
114 - Inorganic Chemistry of Hazardous Waste			
114.010	001	EPA 6010B	Antimony
114.010	002	EPA 6010B	Arsenic
114.010	003	EPA 6010B	Barium
114.010	004	EPA 6010B	Beryllium
114.010	005	EPA 6010B	Cadmium
114.010	006	EPA 6010B	Chromium
114.010	007	EPA 6010B	Cobalt
114.010	008	EPA 6010B	Copper
114.010	009	EPA 6010B	Lead
114.010	010	EPA 6010B	Molybdenum
114.010	011	EPA 6010B	Nickel
114.010	012	EPA 6010B	Selenium
114.010	013	EPA 6010B	Silver
114.010	014	EPA 6010B	Thallium
114.010	015	EPA 6010B	Vanadium
114.010	016	EPA 6010B	Zinc
114.020	001	EPA 6020	Antimony
114.020	002	EPA 6020	Arsenic
114.020	003	EPA 6020	Barium
114.020	004	EPA 6020	Beryllium
114.020	005	EPA 6020	Cadmium
114.020	006	EPA 6020	Chromium
114.020	007	EPA 6020	Cobalt
114.020	008	EPA 6020	Copper
114.020	009	EPA 6020	Lead
114.020	010	EPA 6020	Molybdenum
114.020	011	EPA 6020	Nickel

114.020	012	EPA 6020	Selenium
114.020	013	EPA 6020	Silver
114.020	014	EPA 6020	Thallium
114.020	015	EPA 6020	Vanadium
114.020	016	EPA 6020	Zinc
114.140	001	EPA 7470A	Mercury
114.141	001	EPA 7471A	Mercury

115 - Extraction Test of Hazardous Waste

115.020	001	EPA 1311	Toxicity Characteristic Leaching Procedure (TCLP)
115.021	001	EPA 1311	TCLP Inorganics
115.022	001	EPA 1311	TCLP Extractables
115.023	001	EPA 1311	TCLP Volatiles
115.040	001	EPA 1312	Synthetic Precipitation Leaching Procedure (SPLP)

116 - Volatile Organic Chemistry of Hazardous Waste

116.030	001	EPA 8015B	Gasoline-range Organics
116.040	002	EPA 8021B	Benzene
116.040	039	EPA 8021B	Ethylbenzene
116.040	041	EPA 8021B	Methyl tert-butyl Ether (MTBE)
116.040	047	EPA 8021B	Toluene
116.040	056	EPA 8021B	Xylenes, Total
116.080	001	EPA 8260B	Acetone
116.080	002	EPA 8260B	Acetonitrile
116.080	003	EPA 8260B	Acrolein
116.080	004	EPA 8260B	Acrylonitrile
116.080	006	EPA 8260B	Allyl Chloride
116.080	007	EPA 8260B	Benzene
116.080	010	EPA 8260B	Bromochloromethane
116.080	011	EPA 8260B	Bromodichloromethane
116.080	012	EPA 8260B	Bromoform
116.080	013	EPA 8260B	Bromomethane
116.080	014	EPA 8260B	n-Butyl Alcohol
116.080	015	EPA 8260B	Carbon Disulfide
116.080	016	EPA 8260B	Carbon Tetrachloride
116.080	018	EPA 8260B	Chlorobenzene
116.080	019	EPA 8260B	Chloroethane
116.080	020	EPA 8260B	2-Chloroethyl Vinyl Ether
116.080	021	EPA 8260B	Chloroform
116.080	022	EPA 8260B	Chloromethane
116.080	023	EPA 8260B	Chloroprene
116.080	026	EPA 8260B	Dibromochloromethane
116.080	027	EPA 8260B	Dibromochloropropane

116.080	028	EPA 8260B	1,2-Dibromoethane	
116.080	030	EPA 8260B	Dibromomethane	
116.080	031	EPA 8260B	1,2-Dichlorobenzene	
116.080	032	EPA 8260B	1,3-Dichlorobenzene	
116.080	033	EPA 8260B	1,4-Dichlorobenzene	
116.080	034	EPA 8260B	cis-1,4-Dichloro-2-butene	
116.080	035	EPA 8260B	trans-1,4-Dichloro-2-butene	
116.080	036	EPA 8260B	Dichlorodifluoromethane	
116.080	037	EPA 8260B	1,1-Dichloroethane	
116.080	038	EPA 8260B	1,2-Dichloroethane	
116.080	039	EPA 8260B	1,1-Dichloroethene	
116.080	040	EPA 8260B	trans-1,2-Dichloroethene	
116.080	041	EPA 8260B	cis-1,2-Dichloroethene	
116.080	042	EPA 8260B	1,2-Dichloropropane	
116.080	043	EPA 8260B	1,3-Dichloropropane	
116.080	044	EPA 8260B	2,2-Dichloropropane	
116.080	045	EPA 8260B	1,1-Dichloropropene	
116.080	046	EPA 8260B	cis-1,3-Dichloropropene	
116.080	047	EPA 8260B	trans-1,3-Dichloropropene	
116.080	050	EPA 8260B	1,4-Dioxane	
116.080	052	EPA 8260B	Ethyl Acetate	
116.080	053	EPA 8260B	Ethylbenzene	
116.080	055	EPA 8260B	Ethyl Methacrylate	
116.080	056	EPA 8260B	Hexachlorobutadiene	
116.080	058	EPA 8260B	2-Hexanone (MBK)	
116.080	059	EPA 8260B	Iodomethane	
116.080	060	EPA 8260B	Isobutyl Alcohol	
116.080	062	EPA 8260B	Methacrylonitrile	
116.080	064	EPA 8260B	Methyl tert-butyl Ether (MTBE)	
116.080	065	EPA 8260B	Methylene Chloride	
116.080	066	EPA 8260B	Methyl Ethyl Ketone	
116.080	067	EPA 8260B	Methyl Methacrylate	
116.080	068	EPA 8260B	4-Methyl-2-pentanone (MIBK)	
116.080	069	EPA 8260B	Naphthalene	
116.080	071	EPA 8260B	2-Nitropropane	
116.080	078	EPA 8260B	Propionitrile	Aqueous Only
116.080	081	EPA 8260B	1,1,1,2-Tetrachloroethane	
116.080	082	EPA 8260B	1,1,2,2-Tetrachloroethane	
116.080	083	EPA 8260B	Tetrachloroethene	
116.080	084	EPA 8260B	Toluene	
116.080	086	EPA 8260B	1,2,3-Trichlorobenzene	

116.080	087	EPA 8260B	1,2,4-Trichlorobenzene
116.080	088	EPA 8260B	1,1,1-Trichloroethane
116.080	089	EPA 8260B	1,1,2-Trichloroethane
116.080	090	EPA 8260B	Trichloroethene
116.080	091	EPA 8260B	Trichlorofluoromethane
116.080	092	EPA 8260B	1,2,3-Trichloropropane
116.080	093	EPA 8260B	Vinyl Acetate
116.080	094	EPA 8260B	Vinyl Chloride
116.080	095	EPA 8260B	Xylenes, Total
116.080	097	EPA 8260B	tert-Butyl Alcohol (TBA)
116.080	099	EPA 8260B	Bromobenzene
116.080	100	EPA 8260B	n-Butylbenzene
116.080	101	EPA 8260B	sec-Butylbenzene
116.080	102	EPA 8260B	tert-Butylbenzene
116.080	103	EPA 8260B	2-Chlorotoluene
116.080	104	EPA 8260B	4-Chlorotoluene
116.080	105	EPA 8260B	Isopropylbenzene
116.080	106	EPA 8260B	N-propylbenzene
116.080	107	EPA 8260B	Styrene
116.080	108	EPA 8260B	1,2,4-Trimethylbenzene
116.080	109	EPA 8260B	1,3,5-Trimethylbenzene

117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	EPA 8015B	Diesel-range Total Petroleum Hydrocarbons
117.110	001	EPA 8270C	Acenaphthene
117.110	002	EPA 8270C	Acenaphthylene
117.110	008	EPA 8270C	Anthracene
117.110	010	EPA 8270C	Benzidine
117.110	011	EPA 8270C	Benz(a)anthracene
117.110	012	EPA 8270C	Benzo(b)fluoranthene
117.110	013	EPA 8270C	Benzo(k)fluoranthene
117.110	014	EPA 8270C	Benzo(g,h,i)perylene
117.110	015	EPA 8270C	Benzo(a)pyrene
117.110	016	EPA 8270C	Benzoic Acid
117.110	018	EPA 8270C	Benzyl Alcohol
117.110	019	EPA 8270C	Benzyl Butyl Phthalate
117.110	020	EPA 8270C	bis(2-chloroethoxy)methane
117.110	021	EPA 8270C	bis(2-chloroethyl) Ether
117.110	022	EPA 8270C	Bis(2-chloroisopropyl) Ether
117.110	023	EPA 8270C	Di(2-ethylhexyl) Phthalate
117.110	024	EPA 8270C	4-Bromophenyl Phenyl Ether
117.110	026	EPA 8270C	4-Chloroaniline

117.110	027	EPA 8270C	4-Chloro-3-methylphenol
117.110	029	EPA 8270C	2-Chloronaphthalene
117.110	030	EPA 8270C	2-Chlorophenol
117.110	031	EPA 8270C	4-Chlorophenyl Phenyl Ether
117.110	032	EPA 8270C	Chrysene
117.110	036	EPA 8270C	Dibenz(a,h)anthracene
117.110	037	EPA 8270C	Dibenzofuran
117.110	039	EPA 8270C	1,2-Dichlorobenzene
117.110	040	EPA 8270C	1,3-Dichlorobenzene
117.110	041	EPA 8270C	1,4-Dichlorobenzene
117.110	042	EPA 8270C	3,3'-Dichlorobenzidine
117.110	043	EPA 8270C	2,4-Dichlorophenol
117.110	045	EPA 8270C	Diethyl Phthalate
117.110	053	EPA 8270C	2,4-Dimethylphenol
117.110	054	EPA 8270C	Dimethyl Phthalate
117.110	055	EPA 8270C	Di-n-butyl phthalate
117.110	060	EPA 8270C	2,4-Dinitrophenol
117.110	061	EPA 8270C	2,4-Dinitrotoluene
117.110	062	EPA 8270C	2,6-Dinitrotoluene
117.110	064	EPA 8270C	1,2-Diphenylhydrazine
117.110	067	EPA 8270C	Fluoranthene
117.110	068	EPA 8270C	Fluorene
117.110	069	EPA 8270C	Hexachlorobenzene
117.110	070	EPA 8270C	Hexachlorobutadiene
117.110	071	EPA 8270C	Hexachlorocyclopentadiene
117.110	072	EPA 8270C	Hexachloroethane
117.110	075	EPA 8270C	Indeno(1,2,3-c,d)pyrene
117.110	076	EPA 8270C	Isophorone
117.110	080	EPA 8270C	2-Methyl-4,6-dinitrophenol
117.110	083	EPA 8270C	2-Methylnaphthalene
117.110	084	EPA 8270C	2-Methylphenol
117.110	085	EPA 8270C	3-Methylphenol
117.110	086	EPA 8270C	4-Methylphenol
117.110	087	EPA 8270C	Naphthalene
117.110	092	EPA 8270C	2-Nitroaniline
117.110	093	EPA 8270C	3-Nitroaniline
117.110	094	EPA 8270C	4-Nitroaniline
117.110	095	EPA 8270C	Nitrobenzene
117.110	096	EPA 8270C	2-Nitrophenol
117.110	097	EPA 8270C	4-Nitrophenol
117.110	100	EPA 8270C	N-nitrosodimethylamine

117.110	101	EPA 8270C	N-nitroso-di-n-propylamine
117.110	102	EPA 8270C	N-nitrosodiphenylamine
117.110	110	EPA 8270C	Pentachlorophenol
117.110	112	EPA 8270C	Phenanthrene
117.110	113	EPA 8270C	Phenol
117.110	119	EPA 8270C	Pyrene
117.110	120	EPA 8270C	Pyridine
117.110	129	EPA 8270C	1,2,4-Trichlorobenzene
117.110	130	EPA 8270C	2,4,5-Trichlorophenol
117.110	131	EPA 8270C	2,4,6-Trichlorophenol
117.130	001	EPA 8290	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
117.130	002	EPA 8290	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)
117.130	003	EPA 8290	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	004	EPA 8290	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	005	EPA 8290	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	006	EPA 8290	2,3,7,8-Tetrachlorodibenzofuran (TCDF)
117.130	007	EPA 8290	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)
117.130	008	EPA 8290	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)
117.130	009	EPA 8290	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	010	EPA 8290	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	011	EPA 8290	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)
117.130	012	EPA 8290	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	013	EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)
117.130	014	EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)
117.130	015	EPA 8290	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)
117.130	016	EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)
117.130	017	EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)
117.210	001	EPA 8081A	Aldrin
117.210	002	EPA 8081A	a-BHC
117.210	003	EPA 8081A	b-BHC
117.210	004	EPA 8081A	d-BHC
117.210	005	EPA 8081A	g-BHC (Lindane)
117.210	007	EPA 8081A	a-Chlordane
117.210	008	EPA 8081A	g-Chlordane
117.210	009	EPA 8081A	Chlordane (tech.)
117.210	013	EPA 8081A	4,4'-DDD
117.210	014	EPA 8081A	4,4'-DDE
117.210	015	EPA 8081A	4,4'-DDT
117.210	021	EPA 8081A	Endosulfan I
117.210	022	EPA 8081A	Endosulfan II
117.210	023	EPA 8081A	Endosulfan Sulfate

117.210	024	EPA 8081A	Endrin
117.210	025	EPA 8081A	Endrin Aldehyde
117.210	026	EPA 8081A	Endrin Ketone
117.210	027	EPA 8081A	Heptachlor
117.210	028	EPA 8081A	Heptachlor Epoxide
117.210	031	EPA 8081A	Isodrin
117.210	033	EPA 8081A	Methoxychlor
117.210	039	EPA 8081A	Toxaphene
117.220	000	EPA 8082	PCBs
117.220	001	EPA 8082	PCB-1016
117.220	002	EPA 8082	PCB-1221
117.220	003	EPA 8082	PCB-1232
117.220	004	EPA 8082	PCB-1242
117.220	005	EPA 8082	PCB-1248
117.220	006	EPA 8082	PCB-1254
117.220	007	EPA 8082	PCB-1260

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF LABORATORIES

LABORATORY ACCREDITATION PROGRAM

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

NELAP RECOGNIZED TNI ACCREDITATION BODY

Certifies That

65-00282

Pace Analytical Services Inc - Pittsburgh

1638 Roseytown Suites 2, 3, & 4, Greensburg, PA 15601

Having duly met the requirement of
The act of June 29, 2002 (P.L. 596, No. 90)
dealing with Environmental Laboratories Accreditation
(27 Pa. C.S. §§4104-4113) and the
National Environmental Laboratory Accreditation Program Standard

is hereby approved as an

Accredited Laboratory

As more fully described in the attached Scope of Accreditation

Expiration Date: **03/31/2014**

Certificate Number: **012**

Aaren S. Alger, Chief
Laboratory Accreditation Program
Bureau of Laboratories

Continued accreditation status depends on successful ongoing participation in the program
Certificate not transferable Surrender upon revocation
To be conspicuously displayed at the Laboratory
Not valid unless accompanied by a valid Scope of Accreditation
Shall not be used to imply endorsement by the Commonwealth of Pennsylvania
Customers are urged to verify the laboratory's current accreditation status
PA DEP is a NELAP recognized accreditation body

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF LABORATORIES

January 13, 2014

CERTIFIED MAIL NO. 7004 2510 0000 1327 1153

Dennis J. Leeke
Pace Analytical Services, Inc. - Pittsburgh
1638 Roseytown Suites 2, 3, & 4
Greensburg, PA 15601

RE: Updated Fields of Accreditation (A13-00282-08)
DEP Lab I.D. No. 65-00282
PADWIS I.D. No. 65282

Dear Mr. Leeke:

On December 17, 2013, the Laboratory Accreditation Program of the Pennsylvania Department of Environmental Protection ("Department") received a Part 4—Add FOA Application from your laboratory. The Department reviewed this application and associated materials. Your accreditation status in the Pennsylvania Environmental Laboratory Accreditation Program has changed due to your application request. Your current accreditation status is as shown on the attached listing. That list of accredited fields of testing replaces all previous lists.

Your laboratory shall not use this Scope of Accreditation to imply endorsement by the Department. In order to maintain accreditation, your laboratory must remain in compliance with Departmental regulations.

Any person aggrieved by this action may appeal, pursuant to Section 4 of the Environmental Hearing Board Act, 35 P.S. Section 7514, and the Administrative Agency Law, 2 Pa.C.S. Chapter 5A, to the Environmental Hearing Board, Second Floor, Rachel Carson State Office Building, 400 Market Street, P.O. Box 8457, Harrisburg, PA 17105-8457, 717-787-3483. TDD users may contact the Board through the Pennsylvania Relay Service, 800-654-5984. Appeals must be filed with the Environmental Hearing Board within 30 days of receipt of written notice of this action unless the appropriate statute provides a different time period. Copies of the appeal form and the Board's rules of practice and procedure may be obtained from the Board. The appeal form and the Board's rules of practice and procedure are also available in Braille or on audiotape from the Secretary to the Board at 717-787-3483. This paragraph does not, in and of itself, create any right of appeal beyond that permitted by applicable statutes and decisional law.

IF YOU WANT TO CHALLENGE THIS ACTION, YOUR APPEAL MUST REACH THE BOARD WITHIN 30 DAYS. YOU DO NOT NEED A LAWYER TO FILE AN APPEAL WITH THE BOARD. IMPORTANT LEGAL RIGHTS ARE AT STAKE, HOWEVER, SO YOU SHOULD SHOW THIS DOCUMENT TO A LAWYER AT ONCE. IF YOU CANNOT AFFORD A LAWYER, YOU MAY QUALIFY FOR FREE PRO BONO REPRESENTATION. CALL THE SECRETARY TO THE BOARD (717-787-3483) FOR MORE INFORMATION.

If you have any questions regarding your laboratory's accreditation status, please contact Ronald L. Houck, Jr. at 717-346-8210.

Sincerely,

Aaren Alger

Aaren S. Alger, Chief
Laboratory Accreditation Program

Enclosure

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 012-008 expiration date March 31, 2014. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 65-00282 **EPA Lab Code: PA01457** **TNI Code:** **(724) 850-5600**
PADWIS ID: 65282

Pace Analytical Services Inc - Pittsburgh
1638 Roseytown Suites 2, 3, & 4
Greensburg, PA 15601

Matrix: Drinking Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
ASTM D5174-97		Uranium, total	NELAP	PA	10/12/2010
EPA 900.0		Gross alpha	NELAP	PA	5/27/2008
EPA 900.0		Gross beta	NELAP	PA	5/27/2008
EPA 901.1		Gamma emitters	NELAP	PA	5/27/2008
EPA 903.0		Radium-226	NELAP	PA	5/30/2013
EPA 903.0		Total alpha radium	NELAP	PA	5/27/2008
EPA 903.1		Radium-226	NELAP	PA	7/15/2011
EPA 904.0		Radium-228	NELAP	PA	5/27/2008
EPA 905.0		Strontium-90	NELAP	PA	2/1/2011
EPA 906.0		Tritium	NELAP	PA	5/27/2008
EPA 908.0		Uranium, total	NELAP	PA	10/12/2010
HASL 300 U-02		Uranium-234	NELAP	PA	1/16/2014
HASL 300 U-02		Uranium-235	NELAP	PA	1/16/2014
HASL 300 U-02		Uranium-238	NELAP	PA	1/16/2014
N.J.A.C.7:18-6		Gross alpha (including radium & U, excluding radon)	NELAP	PA	5/27/2008
SM 7110 C		Gross alpha	NELAP	PA	9/25/2008
SM 7500-Rn B		Radon-222 in water	NELAP	PA	10/10/2008
SOP (00282) R-008		Americium-241	NELAP	PA	5/27/2008
SOP (00282) R-008		Plutonium-239	NELAP	PA	5/27/2008
SOP (00282) R-008		Thorium-230	NELAP	PA	5/27/2008
SOP (00282) R-008		Uranium-234	NELAP	PA	5/27/2008
SOP (00282) R-008		Uranium-238	NELAP	PA	5/27/2008

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
ASTM D516-02		Sulfate	NELAP	PA	5/6/2009
ASTM D516-90		Sulfate	NELAP	PA	5/6/2009
ASTM D5174-97		Uranium, total	NELAP	PA	8/12/2008
EPA 120.1		Conductivity	NELAP	PA	6/1/2007
EPA 1311		Toxicity characteristic leaching procedure (TCLP)	NELAP	PA	3/29/2005
EPA 1312		Synthetic precipitation leaching procedure (SPLP)	NELAP	PA	3/29/2005
EPA 160.4		Residue, volatile	NELAP	PA	7/28/2006
EPA 1664	A	Oil and grease	NELAP	PA	11/1/2006
EPA 1664	A	Total recoverable petroleum hydrocarbons (TRPH)	NELAP	PA	2/5/2007

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DEP Laboratory ID: 65-00282 **EPA Lab Code: PA01457** **TNI Code:** **(724) 850-5600**
PADWIS ID: 65282

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 180.1		Turbidity	NELAP	PA	7/28/2006
EPA 200.7	4.4	Aluminum	NELAP	PA	3/29/2005
EPA 200.7	4.4	Antimony	NELAP	PA	3/29/2005
EPA 200.7	4.4	Arsenic	NELAP	PA	3/29/2005
EPA 200.7	4.4	Barium	NELAP	PA	3/29/2005
EPA 200.7	4.4	Beryllium	NELAP	PA	3/29/2005
EPA 200.7	4.4	Boron	NELAP	PA	3/29/2005
EPA 200.7	4.4	Cadmium	NELAP	PA	3/29/2005
EPA 200.7	4.4	Calcium	NELAP	PA	3/29/2005
EPA 200.7	4.4	Chromium	NELAP	PA	3/29/2005
EPA 200.7	4.4	Cobalt	NELAP	PA	3/29/2005
EPA 200.7	4.4	Copper	NELAP	PA	3/29/2005
EPA 200.7	4.4	Iron	NELAP	PA	3/29/2005
EPA 200.7	4.4	Lead	NELAP	PA	3/29/2005
EPA 200.7	4.4	Lithium	NELAP	PA	6/22/2006
EPA 200.7	4.4	Magnesium	NELAP	PA	3/29/2005
EPA 200.7	4.4	Manganese	NELAP	PA	3/29/2005
EPA 200.7	4.4	Molybdenum	NELAP	PA	3/29/2005
EPA 200.7	4.4	Nickel	NELAP	PA	3/29/2005
EPA 200.7	4.4	Phosphorus, total	NELAP	PA	1/4/2007
EPA 200.7	4.4	Potassium	NELAP	PA	3/29/2005
EPA 200.7	4.4	Selenium	NELAP	PA	3/29/2005
EPA 200.7	4.4	Silica, as SiO2	NELAP	PA	6/22/2006
EPA 200.7	4.4	Silicon	NELAP	PA	6/22/2006
EPA 200.7	4.4	Silver	NELAP	PA	3/29/2005
EPA 200.7	4.4	Sodium	NELAP	PA	3/29/2005
EPA 200.7	4.4	Strontium	NELAP	PA	6/22/2006
EPA 200.7	4.4	Sulfur	NELAP	PA	1/9/2012
EPA 200.7	4.4	Thallium	NELAP	PA	3/29/2005
EPA 200.7	4.4	Tin	NELAP	PA	1/4/2007
EPA 200.7	4.4	Titanium	NELAP	PA	3/29/2005
EPA 200.7	4.4	Vanadium	NELAP	PA	3/29/2005
EPA 200.7	4.4	Zinc	NELAP	PA	3/29/2005
EPA 200.7	4.4	Zirconium	NELAP	PA	6/22/2006
EPA 245.1	3.0	Mercury	NELAP	PA	3/29/2005
EPA 300.0	2.1	Bromide	NELAP	PA	5/18/2009
EPA 300.0	2.1	Chloride	NELAP	PA	9/29/2010
EPA 300.0	2.1	Fluoride	NELAP	PA	5/6/2009
EPA 300.0	2.1	Nitrate as N	NELAP	PA	11/9/2010
EPA 300.0	2.1	Nitrite as N	NELAP	PA	9/29/2010
EPA 300.0	2.1	Orthophosphate as P	NELAP	PA	9/29/2010
EPA 300.0	2.1	Sulfate	NELAP	PA	9/29/2010
EPA 3005	A	Preconcentration under acid	NELAP	PA	3/29/2005
EPA 335.4		Total cyanide	NELAP	PA	5/6/2009
EPA 350.1		Ammonia as N	NELAP	PA	5/6/2009

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Laboratory Scope of Accreditation

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DEP Laboratory ID: 65-00282 **EPA Lab Code: PA01457** **TNI Code:** **(724) 850-5600**
PADWIS ID: 65282

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 351.2		Kjeldahl nitrogen, total (TKN)	NELAP	PA	5/6/2009
EPA 3510	C	Separatory funnel liquid-liquid extraction	NELAP	PA	3/29/2005
EPA 3535	A	Solid-phase extraction (SPE)	NELAP	PA	9/18/2013
EPA 3535		Solid-phase extraction (SPE)	NELAP	PA	3/29/2005
EPA 3660	B	Sulfur cleanup	NELAP	PA	3/29/2005
EPA 3665	A	Sulfuric acid/permanganate clean-up	NELAP	PA	3/29/2005
EPA 410.4		Chemical oxygen demand (COD)	NELAP	PA	5/6/2009
EPA 420.1		Total phenolics	NELAP	PA	5/6/2009
EPA 5030	C	Aqueous-phase purge-and-trap	NELAP	PA	9/18/2013
EPA 5030	B	Aqueous-phase purge-and-trap	NELAP	PA	3/29/2005
EPA 6010		Aluminum	NELAP	PA	2/25/2010
EPA 6010		Antimony	NELAP	PA	2/25/2010
EPA 6010		Arsenic	NELAP	PA	2/25/2010
EPA 6010		Barium	NELAP	PA	2/25/2010
EPA 6010		Beryllium	NELAP	PA	2/25/2010
EPA 6010		Boron	NELAP	PA	2/25/2010
EPA 6010		Cadmium	NELAP	PA	2/25/2010
EPA 6010		Calcium	NELAP	PA	2/25/2010
EPA 6010		Chromium	NELAP	PA	2/25/2010
EPA 6010		Cobalt	NELAP	PA	2/25/2010
EPA 6010		Copper	NELAP	PA	2/25/2010
EPA 6010		Iron	NELAP	PA	2/25/2010
EPA 6010		Lead	NELAP	PA	2/25/2010
EPA 6010		Lithium	NELAP	PA	2/25/2010
EPA 6010		Magnesium	NELAP	PA	2/25/2010
EPA 6010		Manganese	NELAP	PA	2/25/2010
EPA 6010	B	Metals by ICP/AES	NELAP	PA	2/25/2010
EPA 6010	C	Metals by ICP/AES	NELAP	PA	9/18/2013
EPA 6010		Molybdenum	NELAP	PA	2/25/2010
EPA 6010		Nickel	NELAP	PA	2/25/2010
EPA 6010		Phosphorus, total	NELAP	PA	2/25/2010
EPA 6010		Potassium	NELAP	PA	2/25/2010
EPA 6010		Selenium	NELAP	PA	2/25/2010
EPA 6010		Silica, as SiO2	NELAP	PA	2/25/2010
EPA 6010		Silicon	NELAP	PA	2/25/2010
EPA 6010		Silver	NELAP	PA	2/25/2010
EPA 6010		Sodium	NELAP	PA	2/25/2010
EPA 6010		Strontium	NELAP	PA	2/25/2010
EPA 6010		Sulfur	NELAP	PA	1/9/2012
EPA 6010		Thallium	NELAP	PA	2/25/2010
EPA 6010		Tin	NELAP	PA	2/25/2010
EPA 6010		Titanium	NELAP	PA	2/25/2010
EPA 6010		Vanadium	NELAP	PA	2/25/2010
EPA 6010		Zinc	NELAP	PA	2/25/2010
EPA 6010		Zirconium	NELAP	PA	2/25/2010

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PADWIS ID: 65282

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 608		4,4'-DDD	NELAP	PA	3/29/2005
EPA 608		4,4'-DDE	NELAP	PA	3/29/2005
EPA 608		4,4'-DDT	NELAP	PA	3/29/2005
EPA 608		Aldrin (HHDN)	NELAP	PA	3/29/2005
EPA 608		Aroclor-1016 (PCB-1016)	NELAP	PA	3/29/2005
EPA 608		Aroclor-1221 (PCB-1221)	NELAP	PA	3/29/2005
EPA 608		Aroclor-1232 (PCB-1232)	NELAP	PA	3/29/2005
EPA 608		Aroclor-1242 (PCB-1242)	NELAP	PA	3/29/2005
EPA 608		Aroclor-1248 (PCB-1248)	NELAP	PA	3/29/2005
EPA 608		Aroclor-1254 (PCB-1254)	NELAP	PA	3/29/2005
EPA 608		Aroclor-1260 (PCB-1260)	NELAP	PA	3/29/2005
EPA 608		Aroclor-1262 (PCB-1262)	NELAP	PA	2/9/2007
EPA 608		Aroclor-1268 (PCB-1268)	NELAP	PA	2/9/2007
EPA 608		Chlordane (tech.)	NELAP	PA	3/29/2005
EPA 608		Dieldrin	NELAP	PA	3/29/2005
EPA 608		Endosulfan I	NELAP	PA	3/29/2005
EPA 608		Endosulfan II	NELAP	PA	3/29/2005
EPA 608		Endosulfan sulfate	NELAP	PA	3/29/2005
EPA 608		Endrin	NELAP	PA	3/29/2005
EPA 608		Endrin aldehyde	NELAP	PA	3/29/2005
EPA 608		Endrin ketone	NELAP	PA	2/5/2007
EPA 608		Heptachlor	NELAP	PA	3/29/2005
EPA 608		Heptachlor epoxide	NELAP	PA	3/29/2005
EPA 608		Toxaphene (Chlorinated camphene)	NELAP	PA	3/29/2005
EPA 608		alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	3/29/2005
EPA 608		alpha-Chlordane	NELAP	PA	2/22/2013
EPA 608		beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	3/29/2005
EPA 608		delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	3/29/2005
EPA 608		gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	3/29/2005
EPA 608		gamma-Chlordane	NELAP	PA	2/22/2013
EPA 624		1,1,1,2-Tetrachloroethane	NELAP	PA	6/22/2006
EPA 624		1,1,1-Trichloroethane	NELAP	PA	3/29/2005
EPA 624		1,1,2,2-Tetrachloroethane	NELAP	PA	3/29/2005
EPA 624		1,1,2-Trichloroethane	NELAP	PA	3/29/2005
EPA 624		1,1-Dichloroethane	NELAP	PA	3/29/2005
EPA 624		1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	3/29/2005
EPA 624		1,1-Dichloropropene	NELAP	PA	6/22/2006
EPA 624		1,2,3-Trichlorobenzene	NELAP	PA	6/22/2006
EPA 624		1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	6/22/2006
EPA 624		1,2,4-Trichlorobenzene	NELAP	PA	6/22/2006
EPA 624		1,2,4-Trimethylbenzene	NELAP	PA	6/22/2006
EPA 624		1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	6/22/2006
EPA 624		1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	6/22/2006

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PADWIS ID: 65282

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 624		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	3/29/2005
EPA 624		1,2-Dichloroethane	NELAP	PA	3/29/2005
EPA 624		1,2-Dichloropropane	NELAP	PA	3/29/2005
EPA 624		1,3,5-Trimethylbenzene	NELAP	PA	6/22/2006
EPA 624		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	3/29/2005
EPA 624		1,3-Dichloropropane	NELAP	PA	5/30/2013
EPA 624		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	3/29/2005
EPA 624		1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	5/30/2013
EPA 624		2,2-Dichloropropane	NELAP	PA	6/22/2006
EPA 624		2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	6/22/2006
EPA 624		2-Chloroethyl vinyl ether	NELAP	PA	6/22/2006
EPA 624		2-Chlorotoluene	NELAP	PA	6/22/2006
EPA 624		2-Hexanone	NELAP	PA	6/22/2006
EPA 624		2-Methylnaphthalene	NELAP	PA	5/30/2013
EPA 624		2-Nitropropane	NELAP	PA	5/30/2013
EPA 624		4-Chlorotoluene	NELAP	PA	5/30/2013
EPA 624		4-Methyl-2-pentanone (MIBK)	NELAP	PA	6/22/2006
EPA 624		Acetone	NELAP	PA	6/22/2006
EPA 624		Acetonitrile	NELAP	PA	5/30/2013
EPA 624		Acrolein (Propenal)	NELAP	PA	6/22/2006
EPA 624		Acrylonitrile	NELAP	PA	6/22/2006
EPA 624		Allyl chloride (3-Chloropropene)	NELAP	PA	5/30/2013
EPA 624		Benzene	NELAP	PA	3/29/2005
EPA 624		Bromobenzene	NELAP	PA	6/22/2006
EPA 624		Bromochloromethane	NELAP	PA	5/30/2013
EPA 624		Bromodichloromethane	NELAP	PA	3/29/2005
EPA 624		Bromoform	NELAP	PA	3/29/2005
EPA 624		Carbon disulfide	NELAP	PA	6/22/2006
EPA 624		Carbon tetrachloride	NELAP	PA	3/29/2005
EPA 624		Chlorobenzene	NELAP	PA	3/29/2005
EPA 624		Chloroethane	NELAP	PA	3/29/2005
EPA 624		Chloroform	NELAP	PA	3/29/2005
EPA 624		Chloroprene (2-Chloro-1,3-butadiene)	NELAP	PA	5/30/2013
EPA 624		Cyclohexane	NELAP	PA	5/30/2013
EPA 624		Cyclohexanone	NELAP	PA	5/30/2013
EPA 624		Dibromochloromethane	NELAP	PA	3/29/2005
EPA 624		Dibromomethane	NELAP	PA	6/22/2006
EPA 624		Dichlorodifluoromethane (Freon 12)	NELAP	PA	6/22/2006
EPA 624		Diethyl ether (Ethyl ether)	NELAP	PA	5/30/2013
EPA 624		Diisopropyl ether (DIPE)	NELAP	PA	5/30/2013
EPA 624		Ethanol	NELAP	PA	5/30/2013
EPA 624		Ethyl acetate	NELAP	PA	5/30/2013
EPA 624		Ethyl methacrylate	NELAP	PA	5/30/2013
EPA 624		Ethylbenzene	NELAP	PA	3/29/2005
EPA 624		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	6/22/2006

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 624		Iodomethane (Methyl iodide)	NELAP	PA	5/30/2013
EPA 624		Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	5/30/2013
EPA 624		Isopropylbenzene (Cumene)	NELAP	PA	6/22/2006
EPA 624		Methacrylonitrile	NELAP	PA	5/30/2013
EPA 624		Methyl acetate	NELAP	PA	5/30/2013
EPA 624		Methyl bromide (Bromomethane)	NELAP	PA	3/29/2005
EPA 624		Methyl chloride (Chloromethane)	NELAP	PA	3/29/2005
EPA 624		Methyl tert-butyl ether (MTBE)	NELAP	PA	6/22/2006
EPA 624		Methylcyclohexane	NELAP	PA	5/30/2013
EPA 624		Methylene chloride (Dichloromethane)	NELAP	PA	3/29/2005
EPA 624		Naphthalene	NELAP	PA	6/22/2006
EPA 624		Propionitrile (Ethyl cyanide)	NELAP	PA	5/30/2013
EPA 624		Styrene	NELAP	PA	6/22/2006
EPA 624		Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	3/29/2005
EPA 624		Tetrahydrofuran (THF)	NELAP	PA	5/30/2013
EPA 624		Toluene	NELAP	PA	3/29/2005
EPA 624		Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	3/29/2005
EPA 624		Trichlorofluoromethane (Freon 11)	NELAP	PA	1/4/2007
EPA 624		Vinyl acetate	NELAP	PA	5/30/2013
EPA 624		Vinyl chloride (Chloroethene)	NELAP	PA	3/29/2005
EPA 624		Xylenes, total	NELAP	PA	3/29/2005
EPA 624		cis-1,2-Dichloroethene	NELAP	PA	6/22/2006
EPA 624		cis-1,3-Dichloropropene	NELAP	PA	3/29/2005
EPA 624		m+p-Xylene	NELAP	PA	6/22/2006
EPA 624		n-Butylbenzene	NELAP	PA	6/22/2006
EPA 624		n-Hexane	NELAP	PA	5/30/2013
EPA 624		n-Propylbenzene	NELAP	PA	6/22/2006
EPA 624		o-Xylene	NELAP	PA	6/22/2006
EPA 624		p-Isopropyltoluene (4-Isopropyltoluene)	NELAP	PA	6/22/2006
EPA 624		sec-Butylbenzene	NELAP	PA	6/22/2006
EPA 624		tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	6/22/2006
EPA 624		tert-Butyl ethyl ether	NELAP	PA	5/30/2013
EPA 624		trans-1,2-Dichloroethene	NELAP	PA	3/29/2005
EPA 624		trans-1,3-Dichloropropene	NELAP	PA	3/29/2005
EPA 624		trans-1,4-Dichloro-2-butene	NELAP	PA	5/30/2013
EPA 625		1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	2/22/2013
EPA 625		1,2,4-Trichlorobenzene	NELAP	PA	3/29/2005
EPA 625		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	3/29/2005
EPA 625		1,2-Diphenylhydrazine	NELAP	PA	6/22/2006
EPA 625		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	3/29/2005
EPA 625		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	3/29/2005
EPA 625		1-Methylnaphthalene	NELAP	PA	2/22/2013
EPA 625		2,4,5-Trichlorophenol	NELAP	PA	6/22/2006
EPA 625		2,4,6-Trichlorophenol	NELAP	PA	3/29/2005
EPA 625		2,4-Dichlorophenol	NELAP	PA	3/29/2005

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PADWIS ID: 65282

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 625		2,4-Dimethylphenol	NELAP	PA	3/29/2005
EPA 625		2,4-Dinitrophenol	NELAP	PA	3/29/2005
EPA 625		2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	3/29/2005
EPA 625		2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	3/29/2005
EPA 625		2-Chloronaphthalene	NELAP	PA	3/29/2005
EPA 625		2-Chlorophenol	NELAP	PA	3/29/2005
EPA 625		2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	3/29/2005
EPA 625		2-Methylnaphthalene	NELAP	PA	2/22/2013
EPA 625		2-Methylphenol (o-Cresol)	NELAP	PA	2/22/2013
EPA 625		2-Nitroaniline	NELAP	PA	2/22/2013
EPA 625		2-Nitrophenol	NELAP	PA	3/29/2005
EPA 625		3+4-Methylphenol (m+p-Cresol)	NELAP	PA	6/14/2011
EPA 625		3,3'-Dichlorobenzidine	NELAP	PA	3/29/2005
EPA 625		4-Bromophenyl phenyl ether	NELAP	PA	3/29/2005
EPA 625		4-Chloro-3-methylphenol	NELAP	PA	3/29/2005
EPA 625		4-Chloroaniline	NELAP	PA	2/22/2013
EPA 625		4-Chlorophenyl phenyl ether	NELAP	PA	3/29/2005
EPA 625		4-Nitroaniline	NELAP	PA	2/22/2013
EPA 625		4-Nitrophenol	NELAP	PA	3/29/2005
EPA 625		Acenaphthene	NELAP	PA	3/29/2005
EPA 625		Acenaphthylene	NELAP	PA	3/29/2005
EPA 625		Acetophenone	NELAP	PA	2/22/2013
EPA 625		Aniline	NELAP	PA	2/22/2013
EPA 625		Anthracene	NELAP	PA	3/29/2005
EPA 625		Atrazine	NELAP	PA	2/22/2013
EPA 625		Benzaldehyde	NELAP	PA	2/22/2013
EPA 625		Benzidine	NELAP	PA	3/29/2005
EPA 625		Benzo[a]anthracene	NELAP	PA	3/29/2005
EPA 625		Benzo[a]pyrene	NELAP	PA	3/29/2005
EPA 625		Benzo[b]fluoranthene	NELAP	PA	3/29/2005
EPA 625		Benzo[ghi]perylene	NELAP	PA	3/29/2005
EPA 625		Benzo[k]fluoranthene	NELAP	PA	3/29/2005
EPA 625		Benzoic acid	NELAP	PA	2/22/2013
EPA 625		Benzyl alcohol	NELAP	PA	2/22/2013
EPA 625		Butyl benzyl phthalate (Benzyl butyl phthalate)	NELAP	PA	3/29/2005
EPA 625		Caprolactam	NELAP	PA	2/22/2013
EPA 625		Carbazole	NELAP	PA	2/22/2013
EPA 625		Chrysene (Benzo[a]phenanthrene)	NELAP	PA	3/29/2005
EPA 625		Di-n-butyl phthalate	NELAP	PA	3/29/2005
EPA 625		Di-n-octyl phthalate	NELAP	PA	3/29/2005
EPA 625		Dibenzo[a,h]anthracene	NELAP	PA	3/29/2005
EPA 625		Dibenzofuran	NELAP	PA	2/22/2013
EPA 625		Diethyl phthalate	NELAP	PA	3/29/2005
EPA 625		Dimethyl phthalate	NELAP	PA	3/29/2005

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Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 625		Fluoranthene	NELAP	PA	3/29/2005
EPA 625		Fluorene	NELAP	PA	3/29/2005
EPA 625		Hexachlorobenzene	NELAP	PA	3/29/2005
EPA 625		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	3/29/2005
EPA 625		Hexachlorocyclopentadiene	NELAP	PA	3/29/2005
EPA 625		Hexachloroethane	NELAP	PA	3/29/2005
EPA 625		Indeno(1,2,3-cd)pyrene	NELAP	PA	3/29/2005
EPA 625		Isophorone	NELAP	PA	3/29/2005
EPA 625		N-Nitrosodi-n-propylamine	NELAP	PA	3/29/2005
EPA 625		N-Nitrosodimethylamine	NELAP	PA	3/29/2005
EPA 625		N-Nitrosodiphenylamine	NELAP	PA	3/29/2005
EPA 625		Naphthalene	NELAP	PA	3/29/2005
EPA 625		Nitrobenzene	NELAP	PA	3/29/2005
EPA 625		Pentachlorophenol (PCP)	NELAP	PA	3/29/2005
EPA 625		Phenanthrene	NELAP	PA	3/29/2005
EPA 625		Phenol	NELAP	PA	3/29/2005
EPA 625		Pyrene	NELAP	PA	3/29/2005
EPA 625		bis(2-Chloroethoxy)methane	NELAP	PA	3/29/2005
EPA 625		bis(2-Chloroethyl) ether	NELAP	PA	3/29/2005
EPA 625		bis(2-Chloroisopropyl) ether	NELAP	PA	3/29/2005
EPA 625		bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	3/29/2005
EPA 7.3.3.2		Reactive cyanide	NELAP	PA	3/29/2005
EPA 7.3.4.2		Reactive sulfide	NELAP	PA	3/29/2005
EPA 7196	A	Chromium VI	NELAP	PA	5/6/2009
EPA 7470	A	Mercury	NELAP	PA	3/29/2005
EPA 8011		1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	6/22/2006
EPA 8011		1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	6/22/2006
EPA 8015		Diesel-range organics (DRO)	NELAP	PA	2/25/2010
EPA 8015		Gasoline-range organics (GRO)	NELAP	PA	2/25/2010
EPA 8015	B	Nonhalogenated organics by GC/FID	NELAP	PA	2/25/2010
EPA 8015	D	Nonhalogenated organics by GC/FID	NELAP	PA	9/18/2013
EPA 8081		4,4'-DDD	NELAP	PA	2/25/2010
EPA 8081		4,4'-DDE	NELAP	PA	2/25/2010
EPA 8081		4,4'-DDT	NELAP	PA	2/25/2010
EPA 8081		Aldrin (HHDN)	NELAP	PA	2/25/2010
EPA 8081		Chlordane (tech.)	NELAP	PA	2/25/2010
EPA 8081		Dieldrin	NELAP	PA	2/25/2010
EPA 8081		Endosulfan I	NELAP	PA	2/25/2010
EPA 8081		Endosulfan II	NELAP	PA	2/25/2010
EPA 8081		Endosulfan sulfate	NELAP	PA	2/25/2010
EPA 8081		Endrin	NELAP	PA	2/25/2010
EPA 8081		Endrin aldehyde	NELAP	PA	2/25/2010
EPA 8081		Endrin ketone	NELAP	PA	2/25/2010

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Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8081		Heptachlor	NELAP	PA	2/25/2010
EPA 8081		Heptachlor epoxide	NELAP	PA	2/25/2010
EPA 8081		Methoxychlor	NELAP	PA	2/25/2010
EPA 8081	B	Organochlorine pesticides by GC/ECD	NELAP	PA	9/18/2013
EPA 8081	A	Organochlorine pesticides by GC/ECD	NELAP	PA	2/25/2010
EPA 8081		Toxaphene (Chlorinated camphene)	NELAP	PA	2/25/2010
EPA 8081		alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	2/25/2010
EPA 8081		alpha-Chlordane	NELAP	PA	2/25/2010
EPA 8081		beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	2/25/2010
EPA 8081		delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	2/25/2010
EPA 8081		gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	2/25/2010
EPA 8081		gamma-Chlordane	NELAP	PA	2/25/2010
EPA 8082		Aroclor-1016 (PCB-1016)	NELAP	PA	3/29/2005
EPA 8082		Aroclor-1221 (PCB-1221)	NELAP	PA	3/29/2005
EPA 8082		Aroclor-1232 (PCB-1232)	NELAP	PA	3/29/2005
EPA 8082		Aroclor-1242 (PCB-1242)	NELAP	PA	3/29/2005
EPA 8082		Aroclor-1248 (PCB-1248)	NELAP	PA	3/29/2005
EPA 8082		Aroclor-1254 (PCB-1254)	NELAP	PA	3/29/2005
EPA 8082		Aroclor-1260 (PCB-1260)	NELAP	PA	3/29/2005
EPA 8082		Aroclor-1262 (PCB-1262)	NELAP	PA	2/9/2007
EPA 8082		Aroclor-1268 (PCB-1268)	NELAP	PA	2/9/2007
EPA 8082	A	PCBs by GC/ECD	NELAP	PA	9/18/2013
EPA 8260		1,1,1,2-Tetrachloroethane	NELAP	PA	2/25/2010
EPA 8260		1,1,1-Trichloroethane	NELAP	PA	2/25/2010
EPA 8260		1,1,2,2-Tetrachloroethane	NELAP	PA	2/25/2010
EPA 8260		1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	2/25/2010
EPA 8260		1,1,2-Trichloroethane	NELAP	PA	2/25/2010
EPA 8260		1,1-Dichloroethane	NELAP	PA	2/25/2010
EPA 8260		1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	2/25/2010
EPA 8260		1,1-Dichloropropene	NELAP	PA	2/25/2010
EPA 8260		1,2,3-Trichlorobenzene	NELAP	PA	2/25/2010
EPA 8260		1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	2/25/2010
EPA 8260		1,2,4-Trichlorobenzene	NELAP	PA	2/25/2010
EPA 8260		1,2,4-Trimethylbenzene	NELAP	PA	2/25/2010
EPA 8260		1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	2/25/2010
EPA 8260		1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	2/25/2010
EPA 8260		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	2/25/2010
EPA 8260		1,2-Dichloroethane	NELAP	PA	2/25/2010
EPA 8260		1,2-Dichloropropane	NELAP	PA	2/25/2010
EPA 8260		1,3,5-Trimethylbenzene	NELAP	PA	2/25/2010
EPA 8260		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	2/25/2010
EPA 8260		1,3-Dichloropropane	NELAP	PA	2/25/2010

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pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 012-008 expiration date March 31, 2014. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 65-00282 **EPA Lab Code: PA01457** **TNI Code:** **(724) 850-5600**
PADWIS ID: 65282

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	2/25/2010
EPA 8260		1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	2/25/2010
EPA 8260		2,2-Dichloropropane	NELAP	PA	2/25/2010
EPA 8260		2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	2/25/2010
EPA 8260		2-Chloroethyl vinyl ether	NELAP	PA	2/25/2010
EPA 8260		2-Chlorotoluene	NELAP	PA	2/25/2010
EPA 8260		2-Hexanone	NELAP	PA	2/25/2010
EPA 8260		2-Methylnaphthalene	NELAP	PA	5/30/2013
EPA 8260		2-Nitropropane	NELAP	PA	2/25/2010
EPA 8260		4-Chlorotoluene	NELAP	PA	2/25/2010
EPA 8260		4-Methyl-2-pentanone (MIBK)	NELAP	PA	2/25/2010
EPA 8260		Acetone	NELAP	PA	2/25/2010
EPA 8260		Acetonitrile	NELAP	PA	2/25/2010
EPA 8260		Acrolein (Propenal)	NELAP	PA	2/25/2010
EPA 8260		Acrylonitrile	NELAP	PA	2/25/2010
EPA 8260		Allyl chloride (3-Chloropropene)	NELAP	PA	2/25/2010
EPA 8260		Benzene	NELAP	PA	2/25/2010
EPA 8260		Bromobenzene	NELAP	PA	2/25/2010
EPA 8260		Bromochloromethane	NELAP	PA	2/25/2010
EPA 8260		Bromodichloromethane	NELAP	PA	2/25/2010
EPA 8260		Bromoform	NELAP	PA	2/25/2010
EPA 8260		Bromomethane (Methyl bromide)	NELAP	PA	2/25/2010
EPA 8260		Carbon disulfide	NELAP	PA	2/25/2010
EPA 8260		Carbon tetrachloride	NELAP	PA	2/25/2010
EPA 8260		Chlorobenzene	NELAP	PA	2/25/2010
EPA 8260		Chloroethane	NELAP	PA	2/25/2010
EPA 8260		Chloroform	NELAP	PA	2/25/2010
EPA 8260		Chloromethane (Methyl chloride)	NELAP	PA	2/25/2010
EPA 8260		Chloroprene (2-Chloro-1,3-butadiene)	NELAP	PA	2/25/2010
EPA 8260		Cyclohexane	NELAP	PA	2/25/2010
EPA 8260		Cyclohexanone	NELAP	PA	2/25/2010
EPA 8260		Dibromochloromethane	NELAP	PA	2/25/2010
EPA 8260		Dibromomethane	NELAP	PA	2/25/2010
EPA 8260		Dichlorodifluoromethane (Freon 12)	NELAP	PA	2/25/2010
EPA 8260		Diethyl ether (Ethyl ether)	NELAP	PA	2/25/2010
EPA 8260		Diisopropyl ether (DIPE)	NELAP	PA	2/25/2010
EPA 8260		Ethanol	NELAP	PA	6/14/2011
EPA 8260		Ethyl acetate	NELAP	PA	2/25/2010
EPA 8260		Ethyl methacrylate	NELAP	PA	2/25/2010
EPA 8260		Ethyl tert-butyl ether (ETBE)	NELAP	PA	2/25/2010
EPA 8260		Ethylbenzene	NELAP	PA	2/25/2010
EPA 8260		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	2/25/2010
EPA 8260		Iodomethane (Methyl iodide)	NELAP	PA	2/25/2010
EPA 8260		Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	2/25/2010
EPA 8260		Isopropylbenzene (Cumene)	NELAP	PA	2/25/2010

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Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260		Methacrylonitrile	NELAP	PA	2/25/2010
EPA 8260		Methyl acetate	NELAP	PA	2/25/2010
EPA 8260		Methyl tert-butyl ether (MTBE)	NELAP	PA	2/25/2010
EPA 8260		Methylacrylate	NELAP	PA	2/25/2010
EPA 8260		Methylcyclohexane	NELAP	PA	2/25/2010
EPA 8260		Methylene chloride (Dichloromethane)	NELAP	PA	2/25/2010
EPA 8260		Naphthalene	NELAP	PA	2/25/2010
EPA 8260		Propionitrile (Ethyl cyanide)	NELAP	PA	2/25/2010
EPA 8260		Styrene	NELAP	PA	2/25/2010
EPA 8260		Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	2/25/2010
EPA 8260		Tetrahydrofuran (THF)	NELAP	PA	2/25/2010
EPA 8260		Toluene	NELAP	PA	2/25/2010
EPA 8260		Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	2/25/2010
EPA 8260		Trichlorofluoromethane (Freon 11)	NELAP	PA	2/25/2010
EPA 8260	C	VOCs by GC/MS	NELAP	PA	9/18/2013
EPA 8260	B	VOCs by GC/MS	NELAP	PA	2/25/2010
EPA 8260		Vinyl acetate	NELAP	PA	2/25/2010
EPA 8260		Vinyl chloride (Chloroethene)	NELAP	PA	2/25/2010
EPA 8260		Xylenes, total	NELAP	PA	2/25/2010
EPA 8260		cis-1,2-Dichloroethene	NELAP	PA	2/25/2010
EPA 8260		cis-1,3-Dichloropropene	NELAP	PA	2/25/2010
EPA 8260		m+p-Xylene	NELAP	PA	2/25/2010
EPA 8260		n-Butylbenzene	NELAP	PA	2/25/2010
EPA 8260		n-Hexane	NELAP	PA	2/25/2010
EPA 8260		n-Propylbenzene	NELAP	PA	2/25/2010
EPA 8260		o-Xylene	NELAP	PA	2/25/2010
EPA 8260		p-Isopropyltoluene (4-Isopropyltoluene)	NELAP	PA	2/25/2010
EPA 8260		sec-Butylbenzene	NELAP	PA	2/25/2010
EPA 8260		tert-Amyl ethyl ether (TAEE)	NELAP	PA	2/25/2010
EPA 8260		tert-Amyl methyl ether (TAME)	NELAP	PA	8/11/2011
EPA 8260		tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	2/25/2010
EPA 8260		tert-Butylbenzene	NELAP	PA	2/25/2010
EPA 8260		trans-1,2-Dichloroethene	NELAP	PA	2/25/2010
EPA 8260		trans-1,3-Dichloropropene	NELAP	PA	2/25/2010
EPA 8260		trans-1,4-Dichloro-2-butene	NELAP	PA	2/25/2010
EPA 8260 SIM		Vinyl chloride (Chloroethene)	NELAP	PA	11/1/2006
EPA 8270		1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	2/25/2010
EPA 8270		1,2,4,5-Tetrachlorobenzene	NELAP	PA	10/2/2012
EPA 8270		1,2,4-Trichlorobenzene	NELAP	PA	2/25/2010
EPA 8270		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	2/25/2010
EPA 8270		1,2-Diphenylhydrazine	NELAP	PA	2/25/2010
EPA 8270		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	2/25/2010
EPA 8270		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	2/25/2010
EPA 8270		1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	2/25/2010
EPA 8270		1-Methylnaphthalene	NELAP	PA	9/18/2013

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Laboratory Scope of Accreditation

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DEP Laboratory ID: 65-00282 **EPA Lab Code: PA01457** **TNI Code:** **(724) 850-5600**

PADWIS ID: 65282

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		2,3,4,6-Tetrachlorophenol	NELAP	PA	10/2/2012
EPA 8270		2,4,5-Trichlorophenol	NELAP	PA	2/25/2010
EPA 8270		2,4,6-Trichlorophenol	NELAP	PA	2/25/2010
EPA 8270		2,4-Dichlorophenol	NELAP	PA	2/25/2010
EPA 8270		2,4-Dimethylphenol	NELAP	PA	2/25/2010
EPA 8270		2,4-Dinitrophenol	NELAP	PA	2/25/2010
EPA 8270		2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	2/25/2010
EPA 8270		2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	2/25/2010
EPA 8270		2-Chloronaphthalene	NELAP	PA	2/25/2010
EPA 8270		2-Chlorophenol	NELAP	PA	2/25/2010
EPA 8270		2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	2/25/2010
EPA 8270		2-Methylnaphthalene	NELAP	PA	2/25/2010
EPA 8270		2-Methylphenol (o-Cresol)	NELAP	PA	2/25/2010
EPA 8270		2-Nitroaniline	NELAP	PA	2/25/2010
EPA 8270		2-Nitrophenol	NELAP	PA	2/25/2010
EPA 8270		3+4-Methylphenol (m+p-Cresol)	NELAP	PA	2/25/2010
EPA 8270		3,3'-Dichlorobenzidine	NELAP	PA	2/25/2010
EPA 8270		3-Nitroaniline	NELAP	PA	2/25/2010
EPA 8270		4-Bromophenyl phenyl ether	NELAP	PA	2/25/2010
EPA 8270		4-Chloro-3-methylphenol	NELAP	PA	2/25/2010
EPA 8270		4-Chloroaniline	NELAP	PA	2/25/2010
EPA 8270		4-Chlorophenyl phenyl ether	NELAP	PA	2/25/2010
EPA 8270		4-Nitroaniline	NELAP	PA	2/25/2010
EPA 8270		4-Nitrophenol	NELAP	PA	2/25/2010
EPA 8270		8-Hydroxyquinoline	NELAP	PA	2/25/2010
EPA 8270		Acenaphthene	NELAP	PA	2/25/2010
EPA 8270		Acenaphthylene	NELAP	PA	2/25/2010
EPA 8270		Acetophenone	NELAP	PA	2/25/2010
EPA 8270		Aniline	NELAP	PA	2/25/2010
EPA 8270		Anthracene	NELAP	PA	2/25/2010
EPA 8270		Atrazine	NELAP	PA	2/25/2010
EPA 8270		Benzaldehyde	NELAP	PA	2/25/2010
EPA 8270		Benzidine	NELAP	PA	2/25/2010
EPA 8270		Benzo[a]anthracene	NELAP	PA	2/25/2010
EPA 8270		Benzo[a]pyrene	NELAP	PA	2/25/2010
EPA 8270		Benzo[b]fluoranthene	NELAP	PA	2/25/2010
EPA 8270		Benzo[ghi]perylene	NELAP	PA	2/25/2010
EPA 8270		Benzo[k]fluoranthene	NELAP	PA	2/25/2010
EPA 8270		Benzoic acid	NELAP	PA	2/25/2010
EPA 8270		Benzyl alcohol	NELAP	PA	2/25/2010
EPA 8270		Benzyl butyl phthalate (Butyl benzyl phthalate)	NELAP	PA	2/25/2010
EPA 8270		Caprolactam	NELAP	PA	2/25/2010
EPA 8270		Carbazole	NELAP	PA	2/25/2010
EPA 8270		Chrysene (Benzo[a]phenanthrene)	NELAP	PA	2/25/2010

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Laboratory Scope of Accreditation

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DEP Laboratory ID: 65-00282 **EPA Lab Code: PA01457** **TNI Code:** **(724) 850-5600**

PADWIS ID: 65282

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		Di-n-butyl phthalate	NELAP	PA	2/25/2010
EPA 8270		Di-n-octyl phthalate	NELAP	PA	2/25/2010
EPA 8270		Dibenzo[a,h]anthracene	NELAP	PA	2/25/2010
EPA 8270		Dibenzofuran	NELAP	PA	2/25/2010
EPA 8270		Diethyl phthalate	NELAP	PA	2/25/2010
EPA 8270		Dimethyl phthalate	NELAP	PA	2/25/2010
EPA 8270		Fluoranthene	NELAP	PA	2/25/2010
EPA 8270		Fluorene	NELAP	PA	2/25/2010
EPA 8270		Hexachlorobenzene	NELAP	PA	2/25/2010
EPA 8270		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	2/25/2010
EPA 8270		Hexachlorocyclopentadiene	NELAP	PA	2/25/2010
EPA 8270		Hexachloroethane	NELAP	PA	2/25/2010
EPA 8270		Indeno(1,2,3-cd)pyrene	NELAP	PA	2/25/2010
EPA 8270		Isophorone	NELAP	PA	2/25/2010
EPA 8270		N-Nitrosodi-n-propylamine	NELAP	PA	2/25/2010
EPA 8270		N-Nitrosodimethylamine	NELAP	PA	2/25/2010
EPA 8270		N-Nitrosodiphenylamine	NELAP	PA	2/25/2010
EPA 8270		Naphthalene	NELAP	PA	2/25/2010
EPA 8270		Nitrobenzene	NELAP	PA	2/25/2010
EPA 8270		Pentachlorophenol (PCP)	NELAP	PA	2/25/2010
EPA 8270		Phenanthrene	NELAP	PA	2/25/2010
EPA 8270		Phenol	NELAP	PA	2/25/2010
EPA 8270		Pyrene	NELAP	PA	2/25/2010
EPA 8270		Pyridine	NELAP	PA	2/25/2010
EPA 8270	D	SOCs by GC/MS	NELAP	PA	9/18/2013
EPA 8270	C	SOCs by GC/MS	NELAP	PA	2/25/2010
EPA 8270		Tributyl phosphate	NELAP	PA	2/25/2010
EPA 8270		bis(2-Chloroethoxy)methane	NELAP	PA	2/25/2010
EPA 8270		bis(2-Chloroethyl) ether	NELAP	PA	2/25/2010
EPA 8270		bis(2-Chloroisopropyl) ether	NELAP	PA	2/25/2010
EPA 8270		bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	2/25/2010
EPA 8270 SIM		Acenaphthene	NELAP	PA	2/25/2010
EPA 8270 SIM		Acenaphthylene	NELAP	PA	2/25/2010
EPA 8270 SIM		Anthracene	NELAP	PA	2/25/2010
EPA 8270 SIM		Benzo[a]anthracene	NELAP	PA	2/25/2010
EPA 8270 SIM		Benzo[a]pyrene	NELAP	PA	2/25/2010
EPA 8270 SIM		Benzo[b]fluoranthene	NELAP	PA	2/25/2010
EPA 8270 SIM		Benzo[ghi]perylene	NELAP	PA	2/25/2010
EPA 8270 SIM		Benzo[k]fluoranthene	NELAP	PA	2/25/2010
EPA 8270 SIM		Chrysene (Benzo[a]phenanthrene)	NELAP	PA	2/25/2010
EPA 8270 SIM		Dibenzo[a,h]anthracene	NELAP	PA	2/25/2010
EPA 8270 SIM		Fluoranthene	NELAP	PA	2/25/2010
EPA 8270 SIM		Fluorene	NELAP	PA	2/25/2010
EPA 8270 SIM		Indeno(1,2,3-cd)pyrene	NELAP	PA	2/25/2010
EPA 8270 SIM		Naphthalene	NELAP	PA	2/25/2010

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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 012-008 expiration date March 31, 2014. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 65-00282 **EPA Lab Code: PA01457** **TNI Code:** **(724) 850-5600**

PADWIS ID: 65282

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270 SIM		Phenanthrene	NELAP	PA	2/25/2010
EPA 8270 SIM		Pyrene	NELAP	PA	2/25/2010
EPA 900.0		Gross alpha	NELAP	PA	5/27/2008
EPA 900.0		Gross beta	NELAP	PA	5/27/2008
EPA 901.1		Gamma emitters	NELAP	PA	8/12/2008
EPA 9010	C	Amenable cyanide	NELAP	PA	8/31/2006
EPA 9010	C	Total cyanide	NELAP	PA	8/31/2006
EPA 9012	A	Total cyanide	NELAP	PA	2/22/2013
EPA 9012	B	Total cyanide	NELAP	PA	8/31/2006
EPA 903.0		Radium-226	NELAP	PA	5/30/2013
EPA 903.0		Total alpha radium	NELAP	PA	5/27/2008
EPA 903.1		Radium-226	NELAP	PA	5/27/2008
EPA 9038		Sulfate	NELAP	PA	5/6/2009
EPA 904.0		Radium-228	NELAP	PA	8/12/2008
EPA 9040	C	Corrosivity (pH)	NELAP	PA	2/22/2013
EPA 9040	C	pH	NELAP	PA	2/22/2013
EPA 9040	B	pH	NELAP	PA	3/29/2005
EPA 905.0		Strontium-90	NELAP	PA	8/12/2008
EPA 9050	A	Conductivity	NELAP	PA	6/1/2007
EPA 906.0		Tritium	NELAP	PA	8/12/2008
EPA 9060	A	Total organic carbon (TOC)	NELAP	PA	9/18/2013
EPA 9060		Total organic carbon (TOC)	NELAP	PA	2/3/2009
EPA 9065		Total phenolics	NELAP	PA	5/6/2009
EPA 908.0		Uranium, total	NELAP	PA	9/25/2008
EPA 9251		Chloride	NELAP	PA	5/6/2009
EPA 9310		Gross alpha	NELAP	PA	5/27/2008
EPA 9310		Gross beta	NELAP	PA	5/27/2008
EPA 9315		Radium-226	NELAP	PA	5/30/2013
EPA 9315		Total radium	NELAP	PA	5/27/2008
EPA 9320		Radium-228	NELAP	PA	5/27/2008
SM 2120 B		Color	NELAP	PA	4/10/2007
SM 2310 B		Acidity as CaCO3	NELAP	PA	10/18/2013
SM 2320 B		Alkalinity as CaCO3	NELAP	PA	1/4/2007
SM 2540 B		Residue, total	NELAP	PA	4/10/2007
SM 2540 C		Residue, filterable (TDS)	NELAP	PA	4/10/2007
SM 2540 D		Residue, nonfilterable (TSS)	NELAP	PA	4/10/2007
SM 2540 F		Residue, settleable	NELAP	PA	4/10/2007
SM 2550 B		Temperature, deg. C	NELAP	PA	4/10/2007
SM 3500-Cr B	20-22	Chromium VI	NELAP	PA	9/18/2013
SM 3500-Cr D	18/19	Chromium VI	NELAP	PA	5/6/2009
SM 3500-Fe B	20/21	Ferrous iron	NELAP	PA	1/9/2012
SM 3500-Fe D	18/19	Ferrous iron	NELAP	PA	1/9/2012
SM 4500-CN- C/E		Total cyanide	NELAP	PA	4/10/2007
SM 4500-CN- G		Amenable cyanide	NELAP	PA	4/10/2007
SM 4500-CN- I		Weak acid dissociable cyanide	NELAP	PA	5/6/2009

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PADWIS ID: 65282

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
SM 4500-CN- M		Thiocyanate	NELAP	PA	5/6/2009
SM 4500-Cl G		Total residual chlorine	NELAP	PA	4/10/2007
SM 4500-Cl- E		Chloride	NELAP	PA	5/6/2009
SM 4500-F- B		Preliminary distillation of fluoride	NELAP	PA	5/6/2009
SM 4500-F- C		Fluoride	NELAP	PA	5/6/2009
SM 4500-H+ B		pH	NELAP	PA	4/10/2007
SM 4500-NO2- B		Nitrite as N	NELAP	PA	6/30/2011
SM 4500-NO3- F		Nitrate as N	NELAP	PA	5/6/2009
SM 4500-O G		Oxygen (dissolved)	NELAP	PA	4/10/2007
SM 4500-P B		Preliminary treatment of phosphate samples	NELAP	PA	5/6/2009
SM 4500-P E		Orthophosphate as P	NELAP	PA	5/6/2009
SM 4500-P E		Phosphorus, total	NELAP	PA	5/6/2009
SM 4500-S F		Sulfide	NELAP	PA	4/10/2007
SM 4500-SO3 B		Sulfite, SO3	NELAP	PA	4/10/2007
SM 5210 B		Biochemical oxygen demand (BOD)	NELAP	PA	5/6/2009
SM 5210 B		Carbonaceous BOD (CBOD)	NELAP	PA	5/6/2009
SM 5310 C		Total organic carbon (TOC)	NELAP	PA	4/25/2008
SM 5540 C		Surfactants as MBAS	NELAP	PA	5/6/2009
SM 7110 C-00		Gross alpha	NELAP	PA	5/27/2008
SM 9222 B		Total coliform (Enumeration)	NELAP	PA	12/7/2009
SM 9222 D		Fecal coliform (Enumeration)	NELAP	PA	12/7/2009

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
ASTM D3987		Water leach	NELAP	PA	10/18/2013
DOE 4.5.2.3		Gamma emitters	NELAP	PA	9/18/2013
EPA 1010		Ignitability	NELAP	PA	3/29/2005
EPA 1311		Toxicity characteristic leaching procedure (TCLP)	NELAP	PA	3/29/2005
EPA 1312		Synthetic precipitation leaching procedure (SPLP)	NELAP	PA	3/29/2005
EPA 160.4		Residue, volatile	NELAP	PA	5/30/2013
EPA 3050	B	Acid digestion of solids	NELAP	PA	3/29/2005
EPA 3051	A	Microwave digestion of solids (HNO3 + HCl)	NELAP	PA	12/9/2013
EPA 3051		Microwave digestion of solids (HNO3 only)	NELAP	PA	5/6/2009
EPA 3060	A	Alkaline digestion of Cr(VI)	NELAP	PA	2/22/2013
EPA 3060		Alkaline digestion of Cr(VI)	NELAP	PA	5/6/2009
EPA 350.1		Ammonia as N	NELAP	PA	8/1/2013
EPA 351.2		Kjeldahl nitrogen, total (TKN)	NELAP	PA	9/18/2013
EPA 3546		Microwave extraction	NELAP	PA	4/20/2009
EPA 3580	A	Waste dilution	NELAP	PA	3/29/2005
EPA 3660	B	Sulfur cleanup	NELAP	PA	3/29/2005
EPA 3665	A	Sulfuric acid/permanganate clean-up	NELAP	PA	3/29/2005

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PADWIS ID: 65282

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 5035	A	Closed-system purge-and-trap (bisulfate option)	NELAP	PA	10/29/2009
EPA 5035	A	Closed-system purge-and-trap (methanol option)	NELAP	PA	10/29/2009
EPA 5035	A	Closed-system purge-and-trap (unpreserved)	NELAP	PA	10/29/2009
EPA 6010		Aluminum	NELAP	PA	2/25/2010
EPA 6010		Antimony	NELAP	PA	2/25/2010
EPA 6010		Arsenic	NELAP	PA	2/25/2010
EPA 6010		Barium	NELAP	PA	2/25/2010
EPA 6010		Beryllium	NELAP	PA	2/25/2010
EPA 6010		Boron	NELAP	PA	2/25/2010
EPA 6010		Cadmium	NELAP	PA	2/25/2010
EPA 6010		Calcium	NELAP	PA	2/25/2010
EPA 6010		Chromium	NELAP	PA	2/25/2010
EPA 6010		Cobalt	NELAP	PA	2/25/2010
EPA 6010		Copper	NELAP	PA	2/25/2010
EPA 6010		Iron	NELAP	PA	2/25/2010
EPA 6010		Lead	NELAP	PA	2/25/2010
EPA 6010		Lithium	NELAP	PA	2/25/2010
EPA 6010		Magnesium	NELAP	PA	2/25/2010
EPA 6010		Manganese	NELAP	PA	2/25/2010
EPA 6010	C	Metals by ICP/AES	NELAP	PA	9/18/2013
EPA 6010	B	Metals by ICP/AES	NELAP	PA	2/25/2010
EPA 6010		Molybdenum	NELAP	PA	2/25/2010
EPA 6010		Nickel	NELAP	PA	2/25/2010
EPA 6010		Phosphorus, total	NELAP	PA	2/25/2010
EPA 6010		Potassium	NELAP	PA	2/25/2010
EPA 6010		Selenium	NELAP	PA	2/25/2010
EPA 6010		Silica, as SiO2	NELAP	PA	2/25/2010
EPA 6010		Silver	NELAP	PA	2/25/2010
EPA 6010		Sodium	NELAP	PA	2/25/2010
EPA 6010		Strontium	NELAP	PA	2/25/2010
EPA 6010		Thallium	NELAP	PA	2/25/2010
EPA 6010		Tin	NELAP	PA	2/25/2010
EPA 6010		Titanium	NELAP	PA	2/25/2010
EPA 6010		Vanadium	NELAP	PA	2/25/2010
EPA 6010		Zinc	NELAP	PA	2/25/2010
EPA 6010		Zirconium	NELAP	PA	2/25/2010
EPA 7.3.3.2		Reactive cyanide	NELAP	PA	3/29/2005
EPA 7.3.4.2		Reactive sulfide	NELAP	PA	3/29/2005
EPA 7196	A	Chromium VI	NELAP	PA	5/6/2009
EPA 7470	A	Mercury	NELAP	PA	3/29/2005
EPA 7471	A	Mercury	NELAP	PA	3/29/2005
EPA 7471	B	Mercury	NELAP	PA	9/18/2013
EPA 8015		Diesel-range organics (DRO)	NELAP	PA	2/25/2010
EPA 8015		Gasoline-range organics (GRO)	NELAP	PA	2/25/2010

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Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8015	D	Nonhalogenated organics by GC/FID	NELAP	PA	9/18/2013
EPA 8015	B	Nonhalogenated organics by GC/FID	NELAP	PA	2/25/2010
EPA 8081		4,4'-DDD	NELAP	PA	2/25/2010
EPA 8081		4,4'-DDE	NELAP	PA	2/25/2010
EPA 8081		4,4'-DDT	NELAP	PA	2/25/2010
EPA 8081		Aldrin (HHDN)	NELAP	PA	2/25/2010
EPA 8081		Chlordane (tech.)	NELAP	PA	2/25/2010
EPA 8081		Dieldrin	NELAP	PA	2/25/2010
EPA 8081		Endosulfan I	NELAP	PA	2/25/2010
EPA 8081		Endosulfan II	NELAP	PA	2/25/2010
EPA 8081		Endosulfan sulfate	NELAP	PA	2/25/2010
EPA 8081		Endrin	NELAP	PA	2/25/2010
EPA 8081		Endrin aldehyde	NELAP	PA	2/25/2010
EPA 8081		Endrin ketone	NELAP	PA	2/25/2010
EPA 8081		Heptachlor	NELAP	PA	2/25/2010
EPA 8081		Heptachlor epoxide	NELAP	PA	2/25/2010
EPA 8081		Methoxychlor	NELAP	PA	2/25/2010
EPA 8081	B	Organochlorine pesticides by GC/ECD	NELAP	PA	9/18/2013
EPA 8081	A	Organochlorine pesticides by GC/ECD	NELAP	PA	2/25/2010
EPA 8081		Toxaphene (Chlorinated camphene)	NELAP	PA	2/25/2010
EPA 8081		alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	2/25/2010
EPA 8081		alpha-Chlordane	NELAP	PA	2/25/2010
EPA 8081		beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	2/25/2010
EPA 8081		delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	2/25/2010
EPA 8081		gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	2/25/2010
EPA 8081		gamma-Chlordane	NELAP	PA	2/25/2010
EPA 8082		Aroclor-1016 (PCB-1016)	NELAP	PA	3/29/2005
EPA 8082		Aroclor-1221 (PCB-1221)	NELAP	PA	3/29/2005
EPA 8082		Aroclor-1232 (PCB-1232)	NELAP	PA	3/29/2005
EPA 8082		Aroclor-1242 (PCB-1242)	NELAP	PA	3/29/2005
EPA 8082		Aroclor-1248 (PCB-1248)	NELAP	PA	3/29/2005
EPA 8082		Aroclor-1254 (PCB-1254)	NELAP	PA	3/29/2005
EPA 8082		Aroclor-1260 (PCB-1260)	NELAP	PA	3/29/2005
EPA 8082		Aroclor-1262 (PCB-1262)	NELAP	PA	2/9/2007
EPA 8082		Aroclor-1268 (PCB-1268)	NELAP	PA	2/9/2007
EPA 8082	A	PCBs by GC/ECD	NELAP	PA	9/18/2013
EPA 8260		1,1,1,2-Tetrachloroethane	NELAP	PA	2/25/2010
EPA 8260		1,1,1-Trichloroethane	NELAP	PA	2/25/2010
EPA 8260		1,1,2,2-Tetrachloroethane	NELAP	PA	2/25/2010
EPA 8260		1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	2/25/2010
EPA 8260		1,1,2-Trichloroethane	NELAP	PA	2/25/2010
EPA 8260		1,1-Dichloroethane	NELAP	PA	2/25/2010
EPA 8260		1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	2/25/2010
EPA 8260		1,1-Dichloropropene	NELAP	PA	2/25/2010

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Laboratory Scope of Accreditation

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DEP Laboratory ID: 65-00282 **EPA Lab Code: PA01457** **TNI Code:** **(724) 850-5600**
PADWIS ID: 65282

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260		1,2,3-Trichlorobenzene	NELAP	PA	2/25/2010
EPA 8260		1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	2/25/2010
EPA 8260		1,2,4-Trichlorobenzene	NELAP	PA	2/25/2010
EPA 8260		1,2,4-Trimethylbenzene	NELAP	PA	2/25/2010
EPA 8260		1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	2/25/2010
EPA 8260		1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	2/25/2010
EPA 8260		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	2/25/2010
EPA 8260		1,2-Dichloroethane	NELAP	PA	2/25/2010
EPA 8260		1,2-Dichloropropane	NELAP	PA	2/25/2010
EPA 8260		1,3,5-Trimethylbenzene	NELAP	PA	2/25/2010
EPA 8260		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	2/25/2010
EPA 8260		1,3-Dichloropropane	NELAP	PA	5/30/2013
EPA 8260		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	2/25/2010
EPA 8260		1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	2/25/2010
EPA 8260		2,2-Dichloropropane	NELAP	PA	2/25/2010
EPA 8260		2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	2/25/2010
EPA 8260		2-Chloroethyl vinyl ether	NELAP	PA	2/25/2010
EPA 8260		2-Chlorotoluene	NELAP	PA	2/25/2010
EPA 8260		2-Hexanone	NELAP	PA	2/25/2010
EPA 8260		2-Methylnaphthalene	NELAP	PA	5/30/2013
EPA 8260		2-Nitropropane	NELAP	PA	5/30/2013
EPA 8260		4-Chlorotoluene	NELAP	PA	2/25/2010
EPA 8260		4-Methyl-2-pentanone (MIBK)	NELAP	PA	2/25/2010
EPA 8260		Acetone	NELAP	PA	2/25/2010
EPA 8260		Acetonitrile	NELAP	PA	5/30/2013
EPA 8260		Acrolein (Propenal)	NELAP	PA	2/25/2010
EPA 8260		Acrylonitrile	NELAP	PA	2/25/2010
EPA 8260		Allyl chloride (3-Chloropropene)	NELAP	PA	5/30/2013
EPA 8260		Benzene	NELAP	PA	2/25/2010
EPA 8260		Bromobenzene	NELAP	PA	2/25/2010
EPA 8260		Bromochloromethane	NELAP	PA	2/25/2010
EPA 8260		Bromodichloromethane	NELAP	PA	2/25/2010
EPA 8260		Bromoform	NELAP	PA	2/25/2010
EPA 8260		Bromomethane (Methyl bromide)	NELAP	PA	2/25/2010
EPA 8260		Carbon disulfide	NELAP	PA	2/25/2010
EPA 8260		Carbon tetrachloride	NELAP	PA	2/25/2010
EPA 8260		Chlorobenzene	NELAP	PA	2/25/2010
EPA 8260		Chloroethane	NELAP	PA	2/25/2010
EPA 8260		Chloroform	NELAP	PA	2/25/2010
EPA 8260		Chloromethane (Methyl chloride)	NELAP	PA	2/25/2010
EPA 8260		Chloroprene (2-Chloro-1,3-butadiene)	NELAP	PA	5/30/2013
EPA 8260		Cyclohexane	NELAP	PA	2/25/2010
EPA 8260		Cyclohexanone	NELAP	PA	5/30/2013
EPA 8260		Dibromochloromethane	NELAP	PA	2/25/2010

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DEP Laboratory ID: 65-00282 **EPA Lab Code: PA01457** **TNI Code:** **(724) 850-5600**

PADWIS ID: 65282

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260		Dibromomethane	NELAP	PA	2/25/2010
EPA 8260		Dichlorodifluoromethane (Freon 12)	NELAP	PA	2/25/2010
EPA 8260		Diethyl ether (Ethyl ether)	NELAP	PA	5/30/2013
EPA 8260		Diisopropyl ether (DIPE)	NELAP	PA	2/25/2010
EPA 8260		Ethanol	NELAP	PA	5/30/2013
EPA 8260		Ethyl acetate	NELAP	PA	5/30/2013
EPA 8260		Ethyl methacrylate	NELAP	PA	5/30/2013
EPA 8260		Ethyl tert-butyl ether (ETBE)	NELAP	PA	2/25/2010
EPA 8260		Ethylbenzene	NELAP	PA	2/25/2010
EPA 8260		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	2/25/2010
EPA 8260		Iodomethane (Methyl iodide)	NELAP	PA	5/30/2013
EPA 8260		Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	5/30/2013
EPA 8260		Isopropylbenzene (Cumene)	NELAP	PA	2/25/2010
EPA 8260		Methacrylonitrile	NELAP	PA	5/30/2013
EPA 8260		Methyl acetate	NELAP	PA	2/25/2010
EPA 8260		Methyl tert-butyl ether (MTBE)	NELAP	PA	2/25/2010
EPA 8260		Methylcyclohexane	NELAP	PA	2/25/2010
EPA 8260		Methylene chloride (Dichloromethane)	NELAP	PA	2/25/2010
EPA 8260		Naphthalene	NELAP	PA	2/25/2010
EPA 8260		Propionitrile (Ethyl cyanide)	NELAP	PA	5/30/2013
EPA 8260		Styrene	NELAP	PA	2/25/2010
EPA 8260		Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	2/25/2010
EPA 8260		Tetrahydrofuran (THF)	NELAP	PA	5/30/2013
EPA 8260		Toluene	NELAP	PA	2/25/2010
EPA 8260		Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	2/25/2010
EPA 8260		Trichlorofluoromethane (Freon 11)	NELAP	PA	2/25/2010
EPA 8260	C	VOCs by GC/MS	NELAP	PA	9/18/2013
EPA 8260	B	VOCs by GC/MS	NELAP	PA	2/25/2010
EPA 8260		Vinyl acetate	NELAP	PA	2/25/2010
EPA 8260		Vinyl chloride (Chloroethene)	NELAP	PA	2/25/2010
EPA 8260		Xylenes, total	NELAP	PA	2/25/2010
EPA 8260		cis-1,2-Dichloroethene	NELAP	PA	2/25/2010
EPA 8260		cis-1,3-Dichloropropene	NELAP	PA	2/25/2010
EPA 8260		m+p-Xylene	NELAP	PA	2/25/2010
EPA 8260		n-Butylbenzene	NELAP	PA	2/25/2010
EPA 8260		n-Hexane	NELAP	PA	2/25/2010
EPA 8260		n-Propylbenzene	NELAP	PA	2/25/2010
EPA 8260		o-Xylene	NELAP	PA	2/25/2010
EPA 8260		p-Isopropyltoluene (4-Isopropyltoluene)	NELAP	PA	2/25/2010
EPA 8260		sec-Butylbenzene	NELAP	PA	2/25/2010
EPA 8260		tert-Amyl methyl ether (TAME)	NELAP	PA	2/25/2010
EPA 8260		tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	2/25/2010
EPA 8260		tert-Butylbenzene	NELAP	PA	2/25/2010
EPA 8260		trans-1,2-Dichloroethene	NELAP	PA	2/25/2010
EPA 8260		trans-1,3-Dichloropropene	NELAP	PA	2/25/2010

Aaron Alger

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Attached to Certificate of Accreditation 012-008 expiration date March 31, 2014. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 65-00282 **EPA Lab Code: PA01457** **TNI Code:** **(724) 850-5600**
PADWIS ID: 65282

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260		trans-1,4-Dichloro-2-butene	NELAP	PA	5/30/2013
EPA 8270		1,2,4,5-Tetrachlorobenzene	NELAP	PA	10/2/2012
EPA 8270		1,2,4-Trichlorobenzene	NELAP	PA	2/25/2010
EPA 8270		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	2/25/2010
EPA 8270		1,2-Diphenylhydrazine	NELAP	PA	2/25/2010
EPA 8270		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	2/25/2010
EPA 8270		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	2/25/2010
EPA 8270		1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	2/25/2010
EPA 8270		1-Methylnaphthalene	NELAP	PA	9/18/2013
EPA 8270		2,3,4,6-Tetrachlorophenol	NELAP	PA	10/2/2012
EPA 8270		2,4,5-Trichlorophenol	NELAP	PA	2/25/2010
EPA 8270		2,4,6-Trichlorophenol	NELAP	PA	2/25/2010
EPA 8270		2,4-Dichlorophenol	NELAP	PA	2/25/2010
EPA 8270		2,4-Dimethylphenol	NELAP	PA	2/25/2010
EPA 8270		2,4-Dinitrophenol	NELAP	PA	2/25/2010
EPA 8270		2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	2/25/2010
EPA 8270		2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	2/25/2010
EPA 8270		2-Chloronaphthalene	NELAP	PA	2/25/2010
EPA 8270		2-Chlorophenol	NELAP	PA	2/25/2010
EPA 8270		2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	2/25/2010
EPA 8270		2-Methylnaphthalene	NELAP	PA	2/25/2010
EPA 8270		2-Methylphenol (o-Cresol)	NELAP	PA	2/25/2010
EPA 8270		2-Nitroaniline	NELAP	PA	2/25/2010
EPA 8270		2-Nitrophenol	NELAP	PA	2/25/2010
EPA 8270		3+4-Methylphenol (m+p-Cresol)	NELAP	PA	2/25/2010
EPA 8270		3,3'-Dichlorobenzidine	NELAP	PA	2/25/2010
EPA 8270		3-Nitroaniline	NELAP	PA	2/25/2010
EPA 8270		4-Bromophenyl phenyl ether	NELAP	PA	2/25/2010
EPA 8270		4-Chloro-3-methylphenol	NELAP	PA	2/25/2010
EPA 8270		4-Chloroaniline	NELAP	PA	2/25/2010
EPA 8270		4-Chlorophenyl phenyl ether	NELAP	PA	2/25/2010
EPA 8270		4-Nitroaniline	NELAP	PA	2/25/2010
EPA 8270		4-Nitrophenol	NELAP	PA	2/25/2010
EPA 8270		Acenaphthene	NELAP	PA	2/25/2010
EPA 8270		Acenaphthylene	NELAP	PA	2/25/2010
EPA 8270		Acetophenone	NELAP	PA	2/25/2010
EPA 8270		Aniline	NELAP	PA	2/25/2010
EPA 8270		Anthracene	NELAP	PA	2/25/2010
EPA 8270		Benzidine	NELAP	PA	2/25/2010
EPA 8270		Benzo[a]anthracene	NELAP	PA	2/25/2010
EPA 8270		Benzo[a]pyrene	NELAP	PA	2/25/2010
EPA 8270		Benzo[b]fluoranthene	NELAP	PA	2/25/2010
EPA 8270		Benzo[ghi]perylene	NELAP	PA	2/25/2010
EPA 8270		Benzo[k]fluoranthene	NELAP	PA	2/25/2010
EPA 8270		Benzoic acid	NELAP	PA	2/25/2010

Aaron Alger

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		Benzyl alcohol	NELAP	PA	2/25/2010
EPA 8270		Benzyl butyl phthalate (Butyl benzyl phthalate)	NELAP	PA	2/25/2010
EPA 8270		Carbazole	NELAP	PA	2/25/2010
EPA 8270		Chrysene (Benzo[a]phenanthrene)	NELAP	PA	2/25/2010
EPA 8270		Di-n-butyl phthalate	NELAP	PA	2/25/2010
EPA 8270		Di-n-octyl phthalate	NELAP	PA	2/25/2010
EPA 8270		Dibenzo[a,h]anthracene	NELAP	PA	2/25/2010
EPA 8270		Dibenzofuran	NELAP	PA	2/25/2010
EPA 8270		Diethyl phthalate	NELAP	PA	2/25/2010
EPA 8270		Dimethyl phthalate	NELAP	PA	2/25/2010
EPA 8270		Fluoranthene	NELAP	PA	2/25/2010
EPA 8270		Fluorene	NELAP	PA	2/25/2010
EPA 8270		Hexachlorobenzene	NELAP	PA	2/25/2010
EPA 8270		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	2/25/2010
EPA 8270		Hexachlorocyclopentadiene	NELAP	PA	2/25/2010
EPA 8270		Hexachloroethane	NELAP	PA	2/25/2010
EPA 8270		Indeno(1,2,3-cd)pyrene	NELAP	PA	2/25/2010
EPA 8270		Isophorone	NELAP	PA	2/25/2010
EPA 8270		N-Nitrosodi-n-propylamine	NELAP	PA	2/25/2010
EPA 8270		N-Nitrosodimethylamine	NELAP	PA	2/25/2010
EPA 8270		N-Nitrosodiphenylamine	NELAP	PA	2/25/2010
EPA 8270		Naphthalene	NELAP	PA	2/25/2010
EPA 8270		Nitrobenzene	NELAP	PA	2/25/2010
EPA 8270		Pentachlorophenol (PCP)	NELAP	PA	2/25/2010
EPA 8270		Phenanthrene	NELAP	PA	2/25/2010
EPA 8270		Phenol	NELAP	PA	2/25/2010
EPA 8270		Pyrene	NELAP	PA	2/25/2010
EPA 8270		Pyridine	NELAP	PA	2/25/2010
EPA 8270	C	SOCs by GC/MS	NELAP	PA	2/25/2010
EPA 8270	D	SOCs by GC/MS	NELAP	PA	9/18/2013
EPA 8270		bis(2-Chloroethoxy)methane	NELAP	PA	2/25/2010
EPA 8270		bis(2-Chloroethyl) ether	NELAP	PA	2/25/2010
EPA 8270		bis(2-Chloroisopropyl) ether	NELAP	PA	2/25/2010
EPA 8270		bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	2/25/2010
EPA 8270 SIM		Acenaphthene	NELAP	PA	2/25/2010
EPA 8270 SIM		Acenaphthylene	NELAP	PA	2/25/2010
EPA 8270 SIM		Anthracene	NELAP	PA	2/25/2010
EPA 8270 SIM		Benzo[a]anthracene	NELAP	PA	2/25/2010
EPA 8270 SIM		Benzo[a]pyrene	NELAP	PA	2/25/2010
EPA 8270 SIM		Benzo[b]fluoranthene	NELAP	PA	2/25/2010
EPA 8270 SIM		Benzo[ghi]perylene	NELAP	PA	2/25/2010
EPA 8270 SIM		Benzo[k]fluoranthene	NELAP	PA	2/25/2010
EPA 8270 SIM		Chrysene (Benzo[a]phenanthrene)	NELAP	PA	2/25/2010
EPA 8270 SIM		Dibenzo[a,h]anthracene	NELAP	PA	2/25/2010

Aaron Alger

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DEP Laboratory ID: 65-00282 EPA Lab Code: PA01457 TNI Code: (724) 850-5600

PADWIS ID: 65282

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270 SIM		Fluoranthene	NELAP	PA	2/25/2010
EPA 8270 SIM		Fluorene	NELAP	PA	2/25/2010
EPA 8270 SIM		Indeno(1,2,3-cd)pyrene	NELAP	PA	2/25/2010
EPA 8270 SIM		Naphthalene	NELAP	PA	2/25/2010
EPA 8270 SIM		Phenanthrene	NELAP	PA	2/25/2010
EPA 8270 SIM		Pyrene	NELAP	PA	2/25/2010
EPA 901.1		Gamma emitters	NELAP	PA	8/12/2008
EPA 9010	C	Total cyanide	NELAP	PA	2/22/2013
EPA 9012	B	Total cyanide	NELAP	PA	2/22/2013
EPA 9012	A	Total cyanide	NELAP	PA	2/5/2007
EPA 9013		Cyanide extraction for solids and oils	NELAP	PA	4/22/2008
EPA 9014		Amenable cyanide	NELAP	PA	4/22/2008
EPA 9014		Total cyanide	NELAP	PA	4/22/2008
EPA 9038		Sulfate	NELAP	PA	4/15/2009
EPA 9040	B	Corrosivity (pH)	NELAP	PA	6/22/2006
EPA 9040	C	Corrosivity (pH)	NELAP	PA	2/22/2013
EPA 9040	C	pH	NELAP	PA	2/22/2013
EPA 9040	B	pH	NELAP	PA	6/22/2006
EPA 9045	D	pH	NELAP	PA	2/22/2013
EPA 9045	C	pH	NELAP	PA	3/29/2005
EPA 905.0 (Modified)		Strontium-90	NELAP	PA	8/12/2008
EPA 906.0 (Modified)		Tritium	NELAP	PA	8/12/2008
EPA 9065		Total phenolics	NELAP	PA	5/6/2009
EPA 9071	B	Oil and grease	NELAP	PA	5/7/2010
EPA 9071	B	Total petroleum hydrocarbons (TPH)	NELAP	PA	5/7/2010
EPA 9095	B	Paint filter liquids test	NELAP	PA	2/22/2013
EPA 9095	A	Paint filter liquids test	NELAP	PA	3/29/2005
EPA 9310		Gross alpha	NELAP	PA	5/27/2008
EPA 9310		Gross beta	NELAP	PA	5/27/2008
EPA 9315		Total radium	NELAP	PA	5/27/2008
EPA 9320		Radium-228	NELAP	PA	5/27/2008
SM 4500-P B		Preliminary treatment of phosphate samples	NELAP	PA	9/11/2009
SM 4500-P E		Phosphorus, total	NELAP	PA	9/11/2009

Aaron Alger

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Laboratory Status Summary

DEP Laboratory ID: 65-00282 **EPA Lab Code: PA01457** **(724) 850-5600**

Pace Analytical Services Inc - Pittsburgh
1638 Roseytown Suites 2, 3, & 4
Greensburg, PA 15601

Matrix: Drinking Water

Method	Revision	Analyte	Status	Effective Date
DOE U-02		Uranium, total	Withdrawn	1/16/2014

Print Date: 01/16/2014

NELAP - RECOGNIZED

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF NELAP ACCREDITATION

Is hereby granted to

Weck Laboratories, Inc.

14859 East Clark Avenue

City of Industry, CA 91745

Scope of the Certificate is limited to the
"NELAP Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **04229CA**

Expiration Date: **10/31/2013**

Effective Date: **11/1/2012**

Richmond, California
subject to forfeiture or revocation

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

NELAP RECOGNIZED

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

NELAP Fields of Accreditation

Weck Laboratories, Inc.

14859 East Clark Avenue
City of Industry, CA 91745
Phone: (626) 336-2139

Certificate No.: 04229CA
Renew Date: 10/31/2013

101 - Microbiology of Drinking Water

101.010	001	SM9215B	Heterotrophic Bacteria
101.020	001	SM9221A,B	Total Coliform
101.021	001	SM9221E (MTF/EC)	Fecal Coliform
101.060	002	SM9223	Total Coliform
101.060	003	SM9223	E. coli
101.120	001	SM9221A,B,C	Total Coliform (Enumeration)
101.130	001	SM9221E (MTF/EC)	Fecal Coliform (Enumeration)
101.160	001	SM9223	Total Coliform (Enumeration)
101.200	001	SM9223B	E. coli (Enumeration)
101.210	001	SM9221B.1/SM9221F	E. coli (Enumeration)

102 - Inorganic Chemistry of Drinking Water

102.020	001	EPA 180.1	Turbidity
102.030	001	EPA 300.0	Bromide
102.030	003	EPA 300.0	Chloride
102.030	005	EPA 300.0	Fluoride
102.030	006	EPA 300.0	Nitrate
102.030	007	EPA 300.0	Nitrite
102.030	010	EPA 300.0	Sulfate
102.040	001	EPA 300.1	Bromide
102.040	002	EPA 300.1	Chlorite
102.040	003	EPA 300.1	Chlorate
102.040	004	EPA 300.1	Bromate
102.045	001	EPA 314.0	Perchlorate
102.047	001	EPA 331.0	Perchlorate
102.048	001	EPA 332.0	Perchlorate
102.050	001	EPA 335.4	Cyanide
102.060	001	EPA 353.2	Nitrate calc.
102.061	001	EPA 353.2	Nitrite
102.070	001	EPA 365.1	Phosphate, Ortho
102.100	001	SM2320B	Alkalinity
102.110	001	SM2330B	Corrosivity (Langlier Index)
102.120	001	SM2340B	Hardness

102.130	001	SM2510B	Conductivity
102.140	001	SM2540C	Total Dissolved Solids
102.163	001	SM4500-Cl G	Chlorine, Free and Total
102.180	001	SM4500-ClO2 D	Chlorine Dioxide
102.190	001	SM4500-CN E	Cyanide, Total
102.192	001	SM4500-CN G	Cyanide, amenable
102.210	001	SM4500-H+ B	pH
102.263	002	SM5310C	TOC/DOC
102.270	001	SM5540C	Surfactants
102.280	001	SM5910B	UV254
102.520	001	EPA 200.7	Calcium
102.520	002	EPA 200.7	Magnesium
102.520	003	EPA 200.7	Potassium
102.520	004	EPA 200.7	Silica
102.520	005	EPA 200.7	Sodium
102.520	006	EPA 200.7	Hardness (calc.)
102.546	001	EPA 326.0	Bromate
102.546	002	EPA 326.0	Bromide
102.546	003	EPA 326.0	Chlorite
102.551	002	SM4500-Cl G	Chlorine, Free, Combined, Total
102.555	002	EPA 415.3	SUVA
102.555	003	EPA 415.3	TOC/DOC

103 - Toxic Chemical Elements of Drinking Water

103.130	001	EPA 200.7	Aluminum
103.130	003	EPA 200.7	Barium
103.130	004	EPA 200.7	Beryllium
103.130	005	EPA 200.7	Cadmium
103.130	007	EPA 200.7	Chromium
103.130	008	EPA 200.7	Copper
103.130	009	EPA 200.7	Iron
103.130	011	EPA 200.7	Manganese
103.130	012	EPA 200.7	Nickel
103.130	015	EPA 200.7	Silver
103.130	017	EPA 200.7	Zinc
103.140	001	EPA 200.8	Aluminum
103.140	002	EPA 200.8	Antimony
103.140	003	EPA 200.8	Arsenic
103.140	004	EPA 200.8	Barium
103.140	005	EPA 200.8	Beryllium
103.140	006	EPA 200.8	Cadmium

103.140	007	EPA 200.8	Chromium
103.140	008	EPA 200.8	Copper
103.140	009	EPA 200.8	Lead
103.140	010	EPA 200.8	Manganese
103.140	011	EPA 200.8	Mercury
103.140	012	EPA 200.8	Nickel
103.140	013	EPA 200.8	Selenium
103.140	014	EPA 200.8	Silver
103.140	015	EPA 200.8	Thallium
103.140	016	EPA 200.8	Zinc
103.160	001	EPA 245.1	Mercury
103.310	001	EPA 218.6	Chromium (VI)

104 - Volatile Organic Chemistry of Drinking Water

104.030	004	EPA 504.1	EDB and DBCP
104.040	000	EPA 524.2	Volatile Organic Compounds
104.040	059	EPA 524.2	Federal regulated VOCs, excluding vinyl chloride
104.040	060	EPA 524.2	Federal unregulated VOCs
104.045	005	EPA 524.2	Trihalomethanes
104.050	006	EPA 524.2	Trichlorotrifluoroethane
104.050	011	EPA 524.2	Oxygenates

105 - Semi-volatile Organic Chemistry of Drinking Water

105.040	000	EPA 508	Chlorinated Pesticides
105.040	016	EPA 508	PCBs as Aroclors (screen)
105.082	009	EPA 515.3	Chlorinated Acids
105.090	029	EPA 525.2	Polynuclear Aromatic Hydrocarbons
105.090	030	EPA 525.2	Adipates
105.090	031	EPA 525.2	Phthalates
105.090	032	EPA 525.2	Other Extractables
105.090	034	EPA 525.2	Pesticides
105.100	000	EPA 531.1	Carbamates
105.120	001	EPA 547	Glyphosate
105.140	001	EPA 548.1	Endothall
105.150	001	EPA 549.2	Diquat
105.170	031	EPA 551.1	Disinfection Byproducts
105.200	009	EPA 552.2	Haloacetic Acids
105.220	001	EPA 632	Diuron
105.230	001	EPA 1613	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

106 - Radiochemistry of Drinking Water

106.010	001	EPA 900.0	Gross Alpha

106.010	002	EPA 900.0	Gross Beta
106.092	001	EPA 200.8	Uranium
106.270	001	SM7110C	Gross Alpha
106.610	001	SM7500-Rn	Radon-222

107 - Microbiology of Wastewater

107.010	001	SM9215B	Heterotrophic Bacteria
107.020	001	SM9221B	Total Coliform
107.030	001	SM9221B	Total Coliform with Chlorine Present
107.040	001	SM9221C,E (MTF/EC)	Fecal Coliform
107.050	001	SM9221E	Fecal Coliform with Chlorine Present
107.100	001	SM9230B	Fecal Streptococci
107.100	002	SM9230B	Enterococci
107.242	001	Enterolert	Enterococci
107.245	001	SM9223	E. coli

108 - Inorganic Chemistry of Wastewater

108.090	001	EPA 160.4	Residue, Volatile
108.110	001	EPA 180.1	Turbidity
108.112	001	EPA 200.7	Boron
108.112	002	EPA 200.7	Calcium
108.112	003	EPA 200.7	Hardness (calc.)
108.112	004	EPA 200.7	Magnesium
108.112	005	EPA 200.7	Potassium
108.112	006	EPA 200.7	Silica
108.112	007	EPA 200.7	Sodium
108.113	001	EPA 200.8	Boron
108.113	002	EPA 200.8	Calcium
108.113	003	EPA 200.8	Magnesium
108.113	004	EPA 200.8	Potassium
108.113	005	EPA 200.8	Silica
108.113	006	EPA 200.8	Sodium
108.120	001	EPA 300.0	Bromide
108.120	002	EPA 300.0	Chloride
108.120	003	EPA 300.0	Fluoride
108.120	004	EPA 300.0	Nitrate
108.120	005	EPA 300.0	Nitrite
108.120	006	EPA 300.0	Nitrate-nitrite
108.120	008	EPA 300.0	Sulfate
108.121	001	EPA 300.1	Bromide
108.183	001	EPA 335.4	Cyanide, Total

108.200	001	EPA 350.1	Ammonia
108.211	001	EPA 351.2	Kjeldahl Nitrogen
108.232	001	EPA 353.2	Nitrate-nitrite
108.232	002	EPA 353.2	Nitrite
108.260	001	EPA 365.1	Phosphate, Ortho
108.261	001	EPA 365.1	Phosphorus, Total
108.264	001	EPA 365.3	Phosphate, Ortho
108.265	001	EPA 365.3	Phosphorus, Total
108.323	001	EPA 410.4	Chemical Oxygen Demand
108.362	001	EPA 420.4	Phenols, Total
108.381	001	EPA 1664A	Oil and Grease
108.385	001	SM2120B	Color
108.410	001	SM2320B	Alkalinity
108.420	001	SM2340B	Hardness (calc.)
108.430	001	SM2510B	Conductivity
108.440	001	SM2540B	Residue, Total
108.441	001	SM2540C	Residue, Filterable
108.442	001	SM2540D	Residue, Non-filterable
108.443	001	SM2540F	Residue, Settleable
108.465	001	SM4500-Cl G	Chlorine
108.473	001	SM4500-CN G	Cyanide, amenable
108.490	001	SM4500-H+ B	pH
108.531	001	SM4500-O G	Dissolved Oxygen
108.560	001	SM4500-SO3 B	Sulfite
108.580	001	SM4500-S= D	Sulfide
108.590	001	SM5210B	Biochemical Oxygen Demand
108.591	001	SM5210B	Carbonaceous BOD
108.601	001	SM5220C	Chemical Oxygen Demand
108.611	001	SM5310C	Total Organic Carbon
108.620	001	SM5320B	Total Organic Halides
108.640	001	SM5540C	Surfactants

109 - Toxic Chemical Elements of Wastewater

109.010	001	EPA 200.7	Aluminum
109.010	002	EPA 200.7	Antimony
109.010	003	EPA 200.7	Arsenic
109.010	004	EPA 200.7	Barium
109.010	005	EPA 200.7	Beryllium
109.010	007	EPA 200.7	Cadmium
109.010	009	EPA 200.7	Chromium
109.010	010	EPA 200.7	Cobalt

109.010	011	EPA 200.7	Copper
109.010	012	EPA 200.7	Iron
109.010	013	EPA 200.7	Lead
109.010	015	EPA 200.7	Manganese
109.010	016	EPA 200.7	Molybdenum
109.010	017	EPA 200.7	Nickel
109.010	019	EPA 200.7	Selenium
109.010	021	EPA 200.7	Silver
109.010	023	EPA 200.7	Thallium
109.010	024	EPA 200.7	Tin
109.010	026	EPA 200.7	Vanadium
109.010	027	EPA 200.7	Zinc
109.020	001	EPA 200.8	Aluminum
109.020	002	EPA 200.8	Antimony
109.020	003	EPA 200.8	Arsenic
109.020	004	EPA 200.8	Barium
109.020	005	EPA 200.8	Beryllium
109.020	006	EPA 200.8	Cadmium
109.020	007	EPA 200.8	Chromium
109.020	008	EPA 200.8	Cobalt
109.020	009	EPA 200.8	Copper
109.020	010	EPA 200.8	Lead
109.020	011	EPA 200.8	Manganese
109.020	012	EPA 200.8	Molybdenum
109.020	013	EPA 200.8	Nickel
109.020	014	EPA 200.8	Selenium
109.020	015	EPA 200.8	Silver
109.020	016	EPA 200.8	Thallium
109.020	017	EPA 200.8	Vanadium
109.020	018	EPA 200.8	Zinc
109.020	020	EPA 200.8	Gold
109.020	021	EPA 200.8	Iron
109.020	022	EPA 200.8	Tin
109.020	023	EPA 200.8	Titanium
109.104	001	EPA 218.6	Chromium (VI)
109.190	001	EPA 245.1	Mercury
109.361	001	EPA 1631E	Mercury
109.811	001	SM3500-Cr D (18th/19th)	Chromium (VI)

110 - Volatile Organic Chemistry of Wastewater

110.040	040	EPA 624	Halogenated Hydrocarbons

110.040	041	EPA 624	Aromatic Compounds
110.040	042	EPA 624	Oxygenates
110.040	043	EPA 624	Other Volatile Organics
111 - Semi-volatile Organic Chemistry of Wastewater			
111.101	030	EPA 625	Pesticides
111.101	032	EPA 625	Polynuclear Aromatic Hydrocarbons
111.101	033	EPA 625	Adipates
111.101	034	EPA 625	Phthalates
111.101	036	EPA 625	Other Extractables
111.120	048	EPA 1625	N-nitrosodimethylamine
111.170	030	EPA 608	Organochlorine Pesticides
111.170	031	EPA 608	PCBs
111.210	006	EPA 632	Diuron
111.273	001	EPA 1664A	Oil and Grease
112 - Radiochemistry of Wastewater			
112.010	001	EPA 900.0	Gross Alpha
112.010	002	EPA 900.0	Gross Beta
112.020	001	EPA 903.0	Total Alpha Radium
112.160	001	EPA 904.0	Radium-228
114 - Inorganic Chemistry of Hazardous Waste			
114.010	001	EPA 6010B	Antimony
114.010	002	EPA 6010B	Arsenic
114.010	003	EPA 6010B	Barium
114.010	004	EPA 6010B	Beryllium
114.010	005	EPA 6010B	Cadmium
114.010	006	EPA 6010B	Chromium
114.010	007	EPA 6010B	Cobalt
114.010	008	EPA 6010B	Copper
114.010	009	EPA 6010B	Lead
114.010	010	EPA 6010B	Molybdenum
114.010	011	EPA 6010B	Nickel
114.010	012	EPA 6010B	Selenium
114.010	013	EPA 6010B	Silver
114.010	014	EPA 6010B	Thallium
114.010	015	EPA 6010B	Vanadium
114.010	016	EPA 6010B	Zinc
114.020	001	EPA 6020	Antimony
114.020	002	EPA 6020	Arsenic
114.020	003	EPA 6020	Barium

114.020	004	EPA 6020	Beryllium
114.020	005	EPA 6020	Cadmium
114.020	006	EPA 6020	Chromium
114.020	007	EPA 6020	Cobalt
114.020	008	EPA 6020	Copper
114.020	009	EPA 6020	Lead
114.020	010	EPA 6020	Molybdenum
114.020	011	EPA 6020	Nickel
114.020	012	EPA 6020	Selenium
114.020	013	EPA 6020	Silver
114.020	014	EPA 6020	Thallium
114.020	015	EPA 6020	Vanadium
114.020	016	EPA 6020	Zinc
114.103	001	EPA 7196A	Chromium (VI)
114.106	001	EPA 7199	Chromium (VI)
114.140	001	EPA 7470A	Mercury
114.141	001	EPA 7471A	Mercury
114.222	001	EPA 9014	Cyanide
114.230	001	EPA 9034	Sulfides, Total
114.240	001	EPA 9040B	Corrosivity - pH Determination
114.241	001	EPA 9045C	Corrosivity - pH Determination
114.250	001	EPA 9056	Fluoride

115 - Extraction Test of Hazardous Waste

115.020	001	EPA 1311	Toxicity Characteristic Leaching Procedure (TCLP)
115.030	001	CCR Chapter11, Article 5, Appendix II	Waste Extraction Test (WET)
115.040	001	EPA 1312	Synthetic Precipitation Leaching Procedure (SPLP)

116 - Volatile Organic Chemistry of Hazardous Waste

116.020	030	EPA 8015B	Nonhalogenated Volatiles
116.020	031	EPA 8015B	Ethanol and Methanol
116.030	001	EPA 8015B	Gasoline-range Organics
116.040	062	EPA 8021B	BTEX
116.080	000	EPA 8260B	Volatile Organic Compounds
116.090	001	EPA 8316	Acrylamide

117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	EPA 8015B	Diesel-range Total Petroleum Hydrocarbons
117.110	000	EPA 8270C	Extractable Organics
117.111	071	EPA 8270C	Pesticides
117.111	073	EPA 8270C	Polynuclear Aromatic Hydrocarbons
117.111	074	EPA 8270C	Adipates

117.111	075	EPA 8270C	Phthalates
117.111	076	EPA 8270C	Other Extractables
117.150	000	EPA 8315A	Carbonyl Compounds
117.171	000	EPA 8330A	Nitroaromatics and Nitramines
117.210	000	EPA 8081A	Organochlorine Pesticides
117.220	000	EPA 8082	PCBs
117.240	000	EPA 8141A	Organophosphorus Pesticides
117.250	000	EPA 8151A	Chlorinated Herbicides
117.270	000	EPA 8318	Carbamates, N-methylcarbamates

120 - Physical Properties of Hazardous Waste

120.010	001	EPA 1010	Ignitability
120.070	001	EPA 9040B	Corrosivity - pH Determination
120.080	001	EPA 9045C	Corrosivity - pH Determination

RON CHAPMAN, MD, MPH
Director & State Health Officer

State of California—Health and Human Services Agency
California Department of Public Health

EDMUND G. BROWN JR.
Governor

January 4, 2012

Alfredo E. Pierri
Weck Laboratories, Inc.
14859 East Clark Avenue
City of Industry, CA 91745-1396

Dear Alfredo E. Pierri:

Certificate No. 1132

This is to advise you that the laboratory named above continues to be certified as an environmental testing laboratory pursuant to the provisions of the Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100825, et seq. Certification for all currently certified Fields of Testing that the laboratory has applied for renewal shall remain in effect until **3/31/2014** unless it is revoked.

Please note that the renewal application for certification is subject to an on-site process, and the continued use of this certificate is contingent upon:

* **successful completion of the on-site process;**
* **acceptable performance in the required proficiency testing (PT) studies;**
* **timely payment of all fees, including an annual fee due before March 31, 2013;**
* **compliance with Environmental Laboratory Accreditation Program Branch (ELAPB); statutes (HSC, Section 100825, et seq.) and Regulations (California Code of Regulations (CCR),Title 22, Division 4, Chapter 19).**

An updated certificate of the "Fields of Testing" will be issued to the laboratory upon successful completion of the on-site process.

The application for the renewal of this certificate must be received before the expiration date to remain in force according to the HSC100845(a).

Please note that the laboratory is required to notify ELAPB of any major changes in the laboratory such as the transfer of ownership, change of laboratory director, change in location, or structural alterations which may affect adversely the quality of analyses (HSC, Section 100845(b)(d)). Please include the above certificate number in all your correspondence with ELAPB.

If you have any questions, please contact ELAPB at (510) 620-3155.

Sincerely,

George C. Kulasingam

George C. Kulasingam, Ph.D., Chief
Environmental Laboratory Accreditation Program Branch

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF ENVIRONMENTAL ACCREDITATION

Is hereby granted to

Weck Laboratories, Inc.

14859 East Clark Avenue

City of Industry, CA 91745

Scope of the certificate is limited to the
"Fields of Testing"
which accompany this Certificate.

Continued accredited status depends on successful completion of on-site, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **1132**

Expiration Date: **3/31/2014**

Effective Date: **4/1/2012**

Richmond, California
subject to forfeiture or revocation

George C. Kulasingam, Ph.D., Chief
Environmental Laboratory Accreditation Program Branch

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

Weck Laboratories, Inc.
14859 East Clark Avenue
City of Industry, CA 91745
Phone: (626) 336-2139

Certificate No.: 1132
Renew Date: 3/31/2014

Field of Testing: 101 - Microbiology of Drinking Water

101.010	001	Heterotrophic Bacteria	SM9215B
101.020	001	Total Coliform	SM9221A,B
101.021	001	Fecal Coliform	SM9221E (MTF/EC)
101.060	002	Total Coliform	SM9223
101.060	003	E. coli	SM9223
101.120	001	Total Coliform (Enumeration)	SM9221A,B,C
101.130	001	Fecal Coliform (Enumeration)	SM9221E (MTF/EC)
101.160	001	Total Coliform (Enumeration)	SM9223
101.200	001	E. coli (Enumeration)	SM9223B
101.210	001	E. coli (Enumeration)	SM9221B.1/SM9221F

Field of Testing: 103 - Toxic Chemical Elements of Drinking Water

103.130	018	Boron	EPA 200.7
103.140	017	Boron	EPA 200.8
103.140	018	Vanadium	EPA 200.8
103.310	001	Chromium (VI)	EPA 218.6

Field of Testing: 104 - Volatile Organic Chemistry of Drinking Water

104.035	001	1,2,3-Trichloropropane	SRL 524M-TCP
104.040	000	Volatile Organic Compounds	EPA 524.2

Field of Testing: 107 - Microbiology of Wastewater

107.010	001	Heterotrophic Bacteria	SM9215B
107.020	001	Total Coliform	SM9221B
107.040	001	Fecal Coliform	SM9221C,E (MTF/EC)
107.060	001	Total Coliform	SM9222B
107.080	001	Fecal Coliform	SM9222D
107.100	001	Fecal Streptococci	SM9230B
107.100	002	Enterococci	SM9230B
107.242	001	Enterococci	Enterolert
107.244	001	Enterococci	EPA 1600
107.245	001	E. coli	SM9223

Field of Testing: 126 - Microbiology of Recreational Water

126.010	001	Total Coliform (Enumeration)	SM9221A,B,C
126.020	001	Total Coliform (Enumeration)	SM9222A,B
126.030	001	Fecal Coliform (Enumeration)	SM9221E
126.040	001	Fecal Coliform (Enumeration)	SM9222D
126.050	001	Total Coliform and E. coli	SM9223

As of 1/3/2012 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

126.070	001	Enterococci	EPA 1600
126.080	001	Enterococci	IDEXX

NELAP - RECOGNIZED

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF NELAP ACCREDITATION

Is hereby granted to

Weck Laboratories, Inc.

Weck Analytical Environmental Services

14859 East Clark Avenue

City of Industry, CA 91745

Scope of the Certificate is limited to the "NELAP Fields of Accreditation" which accompany this Certificate.

Continued accredited status depends on successful ongoing participation in the program.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **04229CA**

Expiration Date: **10/31/2014**

Effective Date: **11/1/2013**

Richmond, California
subject to forfeiture or revocation

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

State of California—Health and Human Services Agency
California Department of Public Health

RON CHAPMAN, MD, MPH
Director & State Health Officer

EDMUND G. BROWN JR.
Governor

November 6, 2013

Alfredo Pierri
Weck Laboratories, Inc.
14859 East Clark Avenue
City of Industry, CA 91745

Dear Alfredo Pierri: Certificate No. 04229CA

This is to advise you that the laboratory named above has been accredited under National Environmental Laboratory Accreditation Program (NELAP) as an environmental testing laboratory pursuant to the provisions of the Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100825, *et seq.*

The Fields of Accreditation for which this laboratory has been accredited are enclosed. The certificate shall remain in effect until **October 31, 2014** unless revoked by California Environmental Laboratory Accreditation Program Branch (ELAPB) or withdrawn at your written request. To maintain accreditation, the laboratory shall comply with the National Environmental Laboratory Accreditation Conference (NELAC) Standards and all associated California ELAPB regulations and statutes.

The application for renewal of this certificate must be received before the expiration date of this certificate to remain in force according to the HSC 100847(a).

Please note that your laboratory is required to notify California ELAPB of any major changes in key accreditation criteria within 30 calendar days of the change. This written notification includes, but is not limited to, changes in ownership, location, key personnel, and major instrumentation (HSC 100847(b), (c), (d), and NELAC Standard Section 4.3.2). The certificate must be returned to California ELAPB upon loss of accredited status.

Your continued cooperation with the above requirements is essential for maintaining the high quality of the data produced by environmental laboratories accredited by the State of California.

If you have any questions, please contact Bill Walker at (818) 551-2012.

Sincerely,

Fred Choshe for

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

Enclosure

Environmental Laboratory Accreditation Program Branch
MS 0511, Building P, 1st Floor, 850 Marina Bay Parkway, Richmond, CA 94804
(510) 620-3155, (510) 620-3165 Fax
www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH
NELAP Fields of Accreditation

NELAP RECOGNIZED

Weck Laboratories, Inc.
Weck Analytical Environmental Services
14859 East Clark Avenue
City of Industry, CA 91745
Phone: (626) 336-2139

Certificate No. 04229CA
Renew Date: 10/31/2014

101 - Microbiology of Drinking Water

101.010	001	SM9215B	Heterotrophic Bacteria
101.020	001	SM9221A,B	Total Coliform
101.021	001	SM9221E (MTF/EC)	Fecal Coliform
101.060	002	SM9223	Total Coliform
101.060	003	SM9223	E. coli
101.120	001	SM9221A,B,C	Total Coliform (Enumeration)
101.130	001	SM9221E (MTF/EC)	Fecal Coliform (Enumeration)
101.160	001	SM9223	Total Coliform (Enumeration)
101.200	001	SM9223B	E. coli (Enumeration)
101.210	001	SM9221B.1/SM9221F-2006	E. coli (Enumeration)
101.240	001	EPA 1603	E. coli (Enumeration)
101.300	001	SM9223B	E. coli
101.305	001	SM9221F	E. coli
101.307	001	SM9230B	Enterococci
101.310	001	Enterolert	Enterococci

102 - Inorganic Chemistry of Drinking Water

102.020	001	EPA 180.1	Turbidity
102.030	001	EPA 300.0	Bromide
102.030	003	EPA 300.0	Chloride
102.030	005	EPA 300.0	Fluoride
102.030	006	EPA 300.0	Nitrate
102.030	007	EPA 300.0	Nitrite
102.030	010	EPA 300.0	Sulfate
102.040	001	EPA 300.1	Bromide
102.040	002	EPA 300.1	Chlorite
102.040	003	EPA 300.1	Chlorate
102.040	004	EPA 300.1	Bromate
102.045	001	EPA 314.0	Perchlorate
102.047	001	EPA 331.0	Perchlorate
102.048	001	EPA 332.0	Perchlorate
102.050	001	EPA 335.4	Cyanide
102.060	001	EPA 353.2	Nitrate calc.
102.061	001	EPA 353.2	Nitrite

102.070	001	EPA 365.1	Phosphate, Ortho
102.100	001	SM2320B	Alkalinity
102.110	001	SM2330B	Corrosivity (Langlier index)
102.120	001	SM2340B	Hardness
102.130	001	SM2510B	Conductivity
102.140	001	SM2540C	Total Dissolved Solids
102.163	001	SM4500-Cl G	Chlorine, Free and Total
102.180	001	SM4500-ClO2 D	Chlorine Dioxide
102.190	001	SM4500-CN E	Cyanide, Total
102.192	001	SM4500-CN G	Cyanide, amenable
102.210	001	SM4500-H+ B	pH
102.261	002	SM5310B	TOC/DOC
102.263	002	SM5310C	TOC/DOC
102.270	001	SM5540C	Surfactants
102.280	001	SM5910B	UV254
102.520	001	EPA 200.7	Calcium
102.520	002	EPA 200.7	Magnesium
102.520	003	EPA 200.7	Potassium
102.520	004	EPA 200.7	Silica
102.520	005	EPA 200.7	Sodium
102.520	006	EPA 200.7	Hardness (calculation)
102.546	001	EPA 326.0	Bromate
102.546	002	EPA 326.0	Bromide
102.546	003	EPA 326.0	Chlorite
102.551	002	SM4500-Cl G	Chlorine, Free, Combined, Total
102.555	001	EPA 415.3	UV254
102.555	002	EPA 415.3	SUVA
102.555	003	EPA 415.3	TOC/DOC
102.565	001	OIA-1677, DW	Cyanide

103 - Toxic Chemical Elements of Drinking Water

103.130	001	EPA 200.7	Aluminum
103.130	003	EPA 200.7	Barium
103.130	004	EPA 200.7	Beryllium
103.130	005	EPA 200.7	Cadmium
103.130	007	EPA 200.7	Chromium
103.130	008	EPA 200.7	Copper
103.130	009	EPA 200.7	Iron
103.130	011	EPA 200.7	Manganese
103.130	012	EPA 200.7	Nickel
103.130	015	EPA 200.7	Silver
103.130	017	EPA 200.7	Zinc

103.130	018	EPA 200.7	Boron
103.140	001	EPA 200.8	Aluminum
103.140	002	EPA 200.8	Antimony
103.140	003	EPA 200.8	Arsenic
103.140	004	EPA 200.8	Barium
103.140	005	EPA 200.8	Beryllium
103.140	006	EPA 200.8	Cadmium
103.140	007	EPA 200.8	Chromium
103.140	008	EPA 200.8	Copper
103.140	009	EPA 200.8	Lead
103.140	010	EPA 200.8	Manganese
103.140	011	EPA 200.8	Mercury
103.140	012	EPA 200.8	Nickel
103.140	013	EPA 200.8	Selenium
103.140	014	EPA 200.8	Silver
103.140	015	EPA 200.8	Thallium
103.140	016	EPA 200.8	Zinc
103.140	017	EPA 200.8	Boron
103.140	018	EPA 200.8	Vanadium
103.160	001	EPA 245.1	Mercury
103.310	001	EPA 218.6	Chromium (VI)

104 - Volatile Organic Chemistry of Drinking Water

104.030	003	EPA 504.1	1,2,3 Trichloropropane
104.030	004	EPA 504.1	EDB and DBCP
104.040	000	EPA 524.2	Volatile Organic Compounds
104.040	059	EPA 524.2	Federal regulated VOCs, excluding vinyl chloride
104.040	060	EPA 524.2	Federal unregulated VOCs
104.045	005	EPA 524.2	Trihalomethanes
104.050	002	EPA 524.2	Methyl tert-butyl Ether (MTBE)
104.050	004	EPA 524.2	tert Amyl Methyl Ether (TAME)
104.050	005	EPA 524.2	Ethyl tert-butyl Ether (ETBE)
104.050	006	EPA 524.2	Trichlorotrifluoroethane
104.050	011	EPA 524.2	Oxygenates
104.055	001	EPA 524.3	Benzene
104.055	002	EPA 524.3	Carbon Tetrachloride
104.055	003	EPA 524.3	Chlorobenzene
104.055	004	EPA 524.3	1,2-Dichlorobenzene
104.055	005	EPA 524.3	1,4-Dichlorobenzene
104.055	006	EPA 524.3	1,2-Dichloroethane
104.055	007	EPA 524.3	cis-1,2-Dichloroethene
104.055	008	EPA 524.3	trans-1,2-Dichloroethene

104.055	009	EPA 524.3	Dichloromethane
104.055	010	EPA 524.3	1,2-Dichloropropane
104.055	011	EPA 524.3	Ethylbenzene
104.055	012	EPA 524.3	Styrene
104.055	013	EPA 524.3	Tetrachloroethene
104.055	014	EPA 524.3	1,1,1-Trichloroethane
104.055	015	EPA 524.3	Trichloroethene
104.055	016	EPA 524.3	Toluene
104.055	017	EPA 524.3	1,2,4-Trichlorobenzene
104.055	018	EPA 524.3	1,1-Dichloroethane
104.055	019	EPA 524.3	1,1,2-Trichloroethane
104.055	020	EPA 524.3	Vinyl Chloride
104.055	021	EPA 524.3	Xylenes, Total
104.055	022	EPA 524.3	1,2-Dibromo-3-chloropropane
104.055	023	EPA 524.3	1,2-Dibromoethane
104.055	024	EPA 524.3	Trihalomethanes, Total

105 - Semi-volatile Organic Chemistry of Drinking Water

105.040	000	EPA 508	Chlorinated Pesticides
105.040	015	EPA 508	PCBs as Aroclors (screen)
105.082	009	EPA 515.3	Chlorinated Acids
105.090	029	EPA 525.2	Polynuclear Aromatic Hydrocarbons
105.090	030	EPA 525.2	Adipates
105.090	031	EPA 525.2	Phthalates
105.090	032	EPA 525.2	Other Extractables
105.090	034	EPA 525.2	Pesticides
105.100	000	EPA 531.1	Carbamates
105.120	001	EPA 547	Glyphosate
105.140	001	EPA 548.1	Endothall
105.150	001	EPA 549.2	Diquat
105.170	001	EPA 551.1	Disinfection Byproducts
105.200	009	EPA 552.2	Haloacetic Acids
105.220	001	EPA 632	Diuron
105.230	001	EPA 1613	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

106 - Radiochemistry of Drinking Water

106.010	001	EPA 900.0	Gross Alpha
106.010	002	EPA 900.0	Gross Beta
106.092	001	EPA 200.8	Uranium
106.270	001	SM7110C	Gross Alpha
106.510	001	SM7500-Rn	Radon-222

107 - Microbiology of Wastewater

107.010	001	SM9215B	Heterotrophic Bacteria

107.020	001	SM9221B	Total Coliform
107.030	001	SM9221B	Total Coliform with Chlorine Present
107.040	001	SM9221C,E (MTFEC)	Fecal Coliform
107.060	001	SM9221E	Fecal Coliform with Chlorine Present
107.060	002	SM9222B-1997	Total Coliform
107.070	002	SM9222B + B 5c-1997	Total Coliform with Chlorine Present
107.080	002	SM9222D-1997	Fecal Coliform
107.090	002	SM9222D-1997	Fecal Coliform with Chlorine Present
107.100	001	SM9230B	Fecal Streptococci
107.100	002	SM9230B	Enterococci
107.242	001	Enterolert	Enterococci
107.244	001	EPA 1600	Enterococci
107.245	001	SM9223	E. coli

108 - Inorganic Chemistry of Wastewater

108.090	001	EPA 160.4	Residue, Volatile
108.110	001	EPA 180.1	Turbidity
108.112	001	EPA 200.7	Boron
108.112	002	EPA 200.7	Calcium
108.112	003	EPA 200.7	Hardness (calculation)
108.112	004	EPA 200.7	Magnesium
108.112	005	EPA 200.7	Potassium
108.112	006	EPA 200.7	Silica
108.112	007	EPA 200.7	Sodium
108.113	001	EPA 200.8	Boron
108.113	002	EPA 200.8	Calcium
108.113	003	EPA 200.8	Magnesium
108.113	004	EPA 200.8	Potassium
108.113	005	EPA 200.8	Silica
108.113	006	EPA 200.8	Sodium
108.120	001	EPA 300.0	Bromide
108.120	002	EPA 300.0	Chloride
108.120	003	EPA 300.0	Fluoride
108.120	004	EPA 300.0	Nitrate
108.120	005	EPA 300.0	Nitrite
108.120	006	EPA 300.0	Nitrate-nitrite
108.120	008	EPA 300.0	Sulfate
108.121	001	EPA 300.1	Bromide
108.183	001	EPA 335.4	Cyanide, Total
108.200	001	EPA 350.1	Ammonia
108.211	001	EPA 351.2	Kjeldahl Nitrogen
108.232	003	EPA 353.2	Nitrate-Nitrite (as N)

108.232	004	EPA 353.2	Nitrite as N
108.260	001	EPA 365.1	Phosphate, Ortho
108.261	001	EPA 365.1	Phosphorus, Total
108.264	001	EPA 365.3	Phosphate, Ortho
108.265	001	EPA 365.3	Phosphorus, Total
108.323	001	EPA 410.4	Chemical Oxygen Demand
108.362	001	EPA 420.4	Phenols, Total
108.381	001	EPA 1664A	Oil and Grease
108.395	001	SM2120B-2001	Color
108.410	001	SM2320B	Alkalinity
108.420	001	SM2340B	Hardness (calculation)
108.430	001	SM2510B	Conductivity
108.440	001	SM2540B	Residue, Total
108.441	001	SM2540C	Residue, Filterable
108.442	001	SM2540D	Residue, Non-filterable
108.443	001	SM2540F-1997	Residue, Settleable
108.465	001	SM4500-Cl G	Chlorine, Total
108.465	002	SM4500-Cl G 2000	Chlorine, Free
108.473	001	SM4500-CN G	Cyanide, amenable
108.490	001	SM4500-H+ B	pH
108.513	001	SM4500-Norg D-1997	Kjeldahl Nitrogen, Total (as N)
108.531	001	SM4500-O G	Dissolved Oxygen
108.560	001	SM4500-SO3 B	Sulfite
108.580	001	SM4500-S= D	Sulfide
108.590	001	SM5210B	Biochemical Oxygen Demand
108.591	001	SM5210B	Carbonaceous BOD
108.594	001	SM5220C-1997	Chemical Oxygen Demand
108.596	001	SM5310B	Organic Carbon-Total (TOC)
108.597	001	SM5310C-2000	Organic Carbon-Total (TOC)
108.640	001	SM5540C	Surfactants
108.925	001	OIA-1677	Cyanide, amenable
108.96	001	ASTM D7511-09	Cyanide
108.99	001	ASTM D7511-09	Cyanide

109 - Toxic Chemical Elements of Wastewater

109.010	001	EPA 200.7	Aluminum
109.010	002	EPA 200.7	Antimony
109.010	003	EPA 200.7	Arsenic
109.010	004	EPA 200.7	Barium
109.010	005	EPA 200.7	Beryllium
109.010	007	EPA 200.7	Cadmium
109.010	009	EPA 200.7	Chromium

As of 11/14/2013, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

109.010	010	EPA 200.7	Cobalt
109.010	011	EPA 200.7	Copper
109.010	012	EPA 200.7	Iron
109.010	013	EPA 200.7	Lead
109.010	015	EPA 200.7	Manganese
109.010	016	EPA 200.7	Molybdenum
109.010	017	EPA 200.7	Nickel
109.010	019	EPA 200.7	Selenium
109.010	021	EPA 200.7	Silver
109.010	023	EPA 200.7	Thallium
109.010	024	EPA 200.7	Tin
109.010	025	EPA 200.7	Titanium
109.010	026	EPA 200.7	Vanadium
109.010	027	EPA 200.7	Zinc
109.020	001	EPA 200.8	Aluminum
109.020	002	EPA 200.8	Antimony
109.020	003	EPA 200.8	Arsenic
109.020	004	EPA 200.8	Barium
109.020	005	EPA 200.8	Beryllium
109.020	006	EPA 200.8	Cadmium
109.020	007	EPA 200.8	Chromium
109.020	008	EPA 200.8	Cobalt
109.020	009	EPA 200.8	Copper
109.020	010	EPA 200.8	Lead
109.020	011	EPA 200.8	Manganese
109.020	012	EPA 200.8	Molybdenum
109.020	013	EPA 200.8	Nickel
109.020	014	EPA 200.8	Selenium
109.020	015	EPA 200.8	Silver
109.020	016	EPA 200.8	Thallium
109.020	017	EPA 200.8	Vanadium
109.020	018	EPA 200.8	Zinc
109.020	020	EPA 200.8	Gold
109.020	021	EPA 200.8	Iron
109.020	022	EPA 200.8	Tin
109.020	023	EPA 200.8	Titanium
109.104	001	EPA 218.6	Chromium (VI)
109.190	001	EPA 245.1	Mercury
109.192	001	EPA 245.7	Mercury
109.381	001	EPA 1631E	Mercury
109.811	001	SM3500-Cr D (18th/19th)	Chromium (VI)

110 - Volatile Organic Chemistry of Wastewater

110.040	040	EPA 624	Halogenated Hydrocarbons
110.040	041	EPA 624	Aromatic Compounds
110.040	042	EPA 624	Oxygenates
110.040	043	EPA 624	Other Volatile Organics

111 - Semi-volatile Organic Chemistry of Wastewater

111.101	030	EPA 625	Pesticides
111.101	032	EPA 625	Polynuclear Aromatic Hydrocarbons
111.101	033	EPA 625	Adipates
111.101	034	EPA 625	Phthalates
111.101	036	EPA 625	Other Extractables
111.103	000	EPA 625	Nitrosamines
111.120	048	EPA 1625	N-nitrosodimethylamine
111.170	030	EPA 608	Organochlorine Pesticides
111.170	031	EPA 608	PCBs
111.210	006	EPA 632	Diuron
111.273	001	EPA 1664A	Oil and Grease

112 - Radiochemistry of Wastewater

112.010	001	EPA 900.0	Gross Alpha
112.010	002	EPA 900.0	Gross Beta

114 - Inorganic Chemistry of Hazardous Waste

114.010	001	EPA 6010B	Antimony
114.010	002	EPA 6010B	Arsenic
114.010	003	EPA 6010B	Barium
114.010	004	EPA 6010B	Beryllium
114.010	005	EPA 6010B	Cadmium
114.010	006	EPA 6010B	Chromium
114.010	007	EPA 6010B	Cobalt
114.010	008	EPA 6010B	Copper
114.010	009	EPA 6010B	Lead
114.010	010	EPA 6010B	Molybdenum
114.010	011	EPA 6010B	Nickel
114.010	012	EPA 6010B	Selenium
114.010	013	EPA 6010B	Silver
114.010	014	EPA 6010B	Thallium
114.010	015	EPA 6010B	Vanadium
114.010	016	EPA 6010B	Zinc
114.020	001	EPA 6020	Antimony
114.020	002	EPA 6020	Arsenic
114.020	003	EPA 6020	Barium

114.020	004	EPA 6020	Beryllium
114.020	005	EPA 6020	Cadmium
114.020	006	EPA 6020	Chromium
114.020	007	EPA 6020	Cobalt
114.020	008	EPA 6020	Copper
114.020	009	EPA 6020	Lead
114.020	010	EPA 6020	Molybdenum
114.020	011	EPA 6020	Nickel
114.020	012	EPA 6020	Selenium
114.020	013	EPA 6020	Silver
114.020	014	EPA 6020	Thallium
114.020	015	EPA 6020	Vanadium
114.020	016	EPA 6020	Zinc
114.103	001	EPA 7196A	Chromium (VI)
114.106	001	EPA 7199	Chromium (VI)
114.140	001	EPA 7470A	Mercury
114.141	001	EPA 7471A	Mercury
114.222	001	EPA 9014	Cyanide
114.230	001	EPA 9034	Sulfides, Total
114.240	001	EPA 9040B	Corrosivity - pH Determination
114.241	001	EPA 9045C	Corrosivity - pH Determination
114.250	001	EPA 9056	Fluoride
115 - Extraction Test of Hazardous Waste			
115.020	001	EPA 1311	Toxicity Characteristic Leaching Procedure (TCLP)
115.030	001	CCR Chapter 11, Article 5, Appendix II	Waste Extraction Test (WET)
115.040	001	EPA 1312	Synthetic Precipitation Leaching Procedure (SPLP)
116 - Volatile Organic Chemistry of Hazardous Waste			
116.020	030	EPA 8015B	Nonhalogenated Volatiles
116.020	031	EPA 8015B	Ethanol and Methanol
116.030	001	EPA 8015B	Gasoline-range Organics
116.080	000	EPA 8260B	Volatile Organic Compounds
116.090	001	EPA 8316	Acrylamide
116.100	001	LUFT GC/MS	Total Petroleum Hydrocarbons - Gasoline
116.100	010	LUFT GC/MS	BTEX and MTBE
117 - Semi-volatile Organic Chemistry of Hazardous Waste			
117.010	001	EPA 8015B	Diesel-range Total Petroleum Hydrocarbons
117.110	000	EPA 8270C	Extractable Organics
117.111	071	EPA 8270C	Pesticides
117.111	073	EPA 8270C	Polynuclear Aromatic Hydrocarbons
117.111	074	EPA 8270C	Adipates
117.111	075	EPA 8270C	Phthalates

117.111	076	EPA 8270C	Other Extractables
117.150	000	EPA 8315A	Carbonyl Compounds
117.171	000	EPA 8330A	Nitroaromatics and Nitramines
117.210	000	EPA 8081A	Organochlorine Pesticides
117.220	000	EPA 8082	PCBs
117.240	000	EPA 8141A	Organophosphorus Pesticides
117.250	000	EPA 8151A	Chlorinated Herbicides
117.270	000	EPA 8318	Carbamates, N-methylcarbamates

120 - Physical Properties of Hazardous Waste

120.010	001	EPA 1010	Ignitability
120.070	001	EPA 9040B	Corrosivity - pH Determination
120.080	001	EPA 9045C	Corrosivity - pH Determination

QUALITY MANUAL

Version 35

For

Eurofins Eaton Analytical, Inc.
750 Royal Oaks Drive
Suite 100
Monrovia, CA 91016
(626) 386-1100

QUALITY MANUAL

Prepared by and for
Eurofins Eaton Analytical, Inc.
750 Royal Oaks Drive
Suite 100
Monrovia, CA 91016
(626) 386-1100

Prepared by: Nilda B. Cox **Date** 7/11/2013
Nilda Cox
Quality Manager

Approved by: for CJ Belt **Date** 7/11/13
Carol J. Belt
Asbestos Technical Manager

Approved by: Andrew Eaton **Date** 7/11/13
Dr. Andrew Eaton
Technical Director

Approved by: **Date** 7/11/2013
Ed Wilson
Laboratory Director

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NELAP ACCREDITED LABORATORY TNI
01114CA

EEA: Controlled Copy
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Revised July 2013

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3.0 STATEMENT OF POLICY

3.1. INTRODUCTION

Eurofins Eaton Analytical, Inc. (EEA) is a premier TNI-NELAC Approved Lab, full-service drinking water and wastewater laboratory that serves a national and international clientele. EEA is located at 750 Royal Oaks Drive, Suite 100, Monrovia, CA 91016 and is an entity that can be held legally responsible. EEA provides organic, inorganic, microbial, and radiochemical analyses in support of the Safe Drinking Water Act (SDWA), Clean Water Act (CWA), National Pollutant Discharge Elimination EEA Systems (NPDES), Resource Conservation and Recovery Act (RCRA), Food and Drug Administration (FDA), and the World Health Organization (WHO) as well as the EPA Unregulated Contaminant Monitoring Regulation (UCMR) Programs. The Quality Assurance Project Plan (QAPP) for the UCMR program is discussed in a separate document as an addendum to the laboratory's comprehensive Quality Manual (QM). The essential elements of the Quality Systems Program of EEA and the quality control procedures utilized by the laboratory to ensure compliance to the UCMR program requirements are discussed in the UCMR QAPP. UCMR QAPPs are developed for specific UCMR programs.

EEA takes an active role in supporting the promulgation of improved methodologies and the practice of differentiating laboratories based on quality of data. EEA participates in the methods development and validation of Standard Methods.

3.2. QUALITY POLICY

Management's commitment to quality and to the management system is stated in the Quality Policy below, which is upheld through the application of related policies and procedures described in EEA's ***Quality Manual***, SOPs and policies.

The foundation of the quality policy lies in the involvement and continuous improvement activities of all aspects at EEA. A system of monitoring, auditing, and reviewing processes is used to bring to light the opportunities for improvement.

The quality policy is signed and dated, and is issued under the authority of the highest level of laboratory management, which demonstrates management's commitment to integrity, ethics, the quality system and associated standards.

Quality Policy Statement

The objective of the quality system and the commitment of management is to consistently provide our customers with data of known and documented quality that meets their requirements. EEA is committed to the production of quality analytical data. The methods by which this is ensured are: 1) meeting or exceeding method performance criteria, 2) providing deliverables to our clients in a timely manner and 3) fostering a spirit of continuous improvement in all areas of management and operations. Our policy is to use good professional practices, to maintain quality, to uphold the highest quality of service, and to comply with the TNI Standard and ISO 17025. The laboratory ensures the personnel are free from any commercial, financial, and other undue pressures, which might adversely affect the quality of work. This policy is implemented and enforced through unequivocal commitment of management, at all levels, to the Quality Assurance (QA) principles and practices outlined in this manual. However, the primary responsibility for quality rests with each individual within the laboratory organization. Every laboratory employee must ensure that the generation and reporting of quality analytical data is a fundamental priority. Every laboratory employee is required to familiarize themselves with the quality documentation and to implement the policies and procedures in their work. All employees are trained annually on ethical principles and procedures surrounding the data that is generated. The laboratory maintains a strict policy of client confidentiality.

Ed Wilson
Laboratory Director

This Quality Manual defines the performance criteria and support procedures by which quality analytical data are generated. Standard Operating Procedures (SOPs) for individual analytical methodologies supplement this Quality Manual. Together they provide the documentation framework for ensuring the generation of uniform, comparable and quality data over time.

The foundation of the quality policy is in the involvement and continuous improvement activities of all personnel at EEA. Opportunities for improvement are showcased with a system of monitoring, auditing, and reviewing processes. The spirit of innovation is encouraged and viewed as paramount to the continued success of the laboratory in serving its clients.

3.3. MISSION STATEMENT

EEA will contribute to global health and safety by providing customers with high quality laboratory and advisory services whilst creating opportunities for EEA employees and generating sustainable shareholder value. EEA will provide outstanding client service and data of known and documented quality to all clients at all times.

3.4. CODE OF ETHICS AND POLICY/DATA INTEGRITY PROCEDURES

EEA was a founding member (1989) of actLABS, the California Association of Testing Laboratories and drafted one of the first lab ethics policies for actLABS. actLABS subsequently became part of ACIL (American Council of Independent Labs). Beginning in 1997 our increased geographic client base required us to give up our actLABS membership.

As a former actLABS member and a current TNI (the NELAC Institute) accredited laboratory, EEA is committed to ensuring the integrity of generated data, meeting the quality needs of clients, and setting high quality and ethical standards in the environmental industry. EEA is committed to managing its businesses by agreeing to:

- Produce results that are accurate and include QA/QC information which meets client predefined Data Quality Objectives.
- Present services in a confidential, honest, and forthright manner.
- Provide employees with guidelines and an understanding of the ethical and quality standards of our industry.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Operate the laboratory to ensure its personnel are free from any commercial, financial and other undue pressure that might adversely affect the quality of the work.
- Obey all pertinent federal, state, and local laws and regulations, and encourage other members of our industry to do the same.
- Educate clients as to the extent and kinds of services available.

In addition any employee of EEA identified as not conforming to the code of ethics of the laboratory, committing fraud or improper data manipulation, falsifying data, or deviating from the contractual requirements will be subject to disciplinary procedures, including suspension and up to termination of employment. Any supervisor or employee applying undue pressure to another coworker that might adversely affect the quality of the work (TNI-EL-V1M2- 2009-4.1.5.b) (ISO/IEC 17025:2005(E)-4.1.5.b) will be subject to the same disciplinary procedures outlined above.

In order to meet the requirements of the TNI data integrity program (TNI-EL-V1M2-2009-5.2.7), the laboratory implements a proactive program for the prevention and detection of improper, unethical or illegal action. This program includes training courses on Laboratory Ethics and Data Integrity Procedures, and educating all personnel on questionable practices. Details of the Laboratory Ethics and Data Integrity Procedures are found in the laboratory SOP. The laboratory SOP includes the implementation of Data Integrity Procedures including:

- Management Responsibilities on Data Integrity Procedures/Signed Contract/Ethics Agreement for all laboratory personnel [TNI-EL-V1M2-2009-4.2.8.1, 4.2.8.1a, 4.2.8.1b].
- Control and documentation – Internal Audit/Periodic Monitoring of Data Integrity/Evidence of Vulnerabilities [TNI-EL-V1M2-2009-4.14.2, 4.14.3][ISO/IEC 17025:2005(E)- 4.14.2, 4.14.3].
- Data Integrity Training and documentation of Examples of Improper Practices in the Laboratory Ethics SOP [TNI-EL-V1M2-2009-5.2.7].

3.5. SERVICE TO THE CLIENT

The laboratory collaborates with clients and/or their representatives in clarifying their request and in monitoring of the laboratory performance related to their work. Each request is reviewed to determine the nature of the request and the laboratory's ability to comply with the request within the confines of prevailing statues and/or regulations without risk to the confidentiality of other clients.

3.5.1. **Client Confidentiality**

EEA recognizes its clients to be its contractors, the regulatory community, and the general public. The day to day operations are defined with considerations to the needs, goals and health of all clients. Protection of clients' confidential information and proprietary rights are considered. Where data are provided for external audits or for other similar reasons, the client's name and identity are concealed as necessary to protect client-confidential information.

In the event that the laboratory transfers ownership or goes out of business, the laboratory will notify all clients to ensure that records are maintained or transferred according to the client's instructions [TNI-EL-V1M2-2009-4.13.3.h].

3.6. REVIEW OF REQUESTS AND CONTRACTS/CONTRACT AMENDMENTS

EEA agrees to assert competency only for work for which adequate preparation has been made. Before commencing new work, the laboratory reviews all new work to ensure that it has the appropriate capability, facilities, resources, and the test method is applicable to the customer's needs. This process assures that all work will be given adequate attention without shortcuts that may compromise data quality.

A contract may be any written or oral agreement to provide a client with environmental testing. The laboratory reviews contracts and informs clients if there are any potential conflicts, deficiencies, lack of accreditations or inability to complete client work. The review also covers any work that will be subcontracted by the laboratory.

3.6.1. **Procedure for the Review of Work Requests**

3.6.1.1. Requests, tenders and contracts received by the laboratory are reviewed to ensure that the laboratory has the necessary personnel, information resources, facilities, equipment, PT, MDLs, QC and current applicable accreditation status [TNI-EL-V1M2-2009-4.4.1][ISO/IEC 17025:2005(E)-4.4.1].

3.6.1.2. For new clients and comprehensive testing, contracts are generated and appropriate lab personnel, such as the Lab Director or Technical Director, review the Contracts to assure that the lab is capable of providing testing prior to the start of work [TNI-EL-V1M2-2009-4.4.1][ISO/IEC 17025:2005(E)-4.4.1].

3.6.1.3. For repetitive, routine tasks the review needs to be made only at the initial inquiry stage or on granting of the contract for ongoing routine work performed under a general agreement with the client, provided that the client's requirements remain unchanged.

3.6.1.4. For any contract amendment for TNI compliance, the laboratory repeats the review process. The client is informed of any deviation from the contract including the test method or sample handling processes. If a contract needs to be amended after work has commenced, the same contract review process is reviewed and amendments are communicated to all affected personnel. If the laboratory's accreditation is suspended, revoked, or voluntarily withdrawn, the laboratory reports to clients any applicable changes of its accreditation status.

3.6.1.5. The designated Project Manager (PM) reviews client samples received by the laboratory and logged in the LIMS. Review of logged tests and methods are documented in the Sample Acknowledgement Report by affixing the PM's signature and/or initials and date of review. A Sample Acknowledgement Report is sent to the client to document approval of LOGGED samples and methods of analysis.

3.6.1.6. Refer to the Nonmethod 26 SOP for detailed Contract Review procedures.

3.6.2. Documentation of Review

3.6.2.1. Records of reviews, including any significant changes, shall be maintained. Records shall also be maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract.

3.7. EEA STANDARD POLICY ON RESOLUTION OF COMPLAINTS

3.7.1. EEA reviews all complaints and determines appropriate action.

3.7.2. EEA will, if it is feasible and within holding times, arrange for repeat of all analyses that do not meet regulatory requirements. We hold ourselves responsible for reporting or re-reporting all results in a format that complies with regulatory requirements, and will make every attempt to correct and when feasible will repeat work at no additional charge for all analyses compromised due to laboratory error in shipping, sample preparation, or analysis. In the event of a sample loss within the required sample collection window, we will discuss with clients the merits of available options for flagging data versus re-sampling for either the individual parameter or the entire suite of samples. In all circumstances, EEA will keep clients completely informed and aware of potential or actual problems as they arise, using e-mail or telephone.

3.7.3. Where a complaint or any other circumstance raises doubt concerning compliance with the laboratory's policies, with the requirement of the TNI and ISO 17025 Standards or otherwise concerning the quality of the laboratory's data, the EEA Quality Assurance Department will conduct an audit of the affected areas of activity.

3.7.4. Documentation of the complaints or initiating event, internal audit findings and resulting corrective action will be maintained by the EEA Quality Assurance Department (TNI-EL-V1M2-2009-4.11.3) (ISO/IEC 17025:2005(E)-4.11.3) and as appropriate be conveyed to the client.

3.8. CAPABILITIES

EEA has the capability to analyze drinking water and wastewater for clients in the private and public sector where work is dictated by the regulatory requirements for the Safe Drinking Water Act (SDWA), Resource Conservation and Recovery Act (RCRA), National Pollutant Discharge Elimination Systems (NPDES), Clean Water Act (CWA), Food and Drug Administration (FDA), World Health Organization (WHO) and the Superfund Amendments and Reauthorization Act (SARA) and the EPA Unregulated Contaminants Monitoring Regulations (UCMR) Program. Our specialized laboratory services include;

- Analysis and identification of inorganic & organic disinfection by-products, taste and odor compounds in drinking water
- Identification and quantitation of coliphage in drinking water and wastewater
- Comparability of alternate test procedures for drinking water and wastewater analysis.
- Analysis of emerging contaminants such as Pharmaceuticals and Personal Care Products (PPCPs), Endocrine Disrupter Compounds (EDCs), and perfluoro octanesulfonate (PFOS).
- Analysis of bottled water and beverage matrices for FDA and WHO regulated analyses.

3.9. CERTIFICATIONS

EEA is currently certified in 45 states and 2 territories to perform various analyses for regulated parameters. EEA is also NELAP accredited in 13 TNI states out of 14 TNI

States' accrediting bodies. EEA holds primary accreditation under California NELAP (01114 CA) and ELAP Program (Certificate No. 1422). Please refer to Table 3-1 for the list of the states, laboratory identification number, and the certification type. An updated list is available in the QA office.

A copy of EEA's NELAP Accreditation plus NELAP fields of accreditation (Fig. 4-3, Fig. 4-4) and a copy of the CA ELAP plus Fields of Testing are attached (Figures 4-5 and 14-6). The most recent certification is available in the QA office.

Arizona Dept of Health Services requires that a copy of EEA's AZ certification and License (AZ0778) be attached in the Lab QM. See the AZ License and list of license parameters in Appendix I. The most recent certification is available in the QA office.

Table 3-1 State Certifications

State Certification List

Item #	State	Lab ID	Drinking Water	Wastewater	Hazardous Waste
1.	Alabama	41060	X		
2.	Alaska	CA0006	X		
3.	Arizona	AZ0778	X	X	X
4	Arkansas		X		
5.	California – NELAP	01114CA	X	X	
	California – ELAP (Monrovia)	1422	X	X	X
	California – ELAP (Colton)	2641	X	X	
	California – ELAP (Folsom)	2820	X		
6.	Colorado		X		
7.	Commonwealth of Northern Mariana Islands	MP0004	X		
8.	Connecticut	PH-0107	X		
9.	Delaware	CA 006	X		
10.	Florida - NELAP	E871024	X	X	
11.	Georgia	947	X		
12.	Guam	12-006r	X		
13.	Hawaii		X		
14.	Idaho		X		
15.	Illinois – NELAP	200033	X		
16.	Indiana	C-CA-01	X		
	Iowa – Not Certified	Lab has not applied	NO		
17.	Kansas – NELAP	E-10268	X		
18.	Kentucky	90107	X		
19.	Louisiana – NELAP	LA130008	X		
20.	Maine	CA0006	X		
21	Maryland	224	X		
22.	Massachusetts	M-CA006	X		
23.	Michigan	9906	X		
	Minnesota - Not Certified - NELAP	Lab has not applied	NO		
24.	Mississippi		X		
	Missouri – Not Certified	Lab has not applied	NO		
25.	Montana (Chemistry)	Cert. 0035	X		
26.	Nebraska		X		
27.	Nevada	CA-06-2012	X	X	X
28.	New Mexico		X		
29.	New Hampshire – NELAP	2959	X		
30.	New Jersey – NELAP	CA 008	X	X	
31.	New York – NELAP	11320	X	X	
32.	North Carolina	06701	X		

Item #	State	Lab ID	Drinking Water	Wastewater	Hazardous Waste
33.	North Dakota	R-009	X		
	Ohio – Not Certified	Certifies only in-state labs (No certification program for out-of-state labs)	NO		
	Oklahoma – Not Certified	Lab has not applied	NO		
34.	Oregon – NELAP	CA 200003	X		
35.	Pennsylvania – NELAP	68-565	X		
36.	Rhode Island	LAO00326	X		
37.	South Carolina	87016001	X		
38.	South Dakota		X		
39.	Tennessee	TN02839	X		
40.	Texas – NELAP	TX104704230	X		
41.	Utah - NELAP	MONT-1	X		
42.	Vermont	VT0114	X		
43.	Virginia - NELAP	00210	X		
44.	West Virginia	9943C	X		
45.	Washington	C 838	X		
46.	Wisconsin	998316660	X		
47.	Wyoming	8TMS-Q	X		

EEA may accept, analyze, and report results for samples from states in which it is not certified if the results are intended for non-regulatory monitoring.

When there is a change in lab location or ownership, the laboratory will report in writing to the accrediting authorities within 30 calendar days of the change.

3.10. SUBCONTRACTED LABORATORY WORK

3.10.1. On occasion laboratory work may be subcontracted to certified laboratories approved by EEA. The subcontractor laboratory will be approved only if the laboratory meets all the necessary certification requirements required by the state where the samples are collected. For example, samples collected from Alaskan Public Water supplies for compliance monitoring must be analyzed by a laboratory certified by the State of Alaska or the USEPA (18 AAC 80.255). For any part of testing covered under NELAP, the laboratory sends the work to a subcontractor accredited under NELAP or to a laboratory that meets applicable satisfactory and regulatory requirements for performing the test and submitting the results of the tests performed [TNI-EL-V1M2-2009-4.5.1][ISO/IEC 17025:2005(E)-4.5.1]. For ISO 17025 subcontracted work, EEA subcontracts work to an ISO 17025 subcontractor or qualified non ISO 17025 accredited subcontractor. Refer to the Nonmethod 31 SOP for the requirements for Non ISO 17025 accredited subcontractors.

3.10.2. Under no circumstances will work be subcontracted without client approval. The laboratory advises the client in writing of its intention to sub-contract any portion of the testing to another laboratory during the project bid proposal or purchase order procurement [TNI-EL-V1M2-2009-4.5.2][ISO/IEC 17025:2005(E)-4.5.2]. Test results provided by the subcontractor are identified by the subcontractor name or applicable accreditation number. The subcontractor shall report the results in writing or electronically [TNI-EL-V1M2-2009-5.10.6] [ISO/IEC 17025:2005(E)-5.10.6]. The laboratory shall make a copy of the subcontractor's report available to the client when requested by the client or when required by regulations.

3.10.3. Subcontracted work is documented in the chain of custody (COC). The COC and other appropriate records are included with the final data package as part of the final deliverables. To comply with California ELAP regulations (Title 22, Division 4, Chapter 19, Article 10, Section 64819), EEA's reports must include the original copies of reports prepared by the subcontracted laboratories. See section 14.4 for all the information required in the final test report.

3.10.4. To help ensure all subcontractors meet EEA's Data Quality Objectives and consistently produce documented data of known quality, EEA requires that the following documentation should be submitted by the vendor for review:

(1) NELAP laboratory accreditation, or state certifications that meet the applicable statutory and regulatory requirements
(2) Laboratory Quality Manual(QM) or at the minimum the signed cover page and table of contents of the lab QM (non-NELAP accredited facilities only)
(3) Notify EEA of 2 failed Proficiency Testing (PT) results or any changes of certification status either suspension or revocation for any relevant tests, if applicable.
(4) Recent state onsite audit findings for the relevant methods and corrective action report, if applicable
(5) For Non-NELAP lab, a copy of Data Integrity/Ethics Policy, if available

3.10.5. At a minimum, the lab's NELAP accreditation or states certification status and the signed cover page and table of contents of the lab QM is verified.

3.10.6. Data deliverables must meet EEA's project needs and requirements. EEA assumes responsibility to the client for the subcontractor's work, except in the case where a client or a regulating authority specified which subcontractor is to be used [TNI-EL-V1M2-2009-4.5.3][ISO/IEC 17025:2005(E)-4.5.3]. At a minimum, laboratory deliverables submitted to EEA must include final report, QC results and acceptance limits. Level 4 data deliverables may be requested by EEA for review as needed. Onsite audit of subcontract laboratory may also be conducted by EEA as needed.

3.10.7. Project managers and the designated subcontracting administrator must ensure all applicable quality documents specified in section 3.10.4 to evaluate subcontractor's qualifications are submitted to EEA for review by the subcontracting administrator. The subcontracting administrator will ensure that all approved subcontract labs and EEA's representatives have signed the required Subcontract Vendor Agreement/checklist. Before subcontracting samples, the designated subcontracting administrator shall review certifications to ensure that the laboratory's subcontractor's certification/ accreditation is current. If certification is not current, the subcontracting administrator shall contact the vendor for a current copy of the vendor's certification before shipping samples.

3.10.8. A register of all subcontractors and a record of evidence (such as NELAP accreditation or appropriate compliance to applicable regulatory requirements) are kept by the designated subcontracting administrator [TNI-EL-V1M2-2009-4.5.4][(ISO/IEC 17025:2005(E)-4.5.4]. A list of subcontracted laboratories approved by EEA is available in the server.

3.10.9. For samples originating in Massachusetts and subcontracted to another lab, EEA must identify, in writing, those samples needing special reports (e.g. MCL exceedance). The subcontract laboratory is responsible for notifying EEA and Massachusetts DEP of any MCL exceedances within 24 hours of obtaining valid data.

3.10.10. Refer to the Nonmethod 31 SOP for detailed Subcontracting procedures.

3.11. FACILITIES

3.11.1. ACCOMODATIONS

EEA's main laboratory is located at 750 Royal Oaks Drive, Suite 100 in Monrovia, California. It has more than 20,000 square feet of analytical laboratory workspace plus almost 15,000 square feet of support space with a staff of 109 in 2011. Figure 3-1 and Figure 3-2 contain the Floor Plans for the first and second floors, respectively of the Monrovia facility.

The Monrovia facility is controlled by access control locks which provide entry through plastic keycards stored with digital signatures of each employee.

Departments of the Main Laboratory include:

Asbestos
GC extractables/volatiles
GC/MS extractables/volatiles
Ion Chromatography
LC/MS/MS Extractables
Metals/Metals Prep

Microbiology
Organic extractions
Radiochemistry
Sample Disposal
Sample Receipt
Shipping – sample bottle preparation
Wet Chemistry (including General Physical)

In addition to the Monrovia facility, there are three service centers that are a part of the laboratory.

- The Inland Empire/Microbiology Lab located at 1012 E. Cooley Dr., Ste P, Colton, California, 92324;
- The Southwest Center located at 15953 N. Greenway Hayden Loop, Ste. C, Scottsdale, Arizona 85260;
- The Northern California Center is located at 180 Blue Ravine Road, Suite A & B, Folsom, CA 95630.

The management systems that are compliant with TNI Standards and ISO 17025 that are documented in the laboratory Quality Manual covers work carried out in the Monrovia facility and in-house sampling procedures associated with field activities.

3.11.2. **ENVIRONMENTAL CONDITIONS**

3.11.2.1. The laboratory ensures that the laboratory environment conditions do not invalidate the results or adversely affect the required quality of any measurement.

3.11.2.2. The laboratory monitors, controls and records environmental conditions as required by the relevant specifications, methods and procedures, or where they influence the quality of the results.

3.11.2.3. Biological sterility and dust are monitored in microbiology to ensure that environmental conditions do not jeopardize the results of the environmental tests and/or calibrations. The laboratory micro walls, floors, work surfaces are non-absorbent and easy to clean and disinfect.

3.11.2.4. Incompatible areas such as Volatiles, Sample Extraction, Microbiology, culture handling or incubation, Radiochemistry preparation areas are separated to prevent cross-contamination.

3.11.2.5. The laboratory work spaces are adequate, and appropriately clean to support environmental testing and ensure an unencumbered work area.

Figure 3-1 Floor Plan First Floor

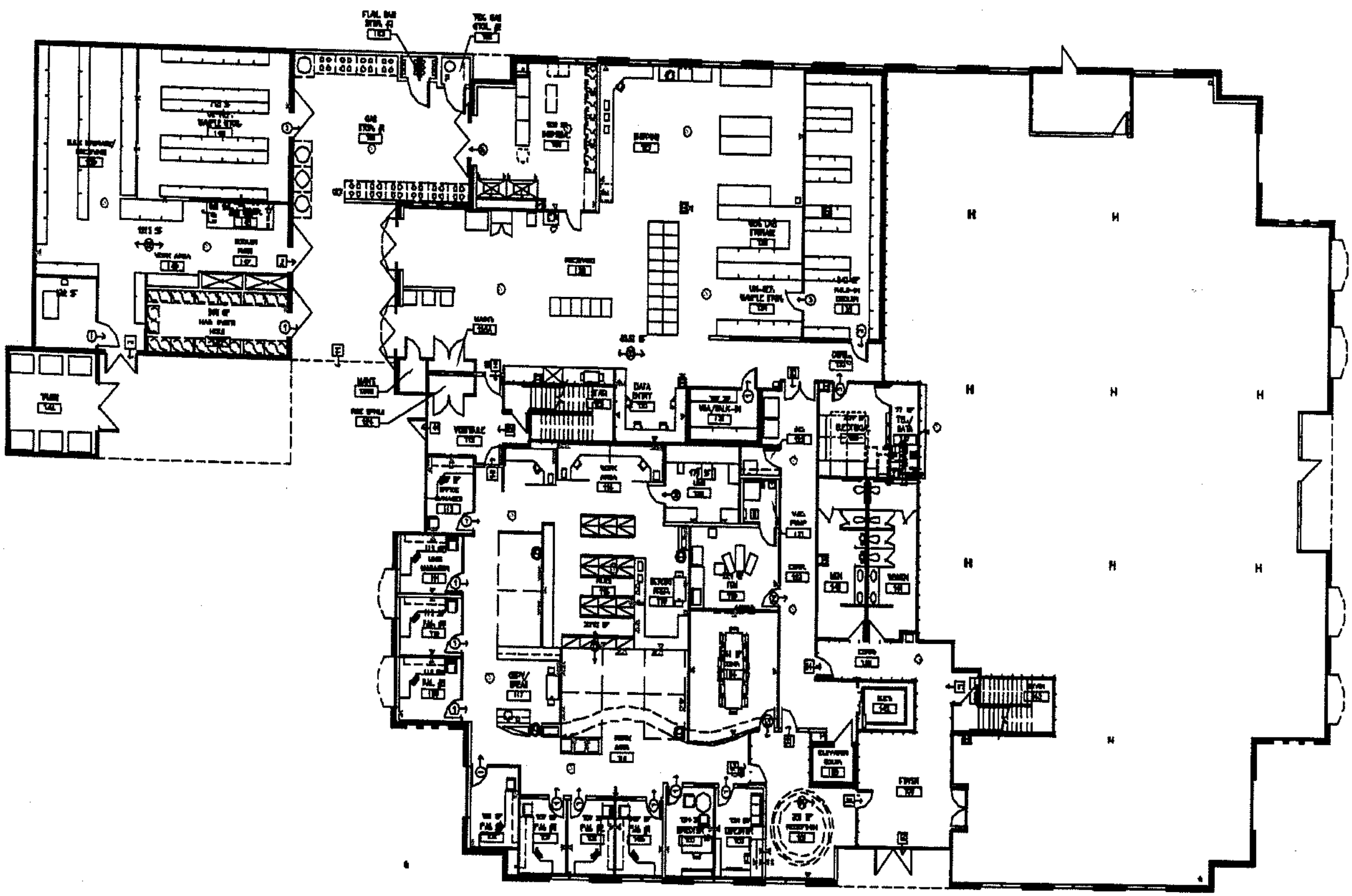
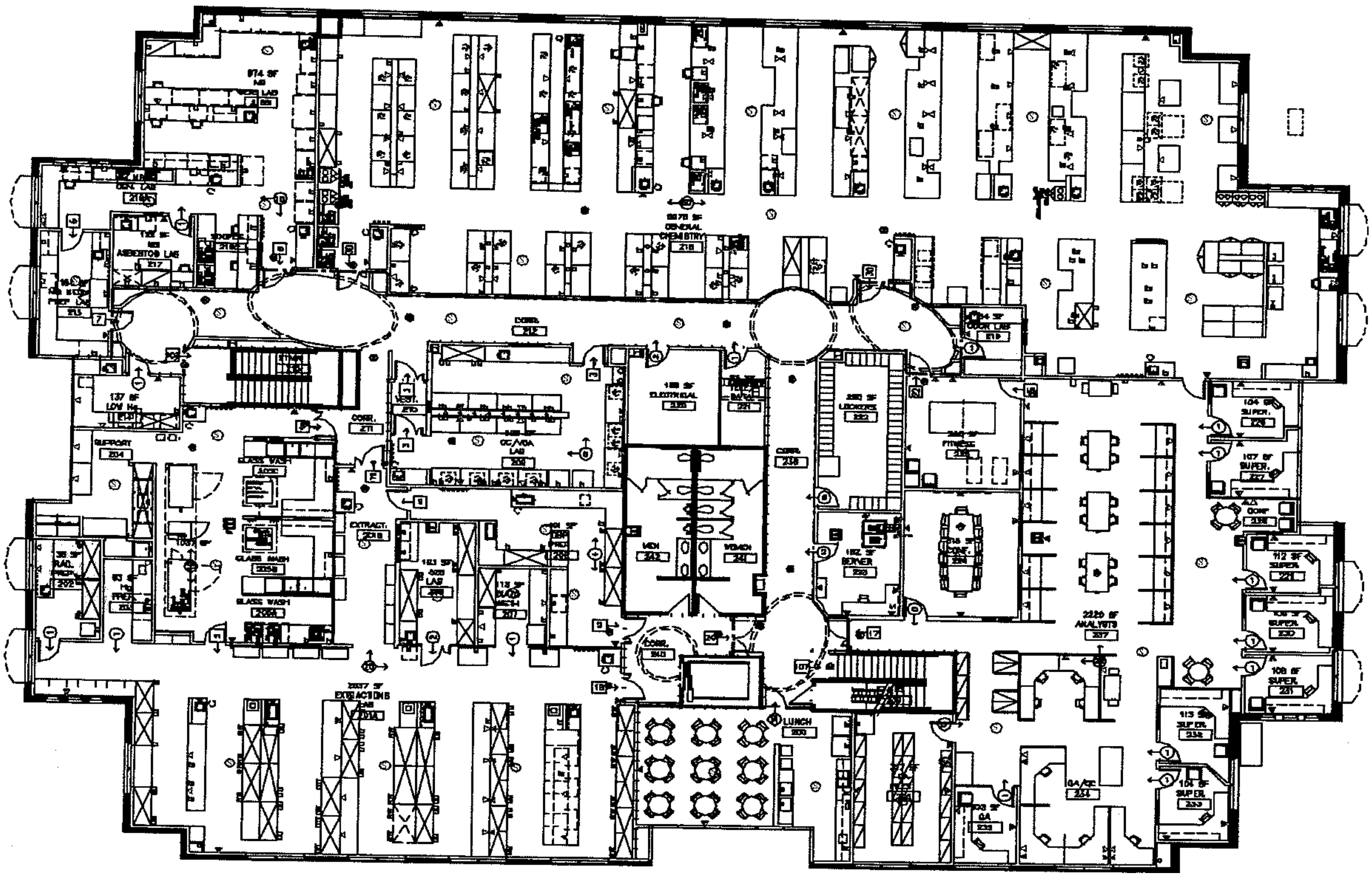


Figure 3-2 Floor Plan 2nd Floor



4.0 PROGRAM ORGANIZATION AND MANAGEMENT

All EEA's analysts and technicians analyzing drinking water samples meet the minimum qualifications specified in the Manual for the Certification of Laboratories Analyzing Drinking Water, Criteria and Procedures, Quality Assurance, 5th Edition. The organization and chain of command for the laboratory is shown in Figure 4-9. Details of assigned positions, responsibilities and qualifications for senior management personnel are summarized below. The laboratory is organized in such a way that managerial staff has the authority and resources needed to discharge their duties. Top Management is the Laboratory Director who makes decisions on policy, endorses the quality policy statement, and allocates resources to implement and maintain the quality system. The Technical Director, Quality Manager, Technical Managers, and deputies are part of the management staff. The Quality Manager reports directly to the EEA Laboratory Director and has the authority to make independent technical judgment not influenced by production, marketing and financing issues. Qualified supervisors are certified as to their educational and technical background and experience, to ensure that supervision is provided by persons familiar with the calibration or test methods and procedures, the objective of the calibration or test and the assessment of the results.

4.1. EEA'S LABORATORIES PERSONNEL

4.1.1. Laboratory Director: Mr. Ed Wilson

Mr. Wilson has over 35 years of environmental chemistry and laboratory management experience to the laboratory. He sets laboratory policy and is responsible for overall laboratory performance and direction. In his role as Lab Director, he has ultimate responsibility for ensuring the operational efficiency and accuracy of laboratory procedures, cost analysis, overhead control, marketing, and project management. His guided management principles are based on achieving outstanding Customer Service and Technical Excellence. Under his direction and leadership, EEA would have systems built on the most sophisticated information technology platform and would be proud to have the best technical staff in the industry.

4.1.2. Technical Director: Dr. Andrew Eaton

Dr. Andrew Eaton has over 30 years of analytical experience including over 20 years of managerial experience. In his capacity as Technical Director, Dr. Eaton certifies that personnel with appropriate educational and/or technical background perform all tests for which the laboratory is accredited. Such certification for each personnel is documented in the analyst's initial demonstration of capability (DOC) certification. The initial DOC certification statement was modified to include the certification for the analyst for having the appropriate educational and/or technical background. A copy of the certification statement is retained in the training files of each affected employee. Dr. Eaton is responsible for Project Management on large projects with significant technical issues, serves as a technical advisor to the laboratory staff and clients, works on special assignments such as productivity assessments and financial analyses, as well as marketing activities with clients whose projects are highly technical in nature. Dr. Eaton also serves as a member of the Joint Editorial Board for Standard Methods for the

Examination of Water and Wastewater (SM). In this capacity, he is responsible for recommending new methods for inclusion in SM and ensuring that all proposed methods include appropriate levels of QC and validation. He is a former member of the TNI Advocacy Committee. Formerly on the Board of actLABS, Dr. Eaton also served as a member of The Methods and Data Comparability Board, which reports to the National Water Quality Monitoring Council.

4.1.3. **Asbestos Technical Manager: Carol J. Belt**

Ms. Belt has over 30 years of environmental laboratory experience in EEA conducting microbiology and asbestos analyses. Her expertise includes analysis of drinking water and wastewater samples for microbiological testing and asbestos analysis. She is responsible for training analysts in various microbiological procedures and in the analytical method for the determination of asbestos fibers in water. As the Technical Manager for Asbestos analysis, Ms. Belt has the overall responsibility for the technical operation of the asbestos testing in the laboratory and currently oversees all aspects of the asbestos testing She is responsible for monitoring the performance of the entire procedure and accurate reporting of all samples received for asbestos analysis. She is also responsible to train other technicians on this methodology and to certify trained analysts as to their educational and technical background and demonstration of capability.

4.1.4. **Client Services Manager: Frederick Haley**

Mr. Haley has over 27 years of environmental laboratory experience. His experience has encompassed analytical method development for soils and water as well as development of mobile laboratory services. Mr. Haley has managed lab operations for both small and large lab settings. He oversaw the daily operations of a small satellite laboratory of 10 staff performing basic analytical methods and has also managed a large laboratory of over 150 personnel conducting wastewater, soil, hazardous waste and drinking water analysis. In addition Mr. Haley has managed projects requiring coordination of schedule, personnel, budget and compliance to technical specifications for local, state and federal agencies as well as private sector companies. Mr. Haley is responsible for the daily supervision of 7 project managers.

4.1.5. **Quality Manager/Regulatory Consulting Manager: Ms. Nilda B. Cox**

Ms. Cox has over 20 years of environmental experience in Quality Assurance/Quality Control including hazardous waste management and safety compliance in the laboratory. Her experience also includes eight years as senior chemist and supervisor of chemistry QA/QC Methods Development Group, and in-charge of the Industrial Hygiene Monitoring Program for a medical device company. Additional experience includes six years in Research and Development in the field of agriculture. Ms. Cox is responsible for providing QA solutions to our clients.

In addition to supporting internal QA/QC, Ms. Cox serves as a resource for numerous outside entities, providing consulting services in the area of QA/QC to assist them in the development of their own in-house QA Programs.

In the absence of the Quality Manager, Robert Dean and Yoon Cha are authorized as the Deputy Quality Managers.

4.1.6. Senior Project Manager/Deputy Technical Director: Linda Geddes

Ms. Geddes has over 30 years experience in the field of analytical chemistry related to environmental issues, including three years as the Quality Assurance Manager at another laboratory, over five years of experience in pharmaceutical chemistry, and 2 years as QA/QC Officer for EEA. Her experience has encompassed analytical methods development and validation for soils, sediments and water, maintaining a quality assurance program and managing Department of Defense site assessment projects. These projects have required coordination of schedule, personnel, budget, and compliance to technical specifications for local, state, and federal agencies, as well as private sector companies. These included compliance monitoring under the Coliform Rule, the Lead and Copper Rule, Phase II and V, the Information Collection Rule (ICR), and the Unregulated Contaminant Monitoring Rule (UCMR). Prior to becoming the Quality Assurance Officer, Ms. Geddes was a Project Manager at EEA for eight years.

In the absence of the Technical Director, Ms. Geddes is designated as the Deputy Technical Director.

4.1.7. Technical Manager/LCMS Supervisor: Mr. Ali Haghani

As EEA's Technical Manager/LCS Supervisor, Mr. Haghani is responsible for method development of new methods and for asset management and currently supervising 4 analysts. Mr. Haghani was previously responsible for overseeing six supervisors and a staff of over 50 analysts performing sample preparation and analysis of environmental samples for organics and a wide range of inorganic parameters. He was also responsible for the day-to-day scheduling of analysts workloads, providing guidance and technical expertise to the analyst, and checking the validity of their work. Mr. Haghani has over 17 years of experience in the environmental monitoring business and has technical expertise in inorganic and organic analytical chemistry.

4.1.8. Technical Manager/Extraction and GC/MS Supervisor: Mr. Charles Grady

Mr. Grady has over 20 years experience in environmental extraction, environmental wet chemistry, environmental GC and environmental GC/MS. He also has experience in hazardous waste, drinking water and waste water testing. Mr. Grady also has two years of experience as an instrument repair service technician.

As Technical Manager/Extraction and GC/MS Supervisor for EEA, Mr. Grady is responsible for supervising 18 analysts, meeting quality control and method requirements, scheduling work, recruiting and training staff, and managing the group budget. He works closely with Client Services, the Lab Directors and department managers to schedule incoming work and to meet QC requirements and specific client needs.

4.1.9. **Technical Manager/GC/HPLC Supervisor: Ms. Sophia Liang**

As EEA's Technical Manager or GC/HPLC supervisor, Ms. Liang is responsible for day to day supervision of a staff of 8 analysts performing organic analysis by GC and HPLC (High Performance Liquid Chromatography). Ms. Liang schedules analysts' workloads to ensure that holding times are not exceeded, approves final data, and insures that all QA guidelines are met. Ms. Liang has over 8 years of experience performing organic analyses.

4.1.10. **Technical Manager/Inorganic Supervisor: Mr. Walter Hsieh**

As EEA's Metals/Radiochemistry/Wet Chemistry supervisor, Mr. Hsieh is responsible for day to day supervision of a staff of 24 analysts performing inorganic analyses such as metals, radiochemistry and wet chemistry. Mr. Hsieh schedules analysts' workloads to ensure that holding times are not exceeded, approves final data, and insures that all QA guidelines are met. Mr. Hsieh has over 20 years experience performing metal and organic analyses in environmental laboratories.

4.1.11. **Technical Manager/Microbiology Supervisor: Ms. Polly Barrowman**

Ms. Barrowman has over 5 years of microbiology and biology experience. She obtained her BS in Biology and Chemistry at Western Michigan University in 2003 and her MS in Environmental Biology at University of Aberdeen, Scotland in 2005. She has been a Microbiologist at EEA's since June 2009, with experience performing water suitability, inhibitory residues, standard plate counts, and coliform analyses. Ms. Barrowman ensures that all holding times are not exceeded and that all QA guidelines are met. Ms. Barrowman is responsible for the daily supervision of a staff of 9 laboratory personnel.

4.1.12. **LIMS Manager: Mr. Ryan Chang**

Mr. Chang has over 15 years of IT experience including technical support for several nationally syndicated radio shows, website implementation for several fortune 1000 companies, intra and internet e-commerce development and was a webmaster for UCLA Business Law Courses. He is skilled in multiple server-side, client-side, database, web server, app-server and e-commerce languages. He holds a Bachelor's of Science in Computer Science and Engineering and a Bachelor of Arts in Economics both, from UCLA.

4.1.13. **Deputy Lab Director: Mr. James Hein**

Mr. Hein has over 30 years of environmental laboratory experience. His experience has encompassed analytical methods development for soils, sediments and water, the development of data assessment procedures for validation of analytical data, and the implementation of numerous bench scale treatment studies for the removal of various environmental pollutants.

He has managed projects requiring coordination of schedule, personnel, budget and compliance to technical specifications for local, state and federal agencies as well as private sector companies. In the absence of the Lab Director, Mr. Hein is designated as the Deputy Lab Director.

4.2. QUALITY SYSTEMS PROGRAM AND ITS MANAGEMENT

The Quality Systems Program is dynamic and is updated frequently when changes to policy and procedures are necessary. The Quality Manager has direct access to the highest level of management, which is the Laboratory Director, where decisions are made on laboratory policy or resources [TNI-EL-V1M2- 2009-4.1.7.1]. It is the responsibility of the Quality Manager to oversee all aspects of this program and document the participation of all staff members. In order to administer and manage this program, the Quality Manager must be knowledgeable in the TNI Quality Systems and ISO 17025 Current Standards and their implementation [TNI-EL-V1M2- 2009-4.1.7.1, 4.2.8.2]. Attendance at the TNI Interim and annual Conferences should be documented in the training files of the Quality Manager.

Vital areas of the Quality Systems Program include:

4.2.1. Preparing annual reports to management on QA related activities in the laboratory. Through the annual report, the Quality Manager notifies the laboratory management of deficiencies in the Quality Systems and monitors corrective actions. (Section 16.4) This includes a periodic QA report, reports on internal and external PT samples, and verbal transmittal of QA information to the Laboratory Director and group supervisors during a weekly staff meeting.

4.2.2. Coordinating analyses of Proficiency Testing (PT) (i.e. water supply study-WS, water pollution study-WP) or blind performance samples; investigating any problems associated with the results; reviewing results, problems and corrective actions with the analytical and supervisory staff; providing timely response to certification authorities with respect to any identified problem areas. (Section 16.3)

4.2.3. Implementing procedures that allow for adequate documentation and control of specific documents. These procedures use a unique identification system that allows for tracking and traceability of official copies and the time period the procedure or document was in force. To ensure that the Quality Manual and SOPs remain controlled documents, the master SOPs and Quality Manual (original official version of the SOP and Quality Manual) and copies of the SOP and Quality Manual will be identified. The cover page of each copy will contain a unique identification indicating that the document is controlled copy ___ of ____ copies, initialed and dated by the Quality Manager (or designee) in red ink. This ensures that the analyst is using the current version. Refer to the Nonmethod 25 SOP for detailed Document Control procedures.

4.2.3.1. The Quality Manual and Standard Operating Procedures (SOP) of EEA are reviewed and updated if needed at least once a year to ensure continuing suitability and compliance with applicable requirements. The laboratory's document control system allows for the amendment of documents by hand, pending the reissue of the documents. The changes are clearly marked, initialed and dated by the personnel that performed the original review. The revised document formerly reissued as soon as practicable [TNI-EL-V1M2- 2009-4.3.3.3, 4.3.3.1][ISO/IEC 17025:2005(E)-4.3.3.3, 4.3.3.1]. All appropriate laboratory personnel signs the Quality Manual Signature Page / SOP Training Documentation Form after the annual review of the Quality Manual / SOPs.

4.2.3.2. See Figure 4-1 QM Signature Page for a copy of the QM Signature Page. See Figure 4-2 SOP/Method Training Documentation for a copy of the SOP Training Documentation Form. See Table 4-1 for a list of SOPs.

4.2.3.3. A SOP/ QM Distribution Form is prepared for each SOP/ QM that includes the SOP/QM ID, control number, individual receiving the SOP/QM, date of issue and the date of completion of the analyst's SOP/QM training documentation.

4.2.4. Documenting participation and performance of the laboratory staff in initial and continuing training courses.

4.2.5. Overseeing and maintaining the training program files for each analyst at EEA.

4.2.6. Providing guidelines for the QS orientation program to newly hired personnel and ensuring that they are familiar with the quality systems program operating within the laboratory.

4.2.7. Interacting with auditors and certifying authorities for in-state programs, out-of-state programs, and internally to the laboratory. (16.2)

4.2.8. Serving as focal point for initiation, implementation, review and dissemination of QA/QC Guidelines to ensure that data quality meets the objectives of certifying authorities and maintaining documentation of those guidelines.

4.2.9. Maintaining copies of procedural write-ups and QA documentation files, and ensuring that all personnel working in the laboratory follow established standard operating procedures that do not compromise the quality of data submitted to clients or violate rules and guidelines from certifying agencies.

4.2.10. Ensuring that analysts are monitoring long-term quality control trends with quality control charts and insuring that corrective action is initiated whenever an out of control event occurs.

4.2.11. Ensuring that sample log-in and traceability are done correctly and that the chain of custody forms and other relevant documentation are properly maintained by periodic spot checks of the records.

4.2.12. Implementing a record management/archival system for control of laboratory notebooks; instrument logbooks; standard logbooks; records for data reduction, validation, storage, and reporting; training records for personnel no longer with the laboratory; outdated manuals and

SOPs; and the eventual removal of outdated documentation. Archived information is stored physically or electronically in-house for 3 months and then physical files are transferred off-site, for storage for 2 years for Arizona or 3 years for Wisconsin. Electronically scanned files are stored for 5 years as per NELAP, and additional 5 years as per Massachusetts, Hawaii and New York. All hard copies and electronic files for Asbestos test method are stored for 30 years.

4.2.13. Maintain a log of names, initials and signatures for all individuals responsible for signing or initialing any laboratory records is maintained by the QA group.

4.2.14. Writing or reviewing QA project specific plans.

4.2.15. Providing the staff with quality assurance information and updates.

4.2.16. Ensuring that all laboratory procedures currently in use are acceptable and will not compromise quality.

4.2.17. Where QA oversight is needed, the Quality Manager (or designee) functions independently from the laboratory operations. The Quality Manager evaluates data objectively and performs assessments without managerial influence. The Quality Manager may enlist the aid of various supervisors of the analytical groups in order to achieve these objectives. The Quality Manager and/or a designee should perform periodic audits of laboratory data or procedures to ensure that QA objectives are being met. The Quality Manager or designee must have a general knowledge of the analytical test methods for which the data review is performed and will arrange for or conduct annual internal audits per TNI-EL-V1M2-2009-4.1.7.1.e and 4.1.7.1.f.

4.2.17.1. Maintaining current certifications, licenses and accreditation materials. See section 3.9 for more information about certification.

4.3. STAFF RESPONSIBILITY

A comprehensive Quality Systems Program requires the involvement of all laboratory personnel. The level of involvement for each staff member is dependent upon his or her assignment within the laboratory. Laboratory analysts are responsible for quality control parameters that are done at the time of analysis. Laboratory management is responsible for monitoring and evaluating the results of the quality control procedures performed by the analysts.

The minimum level for qualifications, experience, and skills necessary for each position varies by job position. A list for each position is available in QA for review. The laboratory follows minimum requirements as per the EPA Drinking Water Manual and TNI Standards.

4.3.1. **Initial Training**

4.3.1.1. The objective for data generated by EEA is that the quality and consistency of the data produced be independent of the analyst performing the analysis. This can only occur when all analyses are performed using SOPs, and the analyst performing the procedure has been properly trained and has demonstrated proficiency with the analysis. This is accomplished at EEA by having a training checklist for each group or set of analyses within a group.

4.3.1.2. This checklist is followed for each trainee analyst by the group supervisor with the help of an assigned analyst mentor. The trainee is issued a set of training materials (i.e. safety information, SOP, Ethics SOP, method reference etc.) and is given hands-on training under the direct supervision of the mentor analyst or supervisor. Progress is monitored closely for the first three to six months by using frequent performance reviews, quality control check samples, performance audits and bench sheet reviews.

4.3.1.3. IDC Certification serves as a record of Authorization and Competence [TNI-EL-V1M2-2009-5.2.5][ISO/IEC 17025:2005(E)-5.2.5]. All Analysts, including contracted personnel when hired, are required to undergo the same training (IDC, MDL Studies, ability to achieve a low background, the precision and accuracy required by the method and satisfactory performance on a PT sample), and IDC Certificate of Competence [TNI-EL-V1M2-2009-5.2.1][ISO/IEC 17025:2005(E)-5.2.1]. A copy is filed in the analyst training record. Demonstration of Capability will also be done for analysts working as a unit. Examples are extraction analysts preparing the IDC and MDL samples and the prepared sample analyzed by the appropriate GC, GCMS, or HPLC analysts. IDC certification is completed for the group of analysts.

4.3.1.4. Initial training for a field sampling personnel is done through overall sampling procedure technique review and through duplicate samples for each new method and/or matrix that each of the field sampling personnel first performed.

For field sampling testing, DOC and MDL studies are performed initially and repeated at the frequency that the specific method requires.

4.3.2. On-going Training/Annual Competency Check

The laboratory performs an annual competency check for each analyst to ensure that each technical employee demonstrates an initial and ongoing proficiency for the tests performed by the technical employee.

On-going proficiency checks are conducted to ensure that the training of personnel is kept up-to-date by the following:

4.3.2.1. A certification that the technical personnel have read, understood and agreed to perform the most recent version of the test method (the approved method or standard operating procedure) and documentation of continued proficiency by at least one of the following once per year:

4.3.2.1.1. Acceptable performance of a blind sample (single blind to the analyst).

4.3.2.1.2. Another initial demonstration of method performance

4.3.2.1.3. Successful analysis of a blind performance sample on a similar test method using the same technology (e.g., GC/MS Volatiles by purge and trap for 524.2, 624 or 5030B/8260) would only require documentation for one of the test methods [TNI-EL-V1M3 to V1M4-ISO-2009]. The laboratory must determine the acceptable limits of the blind performance sample prior to analysis. The laboratory uses the Provider acceptable TNI limits of any blind PT sample that is used to document the annual proficiency documentation for each analyst.

4.3.2.1.4. At least four consecutive laboratory control samples with acceptable levels of precision and accuracy as per method specified precision and accuracy limits.

4.3.2.1.5. If the previous item cannot be performed, because spiking is not an option or QC samples not available, analysis of authentic samples that have been analyzed by another trained analyst with statistically identical results or analysis of Proficiency Test samples obtained from NIST approved providers can be done.

4.3.2.1.6. For specialized situations where extraction analysts have to do the sample preparation for LCS and MDL samples and the analyses of the prepared samples are done by the analysts belonging to another group, such as GC or GCMS areas, the group as a unit completes a Demonstration of Capability.

4.3.2.2. Evidence on file that demonstrates that each employee has read, understood, and is using the latest version of the laboratory's in-house SOP documentation and all other documentation, which relates to his/her job responsibilities.

4.3.2.3. Training courses or workshops on specific equipment, analytical techniques or laboratory procedures shall all be documented.

4.3.3. Training Records

A training file for each analyst and method is kept in the QA department along with a training history form completed at the inception of the present training program or at the time of employment. Each analyst's training file includes; a resume indicating the analyst's qualifications, experience, transcript of records, job description, and an initial demonstration of capability (IDC) and continuing demonstration of proficiency for each analyst. Up-to-date training records of courses in ethical and legal responsibilities, including potential punishments and penalties for violations, are kept in the QA department.

Figure 4-1 QM Signature Page

eurofins | Eaton Analytical

Quality Manual Signature Page

This is to certify that I have read and understood Eurofins Eaton Analytical's Quality Manual.

I further certify that I will comply with the laboratory procedures and practices described in the manual for the generation of high quality data.

If you know any deviations in the laboratory practices, please notify your supervisor or Quality Manager to evaluate if the said deviation adheres to good laboratory practices and affects data quality.

If you find errors in any section applicable to you, please notify your supervisor or Quality Manager to correct them appropriately. The Quality Manual will be revised annually to reflect current laboratory practices.

Signature:	________________	Date:	________________
Name (print):	________________		
QM – Rev. #:	35	Effective Date:	________________

QA FO 0020 (06/11/13)

Figure 4-2 SOP/Method Training Documentation Form

eurofins | Eaton Analytical

Laboratory SOP and Method Reference Training Documentation

I certify that I have read, understood and agreed to perform the techniques and procedures, including instrument calibration procedures if applicable, stated in the most recent version of the approved test method and the laboratory standard operating procedure.

SOP Title: ____________________

SOP ID: ____________________

SOP Revision No.: ____________________

Issue Date: ____________________

Effective Date: ____________________

EPA/SM Method Reference: ____________________

Method Revision No: ____________________

Method Date Revised: ____________________

Analyst Name (Print) ____________________

Analyst Signature ____________________

SOP Training Start Date ____________________

SOP Training Completion Date ____________________

Training Duration ____________________

Trainer Name(s): ____________________

Print:	Signature:	Date:
____________ Supervisor	____________	____________

QA FO 0013 (06/06/13)

Table 4-1 List of SOPs

SOP No.	Analytes	Method	Issue Date	Revision No.
Wet Chem 01	Cyanide Analysis by Ion Selective Electrode (ISE)	EPA 9012B/ SM 4500-CN F,G	4/13/2012	13.0
Wet Chem 02	Fluoride by Ion Selective Electrode	EPA 9214/ SM 4500-F B,C	11/21/2012	13.0
Wet Chem 03	Alkalinity	SM 2320B	6/7/2013	12.0
Wet Chem 04	Total Dissolved Solids (TDS) in water	SM 2540C	11/20/2012	17.0
Wet Chem 05	Total Suspended Solids (TSS) in water	SM 2540D	6/12/2013	8.0
Wet Chem 06	Turbidity - Nephelometric	EPA 180.1/ SM 2130B	6/10/2013	10.0
Wet Chem 07	Total Solids (TS) in Aqueous Sample	SM 2540B	6/12/2013	7.0
Wet Chem 09	Settleable Solids	SM 2540F	11/11/2011	6.0
Wet Chem 11	Color	SM 2120 B	11/11/2011	9.0
Wet Chem 12	Conductivity (EC)	EPA 120.1, 9050A/ SM 2510B	11/21/2012	11.0
Wet Chem 13	Cyanide (Reflux-Distillation) Midi Distillation	EPA 335.4	11/20/2012	11.0
Wet Chem 14	Orthophosphate, Total, Suspended and Dissolved	EPA 365.1/ SM 4500-P F	11/21/2012	8.0
Wet Chem 15	Odor	SM 2150	1/10/2012	9.0
Wet Chem 16	Determination of Perchlorate in Drinking Water using Ion Chromatography	EPA 314.0/ CADHS 300.0 Modified	11/21/2012	10.0
Wet Chem 17	Biochemical Oxygen Demand	SM 5210B	6/12/2013	15.0
Wet Chem 19	Phenolics and Phenolics-Low	EPA 420.1 / 420.4	9/3/2010	13.0
Wet Chem 21	Determination of Nitrate / Nitrite by Flow Injection Analysis	EPA 353.2	11/21/2012	12.0
Wet Chem 22	Total Kjedahl Nitrogen by Colorimetric Analysis follwing Semi-Automated Digestion	EPA 351.2	11/21/2012	12.0
Wet Chem 25	Determination of Anions and Inorganic Disinfectant By-Products by Ion Chromatography	EPA 300.0, 9056	11/21/2012	20.0
Wet Chem 26	Total Volatile Solids/Volatile Suspended Solids in Liquid	EPA 160.4	3/26/2012	8.0
Wet Chem 27	Ammonia as Nitrogen by Rapid Flow Analyzer (RFA)	EPA 350.1/ SM 4500-NH3 D,H	11/28/2012	12.0
Wet Chem 28	pH Value	EPA 9040B, 150.1/ SM 4500-H+B	11/21/2012	7.0
Wet Chem 31	Surfactants, Anionic (MBAS)	SM 5540 C	6/12/2013	8.0
Wet Chem 32	Total Organic Carbon and Dissolved Organic Carbon by UV/ Persulfate Oxidation	EPA 9060A/ SM 5310C	11/21/2012	13.0
Wet Chem 34	Analytical method for Ultraviolet Absorption of Organic constituents at 254 nm	SM 5910B	1/10/2012	6.0
Wet Chem 35	Sulfide Determination (Methylene Blue)	EPA 9030B, 9034/ SM 4500-S2-D	8/20/2010	7.0
Wet Chem 36	Chemical Oxygen Demand (COD)	EPA 410.4/ SM 5220D	11/21/2012	11.0
Wet Chem 37	Determination of Total Cyanide by Semi-Automated Colorimetry	EPA 335.4	4/9/2012	12.0
Wet Chem 38	Determination of Total Phosphate by Flow Injection Analysis Colorimetry	EPA 365.1/ SM 4500-PF	1/18/2012	7.0
Wet Chem 39	Langelier Index by Calculation	SM 2330B	11/21/2012	4.0
Wet Chem 40	Determination of Inorganic Anions and trace Bromate in Drinking Water using Ion Chromatography by the addition of a Post-column reagent and Absorbance Detector in Series with an Electrochemical Detector	EPA 300.1/EPA 317.0	2/8/2013	22.0
Wet Chem 42	Dissolved Organic Halogen: Adsorption-Pyrolysis-Titrimetric Method	SM 5320B	8/20/2010	13.0

SOP No.	Analytes	Method	Issue Date	Revision No.
Wet Chem 43	Dissolved Oxygen, Membrane Electrode	SM 4500 OG	11/11/2011	4.0
Wet Chem 48	Determination of Low Level Perchlorate in Drinking Water using Ion Chromatography	EPA 314.0	11/28/2012	5.0
Wet Chem 49	Determination of Dissolved Hexavalent Chromium in Drinking Water, Groundwater, and Industrial Wastewater Effluents by IC	EPA 218.6	11/28/2012	5.0
Wet Chem 53	A Simplified and Rapid Method for Biodegradable Dissolved Organic Carbon Measurement (BDOC)	N/A	11/11/2011	3.0
Wet Chem 54	Determination of EDTA & NTA in Water Using Ion Chromatography by the Addition of a Post-column Reagent and Absorbance Detector	Metrohm Method	7/7/2010	0.0
Wet Chem 55	Chlorate by 300.1	EPA 300.1	6/18/2013	4.0
Wet Chem 56	UCMR3 – Determination of Hexavalent Chromium in Drinking Water by Ion Chromatography with Post Column Derivatization and UV/VIS Detection	EPA 218.7	6/18/2013	4.0
Extract 03	Liquid - Solid Extraction	EPA 525.2	2/28/2013	16.0
Extract 04	Determination of Endothall in Drinking Water by Solid Phase Extraction	EPA 548.1	11/26/2012	12.0
Extract 05	Liquid-Solid Extraction of Diquat and Paraquat	EPA 549.2	11/26/2012	11.0
Extract 11	Extraction BNA Continuous Liquid-Liquid Extraction	EPA 8270 C	11/19/2012	13.0
Extract 16	Solid Phase Extraction of Phenols in Drinking Water	EPA 528	4/13/2012	3.0
Extract 17	Solid Phase Extraction of Explosives in Drinking Water	EPA 529	1/25/2012	2.0
Extract 18	Solid Phase Extraction of Selected Pesticides and Flame Retardants in Drinking Water	EPA 527	1/19/2012	4.0
Extract 19	Determination of Nitrosamines in Drinking Water by Solid Phase Extraction (SPE)	EPA 521	12/31/2012	3.0
Extract 20	Measurement of Chloroacetanilide and Other Acetamide Herbicide Degradates in Drinking Water by Solid Phase Extraction	EPA 535	12/31/2012	4.0
Extract 21	Determination of MCPA, MCPB and MCPP in Drinking Water by Solid Phase Extraction (SPE) Modified SM 555	EPA 555	4/13/2012	2.0
Extract 22	Liquid-Solid Extraction	EPA 526	7/31/2012	2.0
Extract 23	Determination of Phenylurea Compounds in Drinking Water by SPE	EPA 532	4/13/2012	2.0
Extract 24	EDC4 by Continuous Liquid-Liquid Extraction	EDC4	11/19/2012	3.0
Extract 25	Determination of Nitrosamines in Drinking Water by Liquid-Liquid Phase Extraction	EPA 521	11/19/2012	2.0
Extract 26	Extraction for Determination of 2,3,7,8-TCDD by Isotope Dilution in Drinking Water by Capillary Column Gas Chromatography with Large Volume Injection and Electron Ionization Tandem Mass Spectrometry (EI/MS/MS) Modified EPA 1613B	EPA 1613B	11/19/2012	2.0
Extract 27	Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction	EPA 522	6/18/2013	4.0
GC 03	EDB, DBCP and 1,2,3-TCP in water by Microextraction and Gas Chromatography	EPA 504.1	11/26/2012	14.0
GC 08	Chlorination Disinfection Byproducts and Chlorinated Organic Solvents by Liquid-Lquid Extraction and Gas Chromatography with Electron-Capture Detection	EPA 551.1	11/21/2012	20.0
GC 09	Haloacetic Acids	SM 6251 B	11/26/2012	17.0
GC 16	1,2,-Dibromoethane & 1,2-Dibromo-3-Chloropropane by Microextraction & Gas Chromatography	EPA 8011	11/26/2012	7.0
GC 27	Free and Total Chlorine Analysis and Chloramine Calculation	SM 4500-Cl-G	2/2/2012	8.0
GC 29	Formation of Trihalomethanes and other disinfection by-products. Modified Standard Method 5710 B and 5710D	SM 5710 B and SM 5710 D	8/20/2010	3.0
GC 33	Chlorine Dioxide Analysis	SM 4500-CLO2-D	2/2/2012	3.0
GC 34	Chlorinated Pesticides and PCBs	EPA 505	5/28/2013	13.0
GC 35	Chlorinated Acids in Drinking Water by Liquid-Liquid Extraction, Derivatization and Gas Chromatograph with Electron Capture Detection	EPA 515.4	11/26/2012	10.0

SOP No.	Analytes	Method	Issue Date	Revision No.
GC 36	Chlorine Demand. Modified Standard Method 2350B	SM 2350B	2/2/2012	2.0
GC 37	Aldehydes	EPA 556	2/11/2010	0.0
GC 38	Haloacetic Acids	EPA 552.3 Rev. 1.0	5/3/2010	0.0
GCMS 01	Volatile Organic Compounds in Drinking Water by GC/MS	EPA 524.2 (Modified)	6/7/2013	24.0
GCMS 01a	Determination of 1,2,3 Trichloropropane (TCP) in Drinking Water by Purge and Trap GC/MS in SIM Mode	EPA 524.2 (Modified)	11/21/2012	5.0
GCMS 01b	Determination of tert-Butanol, Epichlorohydrin, 1,2-Dichloropropane, 1,2,3-Trichloropropane and Cyanogen Chloride in Drinking Water by purge and trap GC/MS in SIM mode	EPA 524.2 (Modified)	11/21/2012	3.0
GCMS 02	Determination of Semivolatile Organic Compounds in Drinking Water by Gas Chromatography/Mass Spectrometry	EPA 525.2	6/7/2013	27.0
GCMS 03	Endothall Analysis by GCMS	EPA 548.1	6/7/2013	15.0
GCMS 04	Volatile Organic Compounds in Aqueous Matrix by GC/MS	EPA 624 (Modified)	10/24/2012	11.0
GCMS 05	Analysis of Semivolatile Organic Compounds by GCMS	EPA 625	9/16/2010	10.0
GCMS 07	Volatile Organic Compounds in Water by GC/MS	EPA 8260 B	11/21/2012	11.0
GCMS 08	Analysis of Semivolatile Organic Compounds by GCMS	EPA 8270 C	4/10/2012	9.0
GCMS 15	Determination of Selected Semivolatile Organic Compounds in Drinking Water by Solid Phase Extractions and Capillary Column GCMS	EPA 526	9/16/2010	5.0
GCMS 16	Determination of Phenols in Drinking Water by Capillary Column GCMS	EPA 528 Soda	8/20/2010	4.0
GCMS 17	Taste and Odor Analytes by Solid Phase Micro-Extraction and GCMS	SM 6040D	2/1/2013	5.0
GCMS 20	Determination of Nitrosamines in Drinking Water by Capillary Column GC with Large Volume Injection and Chemical Ionization Trap Mass Spectrometry	EPA 521	3/21/2013	4.0
GCMS 21	Determination of Explosives and Related Compounds in Drinking Water by Solid Phase Extractions and Capillary Column GCMS	EPA 529	9/3/2010	3.0
GCMS 22	Determination of Endocrine Disruptor Chemicals in Wastewater by GCMS Method 4	EDC 4SCR	9/16/2010	3.0
GCMS 23	Determination of Selected Pesticides and Flame Retardants in Drinking Water by Solid Phase Extraction and Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS)	EPA 527	9/3/2010	3.0
GCMS 24	Determination of 2,3,7,8-TCDD in Drinking Water by Capillary Column Gas Chromatography with Large Volume Injection and Electron Ionization Tandem Mass Spectrometry (EI/MS/MS)	EPA 1613B (Modified)	6/7/2013	2.0
GCMS 25	Determination of Galaxolide in Wastewater Using USGS Endocrine Disrupter Chemicals Method 4 by Gas Chromatograph/Tandem Mass Spectrometry	Galaxolide	4/23/2010	0.0
GCMS 26	Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction with GCMS with Selected Ion Monitoring (SIM)	EPA 522	6/18/2013	4.0
GCMS 27	Volatile Organic Compounds in Drinking Water by GC/MS	EPA 524.3	6/18/2013	4.0
HPLC 02	Glyphosate Analysis in Drinking Water by High Performance Liquid Chromatography (HPLC)	EPA 547	11/21/2012	15.0
HPLC 03	Diquat and Paraquat Analysis in Drinking Water by HPLC	EPA549.2	6/7/2013	16.0
HPLC 05	Carbamates Analysis in Drinking Water by HPLC with post column derivatization	EPA 531.2	11/26/2012	7.0
HPLC 06	Determination of Phenylurea Compounds in Drinking water by Solid Phase Extraction and HPLC with UV Detection	EPA 532	11/21/2012	4.0
HPLC 07/ LCMS 01	Determination of Perchlorate in Drinking Water by Liquid Chromatography/Electrospray Ionization Tandem Mass Spectrometry	EPA 331	2/8/2013	4.0
HPLC 08	Analysis of MCPA, MCPB and MCPP in Drinking Water by HPLC	EPA 555	11/15/2012	4.0
HPLC 09	Measurement of Chloroacetanilide and other Acetamide Herbicide Degradates in Drinking Water by Solid Phase Extraction (SPE) and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)	EPA 535	8/19/2010	4.0
HPLC 10/ LCMS 02	Determination of Acrylamide in Drinking Water by Liquid Chromatography Electrospray Ionization/Mass Spectrometry	Acrylamide	8/27/2010	1.0
HPLC 11/ LCMS 03	Determination of Emerging Organic Pollutants in Environmental Matrices by Liquid Chromatography Mass Spectrometry in Tandem Analysis (LC/MS/MS)	EDC 2	8/27/2010	1.0

SOP No.	Analytes	Method	Issue Date	Revision No.
HPLC 12/ LCMS 04	Determination of Perfluorinated Pollutants in Environmental Matrices by Online Solid-Phase Extraction (SPE) coupled with HPLC/MS in Tandem	PFC	4/2/2010	4.0
HPLC 13/ LCMS 05	Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)	EPA 537	11/15/2012	5.0
HPLC 14/ LCMS 06	The Determination of Personal Care Products, Pharmaceutical (PPCP) and Endocrine Disrupters Compounds (EDC), Herbicide and Degradates in Environmental Matrices by Online Solid-Phase Extraction Coupled with High-Performance Liquid Chromatography/Mass Spectrometry in Tandem	PPCP	4/23/2010	0.0
HPLC 16/LCMS 07	Determination of Hormones in Drinking Water by Solid Phase Extraction (SPE) and Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry (LC-ESI-MS/MS)	EPA 539	6/18/2013	4.0
LCMS 08	Determination of Iodide and Iodate in Drinking Water by Liquid Chromatography/Electrospray Ionization Tandem Mass Spectrometry			
LCMS 11	Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)	UCMR3 537	6/18/2013	0.0
Met 01	Analysis of Trace Elements by ICP Emission Spectroscopy	ICP, EPA 200.7, 6010B, 6020A	11/19/2012	20.0
Met 02	Trace Metals by ICP/MS	ICP/MS, EPA 200.8, 6020A	6/7/2013	30.0
Met 04a	Mercury by Cold Vapor Atomic Absorption	SW846 Method 7470, EPA 245.1, 7470A	11/19/2012	19.0
Met 19	Hexavalent Chromium, Colorimetric Method	EPA 7196 A / SM 3500 CR-B /SM3500 CR -D	11/19/2012	11.0
Met 26	Silica by the Molybdosilicate Method	SM 4500-SiO2C	8/19/2010	5.0
Met 27	Hardness by Calculation	EPA 200.7/ SM 2340B	11/21/2012	7.0
Met 28	pH / Turbidity Check for Metals	pH paper/180.1	11/21/2012	4.0
Met 30	Heated Block Metals Digestion	EPA 200.7, 200.8, 6020A	11/15/12	11.0
Met 31	UCMR3 TRACE METALS ANALYSIS BY ICP/MS	EA 200.8	6/18/2013	2.0
Micro 01	Determination of Asbestos Fibers in Water	EPA 100.2	11/26/2012	19.0
Micro 02	Assimilable Organic Carbon Biossay	SM 9217 B	12/20/2011	8.0
Micro 05	Determination of Coliform in drinking water by the ONPG-MUG Method (Colilert)	SM 9223 B	1/10/2012	23.0
Micro 06	Determination of Total and Fecal Coliforms in water, wastewater and soil by Multiple Tube Fermentation Technique	SM 9221	1/10/2012	19.0
Micro 09	Determination of Fecal Streptococci and enterococci in water, wastewater and soil	SM 9230B	12/20/2011	12.0
Micro 11	Heterotrophic Plate Count	SM 9215 A, B	4/16/2012	12.0
Micro 13	Microscopic Particulate Analysis	EPA 910/9-92-029	7/1/2013	11.0
Micro 16	Determination of Coliforms in Water by the CPRG-MUG Method / Colisure	SM 9223	12/20/2011	10.0
Micro 17	Determination of Escherichia Coli in water and wastewater by Multiple Tube Fermentation Technique	SM 9221 F	12/20/2011	10.0
Micro 19	Water Suitability Test	SM 9020B	1/10/2012	7.0
Micro 20	Inhibitory Residues	SM 9020B	1/10/2012	8.0
Micro 21	Microbiology Demonstration of Capability	N/A	1/26/2012	4.0
Micro 23	Male-specific (F+) and Somatic Coliphage in water by Single Agar Layer (SAL) Procedure	EPA 1602 April 2001	1/26/2012	3.0
Micro 24	pH Check of Clean Glassware Using Bromthymol Blue	SM 9020B	1/26/2012	4.0
Micro 26	Determination of Coliforms in Drinking Water by the 18 Hour ONPG-MUG Method	SM 9223B	3/14/2012	5.0
Micro 27	Microcystin by ELISA analysis	USEPA Region 9 SOP	4/16/2012	1.0
Micro 28	Determination of Yeast and Mold in Water	Standard Methods, 21st Ed. (2005) Section 9610 D	4/16/2012	0.0

SOP No.	Analytes	Method	Issue Date	Revision No.
Micro 29	Algae Enumeration and Identification	SM 10200 F, SM 10900 C	8/23/2012	1.0
Micro 30	Cylindrospermopsin		11/1/2012	0.0
Micro 31	Saxitoxin		8/23/2012	0.0
Micro 32	Heterotrophic Plate Count - MF	Coca Cola, SM 9215A,D	6/26/2013	0.0
Micro 33	DETERMINATION OF PSEUDOMONAS AERUGINOSA IN DRINKING WATER BY THE PSEUDALERT METHOD	IDEXX Pseudalert/ IDEXX Quanti-Tray/2000		0.0
Micro Colton 1	Determination of Coliform in drinking water by the ONPG-MUG Method	SM 9223 B	12/22/2011	3.0
Micro Colton 2	Determination of Coliforms in Drinking Water by the 18-hr ONPG-MUG Method	SM 9223B	12/22/2011	3.0
Micro Colton 3	Determination of Coliforms in Water by the CPRG-MUG Method / Colisure	SM 9223	12/22/2011	3.0
Micro Colton 4	Determination of Coliform in water by Multiple Tube Fermentation Technique	SM 9221	12/22/2011	3.0
Micro Colton 5	Heterotrophic plate count	SM 9215 A, B	12/20/2011	3.0
Non Method 01	Sample Receiving and Log In	N/A	2/11/2013	22.0
Non Method 02	Chain of Custody	N/A	2/11/2013	11.0
Non Method 03	Preparation and Shipment of Sample Kits	N/A	2/11/2013	5.0
Non Method 04	Hazardous Waste Management and Sample Disposal Procedures	N/A	6/18/2013	9.0
Non Method 05	Laboratory Ethics/Data Integrity Plan	N/A	8/28/2012	9.0
Non Method 06	Environmental Monitoring for Microbiological Contaminants	N/A	2/11/2013	8.0
Non Method 07	Standards and Reagent Preparation, Documentation, and Labeling	N/A	2/11/2013	10.0
Non Method 08	Compositing and Subsampling in the Laboratory	N/A	2/2/2012	6.0
Non Method 11	Balance Maintenance	N/A	2/11/2013	8.0
Non Method 12	Manual Integration	N/A	2/11/2013	9.0
Non Method 13	Retention of Significant figures	N/A	2/11/2013	7.0
Non Method 14	Instrument Maintenance	N/A	2/11/2013	8.0
Non Method 15	Use of Class A glassware	N/A	2/11/2013	7.0
Non Method 16	Glassware Cleaning	N/A	1/25/2012	5.0
Non Method 19	Temperature Monitoring and Thermometer Calibration	N/A	2/1/2012	4.0
Non Method 20	Handling and Disposal of Foreign Soil Samples	N/A	2/9/2010	4.0
Non Method 22	States Certification & Performance Tests Requirements	N/A	4/23/2012	4.0
Non Method 23	Calibration	N/A	11/26/2012	0.0
Non Method 24	Handling of Controlled Substances	N/A	3/8/2013	2.0
Rad 02	Radon by Liquid Scintillation Counter	SM 7500-Rn	6/7/2013	10.0
Rad 06	Gross alpha and beta Radioactivity	EPA 900.0	6/7/2013	18.0
Rad 09	Ra-226 and Ra-228 by Gamma-Ray Spectrometry Using HPGE Detector	GA Tech	6/7/2013	4.0
UCMR3 PresCheck1	Standardized Procedure for pH, Free Chlorine, and Total Chlorine Checks for UCMR3 Samples	N/A	2/15/2013	1.0

Note: The most current SOP list is available in the QA Department for review.

Table 4-2 Other Certifications

#	AGENCY	LAB ID	EXPIRATION DATE
1	LACSD	10249	-------
2	Radioactive Material License	3069-19	March 15, 2020
3	Soil Permit	S-65114	February 26, 2013
4	CUPA Consolidate Permit/License to Operate	AR0036980	June 30, 2013
5	Drug Enforcement Administration (DEA)	RE0438158	August 31, 2013

The most current licenses are available in the QA Department for review.

Figure 4-3 State of California Accreditation

NELAP - RECOGNIZED

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF NELAP ACCREDITATION

Is hereby granted to

Eurofins Eaton Analytical, Inc. (former M.W.H.)

750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016

Scope of the Certificate is limited to the
"NELAP Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **01114CA**

Expiration Date: **1/31/2014**

Effective Date: **2/1/2013**

Richmond, California
subject to forfeiture or revocation

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

Figure 4-4 List of California Accredited Analytes

State of California—Health and Human Services Agency
California Department of Public Health

RON CHAPMAN, MD, MPH
Director & State Health Officer

EDMUND G. BROWN JR.
Governor

January 9, 2013

Ed Wilson
Eurofins Eaton Analytical, Inc. (former M.W.H.)
750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016

Dear Ed Wilson:

Certificate No. 01114CA

This is to advise you that the laboratory named above has been accredited under National Environmental Laboratory Accreditation Program (NELAP) as an environmental testing laboratory pursuant to the provisions of the Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100825, *et seq.*

The Fields of Accreditation for which this laboratory has been accredited are enclosed. The certificate shall remain in effect until **January 31, 2014** unless revoked by California Environmental Laboratory Accreditation Program Branch (ELAPB) or withdrawn at your written request. To maintain accreditation, the laboratory shall comply with the National Environmental Laboratory Accreditation Conference (NELAC) Standards and all associated California ELAPB regulations and statutes.

The application for renewal of this certificate must be received before the expiration date of this certificate to remain in force according to the HSC 100847(a).

Please note that your laboratory is required to notify California ELAPB of any major changes in key accreditation criteria within 30 calendar days of the change. This written notification includes, but is not limited to, changes in ownership, location, key personnel, and major instrumentation (HSC 100847(b), (c), (d), and NELAC Standard Section 4.3.2). The certificate must be returned to California ELAPB upon loss of accredited status.

Your continued cooperation with the above requirements is essential for maintaining the high quality of the data produced by environmental laboratories accredited by the State of California.

If you have any questions, please contact Bill Walker at (818) 551-2012.

Sincerely,

for
David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

Enclosure

NELAP RECOGNIZED

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH
NELAP Fields of Accreditation

Eurofins Eaton Analytical, Inc. (former M.W.H.)
750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016
Phone: (626) 386-1100

Certificate No.: 01114CA
Renew Date: 1/31/2014

101 - Microbiology of Drinking Water

101.010	001	SM9215B	Heterotrophic Bacteria
101.020	001	SM9221A,B	Total Coliform
101.021	001	SM9221E (MTF/EC)	Fecal Coliform
101.022	001	CFR 141.21(f)(6)(i) (MTF/EC+MUG)	E. coli
101.060	002	SM9223	Total Coliform
101.060	003	SM9223	E. coli
101.070	002	Colisure	Total Coliform
101.070	003	Colisure	E. coli
101.120	001	SM9221A,B,C	Total Coliform (Enumeration)
101.130	001	SM9221E (MTF/EC)	Fecal Coliform (Enumeration)
101.160	001	SM9223	Total Coliform (Enumeration)
101.200	001	SM9223B	E. coli (Enumeration)
101.210	001	SM9221B.1/SM9221F	E. coli (Enumeration)

102 - Inorganic Chemistry of Drinking Water

102.020	001	EPA 180.1	Turbidity
102.022	001	SM2130B	Turbidity
102.030	001	EPA 300.0	Bromide
102.030	002	EPA 300.0	Chlorate
102.030	003	EPA 300.0	Chloride
102.030	004	EPA 300.0	Chlorite
102.030	005	EPA 300.0	Fluoride
102.030	006	EPA 300.0	Nitrate
102.030	007	EPA 300.0	Nitrite
102.030	010	EPA 300.0	Sulfate
102.040	001	EPA 300.1	Bromide
102.040	002	EPA 300.1	Chlorite
102.040	003	EPA 300.1	Chlorate
102.040	004	EPA 300.1	Bromate
102.045	001	EPA 314.0	Perchlorate
102.047	001	EPA 331.0	Perchlorate
102.050	001	EPA 335.4	Cyanide
102.060	001	EPA 353.2	Nitrate calc.

As of 1/9/2013 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

Eurofins Eaton Analytical, Inc. (former M.W.H.)

Certificate No.: 01114CA
Renew Date: 1/31/2014

102.061	001	EPA 353.2	Nitrite
102.070	001	EPA 365.1	Phosphate, Ortho
102.100	001	SM2320B	Alkalinity
102.110	001	SM2330B	Corrosivity (Langlier Index)
102.120	001	SM2340D	Hardness
102.130	001	SM2510B	Conductivity
102.140	001	SM2540C	Total Dissolved Solids
102.163	001	SM4500-Cl G	Chlorine, Free and Total
102.180	001	SM4500-ClO2 D	Chlorine Dioxide
102.191	001	SM4500-CN F	Cyanide, Total
102.192	001	SM4500-CN G	Cyanide, amenable
102.200	001	SM4500-F C	Fluoride
102.210	001	SM4500-H+ B	pH
102.212	001	EPA 150.1	pH
102.240	001	SM4500-P E	Phosphate, Ortho
102.262	001	SM5310C	Total Organic Carbon
102.263	001	SM5310C	DOC
102.263	002	SM5310C	TOC/DOC
102.267	001	SM5310C-OO	TOC/DOC
102.270	001	SM5540C	Surfactants
102.280	001	SM5910B	UV254
102.520	001	EPA 200.7	Calcium
102.520	002	EPA 200.7	Magnesium
102.520	003	EPA 200.7	Potassium
102.520	004	EPA 200.7	Silica
102.520	005	EPA 200.7	Sodium
102.520	006	EPA 200.7	Hardness (calc.)
102.533	002	SM4500-Si D	Silica
102.542	002	SM4500-SiO2 C	Silica
102.545	001	EPA 317.0	Bromate
102.545	003	EPA 317.0	Chlorite
102.551	002	SM4500-Cl G	Chlorine, Free, Combined, Total
102.558	001	SM4500-Cl G-OO	Chlorine, Free, Combined, Total

103 - Toxic Chemical Elements of Drinking Water

103.130	001	EPA 200.7	Aluminum
103.130	003	EPA 200.7	Barium
103.130	004	EPA 200.7	Beryllium
103.130	005	EPA 200.7	Cadmium
103.130	007	EPA 200.7	Chromium
103.130	008	EPA 200.7	Copper

As of 1/9/2013 , this list supersedes all previous lists for this certificate number.
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103.130	009	EPA 200.7	Iron
103.130	011	EPA 200.7	Manganese
103.130	012	EPA 200.7	Nickel
103.130	015	EPA 200.7	Silver
103.130	017	EPA 200.7	Zinc
103.140	001	EPA 200.8	Aluminum
103.140	002	EPA 200.8	Antimony
103.140	003	EPA 200.8	Arsenic
103.140	004	EPA 200.8	Barium
103.140	005	EPA 200.8	Beryllium
103.140	006	EPA 200.8	Cadmium
103.140	007	EPA 200.8	Chromium
103.140	008	EPA 200.8	Copper
103.140	009	EPA 200.8	Lead
103.140	010	EPA 200.8	Manganese
103.140	012	EPA 200.8	Nickel
103.140	013	EPA 200.8	Selenium
103.140	014	EPA 200.8	Silver
103.140	015	EPA 200.8	Thallium
103.140	016	EPA 200.8	Zinc
103.160	001	EPA 245.1	Mercury
103.301	001	EPA 100.2	Asbestos
103.310	001	EPA 218.6	Chromium (VI)

104 - Volatile Organic Chemistry of Drinking Water

104.030	001	EPA 504.1	1,2-Dibromoethane
104.030	002	EPA 504.1	1,2-Dibromo-3-chloropropane
104.030	003	EPA 504.1	1,2,3-Trichloropropane
104.040	000	EPA 524.2	Volatile Organic Compounds
104.040	001	EPA 524.2	Benzene
104.040	002	EPA 524.2	Bromobenzene
104.040	003	EPA 524.2	Bromochloromethane
104.040	006	EPA 524.2	Bromomethane
104.040	007	EPA 524.2	n-Butylbenzene
104.040	008	EPA 524.2	sec-Butylbenzene
104.040	009	EPA 524.2	tert-Butylbenzene
104.040	010	EPA 524.2	Carbon Tetrachloride
104.040	011	EPA 524.2	Chlorobenzene
104.040	012	EPA 524.2	Chloroethane
104.040	014	EPA 524.2	Chloromethane
104.040	015	EPA 524.2	2-Chlorotoluene

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104.040	016	EPA 524.2	4-Chlorotoluene
104.040	018	EPA 524.2	Dibromomethane
104.040	019	EPA 524.2	1,3-Dichlorobenzene
104.040	020	EPA 524.2	1,2-Dichlorobenzene
104.040	021	EPA 524.2	1,4-Dichlorobenzene
104.040	022	EPA 524.2	Dichlorodifluoromethane
104.040	023	EPA 524.2	1,1-Dichloroethane
104.040	024	EPA 524.2	1,2-Dichloroethane
104.040	025	EPA 524.2	1,1-Dichloroethene
104.040	026	EPA 524.2	cis-1,2-Dichloroethene
104.040	027	EPA 524.2	trans-1,2-Dichloroethene
104.040	028	EPA 524.2	Dichloromethane
104.040	029	EPA 524.2	1,2-Dichloropropane
104.040	030	EPA 524.2	1,3-Dichloropropane
104.040	031	EPA 524.2	2,2-Dichloropropane
104.040	032	EPA 524.2	1,1-Dichloropropene
104.040	033	EPA 524.2	cis-1,3-Dichloropropene
104.040	034	EPA 524.2	trans-1,3-Dichloropropene
104.040	035	EPA 524.2	Ethylbenzene
104.040	036	EPA 524.2	Hexachlorobutadiene
104.040	037	EPA 524.2	Isopropylbenzene
104.040	038	EPA 524.2	4-Isopropyltoluene
104.040	039	EPA 524.2	Naphthalene
104.040	040	EPA 524.2	Nitrobenzene
104.040	041	EPA 524.2	N-propylbenzene
104.040	042	EPA 524.2	Styrene
104.040	043	EPA 524.2	1,1,1,2-Tetrachloroethane
104.040	044	EPA 524.2	1,1,2,2-Tetrachloroethane
104.040	045	EPA 524.2	Tetrachloroethene
104.040	046	EPA 524.2	Toluene
104.040	047	EPA 524.2	1,2,3-Trichlorobenzene
104.040	048	EPA 524.2	1,2,4-Trichlorobenzene
104.040	049	EPA 524.2	1,1,1-Trichloroethane
104.040	050	EPA 524.2	1,1,2-Trichloroethane
104.040	051	EPA 524.2	Trichloroethene
104.040	052	EPA 524.2	Trichlorofluoromethane
104.040	053	EPA 524.2	1,2,3-Trichloropropane
104.040	054	EPA 524.2	1,2,4-Trimethylbenzene
104.040	055	EPA 524.2	1,3,5-Trimethylbenzene
104.040	056	EPA 524.2	Vinyl Chloride

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104.040	067	EPA 524.2	Xylenes, Total
104.040	058	EPA 524.2	Hexachloroethane
104.045	001	EPA 524.2	Bromodichloromethane
104.045	002	EPA 524.2	Bromoform
104.045	003	EPA 524.2	Chloroform
104.045	004	EPA 524.2	Dibromochloromethane
104.045	005	EPA 524.2	Trihalomethanes
104.050	002	EPA 524.2	Methyl tert-butyl Ether (MTBE)
104.050	004	EPA 524.2	tert-Amyl Methyl Ether (TAME)
104.050	005	EPA 524.2	Ethyl tert-butyl Ether (ETBE)
104.050	006	EPA 524.2	Trichlorotrifluoroethane
104.050	011	EPA 524.2	Oxygenates
104.055	001	EPA 524.3	Benzene
104.055	002	EPA 524.3	Carbon Tetrachloride
104.055	003	EPA 524.3	Chlorobenzene
104.055	004	EPA 524.3	1,2-Dichlorobenzene
104.055	005	EPA 524.3	1,4-Dichlorobenzene
104.055	006	EPA 524.3	1,2-Dichloroethane
104.055	007	EPA 524.3	cis-1,2-Dichloroethene
104.055	008	EPA 524.3	trans-1,2-Dichloroethene
104.055	009	EPA 524.3	Dichloromethane
104.055	010	EPA 524.3	1,2-Dichloropropane
104.055	011	EPA 524.3	Ethylbenzene
104.055	012	EPA 524.3	Styrene
104.055	013	EPA 524.3	Tetrachloroethene
104.055	014	EPA 524.3	1,1,1-Trichloroethane
104.055	015	EPA 524.3	Trichloroethene
104.055	016	EPA 524.3	Toluene
104.055	017	EPA 524.3	1,2,4-Trichlorobenzene
104.055	018	EPA 524.3	1,1-Dichloroethene
104.055	019	EPA 524.3	1,1,2-Trichloroethane
104.055	020	EPA 524.3	Vinyl Chloride
104.055	021	EPA 524.3	Xylenes, Total
104.055	022	EPA 524.3	1,2-Dibromo-3-chloropropane
104.055	023	EPA 524.3	1,2-Dibromoethane
104.055	024	EPA 524.3	Trihalomethanes, Total

105 - Semi-volatile Organic Chemistry of Drinking Water

105.010	001	EPA 505	Aldrin
105.010	002	EPA 505	Alachlor
105.010	004	EPA 505	Chlordane

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105.010	005	EPA 505	Dieldrin
105.010	006	EPA 505	Endrin
105.010	007	EPA 505	Heptachlor
105.010	008	EPA 505	Heptachlor Epoxide
105.010	011	EPA 505	Lindane
105.010	012	EPA 505	Methoxychlor
105.010	014	EPA 505	Toxaphene
105.010	015	EPA 505	PCBs as Aroclors (screen)
105.010	016	EPA 505	PCB-1016
105.010	017	EPA 505	PCB-1221
105.010	018	EPA 505	PCB-1232
105.010	019	EPA 505	PCB-1242
105.010	020	EPA 505	PCB-1248
105.010	021	EPA 505	PCB-1254
105.010	022	EPA 505	PCB-1260
105.083	001	EPA 515.4	2,4-D
105.083	002	EPA 515.4	Dinoseb
105.083	003	EPA 515.4	Pentachlorophenol
105.083	004	EPA 515.4	Picloram
105.083	005	EPA 515.4	2,4,5-TP
105.083	006	EPA 515.4	Dalapon
105.083	007	EPA 515.4	Bentazon
105.083	008	EPA 515.4	Dicamba
105.083	009	EPA 515.4	Chlorinated Acids
105.090	001	EPA 525.2	Alachlor
105.090	002	EPA 525.2	Aldrin
105.090	003	EPA 525.2	Atrazine
105.090	004	EPA 525.2	Benzo(a)pyrene
105.090	005	EPA 525.2	Butachlor
105.090	006	EPA 525.2	Chlordane
105.090	007	EPA 525.2	Dieldrin
105.090	008	EPA 525.2	Di(2-ethylhexyl) Adipate
105.090	009	EPA 525.2	Di(2-ethylhexyl) Phthalate
105.090	010	EPA 525.2	4,4'-DDD
105.090	011	EPA 525.2	4,4'-DDE
105.090	012	EPA 525.2	4,4'-DDT
105.090	013	EPA 525.2	Endrin
105.090	014	EPA 525.2	Heptachlor
105.090	015	EPA 525.2	Heptachlor Epoxide
105.090	016	EPA 525.2	Hexachlorobenzene

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105.090	017	EPA 525.2	Hexachlorocyclopentadiene
105.090	018	EPA 525.2	Lindane
105.090	019	EPA 525.2	Methoxychlor
105.090	020	EPA 525.2	Metolachlor
105.090	021	EPA 525.2	Metribuzin
105.090	022	EPA 525.2	Molinate
105.090	023	EPA 525.2	Pentachlorophenol
105.090	024	EPA 525.2	Propachlor
105.090	025	EPA 525.2	Simazine
105.090	030	EPA 525.2	Adipates
105.090	031	EPA 525.2	Phthalates
105.090	034	EPA 525.2	Pesticides
105.101	001	EPA 531.2	Carbofuran
105.101	002	EPA 531.2	Oxamyl
105.101	003	EPA 531.2	Aldicarb
105.101	004	EPA 531.2	Aldicarb Sulfone
105.101	005	EPA 531.2	Aldicarb Sulfoxide
105.101	006	EPA 531.2	Carbaryl
105.101	007	EPA 531.2	3-Hydroxycarbofuran
105.101	008	EPA 531.2	Methomyl
105.120	001	EPA 547	Glyphosate
105.140	001	EPA 548.1	Endothall
105.150	001	EPA 549.2	Diquat
105.170	001	EPA 551.1	Bromochloroacetonitrile
105.170	005	EPA 551.1	Chloral Hydrate
105.170	007	EPA 551.1	Chloropicrin
105.170	008	EPA 551.1	Dibromoacetonitrile
105.170	010	EPA 551.1	1,2-Dibromo-3-chloropropane
105.170	011	EPA 551.1	1,2-Dibromoethane
105.170	012	EPA 551.1	Dichloroacetonitrile
105.170	013	EPA 551.1	1,1-Dichloro-2-propanone
105.170	015	EPA 551.1	Trichloroacetonitrile
105.170	018	EPA 551.1	1,1,1-Trichloro-2-propanone
105.175	001	EPA 551.1	Bromodichloromethane
105.175	002	EPA 551.1	Bromoform
105.175	003	EPA 551.1	Chloroform
105.175	004	EPA 551.1	Dibromochloromethane
105.175	005	EPA 551.1	Trihalomethanes
105.190	001	SM6251B	Bromoacetic Acid
105.190	002	SM6251B	Bromochloroacetic Acid

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105.190	003	SM6251B	Chloroacetic Acid
105.190	005	SM6251B	Dibromoacetic Acid
105.190	006	SM6251B	Dichloroacetic Acid
105.190	007	SM6251B	Trichloroacetic Acid
105.190	008	SM6251B	Haloacetic Acids (HAA5)
105.191	001	SM6251B (20th)	Haloacetic Acids (HAA5)
105.201	001	EPA 552.3	Haloacetic Acids (HAA5)
105.201	002	EPA 552.3	Dalapon
105.230	001	EPA 1613	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
106 - Radiochemistry of Drinking Water			
106.010	001	EPA 900.0	Gross Alpha
106.010	002	EPA 900.0	Gross Beta
106.060	001	EPA 904.0	Radium-228
106.092	001	EPA 200.8	Uranium
106.270	001	SM7110C	Gross Alpha
106.610	001	SM7500-Rn	Radon-222
106.651	001	Georgia Inst. of Tech. rev 1.2	Radium-226
106.651	002	Georgia Inst. of Tech. rev 1.2	Radium-228
107 - Microbiology of Wastewater			
107.010	001	SM9215B	Heterotrophic Bacteria
107.020	001	SM9221B	Total Coliform
107.030	001	SM9221B	Total Coliform with Chlorine Present
107.040	001	SM9221C,E (MTF/EC)	Fecal Coliform
107.050	001	SM9221E	Fecal Coliform with Chlorine Present
107.100	001	SM9230B	Fecal Streptococci
107.100	002	SM9230B	Enterococci
107.245	001	SM9223	E. coli
108 - Inorganic Chemistry of Wastewater			
108.020	001	EPA 120.1	Conductivity
108.090	001	EPA 160.4	Residue, Volatile
108.110	001	EPA 180.1	Turbidity
108.112	001	EPA 200.7	Boron
108.112	002	EPA 200.7	Calcium
108.112	003	EPA 200.7	Hardness (calc.)
108.112	004	EPA 200.7	Magnesium
108.112	005	EPA 200.7	Potassium
108.112	006	EPA 200.7	Silica
108.112	007	EPA 200.7	Sodium
108.120	001	EPA 300.0	Bromide

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108.120	002	EPA 300.0	Chloride
108.120	003	EPA 300.0	Fluoride
108.120	004	EPA 300.0	Nitrate
108.120	005	EPA 300.0	Nitrite
108.120	006	EPA 300.0	Nitrate-nitrite
108.120	008	EPA 300.0	Sulfate
108.183	001	EPA 335.4	Cyanide, Total
108.200	001	EPA 350.1	Ammonia
108.211	001	EPA 351.2	Kjeldahl Nitrogen
108.232	001	EPA 353.2	Nitrate-nitrite
108.232	002	EPA 353.2	Nitrite
108.260	001	EPA 365.1	Phosphate, Ortho
108.261	001	EPA 365.1	Phosphorus, Total
108.323	001	EPA 410.4	Chemical Oxygen Demand
108.360	001	EPA 420.1	Phenols, Total
108.362	001	EPA 420.4	Phenols, Total
108.385	001	SM2120B	Color
108.390	001	SM2130B	Turbidity
108.410	001	SM2320B	Alkalinity
108.420	001	SM2340B	Hardness (calc.)
108.430	001	SM2510B	Conductivity
108.440	001	SM2540B	Residue, Total
108.441	001	SM2540C	Residue, Filterable
108.442	001	SM2540D	Residue, Non-filterable
108.443	001	SM2540F	Residue, Settleable
108.465	001	SM4500-Cl G	Chlorine
108.473	001	SM4500-CN G	Cyanide, amenable
108.474	001	SM4500-CN F	Cyanide, Total
108.480	001	SM4500-F C	Fluoride
108.483	001	SM4500-F B	Fluoride
108.490	001	SM4500-H+ B	pH
108.493	001	SM4500-NH3 D or E (19th/20th)	Ammonia
108.498	001	SM4500-NH3 H (18th)	Ammonia
108.531	001	SM4500-O G	Dissolved Oxygen
108.540	001	SM4500-P E	Phosphate, Ortho
108.541	001	SM4500-P E	Phosphorus, Total
108.550	001	SM4500-Si D (18th/19th)	Dissolved Silica
108.551	001	SM4500-SiO2 C (20th)	Silica
108.580	001	SM4500-S= D	Sulfide
108.590	001	SM5210B	Biochemical Oxygen Demand

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108.591	001	SM5210B	Carbonaceous BOD
108.602	001	SM5220D	Chemical Oxygen Demand
108.611	001	SM5310C	Total Organic Carbon
108.620	001	SM5320B	Total Organic Halides
108.640	001	SM5540C	Surfactants

109 - Toxic Chemical Elements of Wastewater

109.002	001	EPA 100.2	Asbestos
109.010	001	EPA 200.7	Aluminum
109.010	002	EPA 200.7	Antimony
109.010	004	EPA 200.7	Barium
109.010	005	EPA 200.7	Beryllium
109.010	007	EPA 200.7	Cadmium
109.010	009	EPA 200.7	Chromium
109.010	010	EPA 200.7	Cobalt
109.010	011	EPA 200.7	Copper
109.010	012	EPA 200.7	Iron
109.010	013	EPA 200.7	Lead
109.010	015	EPA 200.7	Manganese
109.010	016	EPA 200.7	Molybdenum
109.010	017	EPA 200.7	Nickel
109.010	021	EPA 200.7	Silver
109.010	024	EPA 200.7	Tin
109.010	026	EPA 200.7	Vanadium
109.010	027	EPA 200.7	Zinc
109.020	001	EPA 200.8	Aluminum
109.020	002	EPA 200.8	Antimony
109.020	003	EPA 200.8	Arsenic
109.020	004	EPA 200.8	Barium
109.020	005	EPA 200.8	Beryllium
109.020	006	EPA 200.8	Cadmium
109.020	007	EPA 200.8	Chromium
109.020	008	EPA 200.8	Cobalt
109.020	009	EPA 200.8	Copper
109.020	010	EPA 200.8	Lead
109.020	011	EPA 200.8	Manganese
109.020	012	EPA 200.8	Molybdenum
109.020	013	EPA 200.8	Nickel
109.020	014	EPA 200.8	Selenium
109.020	015	EPA 200.8	Silver
109.020	016	EPA 200.8	Thallium

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109.020	017	EPA 200.8	Vanadium
109.020	018	EPA 200.8	Zinc
109.020	022	EPA 200.8	Tin
109.020	023	EPA 200.8	Titanium
109.104	001	EPA 218.6	Chromium (VI)
109.190	001	EPA 245.1	Mercury
109.809	002	SM3500-Cr B (20th)	Chromium (VI)
109.812	001	SM3500-Cr C (20th)	Chromium (VI)

110 - Volatile Organic Chemistry of Wastewater

110.040	001	EPA 624	Benzene
110.040	002	EPA 624	Bromodichloromethane
110.040	003	EPA 624	Bromoform
110.040	004	EPA 624	Bromomethane
110.040	005	EPA 624	Carbon Tetrachloride
110.040	006	EPA 624	Chlorobenzene
110.040	007	EPA 624	Chloroethane
110.040	008	EPA 624	2-Chloroethyl Vinyl Ether
110.040	009	EPA 624	Chloroform
110.040	010	EPA 624	Chloromethane
110.040	011	EPA 624	Dibromochloromethane
110.040	012	EPA 624	1,2-Dichlorobenzene
110.040	013	EPA 624	1,3-Dichlorobenzene
110.040	014	EPA 624	1,4-Dichlorobenzene
110.040	015	EPA 624	1,1-Dichloroethane
110.040	016	EPA 624	1,2-Dichloroethane
110.040	017	EPA 624	1,1-Dichloroethene
110.040	018	EPA 624	trans-1,2-Dichloroethene
110.040	019	EPA 624	1,2-Dichloropropane
110.040	020	EPA 624	cis-1,3-Dichloropropene
110.040	021	EPA 624	trans-1,3-Dichloropropene
110.040	022	EPA 624	Ethylbenzene
110.040	023	EPA 624	Methylene Chloride
110.040	024	EPA 624	1,1,2,2-Tetrachloroethane
110.040	025	EPA 624	Tetrachloroethene
110.040	026	EPA 624	Toluene
110.040	027	EPA 624	1,1,1-Trichloroethane
110.040	028	EPA 624	1,1,2-Trichloroethane
110.040	029	EPA 624	Trichloroethene
110.040	030	EPA 624	Trichlorofluoromethane
110.040	031	EPA 624	Vinyl Chloride

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110.040	043	EPA 624	Other Volatile Organics
111 - Semi-volatile Organic Chemistry of Wastewater			
111.100	001	EPA 625	Acenaphthene
111.100	002	EPA 625	Acenaphthylene
111.100	003	EPA 625	Anthracene
111.100	004	EPA 625	Benzidine
111.100	005	EPA 625	Benz(a)anthracene
111.100	006	EPA 625	Benzo(b)fluoranthene
111.100	007	EPA 625	Benzo(k)fluoranthene
111.100	008	EPA 625	Benzo(g,h,i)perylene
111.100	009	EPA 625	Benzo(a)pyrene
111.100	010	EPA 625	Benzyl Butyl Phthalate
111.100	011	EPA 625	bis(2-chloroethoxy)methane
111.100	012	EPA 625	bis(2-chloroethyl) Ether
111.100	013	EPA 625	Bis(2-chloroisopropyl) Ether
111.100	014	EPA 625	Di(2-ethylhexyl) Phthalate
111.100	015	EPA 625	4-Bromophenyl Phenyl Ether
111.100	016	EPA 625	4-Chloro-3-methylphenol
111.100	017	EPA 625	2-Chloronaphthalene
111.100	018	EPA 625	2-Chlorophenol
111.100	019	EPA 625	4-Chlorophenyl Phenyl Ether
111.100	020	EPA 625	Chrysene
111.100	021	EPA 625	Dibenz(a,h)anthracene
111.100	025	EPA 625	3,3'-Dichlorobenzidine
111.100	026	EPA 625	2,4-Dichlorophenol
111.100	027	EPA 625	Diethyl Phthalate
111.100	028	EPA 625	2,4-Dimethylphenol
111.100	029	EPA 625	Dimethyl Phthalate
111.100	030	EPA 625	Di-n-butyl phthalate
111.100	031	EPA 625	Di-n-octyl phthalate
111.100	032	EPA 625	2,4-Dinitrophenol
111.100	033	EPA 625	2,4-Dinitrotoluene
111.100	034	EPA 625	2,6-Dinitrotoluene
111.100	035	EPA 625	Fluoranthene
111.100	036	EPA 625	Fluorene
111.100	037	EPA 625	Hexachlorobenzene
111.100	038	EPA 625	Hexachlorobutadiene
111.100	039	EPA 625	Hexachlorocyclopentadiene
111.100	040	EPA 625	Hexachloroethane
111.100	041	EPA 625	Indeno(1,2,3-c,d)pyrene

Eurofins Eaton Analytical, Inc. (former M.W.H.)

Certificate No.: 01114CA
Renew Date: 1/31/2014

111.100	042	EPA 625	Isophorone
111.100	043	EPA 625	2-Methyl-4,6-dinitrophenol
111.100	044	EPA 625	Naphthalene
111.100	045	EPA 625	Nitrobenzene
111.100	046	EPA 625	2-Nitrophenol
111.100	047	EPA 625	4-Nitrophenol
111.100	048	EPA 625	N-nitrosodimethylamine
111.100	049	EPA 625	N-nitroso-di-n-propylamine
111.100	050	EPA 625	N-nitrosodiphenylamine
111.100	051	EPA 625	Pentachlorophenol
111.100	052	EPA 625	Phenanthrene
111.100	053	EPA 625	Phenol
111.100	054	EPA 625	Pyrene
111.100	055	EPA 625	1,2,4-Trichlorobenzene
111.100	056	EPA 625	2,4,6-Trichlorophenol
112 - Radiochemistry of Wastewater			
112.010	001	EPA 900.0	Gross Alpha
112.010	002	EPA 900.0	Gross Beta

Figure 4-5 Laboratory Certificate - State of California (ELAP)

CDPH
California Department of Public Health

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF ENVIRONMENTAL ACCREDITATION

Is hereby granted to

MWH LABORATORIES, A DIVISION OF MWH AMERICAS, INC.

750 ROYAL OAKS DRIVE, SUITE 100
MONROVIA, CA 91016

Scope of the certificate is limited to the
"Fields of Testing"
which accompany this Certificate.

Continued accredited status depends on successful completion of on-site, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **1422**
Expiration Date: **01/31/2013**
Effective Date: **02/01/2011**

Richmond, California
subject to forfeiture or revocation

George C. Kulasingam

George C. Kulasingam, Ph.D., Chief
Environmental Laboratory Accreditation Program Branch

Figure 4-6 California (ELAP) Field of Testing

State of California—Health and Human Services Agency
California Department of Public Health

January [illegible], 2012

[illegible]

Dear [illegible]: Certificate No. [illegible]

This is to advise you that the laboratory named above has been certified as an environmental [illegible]

[illegible] "Fields of Testing". The certificate shall remain in effect until January 31, 20[illegible] [illegible]

[illegible]

[illegible] quality of analysis in the Fields of Testing for which this laboratory has been granted a certificate; [illegible]

[illegible]

If you have any questions, please contact [illegible]

Sincerely,

[illegible]

Environmental Laboratory Accreditation Program Branch

[illegible]

101.210 001	E. coli (Enumeration)	[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	Aqueous Only
[illegible]	[illegible]	[illegible]	[illegible]	Aqueous Only
[illegible]	[illegible]	[illegible]	[illegible]	Aqueous Only
[illegible]	[illegible]	[illegible]	[illegible]	Aqueous Only
[illegible]	007	[illegible]	EPA 6010B	Aqueous Only
[illegible]	[illegible]	[illegible]	EPA 6010B	Aqueous Only
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
114.010	010	Molybdenum	EPA 6010B	Aqueous Only
114.010	011	Nickel	EPA 6010B	Aqueous Only
[illegible]	[illegible]	[illegible]	[illegible]	Aqueous Only
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

Figure 4-7 LA County Fire Department License to Operate

LOS ANGELES COUNTY CERTIFIED UNIFIED PROGRAM AGENCY
ADMINISTERED BY LOS ANGELES COUNTY FIRE DEPARTMENT

UNIFIED PROGRAM FACILITY PERMIT

FISCAL YEAR: July 1, 2012 - June 30, 2013

ISSUED TO: MWH LABORATORIES DIV OF AMERIC
750 ROYAL OAKS DR
MONROVIA, CA 91016

[redacted]

FACILITY SITE ADDRESS: 750 ROYAL OAKS DR # 100, MONROVIA, CA 91016

THIS PERMIT IS ISSUED FOR THE FOLLOWING PROGRAMS:

Administering Agency:	Program Description:
CITY OF MONROVIA	HAZARDOUS MATERIALS DISCLOSURE PROGRAM
LA COUNTY FIRE DEPARTMENT	HAZARDOUS WASTE GENERATOR PROGRAM
LA COUNTY FIRE DEPARTMENT	TIERED PERMIT - CONDITIONALLY EXEMPT (CE)

THIS PERMIT MUST BE CONSPICUOUSLY DISPLAYED AT THE FACILITY AT ALL TIMES.

ISSUED BY: Daryl L. Osby
County of Los Angeles Fire Chief

ISSUED ON: Nov 16, 2012

This permit is valid only for the above location and is subject to ALL REQUIRMENTS of State and Local Laws. The permit is non-transferrable and is void upon change in ownership or location.

Figure 4-8 Drug Enforcement Administration Certificate

EUROFINS EATON ANALYTICAL, INC
750 ROYAL OAKS DRIVE
SUITE 100
MONROVIA, CA 91016-0000-000

DEA REGISTRATION NUMBER	THIS REGISTRATION EXPIRES	FEE PAID
RE0438158	08-31-2013	$244

SCHEDULES	BUSINESS ACTIVITY	ISSUE DATE
3,3N,4,	ANALYTICAL LAB	12-03-2012

EUROFINS EATON ANALYTICAL, INC
750 ROYAL OAKS DRIVE
SUITE 100
MONROVIA, CA 91016-0000

CONTROLLED SUBSTANCE REGISTRATION CERTIFICATE
UNITED STATES DEPARTMENT OF JUSTICE
DRUG ENFORCEMENT ADMINISTRATION
WASHINGTON D.C. 20537

Sections 304 and 1008 (21 USC 824 and 958) of the Controlled Substances Act of 1970, as amended, provide that the Attorney General may revoke or suspend a registration to manufacture, distribute, dispense, import or export a controlled substance.

THIS CERTIFICATE IS NOT TRANSFERABLE ON CHANGE OF OWNERSHIP, CONTROL, LOCATION, OR BUSINESS ACTIVITY, AND IT IS NOT VALID AFTER THE EXPIRATION DATE.

CONTROLLED SUBSTANCE REGISTRATION CERTIFICATE
UNITED STATES DEPARTMENT OF JUSTICE
DRUG ENFORCEMENT ADMINISTRATION
WASHINGTON D.C. 20537

DEA REGISTRATION NUMBER	THIS REGISTRATION EXPIRES	FEE PAID
RE0438158	08-31-2013	$244

SCHEDULES	BUSINESS ACTIVITY	ISSUE DATE
3,3N,4,	ANALYTICAL LAB	12-03-2012

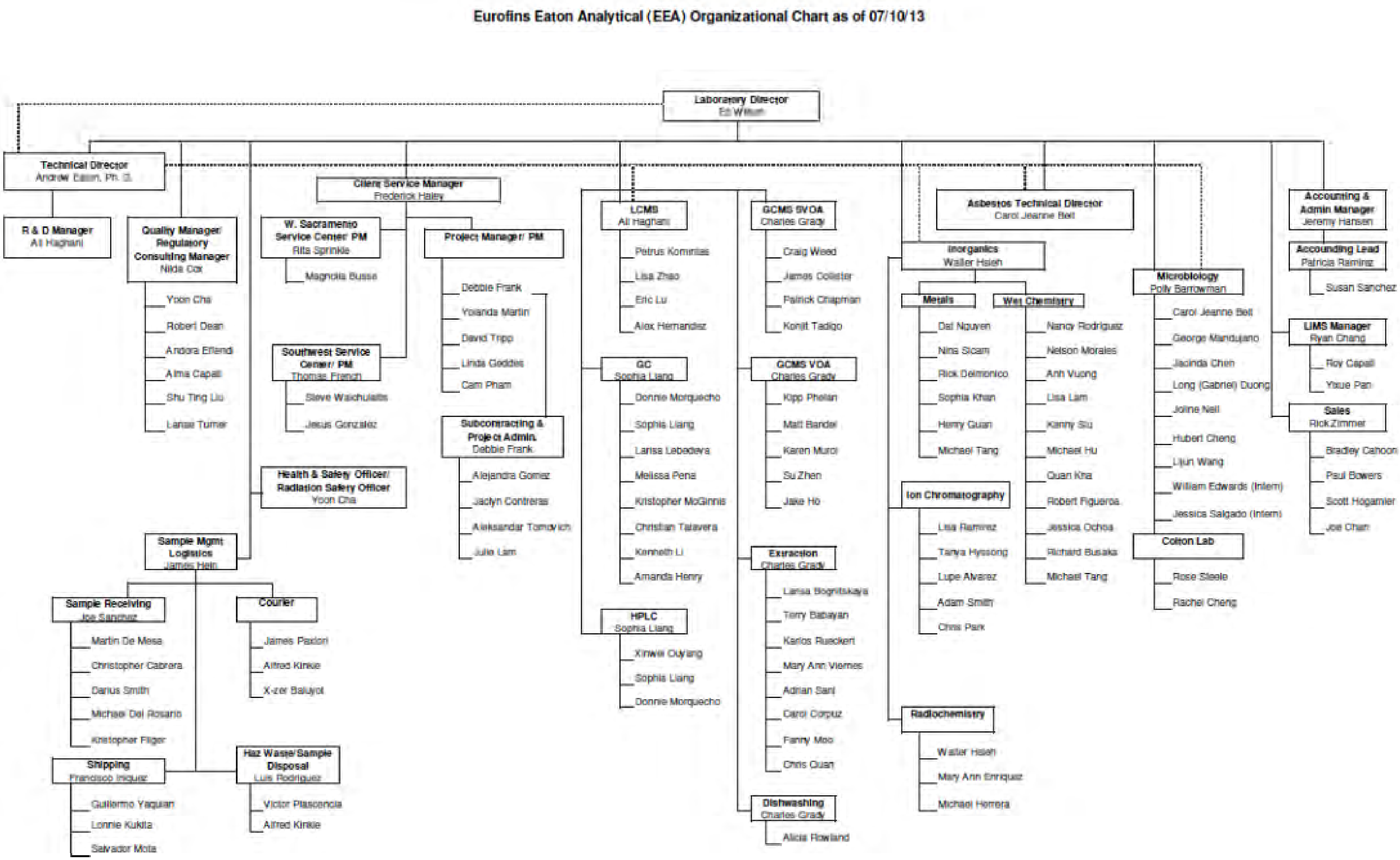
EUROFINS EATON ANALYTICAL, INC
750 ROYAL OAKS DRIVE
SUITE 100
MONROVIA, CA 91016-0000

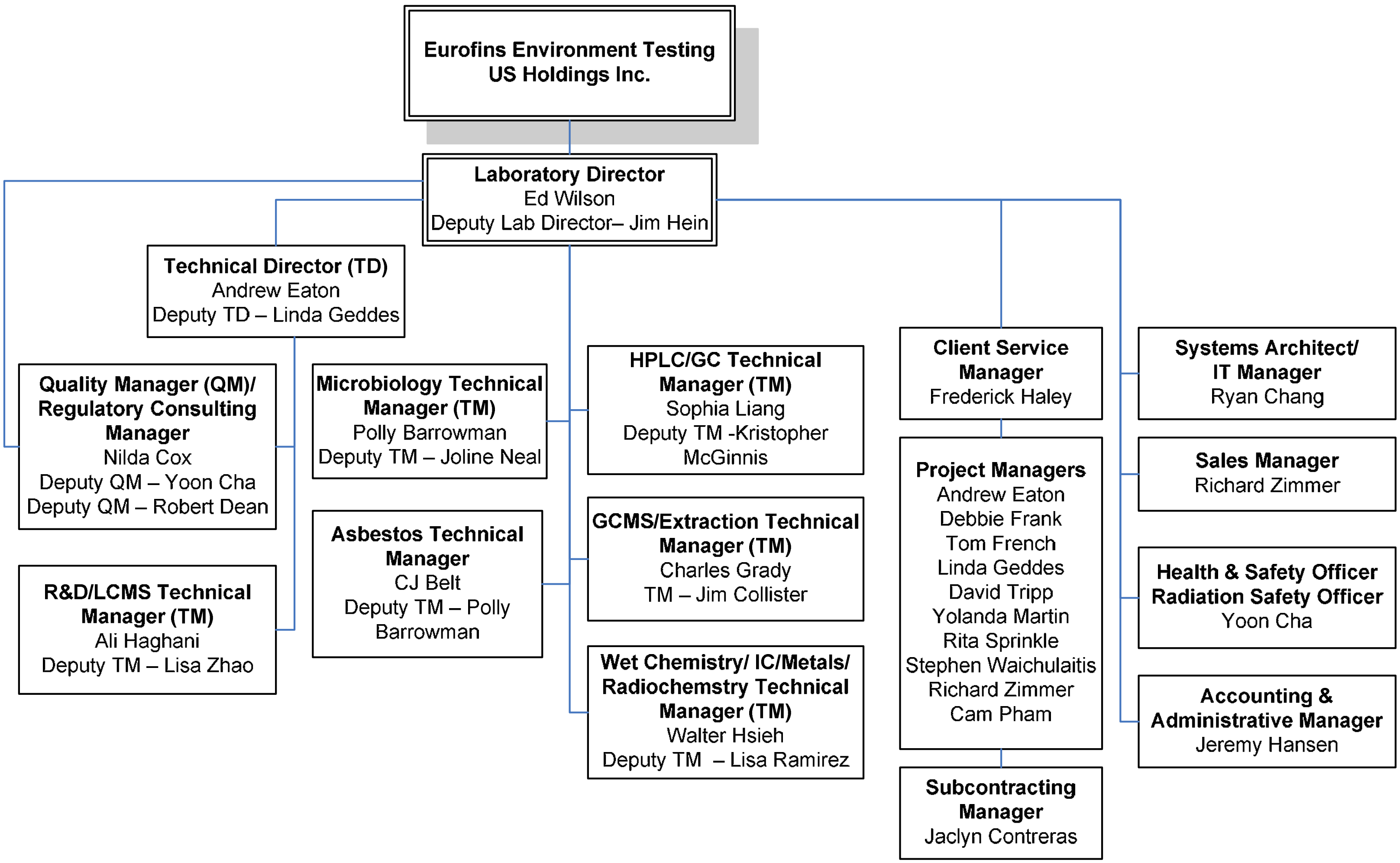
Sections 304 and 1008 (21 USC 824 and 958) of the Controlled Substances Act of 1970, as amended, provide that the Attorney General may revoke or suspend a registration to manufacture, distribute, dispense, import or export a controlled substance.

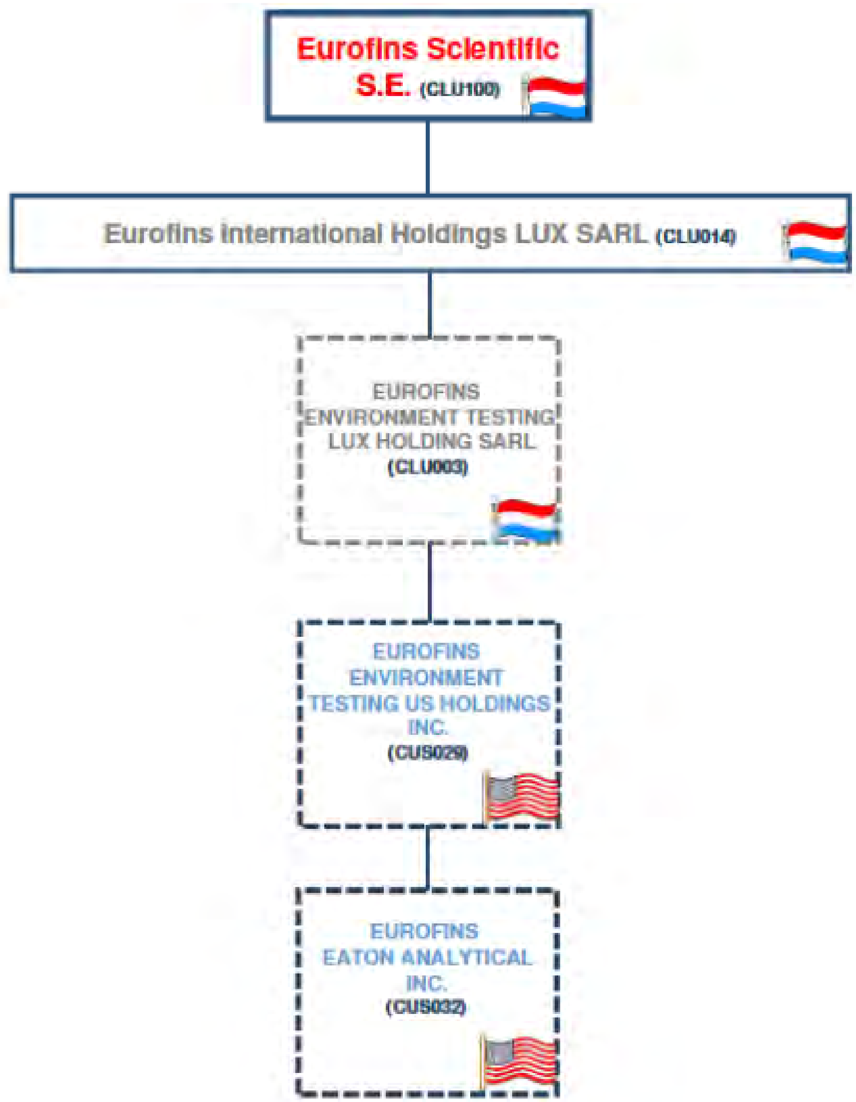
Form DEA-223 (4/07)

THIS CERTIFICATE IS NOT TRANSFERABLE ON CHANGE OF OWNERSHIP, CONTROL, LOCATION, OR BUSINESS ACTIVITY, AND IT IS NOT VALID AFTER THE EXPIRATION DATE.

Figure 4-9 EEA Organizational Chart




Eurofins Environment Testing US Holdings Inc.
Laboratory Director
Ed Wilson
Deputy Lab Director– Jim Hein
Technical Director (TD)
Andrew Eaton
Deputy TD – Linda Geddes
Quality Manager (QM)/ Regulatory Consulting Manager
Nilda Cox
Deputy QM – Yoon Cha
Deputy QM – Robert Dean
R&D/LCMS Technical Manager (TM)
Ali Haghani
Deputy TM – Lisa Zhao
Microbiology Technical Manager (TM)
Polly Barrowman
Deputy TM – Joline Neal
Asbestos Technical Manager
CJ Belt
Deputy TM – Polly Barrowman
HPLC/GC Technical Manager (TM)
Sophia Liang
Deputy TM -Kristopher McGinnis
GCMS/Extraction Technical Manager (TM)
Charles Grady
TM – Jim Collister
Wet Chemistry/ IC/Metals/ Radiochemstry Technical Manager (TM)
Walter Hsieh
Deputy TM – Lisa Ramirez
Client Service Manager
Frederick Haley
Project Managers
Andrew Eaton
Debbie Frank
Tom French
Linda Geddes
David Tripp
Yolanda Martin
Rita Sprinkle
Stephen Waichulaitis
Richard Zimmer
Cam Pham
Subcontracting Manager
Jaclyn Contreras
Systems Architect/ IT Manager
Ryan Chang
Sales Manager
Richard Zimmer
Health & Safety Officer Radiation Safety Officer
Yoon Cha
Accounting & Administrative Manager
Jeremy Hansen


Eurofins Scientific S.E. (CLU100)
Eurofins International Holdings LUX SARL (CLU014)
EUROFINS ENVIRONMENT TESTING LUX HOLDING SARL (CLU003)
EUROFINS ENVIRONMENT TESTING US HOLDINGS INC. (CUS029)
EUROFINS EATON ANALYTICAL INC. (CUS032)

5.0 QUALITY ASSURANCE OBJECTIVES

Before analytical data can be used, the quality of data produced by EEA is measured by the following characteristics: precision, accuracy, completeness, representativeness, comparability, timeliness, and documentation, used in the determination of the suitability of the data for a given purpose. EEA has set specific objectives for each of these characteristics as a means of meeting the data quality objectives of the client. A definition of each of the characteristics follows, along with the specific objectives for each of the characteristics.

Table 5-1 lists specific limit objectives for precision and accuracy for drinking water analyses.

Table 5-2 lists specific limit objectives for precision and accuracy for wastewater analyses.

Table 5-3 lists specific limit objectives for precision and accuracy for hazardous waste analyses.

Criteria for precision and accuracy included are only for representative reference methods. Criteria for the other methods and specific analytes can be found in relevant SOPs.

5.1. PRECISION

Analytical precision is an important component of overall data quality since it is a measure of how far an individual determination may be from the mean of replicate measurements (how well replicate analyses agree). If the precision of an analysis is poor, there is a good probability that the reported result will differ substantially from the true value even if there are no systematic errors leading to bias in the result. Precision is often directly related to concentration.

5.1.1. EEA uses Relative Percent Difference (RPD) to measure agreement between duplicate analyses. RPD is calculated as follows:

$$\mathbf{RPD} = \frac{(S-D)}{(S+D)/2} \times 100$$

where;

RPD	=	Relative Percent Difference
S	=	First Sample Value (original)
D	=	Second Sample Value (duplicate)

5.1.2. The precision of a method is expressed as the Relative Standard Deviation (RSD) of the percent recoveries. Percent RSD (%RSD) is calculated as follows:

$$\%RSD = \frac{S}{X_{avg}} \times 100$$

where:

X_{avg} = the arithmetic mean of the recovery values, and

$$S = \sqrt{\Sigma \frac{(X_i - X)^2}{n-1}}$$

where:

S	=	Standard Deviation
X_i	=	the individual recovery values
X	=	the arithmetic mean of the recovery values
n	=	the number of determinations

5.1.3. To assess precision in the laboratory, EEA uses the following:

- Duplicate Samples
- Duplicate Matrix Spikes
- Duplicate Laboratory Control Samples
- Control Charts

5.2. ACCURACY

Accuracy is the agreement between an experimentally determined value and the accepted reference value (deviation of the analytical value from the "true or known value). Analytical accuracy is a measure of analytical bias due to systematic errors. A measure of this bias along with a measure of the precision will provide the overall accuracy of the results.

The true value for field samples are never known, so accuracy measurements are made on the analysis of QC samples analyzed with field samples. The primary QC tools for assessing accuracy are control standards (LCSs), matrix spikes and spike duplicates (MS/MSD), and surrogate spikes.

5.2.1. Spike recoveries are calculated as follows:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

Where;	%R	=	percent spike recovery
	SSR	=	spiked sample result
	SR	=	sample result
	SA	=	spike amount added

5.2.2. For Laboratory Control Samples, percent recovery (%R) is calculated as follows:

$$\%R = \frac{\text{found concentration}}{\text{true concentration}} \times 100$$

5.2.3. Accuracy is monitored for nearly all methods by percent recoveries of the LCSs and plotted on control charts. The mean recovery ± 2 standard deviations are the warning limits, and the mean recovery ± 3 standard deviations are the control limits. In the event that the method has no acceptance criteria, control charts are reviewed and evaluated to establish internal limits or guidelines [TNI-EL-V1M4-2009-1.7.4.2.a].

To assess accuracy, EEA uses the following:

- MRL Checks
- Laboratory Control Samples
- Matrix Spikes
- Certified Reference Materials
- Blind QC Samples
- Control Charts

5.3. REPRESENTATIVENESS/SAMPLING OF SUB-ALIQUOT

All sample aliquots, which are analyzed, must be representative of the bulk sample from which they are taken [TNI-EL-V1M2-2009-5.7.1][ISO/IEC 17025:2005(E)-5.7.1]. Representativeness is easily achieved for aqueous samples free of suspended material. Obtaining a representative sample is a more difficult task for soils and sludge.

Unless a sample is known to be non-randomly heterogeneous in its composition, the most appropriate manner of obtaining a representative aliquot for analysis is by simple random sampling after the material has been mixed as thoroughly as possible. Thorough mixing is acceptable for inorganic analyses, but any samples requiring volatile or semi-volatile organic analyses must be handled in a manner which minimizes loss of these volatile compounds from the sample.

Representativeness is also impacted by conditions of sample receipt. EEA documents all samples that do not meet acceptance criteria (TNI-EL-V1M2-2009-5.8.3) (ISO/IEC 17025:2005(E)-5.8.3).

The laboratory documents the sampling techniques of aliquots from a submitted sample in the method SOPs to ensure that representativeness of samples are obtained. (TNI-EL-V1M2-2009-5.7.1)(ISO/IEC 17025:2005(E)-5.7.1).

5.4. COMPARABILITY

The characteristic of comparability determines whether analytical conditions are uniform for each analytical run to insure that all of the reported data will be consistent. This requires temporal stability of analytical conditions within the laboratory.

To insure temporal stability, uniform analytical and quality control protocols will be closely adhered to for each analytical run. In addition, traceable standards are used as part of every analytical run. Every analyst is required to demonstrate his precision and accuracy for a particular analysis by analyzing four replicate matrix spiked samples. All newly trained or backup analysts must demonstrate comparable precision and accuracy.

5.5. COMPLETENESS

The characteristic of completeness is a measure of the percentage of specified data which are valid. Valid data are obtained when samples are analyzed in accordance with the quality control procedures outlined in this manual and none of the quality control criteria is exceeded.

Sample data which does not meet the specified quality control criteria will automatically be reanalyzed if sufficient quantity of sample is available and analytical holding times have not been exceeded. The laboratory strives for a completeness percentage of 100%.

5.6. TIMELINESS

EPA guidelines require that samples be analyzed for constituents within specified holding times. These holding times represent a compromise between allowance of a realistic time to perform the analysis and minimization of elapsed time to insure sample integrity.

EEA has adopted a computerized sample tracking system and supervisory review process to insure that samples are scheduled for extraction and analysis within the EPA holding times. In the unforeseen circumstance of instrument performance problems, EEA will do everything possible to meet EPA holding times without compromising the quality of the reported data. The client is notified if a holding time is exceeded.

5.7. DOCUMENTATION

Proper documentation is a vital component in supporting the integrity of analytical results. All of the proceeding quality control components will not support reported data unless they have been fully documented for subsequent review. EEA maintains documentation of sample handling, chain of custody (if applicable), analytical procedures, raw and calculated data, supporting chromatograms, quality control data, and final reports. Please see section 14 for data reduction, validation, and reporting procedures.

NOTE: When the method does not specify the Acceptance Limit, recovery limits are based on control charts.

Table 5-1 Precision and Accuracy for Drinking Water for Mid or High Level Spikes

(A) Inorganics - Wet Chemistry

Parameter Method Name	Method Number	Parameters/ Analytes	Accuracy		Precision RPD Maximum
			LCS/LFB	MS/LFM	
			% Rec.	% Rec.	
Alkalinity	SM 2320B	Bicarbonate	90 - 110	80 - 120	10
		Carbonate	90 - 110	80 - 120	10
		Hydroxide	90 - 110	80 - 120	10
Bromate, BrO3	EPA 317	Bromate	90 - 110	75 - 125	20
Bromate, BrO3	EPA 300.1	Bromate	90 - 110	75 - 125	20
Bromide, Br	EPA 300.0	Bromide	90 - 110	80 - 120	20
Bromide, Br	EPA 300.1	Bromide	90 - 110	85 - 115	20
Chloride, Cl	EPA 300.0	Chloride	90 - 110	80 - 120	20
Chlorine Dioxide	SM 4500-ClO2 D	Chlorine Dioxide	85 - 115	85 - 115	15
Chlorite, ClO2	EPA 300.0	Chlorite	90 - 110	80 - 120	20
Chlorite, ClO2	EPA 300.1	Chlorite	90 - 110	85 - 115	20
Chlorite, ClO2	EPA 317.0	Chlorite	90 - 110	85 - 115	20
Chlorate, ClO3	EPA 300.0	Chlorate	90 - 110	80 - 120	20
Chlorate, ClO3	EPA 300.1	Chlorate	90 - 110	85 - 115	20
Color	SM 2120B	Color	-	-	+1 unit (0-10) +5 units (10-110) +10 units (>110)
Conductivity	SM2510B	Conductivity	95 - 105	-	20
Corrosivity (Langlier Index)	SM 2330B	Corrosivity	85 - 115	85 - 115	15
Cyanide	SM4500CN-F, G	Cyanide	80 - 120	80 - 120	20
	EPA335.4	Cyanide	90 - 110	90 - 110	20
Fluoride	SM 4500 F-C	Fluoride	81 - 116	73 - 124	20
Free & Total Chlorine	SM 4500 Cl G	Free & Total Chlorine	85 - 115	85 - 115	15
Hardness	EPA 200.7/SM 2340B	Calcium Hardness	-	-	-
Nitrate	EPA300.0/353.2	Nitrate	90 - 110	80 - 120	20
Nitrate & Nitrite	EPA 353.2	Nitrate & Nitrite	90 - 110	90 - 110	20
Nitrite	EPA300.0	Nitrite	90 - 110	80 - 120	20
	EPA353.2	Nitrite	90 - 110	90 - 110	20
Odor	SM 2150B	Odor	-	-	20
o-Phosphate	365.1	o-Phosphate	90 - 110	90 - 110	20
	SM4500 P-E, PF	o-Phosphate	90 - 110	90 - 110	20

Parameter Method Name	Method Number	Parameters/ Analytes	Accuracy LCS/LFB % Rec.	Accuracy MS/LFM % Rec.	Precision RPD Maximum
Perchlorate	EPA 314.0	Perchlorate	85 - 115	80 - 120	15
pH	SM4500-HB	pH	98 - 102	-	+ 0.1 pH unit
Phenols	EPA 420.1/420.4	Phenols	70 - 130	70 - 130	10
Residual Disinfectant (Total/ Free Residual Chlorine)	SM4500 Cl-G	Residual Disinfectant	85 - 115	-	20
Silica	EPA200.7	Silica	85 - 115	70 - 130	-
	SM 4500 SiO2C	Dissolved /Reactive Silica	85 - 115	70 - 130	20
Total Dissolved Solids (TDS)	SM 2540C	Total Dissolved Solids (TDS)	80 - 114	-	20
Total Suspended Solids (TSS)	SM 2540D	Total Suspended Solids (TSS)	80 - 120	-	10
Sulfate	EPA 300.0	Sulfate	90 - 110	80 - 120	20
Total Organic Carbon	SM 5310C/EPA 415.3	TOC	80 - 120	80 - 120	20
Dissolved Organic Carbon	SM 5310C/EPA 415.3	DOC	90 - 110	80 - 120	20
Turbidity	EPA180.1	Turbidity	90 - 110	N/A	20
UV 254	SM 5910 B/EPA 415.3	UV/SUVA	82 - 134	N/A	15 (6.0 mg/L/DOC)

(B) Inorganics – Metals

Parameter Method Name	EPA Method Number	Parameters/ Analytes	Accuracy LCS/LFB % Rec	Accuracy MS/LFM % Rec	Precision RPD Maximum
Chromium VI	EPA 218.6	Chromium VI (Dissolved)	90 - 110	90 - 110	20
Mercury	EPA 245.1	Mercury, Hg	85 - 115	70 - 130	20
Metals	EPA200.7	Aluminum, Al	85 - 115	70 - 130	20
		Barium, Ba	85 - 115	70 - 130	20
		Beryllium, Be	85 - 115	70 - 130	20
		Boron, B	85 - 115	70 - 130	20
		Calcium, Ca	85 - 115	70 - 130	20
		Cadmium, Cd	85 - 115	70 - 130	20
		Chromium, Cr	85 - 115	70 - 130	20
		Copper, Cu	85 - 115	70 - 130	20
		Iron, Fe	85 - 115	70 - 130	20
		Magnesium, Mg	85 - 115	70 - 130	20

Parameter Method Name	EPA Method Number	Parameters/ Analytes	Accuracy LCS/LFB % Rec	Accuracy MS/LFM % Rec	Precision RPD Maximum
Metals (con't.)	EPA200.7	Manganese, Mn	85 - 115	70 - 130	20
		Nickel, Ni	85 - 115	70 - 130	20
		Potassium, K	85 - 115	70 - 130	20
		Silica, SiO2	85 - 115	70 - 130	20
		Silver, Ag	85 - 115	70 - 130	20
		Sodium, Na	85 - 115	70 - 130	20
		Thallium, Ti	85 - 115	70 - 130	20
		Tin, Sn	85 - 115	70 - 130	20
		Zinc, Zn	85 - 115	70 - 130	20
Metals	EPA200.8	Aluminum, Al	85 - 115	70 - 130	20
		Antimony, Sb	85 - 115	70 - 130	20
		Arsenic, As	85 - 115	70 - 130	20
		Barium, Ba	85 - 115	70 - 130	20
		Beryllium, Be	85 - 115	70 - 130	20
		Cadmium, Cd	85 - 115	70 - 130	20
		Chromium, Cr	85 - 115	70 - 130	20
		Copper, Cu	85 - 115	70 - 130	20
		Lead, Pb	85 - 115	70 - 130	20
		Manganese, Mn	85 - 115	70 - 130	20

(C) Microbiology/Microscopy Tests

Parameter Method Name	Method Number	Analyte Parameter	Accuracy LCS/LFB % Rec.	Accuracy MS/LFM % Rec.	Precision RPD Maximum
Asbestos	EPA 100.2	Asbestos	-	-	-
Fecal Coliforms--EC Medium, MTF	SM9221E	Fecal Coliforms EC Medium (Enumeration)	-	-	-
Heterotrophic Plate Count (Standard Plate Count)	SM9215B	Heterotrophic Plate Count	-	-	10
Total Coliform by Multiple Tube Fermentation (MF)	SM9221AB	Total Coliform/Enumeration	-	-	-
Total Coliform/ E-Coli (Colilert)	SM 9223B	Total Coliforms (Present or Absent)	-	-	-
Total Coliform/Colilert (Enumeration)	SM 9223B	Total Coliform (Enumeration)	-	-	-
Total Coliforms (MTF) Enumeration	SM9221A, B	Total Coliforms	-	-	-

Parameter Method Name	Method Number	Analyte Parameter	Accuracy		Precision RPD
Total Coliform and E-Coli (Colisure)	SM 9223B	Total Coliform and E-Coli	-	-	-
Coliphage	1602	Coliphage	-	-	-

(D) Organics

Parameter Method Name	EPA Method Number	Parameters/ Analytes	Accuracy		Precision RPD Maximum
			LCS/LFB	MS/LFM	
			% Rec.	% Rec.	
DBCP/EDB	EPA504.1	1,2-Dibromo-3-chloropropane	70 - 130	60 - 140	20
		1,2-Dibromoethane (EDB)	70 - 130	60 - 140	20
		1,2,3-Trichloropropane (1,2,3-TCP)	70 - 130	60 - 140	20
Organohalide Pesticides and Commercial Polychlorinated Biphenyl (PCB)	EPA 505	Alachlor	70 - 130	65 - 135	20
		Aldrin	70 - 130	65 - 135	20
		Chlordane	70 - 130	65 - 135	20
		Dieldrin	70 - 130	65 - 135	20
		Endrin	70 - 130	65 - 135	20
		Heptachlor	70 - 130	65 - 135	20
		Heptachlor Epoxide	70 - 130	65 - 135	20
		Lindane	70 - 130	65 - 135	20
		Methoxychlor	70 - 130	65 - 135	20
		Cis-Nonachlor	70 - 130	65 - 135	20
		Trans-Nonachlor	70 - 130	65 - 135	20
		Toxaphene	70 - 130	65 - 135	20
		Aroclor 1016	58 - 145	65 - 135	20
		Aroclor 1221	65 - 132	65 - 135	20
		Aroclor 1232	56 - 152	65 - 135	20
		Aroclor 1242	70 - 130	65 - 135	20
		Aroclor 1248	63 - 130	65 - 135	20
		Aroclor 1254	78 - 136	65 - 135	20
		Aroclor 1260	70 - 130	65 - 135	20
Chlorinated Acids	EPA 515.4	2,4,5-TP (Silvex)	70 - 130	70 - 130	30
		2,4,5-T	70 - 130	70 - 130	30
		2,4-D	70 - 130	70 - 130	30
		2,4-DB	70 - 130	70 - 130	30
		Acifluorfen	70 - 130	70 - 130	30
		DCPA	70 - 130	70 - 130	30
		Dichloroprop	70 - 130	70 - 130	30
		Dinoseb	70 - 130	70 - 130	30
		4-Nitrophenol	-	-	30
		Pentachlorophenol	70 - 130	70 - 130	30
		Picloram	70 - 130	70 - 130	30

Parameter Method Name	EPA Method Number	Parameters/ Analytes	Accuracy LCS/LFB % Rec.	Accuracy MS/LFM % Rec.	Precision RPD Maximum
Chlorinated Acids (con't.)	EPA 515.4	2,4-Dichlorophenylacetic Acid	70 - 130	70 - 130	30
		3,5-Dichlorobenzoic Acid	70 - 130	70 - 130	30
		Bentazon	70 - 130	70 - 130	30
		Dalapon	70 - 130	70 - 130	30
		Dicamba	70 - 130	70 - 130	30
Purgeable Organic Compounds/ Halogenated & Aromatic Volatiles/ Trihalomethanes, Di-Isopropyl Ether (DIPE), Tertiary Amyl methyl Ether (TAME) Tert-Butyl ethyl ether (ETBE)	EPA524.2	1,1,1-Trichloroethane	70 - 130	70 - 130	20
		1,1,2,2-Tetrachloroethane	70 - 130	70 - 130	20
		1,1,1,2-Tetrachloroethane	70 - 130	70 - 130	20
		1,1,2-Trichloroethane	70 - 130	70 - 130	20
		1,1-Dichloroethane	70 - 130	70 - 130	20
		1,1-Dichloroethylene	70 - 130	70 - 130	20
		1,2,3-Trichlorobenzene	70 - 130	70 - 130	20
		1,2,4 Trichlorobenzene	70 - 130	70 - 130	20
		1,2,3- Trichloropropane	70 - 130	70 - 130	20
		1,2,4- Trimethylbenzene	70 - 130	70 - 130	20
		1,3,5 Trimethyl benzene	70 - 130	70 - 130	20
		1,1-Dichloropropene	70 - 130	70 - 130	20
		1,2-Dichloropropane	70 - 130	70 - 130	20
		1,3-Dichloropropane	70 - 130	70 - 130	20
		2,2-Dichloropropane	70 - 130	70 - 130	20
		Benzene	70 - 130	70 - 130	20
		Bromobenzene	70 - 130	70 - 130	20
		Bromochloromethane	70 - 130	70 - 130	20
		Bromodichloromethane	70 - 130	70 - 130	20
		Bromoform	70 - 130	70 - 130	20
		Bromomethane	70 - 130	70 - 130	20
		Carbon Tetrachloride	70 - 130	70 - 130	20
		Chlorobenzene	70 - 130	70 - 130	20
		Chlorodibromomethane	70 - 130	70 - 130	20
		Chloroform (Trichloromethane)	70 - 130	70 - 130	20
		Chloroethane	70 - 130	70 - 130	20
		Chloromethane (Methyl Chloride)	70 - 130	70 - 130	20
		Dichloromethane	70 - 130	70 - 130	20
		Dibromomethane	70 - 130	70 - 130	20
		Dichlorodifluoromethane	70 - 130	70 - 130	20
		Ethylbenzene	70 - 130	70 - 130	20
		Fluorotrichloromethane (Freon	70 - 130	70 - 130	20
		Hexachlorobutadiene	70 - 130	70 - 130	20

Parameter Method Name	EPA Method Number	Parameters/ Analytes	Accuracy LCS/LFB % Rec.	Accuracy MS/LFM % Rec.	Precision RPD Maximum
Purgeable Organic Compounds/ Halogenated & Aromatic Volatiles/ Trihalomethanes, Di-Isopropyl Ether (DIPE), Tertiary Amyl methyl Ether (TAME) Tert-Butyl ethyl ether (ETBE) (con't.)	EPA524.2	Isopropylbenzene	70 - 130	70 - 130	20
		Methyl Tert-Butyl Ether (MTBE)	70 - 130	70 - 130	20
		m-Dichlorobenzene (1,3-DCB)	70 - 130	70 - 130	20
		Naphthalene	70 - 130	70 - 130	20
		n-Butylbenzene	70 - 130	70 - 130	20
		n-Propylbenzene	70 - 130	70 - 130	20
		Styrene	70 - 130	70 - 130	20
		Tetrachloroethylene (PCE)	70 - 130	70 - 130	20
		Tert-Butyl Alcohol (TBA)	70 - 130	70 - 130	20
		Carbon Disulfide	70 - 130	70 - 130	20
		Methyl Isobutyl Ketone (MIBK)	70 - 130	70 - 130	20
		Toluene	70 - 130	70 - 130	20
		Trichloroethylene	70 - 130	70 - 130	20
		1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	70 - 130	70 - 130	20
		Vinyl Chloride	70 - 130	70 - 130	20
		cis-1,2-Dichloroethylene	70 - 130	70 - 130	20
		cis-1,3-Dichloropropene	70 - 130	70 - 130	20
		sec-Butylbenzene	70 - 130	70 - 130	20
		m,p-Xylenes	70 - 130	70 - 130	20
		1,2-Dichlorobenzene	70 - 130	70 - 130	20
		o-Chlorotoluene	70 - 130	70 - 130	20
		o-Xylene	70 - 130	70 - 130	20
		p-Chlorotoluene	70 - 130	70 130	20
		p-Isopropyltoluene	70 - 130	70 - 130	20
		1,4-Dichlorobenzene	70 - 130	70 - 130	20
		2-Butanone (MEK)	70 - 130	56 - 85	20
		4-Methyl-2-Pentanone	70 - 130	70 - 130	20
		trans-1,2-Dichloroethylene	70 - 130	85 - 129	20
		trans-1,3-Dichloropropene	70 - 130	80 - 131	20
		tert-Butylbenzene	70 - 130	70 - 130	20
		Di-Isopropyl Ether (DIPE)	70 - 130	70 - 130	20
		Tertiary Amyl methyl ether (TAME)	70 - 130	70 130	20
		Tertiarry Butyl ethyl Ether (ETBE)	70 - 130	70 130	20
		Nitrobenzene	80 - 120	70 - 130	20
		Hexachloroethane	80 - 120	70 - 130	20
		1,2-Dichlorobenzene	80 - 120	70 - 130	20

Parameter Method Name	EPA Method Number	Parameters/ Analytes	Accuracy LCS/LFB % Rec.	Accuracy MS/LFM % Rec.	Precision RPD Maximum
(con't.)	EPA 524.2	1,2-Dichloroethane	80 - 120	70 - 130	20
TCP-Low (5ppt)	CA DHS SRLPT/ GCMS	1,2,3-Trichloropropane	80 - 120	-	20
Semi-Volatile Organics Acid/Base Neutrals	EPA 525.2	Acenaphthylene	70 - 130	70 - 130	20*
		Alachlor	70 - 130	70 - 130	20*
		Aldrin	70 - 130	70 - 130	20*
		Anthracene	70 - 130	70 130	20*
		Atrazine	70 - 130	70 130	20*
		Benzo(a)anthracene	70 - 130	70 - 130	20*
		Benzo(a)pyrene	70 - 130	70 - 130	20*
		Benzo(b)fluoranthene	70 - 130	70 - 130	20*
		Benzo(g,h,i)perylene	70 - 130	70 130	20*
		Benzo(k)fluoranthene	70 - 130	70 130	20*
		Butylbenzylphthalate	70 - 130	80 - 131	20*
		Caffeine	70 - 130	70 - 130	-
		a-Chlordane	70 - 130	70 - 130	-
		g-Chlordane	70 - 130	70 130	20*
		Chrysene	70 - 130	70 130	20*
		Di-(2-Ethylhexyl)phthalate	70 - 130	70 - 130	20*
		Di-(2-Ethylhexyl)adipate	70 - 130	70 - 130	20*
		Di-n-Butylphthalate	70 - 130	70 - 130	20*
		Dibenzo(a,h)anthracene	70 - 130	70 - 130	20*
		Diethylphthalate	70 - 130	70 - 130	20*
		Dimethylphthalate	70 - 130	70 - 130	20*
		Endrin	70 - 130	70 - 130	20*
		Fluorene	70 - 130	70 - 130	20*
		Butachlor	70 - 130	70 - 130	20*
		4,4-DDD	70 - 130	70 - 130	20*
		4,4-DDE	70 - 130	70 - 130	20*
		4,4-DDT	70 - 130	70 - 130	20*
		Metolachlor	70 - 130	70 - 130	20*
		Metribuzin	70 - 130	70 - 130	20*
		Propachlor	70 - 130	70 - 130	20*
		Heptachlor	70 - 130	70 - 130	20*
		Heptachlor Expoxide	70 - 130	70 - 130	20*
		Hexachlorobenzene	70 - 130	70 - 130	20*
		Hexachlorocyclopentadiene	70 - 130	70 - 130	20*
		Indeno(1,2,3,c,d)pyrene	70 - 130	70 - 130	20*

Parameter Method Name	EPA Method Number	Parameters/ Analytes	Accuracy LCS/LFB % Rec.	Accuracy MS/LFM % Rec.	Precision RPD Maximum
Semi-Volatile Organics Acid/Base Neutrals (con't.)	EPA 525.2	Lindane	70 - 130	70 - 130	20*
		Methoxychlor	70 - 130	70 - 130	20*
		Molinate	70 - 130	70 - 130	20*
		Pentachlorophenol	70 - 130	70 - 130	20*
		Phenanthrene	70 - 130	70 - 130	20*
		Pyrene	70 - 130	70 - 130	20*
		Simazine	70 - 130	70 - 130	20*
		Thiobencarb	70 - 130	70 - 130	20*
		trans-Nonachlor	70 - 130	70 - 130	20*
		Perylene-d12 (surr)	70 - 130	70 - 130	-
N-methylcarbamoyloximes and N-Methylcarbamates	EPA531.2	3-Hydroxycarbofuran	70 - 130	70 - 130	20
		Aldicarb (Temik)	70 - 130	70 - 130	20
		Aldicarb Sulfone	70 - 130	70 - 130	20
		Aldicarb Sulfoxide	70 - 130	70 - 130	20
		Baygon	70 - 130	70 - 130	20
		Carbaryl	70 - 130	70 - 130	20
		Carbofuran (Furadan)	70 - 130	70 - 130	20
		Methiocarb	70 - 130	70 - 130	20
		Methomyl	70 - 130	70 - 130	20
		Oxamyl (Vydate)	70 - 130	70 - 130	20
		4-Bromo-3,5-Dimethylphenyl-N-Methylcarbamate (BDMC)	70 - 130	70 - 130	20
Glyphosate	EPA547	Glyphosate	70 - 130	70 - 130	-
Endothall	EPA548.1	Endothall	63 - 144	38 - 157	-
Diquat & Paraquat	EPA549.2	Diquat	80 - 120	70 - 130	20
		Paraquat	80 - 120	70 - 130	20
Trihalomethanes, Chloral Hydrate, Haloacetonitrile, EDB (1-2,dibromoethane) DBCP (1,2-dibromo-3-chloropropane	551.1	Bromodichloromethane	80 - 120	80 - 120	20
		Bromoform	80 - 120	80 - 120	20
		Chloral Hydrate	80 - 120	80 - 120	20
		Chloroform	80 - 120	80 - 120	20
		Dibromochloromethane	80 - 120	80 - 120	20
		Dibromoacetonitrile	80 - 120	80 - 120	20
		Dichloroacetonitrile	80 - 120	80 - 120	20
		1,1-Dichloro-2-propanone	80 - 120	80 - 120	20
		Trichloroacetonitrile	80 - 120	80 - 120	20
		1,1-Trichloro-2-propanone	80 - 120	80 - 120	20
		EDB (1-2,dibromoethane)	80 - 120	80 – 120	20
		DBCP (1,2-dibromo-3-chloropropane	80 – 120	80 - 120	20

Parameter Method Name	EPA Method Number	Parameters/ Analytes	Accuracy LCS/LFB % Rec.	Accuracy MS/LFM % Rec.	Precision RPD Maximum
Haloacetic Acids **	SM6251B	Bromochloroacetic Acid	85 - 115	84 - 123	20
		Chlorodibromoacetic Acid	85 - 115	70 - 130	-
		Dibromoacetic Acid	85 - 115	84 - 122	20
		Dichloroacetic Acid	85 - 115	79 - 123	20
		Monobromoacetic Acid	85 - 115	81 - 122	20
		Monochloroacetic Acid	85 - 115	75 - 126	20
		Tribromoacetic Acid	85 - 115	70 - 130	
		Trichloroacetic Acid	85 - 115	82 - 124	20

* RPD-LCS
** Low Level LFB/LCS 50-150 % Recovery

(E) Radiochemistry

Parameter Method Name	EPA Method Name	Parameters/ Analytes	Accuracy LCS/LFB % Rec.	Accuracy MS/LFM % Rec.	Precision RPD Maximum
Uranium	EPA 200.8 (Screen)	Uranium	85 - 115	80 - 120	20
Gross Alpha	EPA 900.0	Gross Alpha	80 - 120	70 - 130	20
Gross Beta	EPA 900.0	Gross Beta	80 - 120	70 - 130	20
Radium 228	EPA 904	Radium 228	80 - 120	70 - 130	20
Radon 222, Liquid Scintillation	SM7500-Rn	Radon 222	80 - 120	-	20

Note: Refer to individual SOPs for precision and accuracy details for all methods

Table 5-2 Precision and Accuracy for Wastewater for Mid or High Level Spikes

(A) Inorganics – Wet Chemistry

Parameter Method Name	Method Name	Parameters/ Analytes	Accuracy LCS/LFB % Rec.	Accuracy MS/LFM % Rec.	Precision RPD Maximum
Alkalinity	SM2320B	Bicarbonate	90 - 110	80 - 120	20
		Carbonate	90 - 110	80 - 120	20
		Hydroxide	90 - 110	80 - 120	20
Ammonia	EPA350.1 / SM4500NH3H/G	Ammonia	90 - 110	90 - 110	20
Biochemical Oxygen Demand (BOD)	EPA 405.1 / SM5210B	Biochemical Oxygen Demand	85 - 115	-	-
Carbon Biochemical Oxygen Demand (CBOD)	SM5210B	Carbon Biochemical Oxygen Demand	85 - 115	-	-
Chemical Oxygen Demand (COD)	EPA410.4 / 5220 D	Chemical Oxygen Demand (COD)	90 - 110	90 - 110	20
Chloride	EPA300.0	Chloride	90 - 110	80 - 120	20
Chlorine, Total Residual	SM4500 Cl G	Chlorine, Total Residual	85 - 115	-	-

Parameter Method Name	Method Name	Parameters/ Analytes	Accuracy		Precision RPD Maximum
			LCS/LFB	MS/LFM	
			% Rec.	% Rec.	
Chromium VI	EPA 218.6/ SM3500 Cr-B, Colorimetric	Chromium VI	90 - 110	90 - 110	20
Specific Conductance	SM2510B / EPA 120.1	Specific Conductance	90 - 110	-	20
Cyanide, Total	EPA 335.4	Cyanide, Total	90 - 110	90 - 110	20
Cyanide, Amenable to Chlorination	SM 4500CN-G	Cyanide, Amenable to Chlorination	80 - 120	80 - 120	20
Fluoride	SM4500 F-C	Fluoride	81 - 116	73 - 124	20
Hardness	SM2340B/EPA 200.7	Hardness	90 - 110	80 - 120	20
Total Kjeldahl Nitrogen	EPA351.2	Kjeldahl Nitrogen	90 - 110	90 - 110	20
Nitrate	EPA353.2	Nitrate + Nitrite	90 - 110	90 - 110	20
	EPA300.0	Nitrate	90 - 110	80 - 120	20
Nitrite	EPA300.0	Nitrite	90 - 110	80 - 120	20
	EPA 353.2	Nitrite	90 - 110	90 - 110	20
Orthophosphate	EPA365.1/ SM4500 P-E/PF	Orthophosphate	90 - 110	90 - 110	20
Perchlorate	EPA 314	Perchlorate	85 - 115	80 - 120	20
pH	SM4500-HB	pH	98 - 102	-	+ 0.1 pH unit
Phenols	EPA 420.1 / 420.4	Phenols	90 - 110	90 - 110	20
Phosphorus, Total	EPA365.1/ SM4500 P-F	Phosphorus, Total	90 - 110	90 - 110	20
Dissolved Silica	SM 4500 SiO2C	Dissolved Silica	85 - 115	70 - 130	-
Residue, Filterable (Total Dissolved Solids--TDS)	SM2540C	TDS	80 - 114	-	20
Residue, Non-filterable (Total Suspended Solids--TSS)	SM2540D	TSS	80 - 120	-	10
Residue, Settleable (Settleable Solids)	SM2540F	Residue, Settleable (Settleable Solids)	-	-	-
Sulfate	EPA300.0	Sulfate	90 - 110	80 - 120	20
Sulfide (Total & Soluble)	SM 4500S-2D/ EPA 376.2	Sulfide	90 - 110	80 - 120	20
Total Residue	SM 2540 B	Total Solids	85 - 115	-	10
Total Organic Carbon (TOC)	SM5310C	Total Organic Carbon (TOC)	90 - 110	80 - 120	20
Total Organic Halide (TOX)	SM 5320B	Total Organic Halide (TOX)	85 - 115	90 - 110	-
Dissolved Oxygen	SM 4500-O G	Dissolved Oxygen	85 - 115	70 - 130	-
Color	SM 2120B	Color	-	-	-
Surfactants	SM 5540C	Surfactants	90 - 110	80 - 120	20
Turbidity	SM 2130B/ EPA 180.1	Turbidity	90 - 110	-	-

(B) Inorganics – Metals

Parameter Method Name	Method Name	Parameters/ Analytes	Accuracy LCS/LFB % Rec.	Accuracy MS/LFM % Rec.	Precision RPD Maximum
Asbestos	EPA 100.2	Asbestos	-	-	2.0X Poisson standard deviation
Metals	EPA200.7	Aluminum, Al	85 - 115	70 - 130	20
		Antimony, Sb	85 115	70 130	20
		Barium, Ba	85 - 115	70 - 130	20
		Beryllium, Be	85 - 115	70 - 130	20
		Boron, B	85 - 115	70 - 130	20
		Cadmium, Cd	85 - 115	70 - 130	20
		Calcium, Ca	85 - 115	70 - 130	20
		Chromium, Cr	85 - 115	70 - 130	20
		Cobalt, Co	85 - 115	70 - 130	20
		Copper, Cu	85 - 115	70 - 130	20
		Iron, Fe	85 - 115	70 - 130	20
		Magnesium, Mg	85 - 115	70 - 130	20
		Manganese, Mn	85 - 115	70 - 130	20
		Molybdenum, Mo	85 115	70 130	20
		Nickel, Ni	85 - 115	70 - 130	20
		Potassium, K	85 - 115	70 - 130	20
		Silica, SiO2	85 - 115	70 - 130	20
		Silver, Ag	85 - 115	70 - 130	20
		Sodium, Na	85 - 115	70 - 130	20
		Tin, Sn	85 - 115	70 - 130	20
		Vanadium, V	85 - 115	70 - 130	20
		Zinc, Zn	85 - 115	70 - 130	20
Metals	EPA 200.8	Aluminum, Al	85 - 115	70 - 130	20
		Antimony, Sb	85 - 115	70 - 130	20
		Arsenic, As	85 - 115	70 - 130	20
		Barium, Ba	85 - 115	70 - 130	20
		Beryllium, Be	85 - 115	70 - 130	20
		Cadmium, Cd	85 - 115	70 - 130	20
		Chromium, Cr	85 - 115	70 - 130	20
		Cobalt, Co	85 - 115	70 - 130	20
		Copper, Cu	85 - 115	70 - 130	20
		Lead, Pb	85 - 115	70 - 130	20
		Manganese, Mn	85 - 115	70 - 130	20
		Molybdenum, Mo	85 - 115	70 - 130	20

Parameter Method Name	Method Name	Parameters/ Analytes	Accuracy		Precision RPD Maximum
			LCS/LFB	MS/LFM	
			% Rec.	% Rec.	
Metals (con't.)	EPA 200.8	Nickel, Ni	85 - 115	70 - 130	20
		Selenium, Se	85 - 115	70 - 130	20
		Silver, Ag	85 - 115	70 - 130	20
		Thallium, Tl	85 - 115	70 - 130	20
		Vanadium, V	85 - 115	70 - 130	20
		Zinc, Zn	85 - 115	70 - 130	20
Mercury	EPA 245.1/7470A	Mercury,Hg	85 - 115	70 - 130	20
Chromium VI	SM 3500Cr B (20th)	Chromium VI	85 - 115	70 - 130	20
Silica, Dissolved	SM 4500SiO2C	Silica, Dissolved	85 - 115	70 - 130	20

(C) Microbiology/Microbiology Tests

Parameter Method Name	Method Name	Parameters/ Analytes	Accuracy		Precision RPD Maximum
			LCS/LFB	MS/LFM	
			% Rec.	% Rec.	
Fecal Coliforms By Multiple Tube Fermentation /EC Medium	SM9221C, E (MTF/EC)	Fecal Coliforms	-	-	-
Fecal Streptococci/ Enterococci by MTF	SM9230B	Fecal Streptococci/ E-Coli by MTF	-	-	-
Heterotrophic Plate Count	SM9215B	Heterotrophic Plate Count	-	-	5
Total Coliforms Multiple Tube Fermentation (MTF)	SM9221B	Total Coliforms	-	-	-

(D) Radiochemistry

Parameter Method Name	EPA Method Name	Parameters/ Analytes	Accuracy		Precision RPD Maximum
			LCS/LFB	MS/LFM	
			% Rec.	% Rec.	
Gross Alpha/Proportional Counting	EPA900.0	Gross Alpha	80 - 120	80 - 120	20
Gross Beta	EPA900.0	Gross Beta	80 - 120	80 - 120	20

Note: Refer to individual SOPs for precision and accuracy details for all methods

Table 5-3 Precision and Accuracy for Hazardous Waste for Mid or High Level Spikes

(A) Inorganics – Wet Chemistry

Parameter Method Name	EPA Method Name	Parameters/ Analytes	Accuracy		Precision RPD Maximum
			LCS/LFB	MS/LFM	
			% Rec.	% Rec.	

Total Organic Halogen	EPA 9020B	Total Organic Halogen	85 - 115	70 - 130	20

(B) Inorganics – Metals

Parameter Method Name	EPA Method Name	Parameters/ Analytes	Accuracy		Precision RPD Maximum
			LCS/LFB	MS/LFM	
			% Rec.	% Rec.	
Metals, Total	EPA6010B	Aluminum, Al	85 - 115	70 - 130	20
		Antimony, Sb	85 - 115	70 - 130	20
		Barium, Ba	85 - 115	70 - 130	20
		Beryllium, Be	85 - 115	70 - 130	20
		Cadmium, Cd	85 - 115	70 - 130	20
		Chromium, Cr	85 - 115	70 - 130	20
		Cobalt, Co	85 - 115	70 - 130	20
		Copper, Cu	85 - 115	70 - 130	20
		Manganese, Mn	85 - 115	70 - 130	20
		Molybdenum, Mo	85 - 115	70 - 130	20
		Nickel, Ni	85 - 115	70 - 130	20
		Silver, Ag	85 - 115	70 - 130	20
		Strontium, Sr	70 - 130	70 - 130	20
		Tin, Sn	85 - 115	70 - 130	20
		Titanium, Ti	70 - 130	70 - 130	20
		Vanadium, V	85 - 115	70 - 130	20
		Zinc, Zn	85 - 115	70 - 130	20
Metals , Total	EPA6020	Antimony, Sb	85 - 115	70 - 130	20
		Arsenic, As	85 - 115	70 - 130	20
		Barium, Ba	85 - 115	70 - 130	20
		Beryllium, Be	85 - 115	70 - 130	20
		Cadmium, Cd	85 - 115	70 - 130	20
		Chromium, Cr	85 - 115	70 - 130	20
		Cobalt, Co	85 - 115	70 - 130	20
		Copper, Cu	85 - 115	70 - 130	20
		Lead, Pb	85 - 115	70 - 130	20
		Molybdenum, Mo	85 - 115	70 - 130	20
		Nickel, Ni	85 - 115	70 - 130	20

Parameter Method Name	EPA Method Name	Parameters/ Analytes	Accuracy		Precision RPD Maximum
			LCS/LFB	MS/LFM	
			% Rec.	% Rec.	
Metals , Total (con't.)	EPA6020	Selenium, Se	85 - 115	70 - 130	20
		Silver, Ag	85 - 115	70 - 130	20
		Thallium, Tl	85 - 115	70 - 130	20
		Vanadium, V	85 - 115	70 - 130	20
		Zinc, Zn	85 - 115	70 - 130	20
Chromium VI	EPA 7196A EPA 7199	Hexavalent Chromium	85 - 115	70 - 130	20
Mercury	EPA7470A	Mercury, Hg	85 - 115	70 - 130	20

(C) Organics

Parameter Method Name	EPA Method Name	Parameters/ Analytes	Accuracy		Precision RPD Maximum
			LCS/LFB	MS/LFM	
			% Rec.	% Rec.	
Halogenated/ Aromatic Volatiles	EPA8260B EPA 624	Acetone	70 - 130	70 - 130	30
		Acrolein (Propenal)	70 - 130	70 - 130	30
		Acrylonitrile (screen)	-	-	30
		Benzene	70 - 130	70 - 130	30
		Bromodichloromethane	70 - 130	70 - 130	30
		Bromoform	70 - 130	70 - 130	30
		Bromomethane	70 - 130	70 - 130	30
		2-Butanone (MEK)	70 - 130	70 - 130	30
		Carbon disulfide	70 - 130	70 - 130	30
		Carbon tetrachloride	70 - 130	70 - 130	30
		Chlorobenzene	70 - 130	70 - 130	30
		Chlorodibromomethane	70 - 130	70 - 130	30
		Chloroethane	70 - 130	70 - 130	30
		2-Chloroethyl vinyl ether	70 - 130	70 - 130	30
		Chloroform	70 - 130	70 - 130	30
		Chloromethane	70 - 130	70 - 130	30
		Acetone	70 - 130	70 - 130	30
		Dibromomethane	70 - 130	70 - 130	30
		1,2-Dichlorobenzene	70 - 130	70 - 130	30
		1,3-Dichlorobenzene	70 - 130	70 - 130	30

Parameter Method Name	EPA Method Name	Parameters/ Analytes	Accuracy LCS/LFB % Rec.	Accuracy MS/LFM % Rec.	Precision RPD Maximum
Halogenated/ Aromatic Volatiles (con't.)	EPA8260B EPA 624	1,4-Dichlorobenzene	70 - 130	70 - 130	30
		Dichlorodifluoromethane	70 - 130	70 - 130	30
		1,1-Dichloroethane	70 - 130	70 - 130	30
		1,2-Dichloroethane	70 - 130	70 - 130	30
		1,1-Dichloroethylene	70 - 130	70 - 130	30
		cis-1,2-Dichloroethene	70 - 130	70 - 130	30
		trans-1,2-Dichloroethene	70 - 130	70 - 130	30
		1,2-Dichloropropane	70 - 130	70 - 130	30
		cis-1,3-Dichloropropene	70 - 130	70 - 130	30
		trans-1,3-Dichloropropene	70 - 130	70 - 130	30
		Ethylbenzene	70 - 130	70 - 130	30
		2-Hexanone	70 - 130	70 - 130	30
		Methylene chloride	70 - 130	70 - 130	30
		4-Methyl-2-pentanone (MIBK)	70 - 130	70 - 130	30
		Naphthalene	70 - 130	70 - 130	30
		2-Pentanone	70 - 130	70 - 130	30
		Styrene	70 - 130	70 - 130	30
		1,1,2,2-Tetrachloroethane	70 - 130	70 - 130	30
		Tetrachloroethene	70 - 130	70 - 130	30
		Toluene	70 - 130	70 - 130	30
		1,2,4-Trichlorobenzene	70 - 130	70 - 130	30
		1,1,1-Trichloroethane	70 - 130	70 - 130	30
		1,1,2-Trichloroethane	70 - 130	70 - 130	30
		Trichloroethene	70 - 130	70 - 130	30
		Trichlorofluoromethane	70 - 130	70 - 130	30
		Vinyl acetate	70 - 130	70 - 130	30
		Vinyl chloride	70 - 130	70 - 130	30
		o-Xylene	70 - 130	70 - 130	30
		m-Xylene	70 - 130	70 - 130	30
		p-Xylene	70 - 130	70 - 130	30
		1,2-Dichloroethane-d4 (surr)	80 - 120	80 - 120	-
		Toluene-d8 (surr)	88 - 110	88 - 110	-
		4-Bromofluorobenzene (surr)	86 - 115	86 - 115	-

6.0 QUALITY OF TEST RESULTS

6.1. ESSENTIAL QUALITY CONTROL PROCEDURES

The laboratory has established a quality control program that is designed to provide two different types of information about a particular analysis. The ability to confidently evaluate laboratory performance in terms of analytical bias and precision is accomplished through the use of both laboratory control samples (LCS), in the absence of sample matrix effects, and the traditional approach of using matrix spikes and duplicate (MS/MSD) analyses.

The quality control program implemented at EEA recognizes the problems associated with the use of matrix spikes and duplicates, and thus decisions regarding method data quality, when matrix effects are present, are made using data obtained from all control samples. The types and frequencies of control samples used at EEA are summarized below. Method Acceptance Limits are used to validate analytical results for each test. When method reference does not specify acceptance limits for the QC type, control limits are calculated and used as acceptance limits. The Control limits are recalculated at least annually for drinking water and waste water matrices and every 6 months for Hazardous Waste matrix. (See relevant SOP for the current control limits).

6.1.1. NEGATIVE CONTROL

6.1.1.1. Method Blanks

A method blank consists of laboratory pure water containing all of the reagents utilized in the analytical procedure. The method blank is prepared in the same manner as a sample and is processed through all of the analytical steps. All reagents are dated upon receipt in the laboratory and each new lot of reagents is checked by performance of method blanks.

Method blanks are processed along with the associated samples (minimum one MB per prep batch or analytical batch of ≤ 20 samples) performed to determine whether there is reagent contamination or instrument contamination due to sample carryover. The method blanks must remain below the MRL for each analyte of interest. Some analyses (see specific SOPs) have a more stringent requirement (e.g. < ½ or < 1/3 MRL). If samples require a preparatory procedure such as a digestion or extraction prior to analysis, a method blank must be carried through the entire process and analyzed in addition to the instrumental calibration blanks.

When a blank is determined to be contaminated, the cause must be investigated and measures taken to minimize or eliminate the problem. Samples associated with a contaminated blank shall be evaluated as to the best corrective action for the samples (e.g. reprocessing or data qualifying codes). In all cases the corrective action must be documented [TNI-EL-V1M4-2009-1.7.4.1.c].

Method blanks are analyzed as part of the initial or daily calibration process (calibration blanks) and after every 20 samples for each matrix type to monitor the overall procedural blank as well as the purity of the reagents. If analyte in method blanks is >MRL and is >1/10 of amount measured in sample and if blank contamination affects samples or individual data, quality, objectives, the problem is eliminated and reprocessed or affected samples appropriately qualified.

6.1.1.2. **Travel Blanks**

The trip blank is required to be analyzed in the event of any detects in the associated field samples. For example, both methods 504.1 and 524.2 for volatiles determination require a trip blank with each set of samples.

When running method 525.2 for phthalates determination for compliance monitoring purposes, the laboratory runs a trip blank if any of the samples are found positive for phthalates. This is necessary to show that samples were not contaminated from bottle caps, the HCl used for preservation, or the latex gloves worn during sampling. If the samples show the presence of phthalates and there was no trip blank with the set of samples then subsequent resamples from the site must be accompanied by a trip blank. If the samples are not to be analyzed for phthalates, the laboratory does not need to run a trip blank.

If a client has submitted a trip blank and wishes it to be analyzed automatically, the sample is logged in with the appropriate tests and with the log-in ID "Trip Blank" so that analysts will know to analyze and report them.

If a trip blank is submitted and is only to be analyzed in the event of hits, the sample is logged in with an ID of "Trip Blank-Hold."

For the analysis of ethylene dibromide and dibromochloropropane by Method 504.1 and phthalates by method 525.2, the analyst and supervisor ensure that if hits are detected in the associated samples, the trip blank is analyzed and reported within holding times.

Because of the relatively short holding times for VOAs by Method 524.2 and 504.1, the trip blanks are usually analyzed (unless specified by client) whether or not there are hits in the associated sample. In this way, Trip Blanks are always analyzed within holding times.

If there is adequate holding time remaining the analyst may elect to not analyze the trip blank. However in this case, the data should be reduced immediately and if there are hits, the sample should be analyzed on the next run, still within holding time.

In the event that no hits are present in the associated client samples the analyst and supervisor enter NA for the trip blank and preferably place a comment on the sample “not analyzed, no hits in field samples".

In the event that an analyte is detected in the trip blank, the analyst gets the associated stationary blank from shipping, if available, and runs that immediately to confirm that the hits are not due to lab contamination when the blank was prepared. The information to associate the proper trip blank to the sample(s) is be found on the sample bottle label, through the LIMS numbering system, and/or on the COC.

6.1.1.3. **Field Blanks**

Field blanks are used to identify contamination that may have occurred during the sample collection process. Empty containers with the applicable preservatives are sent to the field and filled at the sampling location at the time of sampling from a bottle with analyte-free water that was prepared at the laboratory as per client's request. The empty sample bottle and field blank sample bottle will be provided.

6.1.1.4. **Sample Blanks**

Sample blanks are used with spectrophotometric methods where sample characteristics such as color may give erroneous results. The absorbance of a sample is measured before and after the color development process. The absorbance before is subtracted from the absorbance after to give the true absorbance. Sample blanks are analyzed on an as-needed basis.

6.1.1.5. **Calibration Blanks (CB)**

For non-chromatographic analysis, calibration blanks are prepared along with the calibration standards and differ from the standards only in that the calibration blank does not contain any of the analyte(s) of interest. The calibration blank, by definition, provides the "zero point" in the calibration curve.

6.1.2. **Positive Control**

6.1.2.1. **Laboratory Control Sample (LCS)/Laboratory Fortified Blank (LFB)**

The LCS is used to evaluate the performance of the total analytical system, including all preparation and analysis [TNI-EL-V1M4-2009-1.7.3.2.1].

Laboratory control samples (LCSs) are defined as an interference free matrix spiked with a particular set of method-specific target compounds at a level 5-10 times above the minimum reporting limit. The matrix used to prepare aqueous LCS samples is laboratory reagent water (deionized water - carbon-filtered for organic analyses) and all method preservatives. In some cases LCS must be from a second or independent source, but other methods allow for the use of same sources. LCS is run at a frequency of one LCS per prep batch or analytical batch of $\leq$ 20 samples.

The purpose of the LCS matrix is not to duplicate the sample matrix, but more importantly to provide a consistent matrix with which baseline performance data for an analysis can be generated. This feature of the LCS provides one of the most significant advantages over the use of matrix spikes and spike duplicates. The variable matrix interferences inherent to matrix spikes and spike duplicates are manifested in the extremely wide control limits presented in the methods. This variability results in a large relative standard deviation in the data used to calculate the control limits which forces the control limits to become wider. The control of this variability significantly reduces the relative standard deviation of the data and results in control limits that are representative of laboratory precision alone.

6.1.2.2. **Matrix Spike and Matrix Spike Duplicate Samples (MS/MSD)**

MS/MSD samples are defined as a sample matrix spiked with a particular set of method-specific target compounds at a level 5-10 times above the minimum reporting limit. Samples are generally divided into two types of matrices, aqueous and non-aqueous.

Matrix spikes and spike duplicates are prepared using a sample matrix that is representative of the sample type being analyzed for a particular method. Frequency of the analysis of matrix spikes is as per method specifications or as per contract review.

6.1.2.3. **LCS and MS/MSD Concentration Levels**

When the method reference does not specify the LCS and MS/MSD concentration, the following criteria (in order of descending preference) are to be applied when determining the appropriate concentration of any particular analyte in the designated control sample:

6.1.2.3.1. If no MCL exists, or the MCL represents an impractical level relative to MDL or calibration range, the selected level should be set at the corresponding level used in the EPA's reference methods.

6.1.2.3.2. The level selected should be equal to any existing federal maximum contaminant level (MCL). This may not always be practical (as in the case of thallium [Tl]) when the MCL is too close to our actual MRL to yield consistent accuracy and precision.

6.1.2.3.3. If there is no EPA protocol for a particular method, or this level is inappropriate for the method, then the selected level should be near the midpoint of the calibration range. Optimally, this would be equivalent to the MCL, unless the calibration range spans more than 2 orders of magnitude.

6.1.2.3.4. If the calibration range spans 2 or more orders of magnitude, the selected level should be set at approximately 10 times the MRL for each analyte.

In some cases multiple levels (MRL, midpoint, high) are used to monitor control throughout the calibration range.

6.1.2.4. **Selection of Spike Analytes**

Any analyte reported must be included in the LCS and MS spiked sample for drinking water matrix samples. The selection of specific analytes to be spiked should be based on the following scheme:

6.1.2.4.1. If there are regulatory or method specific monitoring requirements for any of the target compounds, these compounds should be included.

6.1.2.4.2. If there are no regulatory or method specific monitoring requirements or additional analytes required to meet the absolute number to be included in the subset, follow TNI-EL-V1M4-2009-1.7.3.2.3 requirements for LCS spiking composition and TNI-EL-V1M4- 2009-1.7.3.3.1 for MS spiking composition.

6.1.2.4.3. As per the TNI Standard, for those test methods that have extremely long lists of analytes, a representative number may be chosen. The analytes selected should be representative of all analytes reported. The following criteria shall be used for determining the minimum number of analytes to be spiked for LCS and MS. However, the laboratory shall ensure that all targeted components are included in the spike mixture over a 2-year period. This can be applied for non-compliance samples, or other non-drinking water matrix samples.

- For methods that include 1-10 targets, spike all components;
- For methods that include 11-20 targets, spike at least 10 or 80%, whichever is greater;
- For methods with more than 20 targets, spike at least 16 components.

6.1.2.4.4. If neither of the above criteria apply, then the analytes should be selected for the subset so that all the different classes of compounds in the list of target compounds for the method are represented.

6.1.2.4.5. Any unique, method-specific problem analyte or element (such as potential loss of a particular analyte during extraction, digestion, or cleanup step or an element subject to severe inter-element interference on the ICP) should be represented in the subset.

6.1.2.4.6. In the absence of specified spiking components, for those components that interfere with an accurate assessment such as spiking simultaneously with technical chlordane, toxaphene and PCBs, the spike chosen represents the chemistries and elution patterns of the components to be reported. (TNI-EL-V1M4- 2009-1.7.3)

6.1.2.5. **Sample Preparation of LCS/LFB and MS/MSD**

The intent of this program is to set our control sample analytes and concentration levels such that a single concentrated stock mix is (1) independently prepared (preferably from different neat materials) from calibration stock solutions, and (2) can be used to prepare LCS samples as well as MS/MSD samples for both aqueous and non-aqueous environmental samples.

The ratio of spiked concentrate to sample aliquot used to prepare MS/MSD samples must be 1 to 10%, depending on the method specifications. In the case of matrix spikes, this practice ensures that we are not diluting the environmental sample to such an extent that we are diluting out any matrix interferences. The purpose of the matrix spike is to provide information regarding the ability to recover an analyte from a particular matrix.

6.1.2.5.1. **Stock Source of LCS/LFB and MS/MSD**

In order to serve its purpose as an external verification (reference) of the calibration, it is essential that the stock solutions used to prepare LCS and matrix spike samples be prepared independently of calibration stocks unless a method specifies a contrary approach. In the organics area, there is a lack of independent sources from which reference materials are obtained but the stock solutions should be prepared independently although they may share a common source.

The source of control sample reference materials should be selected in the following order of preference:

6.1.2.5.1.1. The neat compound must be prepared from either a completely independent sources. For example, a 1000-mg/L stock As solution obtained from Fisher is used to prepare As calibration standards, while a 1000 mg/L stock As solution obtained from Spex is used to prepare the control sample concentrate.

6.1.2.5.1.2. If a completely independent source cannot be obtained, the same vendor may be used, but the solution shall be from a completely different lot (second lot).

6.1.2.5.1.3. If it is impossible to obtain the reference material from two independent sources, or from two different lots, then the material from a single source can be used provided that a different analyst than the one who prepared the calibration stock is responsible for preparing the control sample solution.

6.1.2.6. **Frequency of MS/MSD**

MS/MSD samples are run at a frequency of one pair for every sample batch of 20 or less of a similar matrix. In cases where there is insufficient sample to run a MS/MSD as well as the original, a pair of LCS samples may be substituted to fulfill this requirement. There is often insufficient sample for aqueous samples to have a MS/MSD set up due to the large volumes of sample required for analysis. EEA encourages clients who require precision and accuracy information based on a particular matrix to make arrangements to submit adequate sample volumes for this purpose. By supplying these samples, the client is able to obtain not only specific information regarding laboratory performance (from LCS sample data), but also a measure of the applicability of the sample matrix to the analytical method used (from the matrix spike and duplicate data). If the matrix spike is used in place of the LCS, the acceptance criteria must be as stringent as the LCS [TNI-EL-V1M4-2009-1.7.3.2.3].

6.1.2.7. **Frequency of LCS/LFB**

Laboratory control samples are analyzed throughout a run at a frequency of 5%-10% for environmental samples of a similar matrix. Bias information is provided based on recovery data for the LCS and precision information is available by comparing LCS sample results using a RPD calculation. The frequencies are consistent with the requirements of most methods referenced in Standard Methods, EPA Manual for Chemical Analysis of Water and Waste, 40 CFR 136 for the wastewater methods, and EPA Manual for the Certification of Laboratories Analyzing Drinking Water, 5th Edition. Additional measures of precision and bias are obtained from other control samples, as specified in the SOP's.

In order to ensure that some measure of analytical control is provided with each batch of samples going through a pre-analysis preparation step, an LCS is prepared with each set of 20 samples extracted or digested for these analyses. In each case, an LCS will be associated with each set of samples prepared, to allow documentation of control of the analytical procedures. Some methods require varying concentrations of LCS throughout a run.

6.1.2.7.1. Analyses with a preliminary treatment step (i.e. extraction or digestion):

6.1.2.7.1.1. LCS frequency is one for every 10 to 20 samples (see individual method SOPs) or at least one for every preparation batch of ≤ 20 samples.

6.1.2.7.1.2. MS/MSD or LCS pair (in cases where there is insufficient sample volume for a MS/MSD) is prepared for every sample batch of 20 samples or as per method specifications.

6.1.2.7.2. Analyses not requiring pretreatment:

6.1.2.7.2.1. A LCS must be run with each analytical run at a frequency of no less than one for every 10 or 20 samples (see individual method SOPs).

6.1.2.7.2.2. A MS/MSD or LCS pair must be run for every batch of 20 samples as defined in method specifications or TNI standards.

6.1.2.7.2.3. Any exceptions to this frequency on a given run must be documented on a corrective action form.

6.1.2.8. **Evaluation Criteria of MS/MSD**

MS acceptance criteria are compared to the acceptance criteria as published in the mandated test method if not specified in the method. Advisory limits for each method are established initially based on method validation data. Initial control limits are defined as the mean recovery (accuracy) ± 3 times the standard deviation obtained from the analysis of 4 (or more) replicates spiked at approximately 10x MRL during the method validation process. Warning limits are set as the mean recovery (accuracy) ±2 times the standard deviation.

Firm acceptance criteria, based upon actual laboratory data, are established once a minimum of 20 data points has been generated. These historical control limits are compared to any method specified or recommended limits to assess their feasibility. Control limits are re-calculated at least yearly to verify that there has been no significant change in performance.

Precision is determined as the relative percent difference (RPD) between LCS pairs or MS/MSD samples. By linking a LCS or MS/MSD pair to each batch of 20 environmental samples, it is possible to link a measure of analytical precision (and two measures of analytical accuracy) to each environmental sample analyzed.

Precision control limits for some analytes have been adopted from the EPA CLP program where they exist, otherwise, control limits are set after the analysis of 20 MS/MSD or LCS pairs of samples (40 control samples). Control limits are set as the mean ± 3 standard deviations of the RPD from the 20-30 "pairs", with warning limits set at the mean ± 2 standard deviations. Until such time as 20-30 data points have been accumulated, interim acceptance criteria should be set as 3 times the standard deviations of the RPD obtained during the method validation process.

Whenever MS/MSD or LCS pairs do not meet these limits, an analysis may have a potential problem. Samples with failing LCS shall be reprocessed and reanalyzed or data reported with data qualifying codes. The source of any problems must be investigated and documented by preparing a corrective action or procedural variance report.

For drinking water method, when there is no method specification, the spike level should not be less than the concentration of the sample selected for fortification unless specified by the method. If the sample concentration is unknown or less than detectable, the analyst should choose an appropriate concentration. If the spike level is less than the concentration of the sample selected, the spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level.

6.1.2.9. Evaluation Criteria of LCS/LFB – Marginal Exceedances

If a large number of analytes are in the LCS, it becomes statistically likely that a few will be outside control limits. This may not indicate that the system is out of control, therefore corrective action may not be necessary. Upper and lower marginal exceedance (ME) limits can be established to determine when corrective action is necessary. A ME is defined as being beyond the LCS control limit (3 standard deviations), but within the ME limits. ME limits are between 3 and 4 standard deviations around the mean.

The number of allowable marginal exceedances is based on the number of analytes in the LCS. If more analytes exceed the LCS control limits than is allowed, or if any one analyte exceeds the ME limits, the LCS fails and corrective action is necessary. This marginal exceedance approach is relevant for methods with long lists of analytes. It will not apply to target analyte lists with fewer than 11 analytes.

The number of allowable marginal exceedances is as follows [TNI-EL-V1M4-2009-1.7.4.2]:

- >90 analytes in LCS, 5 analytes allowed in ME of the LCS control limit;
- 71 – 90 analytes in LCS, 4 analytes allowed in ME of the LCS control limit;
- 51 – 70 analytes in LCS, 3 analytes allowed in ME of the LCS control limit;
- 31 – 50 analytes in LCS, 2 analytes allowed in ME of the LCS control limit;
- 11 – 30 analytes in LCS, 1 analytes allowed in ME of the LCS control limit;
- < 11 analytes in LCS, no analytes allowed in ME of the LCS control limit.

Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systematic problem. The source of the error must be located and corrective action taken.

6.2. Sample Specific Controls

6.2.1. Internal and Surrogate Standards

Internal standards are run with GC/MS, GC, and HPLC analyses to monitor the efficiency of the analytical procedure for each sample matrix encountered and to monitor retention time shifts and the efficiency of the auto-sampler injection. Surrogate standards are run with GC/MS, GC, and HPLC analyses to monitor the efficiency of the extraction for each sample matrix encountered. When there are no established criteria for surrogates from the method, the lab determines internal limits through control charts.

Control limits are re-established annually for surrogates based on historical laboratory data from environmental sample matrices. Internal and surrogate standards are added to each sample analyzed by EPA Methods as recommended and run in accordance with the method procedures. For references to specific compounds used for internal and surrogate standards please reference the SOP.

Current surrogate acceptance limits may be found in Table 6-1.

6.2.2. **Spikes – Recoveries, RPDs**

Spiked sample analyses (MS/MSD) are performed to evaluate the effect of the sample matrix on the analytical methodology. A known amount of the analyte(s) of interest is added to an aliquot of sample, which is then analyzed along with the unspiked sample. Spiked samples are prepared and subjected to the same process as the original sample. Spike recoveries are calculated, and used to determine whether the sample matrix interferes with the method.

Spike recoveries are calculated as follows:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

Where;

%R	=	percent spike recovery
SSR	=	spiked sample result (corrected for any dilution in spiking)
SR	=	sample result
SA	=	spike amount added

The Laboratory documents the percent (%) recoveries and %RPD for MS/MSD samples [TNI-EL-V1M4-2009-1.7.4.3.a].

6.2.3. **Duplicates, Duplicate Spikes**

Duplicate analysis of a sample has traditionally been used to obtain a measure of analytical precision in the form of a relative percent difference (RPD) calculation between the two values. EEA routinely will analyze duplicate spiked control samples, MS/MSD to meet specific client's QC requirements such as Arizona.

Since no precision information is obtained when either or both of the duplicates have analyte concentrations below the MRL, duplicate analysis of the spiked samples makes the most sense. While still subject to interference problems the advantage of duplicate matrix spikes is clearly the ability to obtain calculated RPD values specific for a particular sample matrix. Clients are encouraged to submit sufficient sample for the analysis of MS/MSD samples by specific request when a RPD value for their particular matrix is desirable.

Ongoing analytical precision is evaluated by tracking the difference between the MS/MSD (or LCS pairs) analyzed with each batch of 20 samples. These differences are compared to control limits established for each analysis from historical monitoring. In the event that the method does not specify the criteria, control charts are reviewed to set laboratory internal/default QC criteria [TNI-EL-V1M4-2009-1.7.4.3.a].

For those analyses for which MS/MSD or LCS samples are not prepared, sample duplicates are analyzed to monitor performance.

The relative percent difference between duplicates or duplicate spikes is calculated as follows:

$$\textbf{RPD} = \frac{|S-D|}{(S+D)/2} \times 100$$

where;

RPD	=	Relative Percent Difference
S	=	First Sample Value (original)
D	=	Second Sample Value (duplicate)

6.2.4. External Reference Samples/Quality Control Sample (QCS)

Reference samples such as those available from NIST and EPA or other EEA approved vendors are analyzed to verify the accuracy of calibration standards. Reference standards with matrices comparable to the samples being analyzed are also included in the run whenever available.

External reference samples are analyzed immediately following the calibration standards for all inorganic and organic analyses. Appropriate reference samples for organics analyses by GC and GC/MS are less readily available and are only run when a new stock standard is prepared to verify its accuracy

6.2.5. Confirmation

Confirmation is performed to verify the compound identification when positive results are detected on a sample from a location that has not been previously tested by the laboratory. Confirmations are performed on GC organic tests such as pesticides or herbicides. GC confirmation is done following method requirements or recommendations. See method SOPs for detailed discussion of the confirmation methods. Confirmation is not required when a sample is analyzed by mass spectrometer methods. All confirmation is documented in appropriate log books/work books.

6.2.6. Retention Time Windows

Absolute retention time and relative retention time aid in the identification of components in chromatographic analyses and to evaluate the effectiveness of a column to separate constituents. The laboratory ensures that it meets the method acceptance criteria for retention time windows. If the method does not specify acceptance criteria for retention time windows, the laboratory gathers a minimum of 30 data points and calculates the acceptance criteria range using 3 times the standard deviation of the average ($\bar{x} \pm 3sd$).

6.3. DEMONSTRATION OF CAPABILITY (DOC)

6.3.1. Method Detection Limits (MDL) / Limit of Detection (LOD)

6.3.1.1. The laboratory shall utilize MDL determination by 40 CFR Part 136 as one option to provide an LOD for each analyte that is appropriate and relevant for the intended use of the data. An LOD is not required for a test method when test results are not reported outside the calibration range. LOD shall be determined by the protocol in the mandated test method or applicable regulation. If the protocol for determining LOD is not specified, the selection of the procedure must reflect instrument limitations and the intended application of the test method [TNI-EL-V1M4-2009-1.5.2.1].

6.3.1.2. The MDL shall be initially determined for the compounds of interest in each test method in a quality system matrix in which there are not target analytes nor interferences at a concentration that would impact the results of the MDL must be determined in the quality system matrix of interest [TNI-EL-V1M4-2009-1.5.2.1.d].

6.3.1.3. Method Detection Limits (MDLs) will be determined as per 40CFR, part 136, Appendix B. Essentially, this requires that an estimate of the detection limit be determined for each target analyte based on analytical experience or published references. Seven replicates of DI water must then be spiked at this estimated MDL for each method analyte carried through the entire procedure over a minimum of 3 separate analysis/extraction days. The MDL is then calculated as the standard deviation of the 7 replicates multiplied by the statistical "t-value" associated with the actual number of replicates analyzed assuming N-1 degrees of freedom (for exactly 7 replicates, the t-value is 3.143; 40 CFR, Part 136).

6.3.1.4. MDL study must be verified annually as per the EPA Manual at a minimum (or more frequently if stated in the Method such as EPA 300.0 and 353.2 where the MDL study has to be repeated every 6 months). A copy of all associated data must be submitted to the QA group for filing.

6.3.1.5. An MDL study must be repeated for each new analyst trained in a particular method, or if there is a change in the instrumentation or the test method that is used for the analysis in question. This is a necessary requirement to ensure that each new analyst has received sufficient training such that the data generated will be comparable to that of former analysts. It is necessary to repeat the MDL process with a change in instrumentation to ensure that the new instrumentation is capable of achieving equivalent sensitivity. An MDL study must also be repeated when there is any significant change in background or instrument response.

6.3.1.6. A minimum of a three-point calibration will be performed prior to the MDL study. One of the points must be at the MDL spike level. The calibration must meet all criteria outlined in the Calibration Policy.

6.3.1.7. The spiked level must be within 10 times the calculated MDL or the process must be repeated at a lower spike concentration. The spike level should be greater than the calculated level.

6.3.1.8. If there is a significant blank level, the spike level for the MDL determination must be at least three times greater than the blank concentration.

6.3.2. Minimum Reporting Limits (MRL) / Limits of Quantification (LOQ)

6.3.2.1. The Minimum Reporting Limit (MRL) is the lowest concentration normally reported to the client. It represents the reporting value linked to a specific analyte for aqueous matrix in the LIMS system. The MRL represents a conservative, nominal reporting limit designed to be representative of the minimum quantifiable concentration level for a particular analyte in a real environmental matrix as opposed to the statistically derived MDL calculation.

6.3.2.2. The MRL will generally be established by multiplying the statistically derived MDL by a factor of 2 or 3. The rationale for this approach is that the resultant value becomes approximately 10 times the standard deviation obtained during the MDL study; the EPA frequently refers to this concentration as the "Limit of Quantification (LOQ)", and defines it as the level above which accurate quantitation can be achieved. This level is also more similar to the SW-846 and SDWA concept of "Practical Quantitation Limits" (PQL). At a minimum, the MRL needs to be greater than or equal to the MDL.

6.3.2.3. Perform an MRL check and calculate the acceptance criteria for recovery of spiked analyte at MRL is 50-150 % or ± 3 standard deviations, whichever is greater if the method does not specify acceptance limits. MRL Check is run daily as per EPA Manual for the Certification of Laboratories Analyzing Drinking Water, 5th Edition.

6.3.2.4. Final MRLs should only be established after receiving input from the Group Technical Manager, Client Services Manager, Lab Director and Quality Manager. This ensures that all relevant issues regarding the selection of MRLs have been considered. These issues include specific minimum reporting limits required by a particular state or regulatory body, contractually required reporting limits for a specific client, the need to provide consistent reporting limits for our clients that have historically submitted samples associated with long-term monitoring efforts, as well as to remain competitive in the market. Thus a specific client may require that we use an MDL on our reports rather than an MRL. This deviation must be documented on client reports. A "J" flag is used to qualify results greater than MDL, but less than MRL (>MDL, <MRL). A "U" flag is used to qualify results not detected at the MDL.

6.3.3. Initial Demonstration of Capability(IDC)

6.3.3.1. An IDC is performed for each analyst and instrument. The IDC for each analyst includes a demonstration of the ability to achieve a low background, the precision and accuracy required by the method, the method detection limit (MDL) in accordance with procedure in 40 CFR 136, Appendix B and satisfactory performance on an unknown sample as on-going proficiency test result are also filed.

6.3.3.2. The IDC is repeated when there is a change in analyst, test method or instrument.

6.3.3.3. All initial demonstrations of capability and method certification shall be documented [TNI-EL-V1M3 to V1M7-2009-1.6]. A copy of the certification should be retained in the personnel records of each affected employee [TNI-EL-V1M3 to V1M7-2009-1.6.1].

6.3.3.4. Initial demonstration of method performance is completed each time there is a significant change in instrument type, personnel, or test method.

6.3.3.5. Continuing demonstration of method performance (such as laboratory control and matrix spike samples) is monitored by use of control charts.

6.3.3.6. The QC sample used for the IDC analysis is obtained from an outside source. If an external vendor is not available, the laboratory prepares the QC sample independent of the instrument calibration standard.

6.3.3.7. The QC sample concentration prepared for the IDC is approximately 1-4 times the MRL for spike concentration if not specified by the method or regulations. Four aliquots of the sample are analyzed concurrently (same day) or over a period of days. Average recovery and standard deviation for each parameter of interest are calculated in the units used for reporting to clients. The resulting average recovery and standard deviation must meet the acceptance criteria for the method.

6.3.3.8. When it is not possible to determine mean and standard deviations, such as for presence/absence and logarithmic values, the laboratory assesses performance against established and documented criteria. If there is no mandatory criteria in the method, either reference or laboratory generated limits are used.

6.3.3.9. If standards cannot be prepared, as for Microbiology, QC samples or PE samples obtained from NIST or other approved PT providers are used for the IDC. The laboratory retains all associated supporting data necessary to reproduce analytical results summarized in the IDC certification statement. The Microbiology DOC SOP provides the details of the DOC procedure.

6.3.3.10. Analysis of actual samples is not done until all parameters of interest for the IDC meet acceptance criteria. If one or more of the test parameters do not meet the acceptance criteria, the problem is corrected, followed by repeated analysis of the four aliquots for those that failed to meet criteria. If the repeat analyses fail acceptance criteria the laboratory investigates, corrects the problem and repeats the test for all parameters.

6.4. METHOD SPECIFIC QUALITY CONTROL

6.4.1. Gravimetric

6.4.1.1. All laboratory analytical balances and thermometers of ovens are calibrated annually with Class S weights and a certified thermometer. Records of this balance calibration are maintained by the balances and periodically turned in to the QA Officer for filing as records are completed. Balances are verified on each day of use.

6.4.1.2. A sufficient number of dessicators are maintained to insure that samples are not crowded to the point where they cannot cool to room temperature at the end of the specified drying period. Desiccant replacement is based on color changes.

6.4.1.3. LCS samples are analyzed at a frequency of 5 or 10% and are specified in each method SOP. At least one LCS is analyzed for each analytical run.

6.4.1.4. MS/MSD samples (or LCS pairs) are analyzed at the rate of once every batch of 20 samples of a similar matrix, or at other frequency, depending on the method requirements.

6.4.2. Titration

6.4.2.1. Use of an automated titrator set to proper delivery speed insures that every sample is titrated to the same endpoint. For manual titration, selection of the proper endpoint is achieved by comparing the color of the sample currently being titrated with the color of the previously titrated sample. The analyst must be particularly careful when performing a titration with a fading endpoint. In such instances, it is important to complete the titration as rapidly as possible.

6.4.2.2. An external reference sample is analyzed with each new set of standards or titrant to verify the accuracy of the titrant standardization and the endpoint determination. In addition, the endpoint pH is checked for each sample.

6.4.2.3. LCS samples are analyzed at a frequency of 5 or 10% and are specified in each method SOP. At least one LCS is analyzed for each analytical run.

6.4.2.4. MS/MSD samples (or LCS pairs) are analyzed at the rate of once every batch of 20 samples of a similar matrix, or at other frequency, depending on the method requirements.

6.4.3. Colorimetric Spectrophotometry

6.4.3.1. The alignment of the cell holder and light source is checked when absorbancy indicates a problem.

6.4.3.2. A minimum of three standards plus a blank, equally spaced over the concentration range, are used to calibrate the spectrophotometer in the absorbance mode, except where methods specify the use of one standard only.

6.4.3.3. The analyst records the absorbance reading for the top standard and notes on the form if a gradual increase or decrease in the absorbance of this standard is occurring. A gradual decrease in absorbance values from week to week is usually indicative of a deteriorating standard or the initial stage of lamp failure.

6.4.3.4. The rate of color development and color stability of spectrophotometric procedures varies considerably. The allowable time interval for reading the absorbance of the sample is specified in the method and must be rigidly adhered to in order to obtain accurate results.

6.4.3.5. Measuring a blank and a calibration standard after every twenty samples checks the stability of the spectrophotometer. If the baseline absorbance or the standard absorbance value has changed by more than 0.005 absorbance units or 10% from the initial calibration standard, whichever is greater, the instrument must be recalibrated and all samples analyzed since the last acceptable calibration check must be reanalyzed.

6.4.3.6. Some water samples have a natural color or turbidity which absorbs appreciably at the wavelength used in the analysis. If the sensitivity of a procedure is sufficiently high, it is usually possible to minimize this interference by diluting the sample. If the sensitivity is not adequate to permit sample dilution, the turbidity or color interference is corrected for, by reading the absorbance of the sample carried through the procedure without addition of the indicator reagent when instrumentation permits it. This absorbance reading is then subtracted as a blank from the absorbance reading of the sample.

6.4.3.7. LCS samples are analyzed at a frequency of 5 or 10% and are specified in each method SOP. At least one LCS is analyzed for each analytical run.

6.4.3.8. MS/MSD samples (or LCS pairs) are analyzed at the rate of once every batch of 20 samples of a similar matrix, or at other frequency, depending on the method requirements.

6.4.4. ICP Emission Spectroscopy & ICPMS

6.4.4.1. The sensitivity of each element is recorded in order to detect deficiencies in the instrument or operating conditions.

6.4.4.2. Reagent blanks followed by a calibration check standard are run for each metal determined with a frequency of 10%. If there is a difference of >10% from the initial standard reading, the instrument must be recalibrated and all samples that were analyzed after the last acceptable calibration check must be reanalyzed.

6.4.4.3. For ICP analysis using the simultaneous system, inter-element correction factors must be available for each wavelength used. Background correction must be used for each element.

6.4.4.4. LCS samples are analyzed at a frequency of 5 or 10% as specified in each method SOP. At least one LCS is analyzed for each analytical run.

6.4.4.5. MS/MSD samples (or LCS pairs) are analyzed at the rate of once every batch of 20 samples of a similar matrix, or at other frequency, depending on the method requirements.

6.4.5. Radiochemistry

6.4.5.1. The laboratory participates in performance studies for gross alpha and beta, Uranium and radium. Results must be within the control limits established by the vendor for each analysis.

6.4.5.2. The laboratory monitors monthly radiation measurement of laboratory instrumentation for radioactive contamination [TNI-EL-V1M6-2009-1.7.1.d]. The procedure is discussed in the CHP Manual including criteria and corrective action procedure.

6.4.5.3. Efficiency curves are run at least annually and the data recorded in the radiation notebook.

6.4.5.4. A background is run monthly for gas proportional counter, and each day of use for scintillation counter) and a known reference sample is run with each batch of radiation samples analyzed. Background check measurements shall be performed at least weekly for gas proportional counter [TNI-EL-V1M6-2009-1.7.1.c.iii]. EEA performs background check measurements each day of use for gas proportional counter. Method blank shall be performed at a frequency of at least one per preparation batch. If the acceptance criteria specified in the SOP are not met, the specified corrective action and contingencies shall be followed and the result reported with appropriate data qualifying codes [TNI-EL-V1M6- 2009-1.7.3.1.c].

6.4.5.5. LCS samples are analyzed at a frequency of 5 or 10% and are specified in each method SOP. At least one LCS is analyzed for each analytical run. The activity of LCS shall be at least10 times the Minimum Detectable Activity (MDA) or at a level comparable to that of the routine samples if the sample activities are expected to exceed 10 times the detection limit [TNI-EL-V1M6-2009-1.7.2.2.e].

6.4.5.6. Gross alpha and gross beta require MS for aqueous samples. When there is not sufficient sample aliquot size to perform a matrix spike, it shall be noted on the lab report [TNI-EL-V1M6-2009-1.7.2.3.a.iv]. The activity of the matrix spike analytes shall be greater than five times the MDA [TNI-EL-V1M6-2009-1.7.2.3.a.v].

6.4.5.7. The laboratory standards used to prepare LCS and MS shall be from a source independent of the laboratory standards used for instrument calibration [TNI-EL-V1M6-2009-1.7.2.2.f]. The MS shall be prepared by adding a known activity of target analyte.

6.4.5.8. Replicate shall be performed at a frequency of one per preparation batch where there is sufficient sample to do so. The replicate result shall be assessed against the specific acceptance criteria specified in the laboratory SOP. For low level samples (less than approximately three times the MDA) the laboratory may analyze duplicate laboratory control samples or a replicate matrix spike (matrix spike and a matrix spike duplicate) to determine reproducibility within a preparation batch [TNI-V1M6-2009-1.7.2.3.b.iv].

6.4.5.9. Consistent test conditions for RAD testing are maintained through a radiological control program that addresses analytical radiological control (See EEA's Radiation Safety Program Manual). The program shall address the procedures for segregating samples with potentially widely varying levels of radioactivity. The radiological control program shall explicitly define how low level and high level samples will be identified, segregated and processed in order to prevent sample cross-contamination. The radiological control program shall include the measures taken to monitor and evaluate background activity or contamination on an ongoing basis [TNI-EL-V1M6-2009-1.7.2.7.c].

6.4.6. <u>Gas Chromatography</u>

6.4.6.1. A laboratory water blank is analyzed for all analyses to check for artifacts from the GC system and for the presence of impurities in the water blank making it unsuitable for LCS preparation.

6.4.6.2. A field or travel blank should be analyzed for each set of field samples taken. With each set of travel blanks sent out, a stationary travel blank is kept in the laboratory for analysis to demonstrate that the water sent out was free of contamination.

6.4.6.3. A series of continuing calibration standards are run with the analysis each day for all GC analyses.

6.4.6.4. LCS and/or MS/MSD samples for assessing precision and accuracy are determined by carrying the control samples or spike and spike duplicates through the extraction procedure as well as the instrumental analysis.

6.4.6.5. LCS samples are analyzed at a frequency of 5 or 10% and are specified in each method SOP. At least one LCS is analyzed for each analytical run.

6.4.6.6. MS/MSD samples (or LCS pairs) are analyzed at the rate of once every batch of 20 samples of a similar matrix.

6.4.7. Gas Chromatography/Mass Spectrometry

6.4.7.1. GC/MS Tuning Specifications

The mass spectrometer must be shown to be properly tuned during each daily 12 hour shift. This insures that the masses and abundance's, which the data system determines, are accurate. The EPA has suggested criteria for tuning the GC/MS with two standard compounds, decafluorotriphenylphosphine (DFTPP) and 1-bromo-4-fluorobenzene (BFB). Tuning criteria are shown in Table 11-3.

The following settings are maintained:

- Emission Current: 0.5 ma
- Electron Energy: 70 ev
- Electron Multiplier: 1000-2000 volts as required for sensitivity
- Dynodes: 3000 V

For HPLC and LCMS tuning, please consult the appropriate Standard Operating Procedure for the method in question

6.4.7.2. Quantitation of Identified Compounds/Quantitation from Initial Instrument Calibration

The calibration procedure for GCMS is based on the EPA Methods Reference, for example 524.2, 525.2, 624, and 625. A minimum five point standard curve is run for all analytes. For each calibration compound a response factor (Rf) and the %RSD are calculated.

The procedure to be employed for evaluation of the acceptability of the initial calibration curve based on the EPA Methods Reference, see individual SOPs for specific examples.

All quantitation are done from initial instrument calibration and not from continuing calibration unless required by the method, regulation or program [TNI-EL-V1M4-2009-1.7.1.1.c].

6.4.7.3. Internal and Surrogate Standards (IS and SS)

The internal standard area counts are recorded for all volatile and semi-volatile samples.

If any sample is found to have an IS beyond ± 50% based on ICAL (± 30% for CCV) of the IS counts for the daily continuing calibration standard, the sample is re-analyzed unless an obvious matrix problem can be documented.

Surrogate standards are utilized in both the volatile and semi-volatile analysis.

Any volatile sample surrogate recovery that falls outside of the lab limits is immediately re-analyzed. If surrogate recoveries are still outside of the limits, a QIR is written and the report is annotated. If the second result is within the control limits, this result is reported.

For semi-volatile samples with unacceptable surrogate recoveries, the extraction run logs are examined for matrix related or other documented problems. In addition, the LCS recoveries are reviewed for the sample extraction set. If none of these indicate a matrix problem, the sample is re-extracted if still within holding times. If the analysis of the re-extract shows unacceptable surrogate recoveries, a QIR form is generated, then the sample report is annotated and the data reported.

6.4.7.4. Criteria for Tentatively Identified Compounds (TIC's)

A primary advantage of GC/MS is the ability to identify compounds for which the retention time and mass spectra are not well known to the operator. This is accomplished by performing a library search using the EPA/NIST library of mass spectra and comparing unknown to these spectra. The library search program gives five or ten of the "best fits". The best fits are determined by comparing the top eight mass fragments in the unknown to the spectra in the library. The program matches the mass numbers and the abundances at each mass number to those in the library. The program lists the possible identifications along with the numbers, which can be used by the MS operator to determine the quality of the identification. The fit is the degree to which the peaks and intensities in the unknown match those of a particular compound in the library. A perfect match would be 1000 or 1.000, depending on the software. EEA utilizes CLP criteria and method specifications for determining identification of unknowns. This includes the presence of all major ions greater than 10% relative intensity, agreement of ± 20% for major ions in the sample and reference spectra, and the review of all ions present in the sample spectrum for possible background contamination or interference.

In general a computer fit of 850 or 0.850 should be the minimum used for identification. It should be noted that even with computer library searches, there is no substitute for the judgment of a trained analyst.

6.4.7.5. Control Samples

LCS samples are analyzed at a frequency of 5%. At least one LCS is analyzed for each analytical run.

MS/MSD samples (or Duplicate) are analyzed at the rate of once every batch of 20 samples of a similar matrix, as required by TNI. Duplicates are usable only when target analytes are positives.

6.4.7.6. Blanks

Laboratory reagent water blank is normally the first sample analyzed at the beginning of each working day to demonstrate that the system is free from contamination. If the blank result indicates contamination, the system is cleaned by running additional water blanks or if necessary, finding an alternate source of contaminant free water.

6.4.8. Total Organic Carbon (TOC)

6.4.8.1. Samples are diluted to fall within the linear range of the standards.

6.4.8.2. Every tenth sample is an LCS and %recoveries must fall within acceptable control limits. MS/MSD samples (or LCS pairs) are analyzed at the rate of once every batch of 20 samples of a similar matrix as per method requirements.

6.4.9. Total Organic Halogen (TOX)

6.4.9.1. Three carbon blanks (carbon packed adsorption columns washed with nitrate-wash solution only) are analyzed at the beginning of each workday. All values must be within 20% of the average blank value obtained before standards can be run.

6.4.9.2. Each day, a set of three calibration standards is analyzed prior to analysis of samples. Calculated values for the standards must fall within 5% of the nominal value except for the 1.0 standard, which is allowed a 10% range.

6.4.9.3. Every eighth sample is, alternately, a continuing calibration standard or a carbon blank.

6.4.9.4. All samples are analyzed in duplicate. If the net values of the duplicates are not within acceptance criteria of 20%, a third and possibly a fourth replicate is analyzed.

Results are compared to the first and second replicate and the average of the two closest samples is reported.

6.4.9.5. The titration cell is revitalized by rinsing with fresh cell solution after every twenty analyses or sooner if necessary.

6.4.9.6. Samples are diluted to fall within the linear range of the standards.

6.4.9.7. Two or three serial adsorption columns from each sample adsorption are analyzed separately to determine if any organic halogen breakthrough is occurring. In the event of breakthrough, an additional diluted sample is analyzed. Every tenth sample is an LCS and %recoveries must fall within acceptable control limits.

6.4.9.8. MS/MSD samples (or LCS pairs) are analyzed at the rate of once every batch of 20 samples of a similar matrix.

6.4.9.9. The purity and adsorption capacity of each new batch of carbon purchased is assessed by duplicate analysis of an adsorption efficiency standard. This adsorption efficiency standard (standards injected into reagent water then filtered) must be within 5% of the standard value. In addition, duplicate carbon blank results must be less than 1 µg Cl-.

6.4.10. General Microbiology - Use of Commercial Dehydrated Powder for Coliform Testing

6.4.10.1. The individual collecting samples should be aware of the sampling precautions outlined in Standard Methods.

6.4.10.2. Specific sampling instructions are available from the EEA Microbiology Department. They list required precautions to follow to maintain the integrity of the samples and prevent contamination.

6.4.10.3. The maximum holding time for microbiological samples is 30 hours for drinking water and 6 hours for water/wastewater, and 8 hours for source water.

6.4.10.4. The bottles should be shipped sealed in strong plastic zip lock or bubble bags. This keeps the melting ice from contaminating the samples. Ice cubes or their equivalent must be placed around the samples but care must be taken that the samples do not freeze.

6.4.10.5. Sterility check on sample containers shall be performed on at least one container for each lot of purchased pre-sterilized sample containers. For containers prepared and sterilized in the lab, a sterility check shall be performed on one container per sterilized batch with non-selective growth media [TNI-EL-V1M5-2009-1.7.3.1.b.iii]. Microbiology sample containers are disposable high clarity polystyrene vessels with sodium thiosulfate sufficient to neutralize at minimum 5 mg/L of chlorine (IDEXX Cat No. WS216PS) for drinking water and 15 mg/L of chlorine for wastewater samples. Containers from each lot of “ready to use” are tested to ensure efficacy of $Na_2S_2O_3$ to 5 mg/L Cl_2 for drinking water and 15 mg/L Cl_2 for wastewater. Thus, samples received in the lab are not tested for additional residual Cl_2 testing [TNI-EL-V1M5-2009-1.7.5.b]. When the residual chlorine concentration is checked in the field, the result is documented in the COC.

6.4.10.6. A sterilization indicator is used during each autoclave cycle. If problems exist as indicated by a failure of the sterilization indicator, none of the items from that autoclave load is used and the group leader is notified. Demonstration of effective sterilization is provided by the use of biological indicators at least once per month of use [TNI-EL-V1M5-2009-1.7.3.7.b.ii].

6.4.10.7. Culture media are prepared from commercial dehydrated powders or ready to use media such as colilert medium. The laboratory does not prepare media or its culture media from basic ingredients. [TNI-EL-V1M5-2009-1.7.3.5.a]

6.4.10.8. Only nanopure water is used for the preparation of media. Once opened, the powdered media is tightly recapped to prevent hydration.

6.4.10.9. Prepared liquid medium is stored in the dark at refrigeration of 4°C and used within 3 months. The media is labeled with the type of medium, date prepared and the initials of the analyst who weighed out the dehydrated powder.

6.4.10.10. Prepared agar plates are stored in plastic bags, agar up, in the refrigerator. The bag is labeled to identify the type of medium, date prepared and the initials of the analyst who prepared it.

6.4.10.11. When bacteriological samples are incubated in a water bath or incubator, the temperature is recorded each morning and afternoon on the appropriate temperature sheet.

6.4.10.12. A thermometer calibrated at 44.5˚C is used for the water bath when fecal coliforms are incubated.

6.4.10.13. A positive control culture obtained from the American Type Culture Collection is inoculated for each batch of media including chromofluorogenic medium, incubated and read to indicate the acceptability of a media to a particular bacteria type. A negative control consisting of an inoculation of sterile phosphate buffer or an un-inoculated portion of media is also incubated to demonstrate the absence of contamination prior to first use of the medium.

6.4.10.14. When membrane filtration methods are used to analyze samples, a control blank of sterile dilution water is analyzed at the beginning of each set of samples. For membrane filter or plate media, duplicate counts shall be performed monthly on one positive sample for each month that the test is performed. If more than one analyst, each analyst shall count typical colonies on the same plate and count must be within 10%. If only one analyst, sample plate shall be counted twice by the analyst, with <5% difference between counts.

6.4.10.15. The laboratory analyzes a bacteriological proficiency test sample from ERA semi-annually for NELAP accreditation. The coliform test, standard plate count, is conducted on this reference sample.

6.4.10.16. A completed test is conducted on 10% of all positive coliform samples for wastewater matrix. If no positives are found, at least one positive source water or control sample is completed quarterly.

6.4.10.17. Environmental monitoring is conducted weekly using PCA plates to measure background contamination occurring from bacteria, yeast and mold carried in the air. The number of colonies on the air density plate should not exceed 15 colonies/plate/15 minutes of exposure.

6.4.11. <u>Asbestos</u>

6.4.11.1. The sampling technique follows the methods outlined by EPA in Method 100.2- Analytical Method for Determining Asbestos Fibers in Water EPA-600/R-94/134, June 1994. All samples are to be stored at 4°C until filtration and completion of analysis.

6.4.11.2. Specific sampling instructions are available from the Microbiology Department. They list precautions to follow in order to maintain the integrity of the samples and prevent contamination.

6.4.11.3. The procedure is outlined in the Method 100.2. All modifications of procedures including reasons for modifications are recorded in the SOP.

6.4.11.4. All counts for calculations and report generation are entered into LIMS to eliminate inconsistency in the final report.

6.4.11.5. The manufacturers' manuals for proper operation of all equipment used in asbestos analyses are properly filed and accessible. Records of periodic inspection, calibration and service of equipment are maintained in appropriate logbooks. Phone numbers for instrument service are posted by each instrument.

6.4.11.6. Blank using fiber-free water is processed each day that samples are filtered as stated in Method 100.2. The criterion for acceptability of bottle and process blanks is < 0.01 MFL > 10 microns in length. If this limit is exceeded, the samples filtered on the same day as the blank must be re-filtered.

6.4.11.7. All samples are filtered within 48 hours of sample collection. Samples received past 48 hours of collection are treated with O3 –UV.

6.4.11.8. The absolute (HEPA) filtration system is monitored daily and filters are changed when needed.

6.4.11.9. Asbestos glassware is prepared using sonication as stated in the method.

Table 6-1 Example of Surrogate Acceptance Limits

Method	Compound	Acceptance Limits, %
504.1/8011	1,2-Dibromopropane	60-140
524.2	4-Bromofluorobenzene	70-130
	1,2-Dichloroethane-d4	70-130
	Toluene-d8	70-130
525.2	perylene-d12	70-130
	1,3-dimethyl-2-nitrobenzene	70-130
	triphenylphosphate	70-130
531.2	BDMC	70-130
551.1	1,2-Dibromopropane	80-120
624	4-Bromofluorobenzene	70-130
	1,2-Dichloroethane-d4	70-130
	Toluene-d8	70-130
625/8270	Nitrobenzene-d5	24-118
	2-Fluorobiphenyl	24-117
	Terphenyl-d14	27-149
	2-Fluorophenol	11-126
	Phenol-d5	20-118
	2,4,6-Tribromophenol	24-141
6251 B	3,5-Dichlorobenzoic Acid	70-130
8260B	4-Bromofluorobenzene	70-130
	1,2-Dichloroethane-d4	70-130
	Toluene-d8	70-130

Note: Refer to individual SOPs for detailed Surrogate Acceptance Limits.

7.0 SAMPLE COLLECTION, PRESERVATION, IDENTIFICATION, HANDLING, AND STORAGE

Sample collection and sample handling techniques are important aspects of the overall sample analysis process and have a major impact on the validity of the results. Specific containers and preservatives are used to ensure that the analytes originally present in the sample are not lost through degradation or do not become more concentrated. In addition, contaminants that would interfere with the analysis or give erroneously high results must be mitigated.

The laboratory provides sampling instructions to all clients to guide clients on the appropriate sample collection procedures. If a client chooses to collect their own samples, experienced lab staff can brief clients by telephone or in writing through EEA's sampling collection instruction on the proper methods of sample collection. If a client chooses to hire the laboratory to do the sampling, the sampling will be done by trained sampling personnel.

7.1. SAMPLE COLLECTION AND BOTTLE PREPARATION

Production of quality analytical data requires that the collected sample is representative of the sampled area. Sampling procedures should adhere to the guidelines established by EPA and other regulatory agencies and be appropriate for the sample matrix and types of analytical parameters to be determined.

The laboratory provides sampling instructions to all clients to guide clients on the appropriate sample collection procedures. If a client chooses to collect their own samples, experienced lab staff can brief clients by telephone or in writing through our sampling collection instruction on the proper methods of sample collection. If a client chooses to hire the laboratory to do the sampling, the sampling will be done by a trained sampling personnel.

Sample bottles for all analyses except bacteriological are purchased pre-cleaned according to EPA Protocol specifications from various vendors. Certification statements for each lot of bottles are kept on file in the shipping department and each bottle is marked with its lot number. Each new lot of bottles used for volatiles analyses are checked for volatiles and trace metals contamination. All files regarding Bottle Testing are kept in the QA Files. Glass bottles are wrapped in bubble bags to prevent breakage and normally shipped to the sampling site in coolers with gel packs for chilling samples. A copy of the original kit order is included with each shipment and should be returned with properly cooled samples to the laboratory along with a properly completed chain of custody form (COC). The kit order specifies the numbers of bottles sent for each analysis and is used during the log in procedure in the laboratory.

7.2. CONTAINERS, PRESERVATIVES, HOLDING TIMES AND SAMPLE KITS

EEA supplies the appropriate sample containers, preservatives, chain-of-custody forms, coolers, and packing materials to a client upon request. The container types, bottle sizes, preservatives, container closures, and recommended holding times are shown in Table 6-1 for Drinking Water, Table 6-2 for Wastewater, and Table 6-3 for Hazardous Waste. These specifications follow CFR 136-149, Required Containers, Preservation Technique and Holding times July 1, 2011 edition and updates. Also followed is the Manual for the Certification of Laboratories Analyzing Drinking Water, Fifth Edition. Arrangements for sample kits may be made through the Client Services department. Preservatives are shipped to clients only in the specified container; bulk preservatives are not normally shipped. Only reagent grade (or better) preservatives are used. The chemicals used as preservatives are as follows:

Ascorbic Acid	Nitric acid	Sodium sulfite
Ammonium chloride	Potassium Citrate	Trizma Buffers
Copper Sulfate	Sodium hydroxide	Zinc acetate
Ethylenediamine	Sodium thiosulfate	Sodium azide
Hydrochloric acid	Sulfuric acid	Maleic Acid

Containers are delivered to the client by the following methods:
(1) Client comes to laboratory to take sample kit,
(2) Containers are sent to client by courier,
(3) Containers are shipped (via UPS/FedEx/DHL) in coolers meeting all DOT regulations.

To ensure that samples meet the temperature requirements, the laboratory checks and records the sample temperature upon receipt on the COC. The temperature check documents that the samples are kept cold (>1°C, ≤6°C), not frozen, during transport. Samples that arrive on the same day of collection and have not reached <6°C must have evidence of cooling to be acceptable.

7.3. SAMPLE STORAGE

7.3.1. Under normal circumstances storage is maintained in a refrigerator kept at 4 ± 2°C for one month from receipt [TNI-EL-V1M2-2009-5.8.9.a.i]. All samples are normally retained for at least 2 months after sample receipt or until holding times have expired, whichever is shorter. A different storage period can be arranged at the request of the client. All samples are kept in the proper storage environment for one month from receipt and then stored in the waste storage area until disposal.

7.3.2. Samples are kept in refrigerators or if storage at ambient temperature is permitted, on shelving in the designated area. Samples in the designated areas are available for the analyst to take as necessary. Documentation that these samples have been taken is available in the run log. The analyst uses their run log (Figure 8-7) as a means of tracking their samples.

7.3.3. Samples designated for volatile analysis are not kept in the same refrigerators as samples designated for non-volatile analysis.

7.3.4. Temperature in the cold storage areas is monitored twice a day at least 4 hours apart to ensure all samples meet storage temperature requirements. Storage temperatures are recorded in appropriate logbooks [TNI-EL-V1M2-2009-5.9.3.a.viii].

7.4. SAMPLE DISPOSAL

7.4.1. All laboratory wastes including excess samples, excess calibration standards, any excess test items, digestates, leachates, extracts or other sample preparation products are identified by their composition. Six waste streams are identified in the laboratory; extraction solvent, Methylene chloride wastewater, chloroform, Freon, rapid flow analyzer, corrosive acids and bases, HPLC, and flammable. Each type of waste is placed into a separate, clearly identified steel drum located in a secure area outside the laboratory. Each drum also has a characterization sheet (manifest) attached. This sheet is completed every time a waste is introduced into the drum. Drums are taken for disposal/recycling once the drum is 75 % full or every 90 days from the start date of accumulation.

7.4.2. A large majority of samples received by EEA are raw or potable waters. Residual samples, if not extracted, are disposed of by neutralizing with sodium hydroxide (NaOH) or nitric acid (HNO_3). The type and amount of waste is recorded in a logbook.

7.4.3. A continuous pH meter is attached to the effluent outfall into the city sewer to record pH of all outgoing fluids from the laboratory.

7.4.4. Hazardous waste is disposed of in 55 gallon drums. Characterization sheet is available for each type of waste or waste profile.

7.4.5. Sample disposal procedures details are available in the disposal area and available through our SOP titled, "Hazardous Waste Management and Sample Disposal Procedures". The SOP describes the requirements for the safe and effective disposal of all sample, extract and digestate waste contained in the laboratory. Means of disposal include dispensing into manifested 55 gallon drums.

7.4.6. All samples that are considered to be potentially hazardous based upon analytical results or matrix will be disposed of through a hazardous waste disposal company or a client may request that the samples be returned to them for disposal. All disposal arrangements should be made with a project manager. All samples are disposed of in accordance to RCRA and county regulations.

Table 7-1 Preservation and Holding Times for Drinking Water

(A) Inorganics – Wet Chemistry – Drinking Water
No Extract Holding Time

Parameter/ Method Name	EPA/SM Method Number	Preservative	Sample Holding Time	Recommended Minimum Sample Size	Type of Container
Alkalinity	SM2320B	Cool, 4 ± 2°C	14 days	125 mL	Plastic
Bromate	EPA 300.1/ EPA 317.0	5mg Ethylene Diamine (EDA)/ 125 mL	28 days	125 mL	Plastic
Bromide	EPA 300.0/ EPA 300.1	None or EDA	28 days	125 mL	Plastic
Chloride	EPA300.0	None	28 days	125 mL	Plastic
Chlorate	EPA 300.0/ EPA 300.1	5 mg Ethylene Diamine/125 mL	28 days	125 mL	Plastic
Chlorite	EPA 300.0/ EPA 300.1/ EPA 317.0	5 mg Ethylene Diamine/ 125 mL Cool, 4 ± 2°C	14 days	125mL	Plastic
Color	SM2120B	Cool, 4 ± 2°C	48 hours	500 mL	Glass
Conductivity	SM2510B	Cool, 4 ± 2°C	28 days	125 mL	Plastic
Cyanide	SM4500CN-F/ EPA335.4	Cool, 4 ± 2°C, 1 mL Ascorbic acid. (if chlorinated), 1 mL NaOH, pH>12	14 days	1 L	Plastic
Fluoride	SM4500 F-C	None	28 days	125 mL	Plastic
Foaming Agents Surfactant (MBAS)	SM5540C	Cool, 4 ± 2°C	48 hours	500 mL	Plastic
Nitrate (chlorinated)	EPA300.0/ EPA 353.2	Cool, 4 ± 2°C	14 days	125 mL	Plastic
Nitrate (non-chlorinated)	EPA300.0/ EPA 353.2	Cool, 4 ± 2°C	48 hours	125 mL	Plastic
Nitrate + Nitrite	EPA 353.2 EPA 300.0	Cool, 4 ± 2°C, 0.5 mL H_2SO_4, pH<2	28 days	125 mL	Plastic
Nitrite	EPA300.0 EPA 353.2	Cool, 4 ± 2°C	48 hours	125 mL	Plastic
Odor	SM2150B	Cool, 4 ± 2°C	24 hours	500 mL	Glass
Perchlorate	EPA 314	None	28 days	125 mL	Plastic
Perchlorate	EPA 331	Sterile, Cool, 4 ± 2°C	28 days	125 mL	Plastic
pH	SM4500-HB	Cool, 4 ± 2°C	15 minutes*	125 mL	Plastic

Parameter/ Method Name	EPA/SM Method Number	Preservative	Sample Holding Time	Recommended Minimum Sample Size	Type of Container
o-Phosphate	SM4500 P-E	Filter immediately, Cool, 4 ± 2°C	48 hours	125 mL	Polyglass Glass
Residual Disinfectant (Total/Free Residual Chlorine)	SM 4500 Cl-G	None (Analyzed on the day of collection)	15 minutes*	200 mL	Amber Glass Bottle
Silica Dissolved/ Reactive Silica	EPA 200.7 SM 4500Si-D	Cool, 4 ± 2°C	28 days	125 mL	Plastic
Solids (TDS)	SM 2540C	Cool, 4 ± 2°C	7 days	125 mL	Plastic
Sulfate	EPA 300.0	Cool, 4 ± 2°C	28 days	125 mL	Plastic
Turbidity	EPA 180.1	Cool, 4 ± 2°C	48 hours	125 mL	Plastic
Total Organic Carbon/ Dissolved Organic Carbon (DOC)	SM 5310 C/ EPA 415.3	0.5 ml H_2SO_4 to pH<2 Cool, 4 ± 2°C	28 days	125 mL	Amber Glass Bottle Teflon lined cap
UV 254/SUVA	SM 5910 B/ EPA 415.3	Cool, 4 ± 2°C	48 hours	125 mL	Amber Glass Bottle Teflon lined cap

* Must be analyzed immediately in the field for compliance.

(B) Inorganics – Metals – Drinking Water

No Extract Holding Time

Parameter/ Method Name	EPA/SM Method Number	Preservative	Sample Holding Time	Recommended Minimum Sample Size	Type of Container
Metals (except Hg)	EPA200.7/ EPA200.8	0.5 mL HNO_3, pH<2	6 months	1 L	Plastic
Metals (Ca, Mg, K, Na)	EPA200.7	0.5 mL HNO_3, pH<2	6 months	500 mL	Plastic
Mercury	EPA245.1	2 mL HNO_3, pH<2	28 days	500 mL	Plastic
Chromium VI (Dissolved)	EPA218.6	Ammonium Sulfate/Ammonium Hydroxide Buffer, NaOH, 4 ± 2°C, pH 9.2-9.7	28 days (24 hours for DW)	125 mL	Plastic
Hardness	EPA200.7/ SM 2340B	0.5 mL HNO_3, pH <2	28 days	500 mL	Plastic

(C) Microbiology/Microscopy Tests – Drinking Water
No Extract Holding Time

Parameter/ Method Name	EPA/SM Method Number	Preservative	Sample Holding Time	Recommended Minimum Sample Size	Type of Container
Asbestos	EPA 100.2	Cool, 4 ± 2°C	48 hours	1 L	1 L Plastic Bottle
Drinking Water Source Enumeration	SM9223 (Colilert) SM9221BE (MTF)	Cool, 4 ± 2°C, 0.2 mL of 3% $Na_2S_2O_3$	8 hours	100 mL	Sterile Plastic Bottle
Fecal Coliforms--EC Medium	SM9221E (MTF)	Cool, 4 ± 2°C, 0.2 mL 3% $Na_2S_2O_3$	30 hours	100 mL	Sterile Plastic Bottle
Heterotrophic Plate Count (Standard Plate Count)	SM9215B	Cool, 4 ± 2°C, 0.2 mL 3% $Na_2S_2O_3$	8 hours	100 mL	Sterile Plastic Bottle
Total Coliforms; By Multiple Tube Fermentation (MTF)	SM9221AB	Cool, 4 ± 2°C, 0.2 mL 3% $Na_2S_2O_3$	30 hours	100 mL	Sterile Plastic Bottle
Total Coliforms--E. Coli	SM9223	Cool, 4 ± 2°C	30 hours	100 mL	Sterile Plastic Bottle
Total Coliforms--E. Coli	SM 9223B - Colisure	Cool, 4 ± 2°C	30 hours	100 mL	Sterile Plastic Bottle
Coliphage	EPA 1602	Cool, 4 ± 2°C	48 hours	1000 mL	Sterile Plastic Bottle

(D) Organics – Drinking Water

Parameter/ Method Name	EPA/SM Method Number	Preservative	Sample Holding Time	Extract Holding Time	Recommended Minimum Sample Size	Type of Container
DBCP/EDB	EPA504.1	3 mg Sodium Thiosulfate Cool, 4 ± 2°C	14 days	4 °C, 24 hours	40 mL	Glass with Teflon Lined Septum

Parameter/ Method Name	EPA/SM Method Number	Preservative	Sample Holding Time	Extract Holding Time	Recommended Minimum Sample Size	Type of Container
Organohalide Pesticides and PCB	EPA 505	3 mg Sodium Thiosulfate Cool, 4 ± 2°C	14 days/ 7 days for heptachlor	4 °C, 24 hours	40 mL	Vial with PTFE-lined Screw caps
Chlorinated Herbicides (GC with Electron Capture	EPA515.4	Sodium Sulfite, dark, cool ≤ 10°C (first 48 hours, 4 ± 2°C after 48 hours)	14 days	≤0°C dark, 21 days	1 L	Amber Glass with Teflon lined Cap
Nitrosamines	EPA 521	80 – 100 mg sodium thiosulfate; Cool, 10°C (first 48 hours, 4 ± 2°C after 48 hours)	40 days	7 days	1 L	Amber glass with PTFE-lined Screw caps
Purgeable Organic Compounds/ Halogenated Aromatics, THMs, Di-Isopropyl Ether (DIPE), Tertiary Amyl methyl ether (TAME), Tert Butyl ethyl ether (ETBE) Low level TCP	EPA 524.2	25 mg Ascorbic Acid, then HCl pH < 2; Cool, 4 ± 2°C	14 days	NA	2x40 ml	Teflon Lined Septum
	EPA 524.3	25 mg Ascorbic Acid, Maleic Acid; Cool, 4 ± 2°C	14 days	NA	3x 40 mL	Teflon Lined Septum
Low Level TCP (GC/MS)	EPA 524.2/ CA DHS	Cool, 4 ± 2°C or thiosulfate, HCL pH<2	14 days	NA	2x40 ml	Teflon Lined Septum
Semi-Volatile Organics Acid/Base Neutrals, including thiobencarb (GC/MS)	EPA525.2	40-50 mg Sodium Sulfite, Dark, Cool, 4 ± 2°C, HCl, pH<2. HCL must be added after sample dechlorination	14 days	≤ 4˚C 30 days from collectio n	1 L	Amber Glass with teflon lined Cap

Parameter/ Method Name	EPA/SM Method Number	Preservative	Sample Holding Time	Extract Holding Time	Recommended Minimum Sample Size	Type of Container
Acetanilide Pesticide Parent Compounds	EPA 525.2	40-50 mg Sodium Sulfite, Dark, Cool, 4 ± 2°C, HCl, pH<2. HCL must be added after sample dechlorination	14 days	≤ 4˚C 14 days	1 L	Amber Glass with teflon lined Cap
Pesticides and Flame Retardants	EPA 527	0.10 g/L of L-Asorbic Acid, 0.35 g/L of Trisodium EDTA, and 9.4 g/L of Potassium dihydrogen citrate; Cool, 10°C (first 48 hours, 4 ± 2°C after 48 hours)	28 days	14 days	1 L	Amber glass with PTFE-lined Screw caps
Explosives	EPA 529	0.5 g/L of Copper Sulfate pentahydrate, 5.0 g of Trizma buffer; Cool, 10°C (first 48 hours, 4 ± 2°C after 48 hours)	30 days	14 days	1 L	Amber glass with PTFE-lined Screw caps
Carbamates	EPA 531.2	0.38 g/40-mL vial Potassium dihydrogen citrate If residual chlorine is present, 6-mg of sodium thiosulfate/40-mL vial	Cool, <10°C first 48 hrs; 4 ± 2°C thereafter; dark; 28-days; pH - 3.8	< 6°C; 28-days	40 mL	Vial with PTFE-lined Screw caps
Acetanilide Pesticide Degradation Products	EPA 535	25 – 30 mg ammonium chloride; Cool, 10°C (first 48 hours, 4 ± 2°C after 48 hours)	28 days	14 days	250 mL	Amber glass with PTFE-lined Screw caps

Parameter/ Method Name	EPA/SM Method Number	Preservative	Sample Holding Time	Extract Holding Time	Recommended Minimum Sample Size	Type of Container
Glyphosate (HPLC with Fluorescence Detector)	EPA547	6 mg Sodium Thiosulfate Cool, 4 ± 2°C	14 days (18 mo. If frozen)	NA	60 mL	Amber Glass with teflon lined septum
Endothall (GC/MS)	EPA548.1	Sodium Thiosulfate (HCl, pH 1.5-2 if high bio activity) Cool, 4 ± 2°C, Dark	7 days	14 days ≤4°C	250 mL	Amber Glass with teflon lined septum
Diquat & Paraquat (HPLC with Photoiode, Array Detector)	EPA549.2	100 mg Sodium Thiosulfate (H_2SO_4, pH<2 if bio active) Cool, 4 ± 2°C, Dark	7 days	21 days	1 L	Amber Plastic
THMs & EDB (1-2,dibromoethane) DBCP (1,2-dibromo-3-chloropropane	EPA 551.1	Sodium Sulfite, 10-50 mg NH4Cl/40 mL + 400-mg phosphate buffer/ 40 ml, Cool, 4 ± 2°C	14 days	14 days	3x60 ml	Amber Glass with Teflon lined cap
Haloacetic Acids	SM6251B	65 mg NH4Cl / 40 ml Cool, 4 ± 2°C	14 days	7 days	2 x 40 mL	Amber Glass with teflon lined cap
1,4-Dioxane	EPA 522	50 mg/L Sodium Sulfite ; 1 g/LSodium Bisulfate	14 days	30 days	2 x 250mL	Amber Glass with teflon lined cap
Dioxin	EPA 1613B	Sodium Thiosulfate Cool, 0-4°C	NA	40 days	1 L	Amber Glass with PTFE lined cap
Aldehyde	SM 6252	Cool, 4 ± 2°C	14 days	7 days	2 x 40 mL	Amber glass containers with

Parameter/ Method Name	EPA/SM Method Number	Preservative	Sample Holding Time	Extract Holding Time	Recommended Minimum Sample Size	Type of Container
		If residual chlorine is present, 10 – 50 mg of ammonium chloride/40-mL vial				teflon-faced septa and open top screw caps

(E) Radiochemistry – Drinking Water
No Extract Holding Time

Parameter/ Method Name	EPA/SM Method Number	Preservative	Sample Holding Time	Recommended Minimum Sample Size	Type of Container
Uranium	EPA 200.8	0.5 mL HNO_3 to pH<2	6 months	125 mL	Plastic
Gross Alpha	EPA 900.0	2.0 mL HNO_3 to pH<2	6 months	1 L	Plastic
Gross Beta	EPA 900.0	2.0 mL HNO_3 to pH<2	6 months	1 L	Plastic
Radium 228	EPA 904.0	2-mL HNO_3 per liter; pH <2	6-months, if unpreserved; after 5-days, preserve and hold in the original container for minimum of 16-hrs.before analysis	1 L	Plastic
Radon 222	SM 7500 Rn	None, no headspace	4 days	250 ml	Glass

Note: Refer to individual SOPs for preservation and holding times for all other methods not listed in Quality Manual.

Table 7-2 Preservation and Holding Times for Wastewater

(A) Inorganics – Wet Chemistry – Waste Water
No Extract Holding Time

Parameter/ Method Name	EPA/SM Method Number	Preservative	Sample Holding Time	Recommended Minimum Sample Size	Type of Container
Alkalinity, (Bicarbonate, Carbonate, & Total Hydroxide)	SM 2320B	Cool, > 0°C , < 6°C not frozen	14 days	125 mL	Plastic
Ammonia	EPA350.1 SM4500NH3-H	Cool, > 0°C , < 6°C not frozen, 0.5 mL of H_2SO_4 to pH < 2	28 days	125 mL	Plastic
Biochemical Oxygen Demand (BOD)	SM5210B	Cool, > 0°C , < 6°C not frozen	48 hours	500 mL	Plastic
Bromide	EPA300.0	None	28 days	125 mL	Plastic
Carbon Biochemical Oxygen Demand (CBOD)	SM5210B	Cool, > 0°C , < 6°C not frozen	48 hours	500 mL	Plastic
Chemical Oxygen Demand (COD)	EPA410.4/ SM 5220D	Cool, > 0°C , < 6°C not frozen, 0.5 mL of H_2SO_4 to pH < 2	28 days	125 mL	Plastic
Chloride	EPA300.0	None	28 days	125 mL	Plastic
Chlorine, Total Residual	SM4500 Cl G	Cool, > 0°C , < 6°C not frozen	15 minutes * (immediately)	250 mL	Amber Glass
Chromium VI	SM 3500Cr-D/ EPA 218.6	Cool, > 0°C , < 6°C not frozen, Ammonia Sulfate buffer, NaOH, pH 9.3-9.7,	28 days	125 mL	Plastic
Cyanide, Total	EPA 335.4	Cool, > 0°C , < 6°C not frozen, 4 mL NAOH to pH>12, 0.6 g Ascorbic Acid (if chlorinated)	14 days	1 L	Plastic
Cyanide, Amenable to Chlorination	EPA 335.1/ SM 4500 CN-G	Cool, > 0°C , < 6°C not frozen, 4 mL of NAOH to pH>12, 0.6 g Ascorbic Acid (if chlorinated)	14 days	1 L	Plastic
Fluoride	SM4500 F-C	None	28 days	125 mL	Plastic
Hardness	EPA 200.7/ SM 2340B	1.0 mL HNO_3 to pH< 2	6 months	250 mL	Plastic
Kjeldahl Nitrogen	EPA 351.2	Cool, > 0°C , < 6°C not frozen, 0.5 mL of $H_2SO_4$to pH < 2	28 days	125 mL	Plastic

Parameter/ Method Name	EPA/SM Method Number	Preservative	Sample Holding Time	Recommended Minimum Sample Size	Type of Container
Nitrate	EPA 353.2/ EPA 300.0	Cool, > 0°C , < 6°C not frozen	48 hours	125 mL	Plastic
Nitrite	EPA300.0/ EPA 354.1/ 353.2	Cool, > 0°C , < 6°C not frozen	48 hours	125 mL	Plastic
Orthophosphate	EPA 365.1/ SM4500 P-F	Filter Immediately, Cool, > 0°C , < 6°C not frozen	48 hours	125 mL	Plastic
Perchlorate	EPA 314.0	None	28 days	125 mL	Plastic
pH	SM4500-HB	None	15 minutes *	125 mL	Plastic
Phenols	EPA 420.4/ EPA 420.1	Cool, > 0°C , < 6°C not frozen, 2.0 mL H_2SO_4 to pH < 2	28 days	500 mL	Amber Glass
Phosphorus, Total	EPA 365.1/ SM4500 P-F	Cool, > 0°C , < 6°C not frozen,0.5 mL H_2SO_4 to pH < 2	28 days	125 mL	Plastic
Residue, Filterable (Total Dissolved Solids--TDS)	SM2540C	Cool, > 0°C , < 6°C not frozen	7 days	500 mL	Plastic
Residue, Non-filterable (Total Suspended Solids,TSS)	SM 2540D	Cool, > 0°C , < 6°C not frozen	7 days	500 mL	Plastic
Residue, Settleable (Settleable Solids)	EPA 160.5/ SM 2540F	Cool, > 0°C , < 6°C not frozen	48 hours	500 mL	Plastic
Specific Conductance	SM 2510B	Cool, > 0°C , < 6°C not frozen	28 days	125 mL	Plastic
Sulfate	EPA300.0	Cool, > 0°C , < 6°C not frozen	28 days	125 mL	Plastic
Sulfide (Total & Soluble)	SM 4500 S-2D	Cool, > 0°C , < 6°C not frozen, Zinc Acetate, plus NaOH to pH > 9	7 days	125 mL	Plastic
Total Organic Carbon (TOC)	SM 5310C	Cool, > 0°C , < 6°C not frozen,0.5 mL H_2SO_4 to pH < 2	28 days	125 mL	Amber Glass
Total Organic Halide (TOX)	SM 5320B	Sulfite & H_2SO_4	14 days	250 mL	Amber Glass
Turbidity	EPA180.1	Cool, > 0°C , < 6°C not frozen	48 hours	125 mL	Plastic

* Must be analyzed immediately in the field for compliance.

(B) Inorganics – Metals – Waste Water
No Extract Holding Time

Parameter/ Method Name	EPA/SM Method Number	Preservative	Sample Holding Time	Recommended Minimum Sample Size	Type of Container
Metals (except Hg)	EPA200.7 EPA200.8	0.5 mL HNO_3 to pH< 2	6 months	125 mL	Plastic
Metals (Ca, Mg, K, Na)	EPA200.7	0.5 mL HNO_3 to pH< 2	6 months	125 mL	Plastic
Mercury, Hg	EPA245.1	2.0 mL HNO_3 to pH< 2	28 days	500 mL	Plastic

(C) Microbiology/Microscopy Tests – Waste Water
No Extract Holding Time

Parameter/ Method Name	EPA/SM Method Number	Preservative	Sample Holding Time	Recommended Minimum Sample Size	Type of Container
Asbestos	EPA 100.2	Cool, > 0°C , < 6°C not frozen	48 hours	800 mL	Plastic (1 L)
Fecal Coliforms By Multiple Tube	SM9221E	Cool, > 0°C , < 6°C not frozen; 0.2 mL 3% $Na_2S_2O_3$ (if chlorinated)	6 hours	100 mL	Sterile Plastic
Fecal Streptococci/ Enterococci by MTF	SM9230B	Cool, > 0°C , < 6°C not frozen; 0.2 mL 3% $Na_2S_2O_3$ (if chlorinated)	6 hours	100 mL	Sterile Plastic
Heterotrophic Plate Count	SM9215B	Cool, > 0°C , < 6°C not frozen; 0.2 mL 3% $Na_2S_2O_3$ (if chlorinated)	6 hours	100 mL	Sterile Plastic
Total Coliforms By Multiple Tube Fermentation (MTF)	SM9221B	Cool, > 0°C , < 6°C not frozen; 0.2 mL 3% $Na_2S_2O_3$ (if chlorinated)	6 hours	100 mL	Sterile Plastic

(D) Organics – Waste Water

Parameter/ Method Name	EPA/SM Method Number	Preservative	Sample Holding Time	Extract Holding Time	Recommended Minimum Sample Size	Type of Container
Halogenated Volatiles/ Aromatic Volatiles	EPA 624	Cool, > 0°C , < 6°C not frozen, 10 mg $Na_2S_2O_3$ for residual Cl_2,HCl** pH < 4-5	14 days	NA	40 mL	Amber Glass/ Teflon lined Septum
Semi-Volatiles, Acid and Base/ Neutral Compounds	EPA 625	Cool, > 0°C , < 6°C not frozen, 80 mg $Na_2S_2O_3$ for residual Cl_2	7 days	40 days	1 L	Amber Glass/ Teflon lined Cap

**HCl must be added after sample dechlorination

(E) Radiochemistry – Waste Water

No Extract Holding Time

Parameter/ Method Name	EPA/SM Method Number	Preservative	Sample Holding Time	Recommended Minimum Sample Size	Type of Container
Uranium	EPA200.8	0.5 ml HNO_3 to pH <2	6 months	125 ml	Plastic
Gross Alpha	EPA900.0	4.0 mL HNO_3 (18%) to pH<2	6 months	1 L	Plastic
Gross Beta	EPA900.0	4.0 mL HNO_3 (18%) to pH<2	6 months	1 L	Plastic
Radon 222	SM 7500 Rn-B	None	4 days	250 ml	Glass

Note: Refer to individual SOPs for preservation and holding times for all other methods not listed in Quality Manual.

Table 7-3 Preservation and Holding Times for Hazardous Waste (Aqueous Matrix Only)

(A) Inorganics – Wet Chemistry – Hazardous Waste (Aqueous)

No Extract Holding Time

Parameter/ Method Name	Matrix	EPA/SM Method Number	Preservative	Sample Holding Time	Sample Size	Type of Container

Parameter/ Method Name	Matrix	EPA/SM Method Number	Preservative	Sample Holding Time	Sample Size	Type of Container
Chromium VI	Aqueous	EPA 7196A EPA 7199	Cool, > 0°C , < 6°C not frozen, add buffer or NAOH	24 hours	125 mL	Plastic
Conductivity	Aqueous	EPA 9050A	Cool, > 0°C , < 6°C not frozen	28 days	125 mL	Plastic
Cyanide, Total	Aqueous	EPA 9012A	4 mL NaOH to pH > 12, Cool, > 0°C , < 6°C not frozen	14 days	1 L	Plastic
Fluoride	Aqueous	EPA 9214	Cool, > 0°C , < 6°C not frozen	28 days	125 mL	Plastic
Nitrate as N	Aqueous	EPA 9056	Cool, > 0°C , < 6°C not frozen	48 hours	125 mL	Plastic
Perchlorate	Aqueous	EPA 314/ EPA 331	Sterile, > 0°C , < 6°C not frozen	28 days	125 mL	Plastic
pH	Aqueous	EPA 9040B	None	7 days	125 mL	Plastic
Phenol	Aqueous	EPA 9066	Cool, >0°C, < 6°C not frozen, 2.0 mL H_2SO_4 to pH < 2	28 days	500 mL	Amber Glass
Sulfide, Total	Aqueous	EPA 9030B	Zinc Acetate, NaOH pH > 9, Cool, > 0°C , < 6°C not frozen	7 days	125 mL	Plastic
Total Organic Halides (TOX)	Aqueous	EPA 9020B	Sulfite & H_2SO_4	14 days	250 mL	Amber Glass
Chloride, Chlorite, Sulfate, Nitrite	Aqueous	EPA 9056	Cool, > 0°C , < 6°C not frozen	48 hours	125 ml	Plastic

(B) Inorganics – Metals – Hazardous Waste (Aqueous)
No Extract Holding Time

Parameter/ Method Name	Matrix	EPA/SM Method Number	Preservative	Sample Holding Time	Sample Size	Type of Container
Arsenic, As, Dissolved Arsenic, As, Total	Aqueous	EPA 6020	0.5 mL HNO_3 to pH < 2	6 months	125 mL	Plastic
Mercury, Total	Aqueous	EPA 7470A	2.0 mL HNO_3 to pH < 2	28 days	500 mL	Plastic

Parameter/ Method Name	Matrix	EPA/SM Method Number	Preservative	Sample Holding Time	Sample Size	Type of Container
Mercury, Dissolved			Filtered on site, 2.0 mL HNO_3 to pH < 2			
Metals, Total *	Aqueous	EPA 6010B EPA 6020	0.5 mL HNO_3 to pH < 2	6 months	125 mL	Plastic
Metals, Dissolved *	Aqueous	EPA6010B EPA6020	Filtered on site, HNO_3 to pH < 2	6 months	125 mL	Plastic

* Aluminum, Antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, vanadium and zinc.

(C) Organics – Hazardous Waste (Aqueous)

Parameter/ Method Name	Matrix	EPA/SM Method Number	Preservative	Sample Holding Time	Extract Holding Time	Recommended Minimum Sample Size	Type of Container
EDB/DBCP	Aqueous	EPA 8011	3 mg sodium thiosulfate, Cool, > 0°C , < 6°C not frozen	14 days	< 6°C, 24 hours	40 mL	Glass/ Teflon lined septum
Halogenated Volatiles & Aromatic Volatiles	Aqueous	EPA8260B	10 mg $Na_2S_2O_3$ for residual chlorine, HCl, pH < 2 Cool, > 0°C , < 6°C not frozen	14 days	NA	40 mL	Amber Glass/ Teflon lined Septum
Semi-Volatile Organic Compounds	Aqueous	EPA8270C	80 mg $Na_2S_2O_3$, Cool, > 0°C , < 6°C not frozen	7 days	40 days	1 L	Amber Glass/ Teflon lined Cap
1,4-Dioxane	Aqueous	50 mg/L Sodium Sulfite ; 1 g/LSodium Bisulfate	EPA 522	50 mg/L Sodium Sulfite ; 1 g/LSodium Bisulfate	30 days	2 x 250mL	Amber Glass with teflon lined cap

Note: Refer to individual SOPs for preservation and holding times for all other methods not listed in Quality Manual.

8.0 SAMPLE MANAGEMENT

8.1. SAMPLE RECEIPT AND LOG-IN/SAMPLE RECEIPT PROTOCOL

EEA receives all samples through its sample control group. Upon receipt of samples, the sample control group inspects each sample for breakage or leakage, inverted septa, inappropriate caps or bottles, air bubbles in volatile organics samples, incomplete sample labels, incomplete paperwork, or discrepancies between the sample labels and the paperwork. The sample custodian checks the sample temperature to ensure that the required temperature is maintained during transport. EPA requires for most methods that a sample temperature of 4 ± 2°C (TNI > 0, < 6˚C) shall be maintained during transport. The sample custodian records the sample temperature on the Chain of Custody. If the reading is above 6°C, the Project Manager (PM) is notified who then notifies the client regarding his sample condition. For samples that arrive at the laboratory > 6°C, the client will be notified that the affected samples are unacceptable for regulatory compliance purposes, if not received on the same day of collection with evidence of cooling, and analysis is at the discretion of the client. (Acceptance criteria as per MUR, March 12, 2007 is ≤ 6°C).

The sample custodian also screens all hazardous waste and wastewater samples from a new client with the Geiger Counter meter for presence of radiation levels above background. For additional details refer to Sample Receiving and Log-In SOP. Any sample receipt problems are recorded either on the Chain of Custody (COC) Form (Figure 8-6) for Level I or on COC and Sample Cooler Receipt Form (Figure 8-1) for Level II samples. The Client Services Manager or designated Project Manager is notified about the problems. The client is informed of these problems, the appropriate course of action is determined and a decision is made immediately whether re-sampling is required.

Sample control employees are designated to receive all shipments and deliveries to the laboratory. The procedure for receiving samples is detailed in the Sample Receipt SOP kept on file in the log-in area and central QA files. A EEA Kit Order Form (KO) is filled out for each client's samples. An example of the KO is shown in Figure 8-2. A computer assigned laboratory number is placed on each sample bottle and the bottles are stored in refrigerators segregated by receipt date.

8.1.1. Sample Labeling System

Sample bottles must be clearly labeled so that the laboratory tracking system can function optimally. All sample bottles are shipped with labels containing the particular parameters to be tested from each bottle as well as any preservative information. The client must fill in the sampling date and sample site, and the client name/identification, on the label. The sample control group insures that all returned samples contain sample site identifications.

After log-in, the sample control group attaches a label with the laboratory sample tracking number to each sample bottle. All sample bottles collected for a particular sample site normally receive the same base laboratory sample tracking number and a stamped label with this number is attached to each bottle. When analysts run a sample work schedule for their particular analysis, they receive a computer printout listing the laboratory sample numbers requiring that analysis. The analyst must then find the samples with these assigned numbers in their appropriate containers in refrigerated or non-refrigerated storage. The work schedule printout also gives the name of the client and sample ID that is compared with the information printed on the sample label to insure a proper identification.

The assigned laboratory numbers utilized for sample tracking are always a twelve-digit number. The first eight digits represent the year, month and day the sample was logged in. The remaining four digits are utilized to give each sample a unique identification number and these numbers are assigned consecutively from 1 to 9999 by the computer when the samples are logged in. These last four digits are reset back to one (1) at the beginning of each day. The laboratory also assigns a unique laboratory identification number to each sample and subsample container, and attaches a durable label to each sample container. The assignment of unique laboratory ID is done for each subsample except for samples that have short holding times. All laboratory ID codes assigned to each sample are documented in each appropriate logbooks/workbook for related laboratory activities such as sample preparation calibration and analysis.

8.1.2. Sample Receipt Acceptance Criteria:

8.1.2.1. The laboratory establishes and implements a sample acceptance/rejection policy per TNI-EL-V1M2-2009-5.8.6. The laboratory accepts a sample when the following criteria are met:

8.1.2.1.1. Proper, full, and complete documentation, which shall include sample identification, the location, date and time of collection, collector's name, preservation type, sample type and any special remarks concerning the sample;

8.1.2.1.2. Proper sample labeling to include unique identification and a labeling system for the samples with requirements concerning the durability of the labels (water resistant) and the use of indelible ink;

8.1.2.1.3. Use of appropriate sample containers;

8.1.2.1.4. Adherence to specified holding times;

8.1.2.1.5. Adequate sample volume. Sufficient sample volume must be available to perform the necessary tests.

8.1.2.1.6. Procedures to be used when sample shows signs of damage or contamination.

8.1.2.1.7. All samples, which require thermal preservation, shall be considered acceptable if the arrival temperature is ≤ 6°C, not frozen or the method specified range. For samples with a specified temperature of 4°C, samples with a temperature ranging from just above the freezing temperature of water to 6°C shall be acceptable. Samples that are hand delivered to the laboratory immediately after collection may not meet these criteria. In these cases, the samples shall be considered acceptable if there is evidence that the chilling process has begun such as arrival on ice.

8.1.2.1.8. The laboratory implements procedures for checking chemical preservation using readily available techniques, such as pH or free chlorine, prior to or during sample preparation or analysis [TNI-EL-V1M4-2009-1.7.5.b]. Residual Free Chlorine and pH testing are done for Volatile samples (524.2). Also samples for semivolatiles by 525.2 analysis and THMs by 551.1 are verified for proper preservation by checking the pH of the sample at the analyst's sample preparation area.

8.1.2.2. Results of all checks are recorded in the appropriate logbooks. If the sample does not meet the laboratory sample receipt acceptance criteria, the laboratory either:

8.1.2.2.1. Retains correspondence and/or records of conversations concerning the final disposition of rejected samples; or

8.1.2.2.2. Fully documents any decision to proceed with the analysis of samples not meeting acceptance criteria.

8.1.2.2.2.1. The condition of these samples shall, at a minimum, be noted on the chain of custody or transmittal form and laboratory receipt documents.

8.1.2.2.2.2. The analysis data shall be appropriately "qualified" on the final report.

8.1.2.3. After LIMS entries have been completed for a group, a sample acknowledgment is printed out (see figure 8-9). The original acknowledgment is emailed to the client immediately after log-in and reviewed by the client's project manager. The sample acknowledgment report allows the clients to confirm if methods and tests assigned to the samples are correct.

8.2. CHAIN OF CUSTODY

Chain of custody procedures provides legal evidence that tampering with a sample has not occurred. This is achieved by documenting an accurate written record tracing possession of the sample from collection through its final analysis and disposal. The EEA's chain of custody form provided with sample bottle shipments is presented in Figure 8-6. The laboratory maintains two levels of custody. As a standard protocol, the laboratory utilizes Level I chain of custody. Level II chain of custody is available upon request only and at an additional charge.

8.2.1. Level I

This process relies on the fact that the laboratory is a secure building. The laboratory either has custody of the sample, or not. Evidence of laboratory custody is shown through the receipt signatures on the chain of custody form. Documentation is available in the laboratory for the tracking and disposition of a sample, however this information is not intended to withstand rigorous legal scrutiny. Level I chain of custody is consistent with EPA's definition of custody. Documentation associated with this level of custody includes:

8.2.1.1. A copy of the Chain of Custody is kept in the project file.

8.2.1.2. Run logs indicating when samples were handled/analyzed.

8.2.2. Level II

Also known as Legal Chain of Custody, this process requires that the disposition of each sample be defined in terms of time and possession for the life span of the sample; from sample bottle preparation to the disposal or complete depletion of the sample during analysis. Documentation associated with this level of custody includes:

8.2.2.1. Requirements for Level I followed

8.2.2.2. Chain of custody signed by sample control personnel upon receipt of sample(s)

8.2.2.3. Airbills and/or courier receipts filed in the project file by sample control

8.2.2.4. Internal custody logbook and key to secure and separate storage refrigerators maintained by sample control personnel; all sample/extract/digestate transfers, including those to secured storage, recorded herein

8.2.2.4.1. This storage area is locked and entry is permitted only upon signing for the custody of the sample(s)/extract(s)/digestate(s).

8.2.2.5. Internal custody logbook entries include client, client sample ID, date sampled, analyses, laboratory ID, internal dates and times transferred, initials (all samples are returned at the end of each shift) see Figure 8-4.

8.2.2.6. Upon disposal the technician will complete the custody notebook (all client identifying label(s) on the container defaced or removed)

8.2.2.7. Errors deleted by drawing a single line through the item, dating and initialing and reasons clearly indicated.

8.2.2.8. Disposal of samples occur only with the concurrence of the affected legal authority, sample data user and/or submitter of the sample

8.2.2.9. Conditions of disposal and all correspondence between all parties concerning final disposition of the physical sample recorded and retained by the laboratory

8.2.2.10. Level II chain of custody sample disposal logbook (Figure 8-5) which indicates the date of disposal, nature of disposal (such as sample depleted, sample disposed in hazardous waste facility or sample returned to client, and the name of the individual who performed the task

8.2.3. Sub-contract Laboratories

When samples are sent to a sub-contract laboratory, a chain of custody is initiated by sample control or the subcontract administration group. The original chain of custody is filed in the project file with a reference to the second chain of custody. This sample is tracked internally and is identified as a subbed-out sample from an entry made into LIMs by sample control. All information from the original chain of custody is transferred to the second chain of custody in addition our internal Laboratory IDs are referenced. If samples were extracted at EEA and the extracts sent out, then the QC set for that extraction batch is sent out to the sub-contract laboratory also.

8.2.4. The Quality Manager or the Project Manager periodically inspects the chain of custody logbook to verify that analysts are signing samples back into custody the same day they are removed.

8.3. SAMPLE STORAGE AND DISPOSAL

Sample storage and disposal procedures are found in section 7.3 Sample Storage and 7.4 Sample Disposal.

8.4. SAMPLE TRACKING

When samples pass initial inspection, they are logged into the computer running the lab LIMS system. This system tracks samples from the time they arrive in the laboratory until final data are transmitted to the client. Multiple queries can be made of the database, and new routines can be written for retrieving certain information in a specified format. The following are example queries made from LIMS, printouts of these queries are available for personnel, on demand:

8.4.1. **Sample Disposition** - Shows which analyses have been performed on a given sample, which results have been validated by the manager/supervisor, and the results.

8.4.2. **Due Date/Hold time Date** - Allows analysts to schedule tests by accessing sample information according to priority date (hold time/turnaround time); query can be made per test, per group, per client, or per prompted date.

8.4.3. **QC Data** - Accessibility to QC information which can be tabulated and used to derive acceptability ranges, trend analyses, control charts etc.

8.4.4. **Formats** - Data is available for clients in various hard-copy layouts and/or electronic data format.

8.5. LABORATORY INFORMATION MANAGEMENT SYSTEM (LIMS)

8.5.1. The current Laboratory Information Management Software (LIMS) used by EEA is the STARLIMS software package developed by STARLIMS Corporation located in Hollywood, FL. The XML web based system is written in a proprietary scripted language and accesses a Microsoft SQL server.

8.5.2. The STARLIMS system provides functions to access client accounts, tests/analyses, sample tracking, test backlog generation, data entry/verification, data validation, client data in a variety of formats, monthly financial and statistical reports, and archival storage of data.

8.5.3. The security of the information contained in the LIMS is maintained through the restricted use of the database. All personnel have a unique access ID and password. The type of information entered or queried is dependent upon the level of access associated with the user.

8.5.4. LIMS has several defined user types. Access to key areas is restricted and based on the user type designated.

8.5.4.1. **Analyst/Reviewer** – Original data is entered by an analyst on an analytical batch basis (batch is no more than 20 samples). Once entered, the analyst cannot change the data nor can the analyst access the data at a higher level to review. Review must be conducted by a peer or supervisor.

8.5.4.2. **Manager/Validation** – After the secondary check, the group manager validates the data. Upon validation, the data is available to the client.

8.5.4.3. **User** – Personnel who only query the database, rather than enter data, are assigned this third level of access.

8.5.5. Final reports are uploaded to an external server (DMZ) for the client to access via a secure password and unique ID. Hardcopies are mailed upon request. Reports are electronically signed by the Project Manager before uploading to the DMZ. Invoices are mailed or electronically delivered based on client preference.

8.5.5.1. **Report Storage** – The LIMS generates an electronic file that is uploaded to an internal server. The files are stored by client/project and file type. Version numbers are noted on the file name extensions. Reports are kept electronically for 10 years. Hardcopies are no longer printed and scanned as the STARLIMS system can electronically merge all components of a final report.

8.5.5.2. **Electronic Data Deliverables (EDDs**) – Electronic data or magnetic medium data are delivered to the client using e-mail or by the client accessing the DMZ via a unique ID and password. The LIMS generates the final data report and merges this with the Chain of Custody, Acknowledgement sheet, subcontract report, case narrative, and any explanations regarding the visual sample condition into one file for the client to access.

8.5.5.3. **LIMS Maintenance** – The LIMS hardware is maintained by the IT Department of EEA and the Systems Architect/IT Manager on-site at the laboratory. The software is maintained by STARLIMS and upgrades are provided by the vendor for a yearly fee. Software validation is performed by the vendor prior to installation of the product.

A hardware/software maintenance logbook is kept with the manager of computer services. In addition to this record, all servicing performed by STARLIMS or outside vendors is documented by their staff and is available for our use.

8.5.6. Sample Status

Samples are logged into the system upon receipt in the laboratory. A laboratory number is assigned to each sample by the computer and the required tests are scheduled. Each sample then appears on the work schedule for the appropriate department. Turnaround time is automatically assigned to each sample test based on the sampling date and time and EPA holding times.

The work schedule is the primary means of checking the backlog for the analyst. The analyst can schedule the samples according to priority date, which is calculated according to the laboratory turnaround time and priority. An example of a computer generated work schedule is shown in Figure 8-8.

Operations meetings are held weekly to discuss the status of data. An Operations Report (Figure 8-10) is used by the supervisors and Project Managers during operations meetings. The Operations Report includes the group No., Client ID, Total number of Tests, Tests ready to be validated and, incomplete tests by department. The Operations Reports allow the supervisor and the project manager to monitor sample status. Also during the Operations meeting, Project managers are informed of any issues that may have arisen so that they can proactively contact the client. A list of samples with short turnaround time, 72 hours or less, is kept at sample control. Sample control contacts the analyst when short holding time samples arrive. Bottle orders are completed when clients request containers and supplies. This allows sample control to monitor the amount of samples due to arrive in the near future.

8.5.7. Data Entry and Report Generation

Data entry is accomplished through a variety of interactive sub-systems. Some situations require the entry of raw data and the system performs calculations, and reports final results and detection limits. In other cases, final data is entered either manually or via instrument interfaces. When the final scheduled test result goes into the system, the Technical Manager/Group Supervisor passes on the reports to the validation section within the system for approval. In all cases, client reports are generated and printed automatically after the verification and approval by the supervisor of each analytical group.

Results are stored in LIMS in such a manner that immediate access is available to these reports. A list of all reports completed, indexed by client number, is maintained on the system. A few keystrokes can recall every report produced for a given client. Additionally, the system provides constant information on laboratory performance. This includes turnaround times reports for every analysis done by the laboratory, and productivity reports grouped into cost isolation accounts. A weekly laboratory Turnaround time report allows the tracking of turnaround time per department to ensure that the laboratory continuously improves its turnaround time and meets client needs. See example of weekly Lab Turnaround Time Report (Figure 8-11).

The system provides several levels of security. The first level is the entry of a password to initially log on to the computer, and then the person must be designated as a qualified user. Additionally, the department to which a person is assigned governs/accesses the various functions of the system. The system also provides for read-only access to results to further protect the data from unauthorized modification or deletion.

Figure 8-1 Cooler Receipt Form

EUROFINS EATON ANALYTICAL, INC. COOLER RECEIPT FORM

PROJECT:________________________ DATE RECEIVED:________________

Use back of form to note check-in problems and describe action(s) regarding the resolution(s) of problems.

A. PRELIMANARY EXAMINATION
. Date Cooler Opened: ________________
By (print)____________________ (sign)________________________

1. Did cooler come with shipping slip (air bill, etc.)? YES NO
   If yes, attach and enter carrier and air bill number here:______________
2. Were custody seals on outside of cooler? YES NO
   If yes, how many and where:________________________________
   If yes, enter the following: seal date:______________ seal name:______________
3. Were custody seals unbroken and intact at delivery? YES NO
4. Were custody papers sealed in bag and taped to lid? YES NO
5. Were custody papers filled out properly (ink, etc.)? YES NO
6. Did you sign custody papers in the appropriate place? YES NO
7. Was project identifiable from custody papers? YES NO
8. Have designated person(s) initial and acknowledge receipt: __________ date:__________

B. LOGIN PHASE
Date samples were logged in:________________
By (print)____________________ (sign)________________________

9. Describe packing: ____
10. If required, was enough ice used? YES NO
11. Were all bottles sealed in separate plastic bags? YES NO
12. Did all bottles arrive unbroken and in good condition? YES NO
13. Were all bottle labels complete (ID, date, sign, preservative)? YES NO
14. Did all bottle labels agree with custody papers? If no, list on back. YES NO
15. Were correct containers used for the analytes? YES NO
16. Were correct preservatives used when required? YES NO
17. Was sufficient amount of sample sent for tests? YES NO
18. Bubbles absent in VOA vials? If no, list by sample ID on back. YES NO
19. Was Client Services informed of problems? YES NO

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Figure 8-2 Kit Order Form

eurofins | Eaton Analytical

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
(626) 386-1100 FAX (626) 386-1101

Kit Order for MWH Laboratories

Andora.I.Effendi is your Eurofins Eaton Analytical Project Manager

Note: Sampler Please return this paper with your samples

Kit #: 65304
[illegible]
[illegible]
Ship By: 06/07/2012
STG: Bottle Orders

Client ID: MWH LAB MONR CA
[illegible]
[illegible]
PO#/JOB#:

[illegible] . Attn:	[illegible] Suite 100 Monrovia, CA 91106 Attn: Andora Effendi Phone: (626) 386-1100 Fax: (626) 386-1139	[illegible] Suite 100 Monrovia, CA 91106 Attn: Andora Effendi Phone: (626) 386-1100 Fax: (626) 386-1139

# of Samples	Tests	Bottles - Qty for each sample, type & preservative if an	UN DOT #
1	Free Chlorine Residual	1 125ml amber glass CHL_no preservative	

Comments

Code	Status	Date Shipped	Via	Tracking #	# of Coolers	Prepared By

Figure 8-3 Example Sample Labels

Eurofins Eaton Analytical
750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
(626) 386-1100 Fax (626) 386-1101

1

Client:	MWH-LAB-MONR-CA	☐ Grab ☐ Comp
Project:	WATER QUALITY	Date:
Site Name:		Time:
Sample ID:	DI Water	0.5ml H2SO4 (50%)
Analysis:	Ammonia Nitrogen	
55144	**Monrovia - Monthly**	**Monrovia**

Figure 8-4 Internal Custody Logbook

Internal COC														
Log In Received Date	Client	Client Sample ID	Sampling Date	Analysis	Laboratory Sample ID	Removal Code	Bottle #	Volume Taken	By (Staff Initial)	Date/Time Stored	Date/Time Removed	Date/Time Returned	Volume Returned	Peer Review Date/Time/Initial

Figure 8-5 Internal Sample Disposal (Level II)

Level II Chain of Custody Sample Disposal Logbook

Log in Rec'd Date	Client	Lab Sample ID	Authorized to Dispose By:	Tag Label		Date of Disposal	Nature of Disposal				Initials	Signature
				Yes	No		Sample Depleted	Hazwaste Drum	Sewer	Returned to Client		

Figure 8-6 Chain-of-Custody Form

eurofins | Eaton Analytical

CHAIN OF CUSTODY RECORD

750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629
Phone: 626 386 1100
Fax: 626 386 1101
800 566 LABS (800 566 5227)

EUROFINS EATON ANALYTICAL USE ONLY:

LOGIN COMMENTS: ____________________

SAMPLES CHECKED AGAINST COC BY: ________

SAMPLES LOGGED IN BY: ________

SAMPLE TEMP RECEIVED AT:

☐ Colton / No. California / Arizona ______ °C (Compliance: 4 ± 2 °C)

☐ Monrovia ______ °C (Compliance: 4 ± 2 °C)

SAMPLES REC'D DAY OF COLLECTION? ☐ (check for yes)

CONDITION OF BLUE ICE: Frozen ______ Partially Frozen ______ Thawed ______ Wet Ice ______ No Ice ______

METHOD OF SHIPMENT: Pick-Up / Walk-In / FedEx / UPS / DHL / Area Fast / Top Line / Other: ________

TO BE COMPLETED BY SAMPLER:

COMPANY/AGENCY NAME:		PROJECT CODE:
EEA CLIENT CODE:	COC ID:	SAMPLE GROUP:
TAT requested: rush by adv notice only		STD ___ 1 wk ___ 3 day ___ 2 day ___ 1 day ___

COMPLIANCE SAMPLES ☐ (check for yes) – Requires state forms ☐

NON-COMPLIANCE SAMPLES ☐ (check for yes)

REGULATION INVOLVED: ________

Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION (eg. SDWA, Phase V, NPDES, FDA,...)

SEE ATTACHED BOTTLE ORDER FOR ANALYSES ☐ (check for yes), OR

list ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)

SAMPLE DATE	SAMPLE TIME	SAMPLE ID	CLIENT LAB ID	MATRIX *	FIELD DATA	FIELD DATA															SAMPLER COMMENTS

*** MATRIX TYPES:** **RSW** = Raw Surface Water, **RGW** = Raw Ground Water, **CFW** = Chlor(am)inated Finished Water, **FW** = Other Finished Water, **SEAW** = Sea Water, **WW** = Waste Water, **BW** = Bottled Water, **SW** = Storm Water, **SO** = Soil, **SL** = Sludge, O = Other - Please Identify

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
SAMPLED BY:					
RELINQUISHED BY:					
RECEIVED BY:					
RELINQUISHED BY:					
RECEIVED BY:					

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Figure 8-7 Run Logbook

No.,	Sample Name,	Time,	Comment	Dil.Fac.,	Amount SD4, ECD_1		
1,	WASH	12/21/11 14:00,		1,	n.a.		
2,	autocal1	12/21/11 14:12,		1,	n.a.		
3,	autocal2	12/21/11 14:24,		1,	0.2429		
4,	autocal3	12/21/11 14:37,		1,	0.4945		
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		
8,	autocal7	12/21/11 15:26,		1,	9.3196		
9,	autocal5	12/21/11 15:39,		1,	2.2017		
10,	autocal8	12/21/11 15:51,		1,	19.0900		
11,	autocal9	12/21/11 16:04,		1,	50.7623		
12,	autocal10	12/21/11 16:16,		1,	99.8682		
13,	autocal11	12/21/11 16:28,		1,	190.8361		
14,	20PPM/LDR	12/22/11 10:12,		1,	339.7175	DNR	
15,	HCV2	12/22/11 10:24,		1,	160.5565	100% 90%-110%	
16,	HCV1	12/22/11 10:36,		1,	99.5146	100% 90%-110%	
17,	MBLK	12/22/11 10:49,		1,	n.a.		
18,	MRLLW	12/22/11 11:01,		1,	0.2818	113% 50%-150%	
19,	MRL_CHK	12/22/11 11:14,	@ANION28	1,	0.9902	99% 50%-150%	
20,	LCS1	12/22/11 11:26,	632011	1,	51.1789	102% 90%-110%	
21,	LCS2	12/22/11 11:38,	@anion48	1,	51.3993	103% 90%-110%	
22,	MCV	12/22/11 11:51,	631998	1,	41.2474	103% 90%-110%	
23,	CCB	12/22/11 12:03,		1,	n.a.		
24,	MRLCHECK	12/22/11 12:38,		1,	0.9579	96% 50%-150%	
25,	201112210080	12/22/11 12:51,		1,	2.6984		
26,	201112210075	12/22/11 13:03,		1,	21.0028		
27,	201112210076	12/22/11 13:15,	H3	1,	8.5469		
28,	201112220169	12/22/11 13:28,		1,	48.0434		
29,	201112220153 12/24/11	12/22/11 13:40,		1,	34.1957		
30,	201112220157_1/2	12/22/11 13:53,		2,	256.0393 DNR		
31,	201112220164	12/22/11 14:05,		1,	4.7805		
32,	201112220298_1/2	12/22/11 14:17,	HA	2,	135.9263		
33,	201112220132	12/22/11 14:30,		1,	10.5028		
34,	201112220140_1/5	12/22/11 14:42,	H3	5,	59.9622		
35,	201112220140MS	12/22/11 14:55,		5,	194.5431	26.9 108%	80%-120%
36,	201112220140MSD	12/22/11 15:07,		5,	194.8758	27.0 108%	80%-120%
37,	MCV	12/22/11 15:19,		1,	42.0281	105% 90%-110%	
38,	CCB	12/22/11 15:32,		1,	n.a.		
39,	201112220155	12/22/11 15:44,	ic under presure	1,	n.a.		
40,	MRLlow	12/22/11 16:05,		1,	0.2304	112% 50%-150%	
41,	201112220149	12/22/11 16:18,		1,	56.2977		
42,	201112220096_1/2	12/22/11 16:30,		2,	60.0654		
43,	201112220147_1/2	12/22/11 16:42,		2,	115.9345		
44,	201112220151_1/2	12/22/11 16:55,		2,	29.3873		
45,	201112220151MS	12/22/11 17:07,		2,	86.0782	28.3 113%	80%-120%
46,	201112220151MSD	12/22/11 17:20,		2,	84.4530	27.5 110%	80%-120%
47,	201112220162_1/2	12/22/11 17:32,		2,	121.0277		
48,	201112220160_1/2	12/22/11 17:44,		2,	93.2843		
49,	201112220171	12/22/11 17:57,		1,	12.7606		

Figure 8-8 Example Work Schedule Printout

Departmental Daily Report for: Chlorite by EPA 317

Purple/Italic = RUSH Order #
Red / Underline = Priority 1

Folder #	Sample #	Client (Project)	Sampled	Hold	Sample ID	Status	Analyze By	Profile	Method	Prepped	Run #
312174	200908140307	MIKE (CONTRACT FEES)	8/14	8/28	dumpty	Logged	08/28/2009	Chlorite by EPA 317	EPA 317		
312686	200908200575	LONGBEACHWD (DRINKING)	8/19	9/02	MF PERMEATE	Logged	08/28/2009	Chlorite by EPA 317	EPA 317		
312686	200908200576	LONGBEACHWD (DRINKING)	8/19	9/02	NF NORTH TRAIN 1ST PASS	Logged	08/28/2009	Chlorite by EPA 317	EPA 317		
312686	200908200577	LONGBEACHWD (DRINKING)	8/19	9/02	NF NORTH TRAIN 1ST	Logged	08/28/2009	Chlorite by EPA 317	EPA 317		
312686	200908200578	LONGBEACHWD (DRINKING)	8/19	9/02	NF NORTH TRAIN (PERMEATE)	Logged	08/28/2009	Chlorite by EPA 317	EPA 317		

Figure 8-9 Sample Acknowledgement

eurofins | Eaton Analytical

Acknowledgement of Samples Received

Addr: **MWH Laboratories** 750 Royal Oaks Drive Suite 100 Monrovia, CA 91106	Client ID: MWH-LAB-MONR-CA Folder #: 405936 Project: WS (WS PT) Sample Group: WS PT
Attn: Andora Effendi Phone: (626) 386-1100	Project Manager: Alma.B.Capati Phone: PO #: ERA WS192 PT - Inorganics

The following samples were received from you on **August 17, 2012**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical.

Sample #	Sample ID	Sample Date
201208170474	WS Inorganics	08/17/2012 0000
	Sample Point ID: ERA WS 192 PT_Inorganics	
	Nitrate + Nitrite as N by RFA; Nitrate as N by RFA (calc)	

Test Description

Reported: 08/21/2012 Page 1 of 1

750 Royal Oaks Drive, Suite 100, Monrovia, CA 91016 Tel (626) 386-1100 Fax (626) 386-1101 http://www.EatonAnalytical.com

Figure 8-10 Operations Report

Due	PM	Client ID	Folder	Sampled	Order	Sample ID	Test	Run #	Department	Prep Date	Status
-16	AIE	MWH-LAB-MONR-CA	310880	7/26/2009	200907290297	Source Water E.Coli	E. Coli Bacteria	0	Micro/Asbestos		Logged
-41	AIE	MWH-LAB-MONR-CA	310553	7/10/2009	200907230384	Source Water E.Coli	MICR_COLI	0	Micro/Asbesto-P		Logged
-29	AIE	MWH-LAB-MONR-CA	309978	7/13/2009	200907160491	WP Simple Nutrients	Nitrate as N by RFA	517052	Metal/Wet		Logged
-17	AIE	MWH-LAB-MONR-CA	311411	8/4/2009	200908050946	PRD 1029	@ICPMS	521611	Metals		Logged
-16	AIE	MWH-LAB-MONR-CA	310879	7/26/2009	200907290296	Source Water E.Coli	E. Coli Bacteria	0	Micro/Asbestos		Logged
-35	AIE	MWH-LAB-MONR-CA	310552	7/10/2009	200907230383	Source Water E.Coli	@COLI10	0	Micro/Asbestos		Need Prep
-35	AIE	MWH-LAB-MONR-CA	310554	7/10/2009	200907230388	MicrobE D	@MPN10	0	Micro/Asbestos	8/17/2009	Logged
-41	AIE	MWH-LAB-MONR-CA	310552	7/10/2009	200907230383	Source Water E.Coli	MICR_COLI	0	Micro/Asbesto-P		Logged
-35	AIE	MWH-LAB-MONR-CA	310554	7/10/2009	200907230386	MicrobE B	@MPN10	0	Micro/Asbestos	8/17/2009	Logged
-35	AIE	MWH-LAB-MONR-CA	310554	7/10/2009	200907230389	MicrobE E	@MPN10	0	Micro/Asbestos	8/17/2009	Logged
-17	AIE	MWH-LAB-MONR-CA	311411	8/4/2009	200908050952	PRD 1082	@ICPMS	521611	Metals		Logged
-17	AIE	MWH-LAB-MONR-CA	311411	8/4/2009	200908050955	PRD 1111	@ICPMS	521611	Metals		Logged
-17	AIE	MWH-LAB-MONR-CA	310790	7/28/2009	200907280135	DI Water	PH (H3=past HT not compliant)	0	Wet Chemistry		Logged
-17	AIE	MWH-LAB-MONR-CA	310790	7/28/2009	200907280136	Nano Pure Water	PH (H3=past HT not compliant)	0	Wet Chemistry		Logged
-17	AIE	MWH-LAB-MONR-CA	311411	8/4/2009	200908050950	PRD 1069	@ICPMS	521611	Metals		Logged
-17	AIE	MWH-LAB-MONR-CA	311411	8/4/2009	200908050953	PRD 1102	@ICPMS	521611	Metals		Logged
-17	AIE	MWH-LAB-MONR-CA	311411	8/4/2009	200908050954	PRD 1109	@ICPMS	521611	Metals		Logged
-16	AIE	MWH-LAB-MONR-CA	310882	7/26/2009	200907290300	Source Water E.Coli	E. Coli Bacteria	0	Micro/Asbestos		Logged
-17	AIE	MWH-LAB-MONR-CA	311411	8/4/2009	200908050951	PRD 1074	@ICPMS	521611	Metals		Logged
-17	AIE	MWH-LAB-MONR-CA	311411	8/4/2009	200908050947	PRD 1031	@ICPMS	521611	Metals		Logged
-35	AIE	MWH-LAB-MONR-CA	310554	7/10/2009	200907230385	MicrobE A	@MPN10	0	Micro/Asbestos	8/17/2009	Logged
-29	AIE	MWH-LAB-MONR-CA	309978	7/13/2009	200907160513	WP Total Phenolics	Phenolic Compounds-low level	0	Metal/Wet	7/21/2009	Need Prep
-29	AIE	MWH-LAB-MONR-CA	309978	7/13/2009	200907160483	WP Hardness	@ICP	0	Metals		Done
-17	AIE	MWH-LAB-MONR-CA	311411	8/4/2009	200908050948	PRD 1049	@ICPMS	521611	Metals		Logged
-35	AIE	MWH-LAB-MONR-CA	310553	7/10/2009	200907230384	Source Water E.Coli	@COLI10	0	Micro/Asbestos		Need Prep
-17	AIE	MWH-LAB-MONR-CA	311411	8/4/2009	200908050945	PRD 1025	@ICPMS	521611	Metals		Logged
-17	AIE	MWH-LAB-MONR-CA	311411	8/4/2009	200908050949	PRD 1055	@ICPMS	521611	Metals		Logged
0	AIE	MWH-LAB-MONR-CA	312685	8/20/2009	200908200573	Lot# B-9-196-01VB	@TCP_PREP	0	Volatiles-P		Logged
2	AIE	MWH-LAB-MONR-CA	312401	8/18/2009	200908180396	Lot# 915507	GCVO_HAA	521751	GC Volatiles-P		Logged
-35	AIE	MWH-LAB-MONR-CA	310554	7/10/2009	200907230387	MicrobE C	@MPN10	0	Micro/Asbestos	8/17/2009	Logged
-17	AIE	MWH-LAB-MONR-CA	311411	8/4/2009	200908050956	PRD 1112	@ICPMS	521611	Metals		Logged
2	AIE	MWH-LAB-MONR-CA	312401	8/18/2009	200908180397	Lot# 915507	GCVO_HAA	521751	GC Volatiles-P		Logged
4	AIE	MWH-LAB-MONR-CA	312401	8/18/2009	200908180396	Lot# 915507	@HAA	0	GC Volatiles		Need Prep
6	AIE	MWH-LAB-MONR-CA	312685	8/20/2009	200908200573	Lot# B-9-196-01VB	@TCP	0	Volatiles		Need Prep
6	AIE	MWH-LAB-MONR-CA	312685	8/20/2009	200908200572	Lot# B-9-134-01VB - Acid Lot No. #24	@551	0	GC Volatiles		Need Prep
4	AIE	MWH-LAB-MONR-CA	312401	8/18/2009	200908180397	Lot# 915507	@HAA	0	GC Volatiles		Need Prep
4	AIE	MWH-LAB-MONR-CA	312685	8/20/2009	200908200572	Lot# B-9-134-01VB - Acid Lot No. #24	GCVO_551	0	GC Volatiles-P		Logged

Figure 8-11 Weekly Lab Turnaround Time

HPLC Department

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1/14/12 0:00 - 1/20/12 0:00

Total Test		OnTime (%)		Re-Test	
Analyzed	Approved	Analyzed	Approved		
22	40	100	95	0	**@531**
16	16	100	100	0	**@531LOW**
7	7	71	71	0	**@532**
0	40	0	88	0	**@549**
9	9	100	100	0	**@ML555**
30	40	100	100	0	**Glyphosate**

			On Time		**Re-Test**	
Analyzed	84		82	97.6%	0	
Approved		152	143	94.1%		

Average Days to Complete Peer Review: 3.0 +/- 1.5

Median: 4.00

9.0 ANALYTICAL PROCEDURES

9.1. SOURCES FOR METHODS

9.1.1. **Standard Methods**

9.1.1.1. The laboratory shall evaluate the Precision and Bias of a standard method for each analyte of concern for each quality system matrix according to the single-concentration four-replicate recovery study procedures in TNI-EL-V1M3 to V1M6-2009-1.6.2.2 (or alternate procedure documented in the quality manual when the analyte cannot be spiked into the sample matrix and QC samples are not commercially available) [TNI-EL-V1M4 and V1M6-2009-1.5.3.a].

9.1.1.2. The analytical methods performed by EEA are based primarily on methods specified by various federal, state, and local regulations. If more stringent standards or requirements are included in the mandated test method or by regulation than the TNI standard, the laboratory ensures that all SOPs meet such requirements. If it is unclear which requirements are more stringent, the laboratory follows the requirements from the method or regulation. All analysts must follow all the Quality Control protocols and all essential QC measures specified by the laboratory's SOPs. The majority of methods come from the U.S. Environmental Protection Agency. Other methods are from Standard Methods for the Examination of Water and Wastewater, 19th, 20th, and online Editions. Additional methods may be used when appropriate.

Methods from the EPA are listed in section 9.6, the references section.

9.1.2. **Non Standard Methods**

9.1.2.1. Methods not covered by standard methods are properly validated before use. Non-standard methods when used by the laboratory are subjected to agreement with the Client incorporating the Client's specification requirements, including the purpose of the environmental test. The method is validated appropriately before use [TNI-EL-V1M3 to V1M4-2009-1.4].

9.1.2.2. For laboratory-developed test methods or non-standard test methods as defined in TNI-EL-V1M2- 2009-5.4.3 and ISO/IEC 17025:2005(E)-5.4.3 and TNI-EL-V1M3 to V1M7-2009-1.4 that were not in use by the laboratory before July 2003, the laboratory must have a documented procedure to evaluate precision and bias. The laboratory must also compare results of the precision and bias measurements with criteria established by the client, by criteria given in the reference method or criteria established by the laboratory.

9.1.2.3. Laboratory developed methods may be used when the client does not specify the method to be used or where methods are employed that are not required by regulations, as in the Performance Based Measurement System Approach, the methods shall be fully documented and validated (TNI-EL-V1M2-2009-5.4.2) (ISO/IEC 17025:2005(E)-5.4.2) and TNI-EL-V1M3 to V1M7-2009-1.4), and be available to the Client and other recipients of the relevant reports. The laboratory shall select appropriate methods that have been published either in international, regional or national standards, or by reputable technical organizations, or in relevant scientific texts or journals, or as specified by the manufacturer of the equipment. Laboratory-developed methods or methods adopted by the laboratory are used only if appropriate to the intended use and are validated. The laboratory informs the Client as to the method chosen. [TNI-EL-V1M2-2009-5.4.2][ISO/IEC 17025:2005(E)-5.4.2]

9.1.2.4. The laboratory informs the Client when the method proposed by the Client is considered to be inappropriate or out of date. [TNI-EL-V1M2-2009-5.4.2][ISO/IEC 17025:2005(E)-5.4.2]

9.1.3. The introduction of environmental test and calibration methods developed for the laboratory for its own use is a planned activity and is assigned to qualified personnel equipped with adequate resources.

9.2. INITIAL TEST METHOD EVALUATION PROCEDURES

For all test methods (other than microbiology or methods where LOD/LOQ determinations are not relevant) the following LOD and LOQ requirements apply.

9.2.1. Limit of Detection (LOD)

9.2.1.1. The laboratory shall determine the LOD by performing the MDL studies determination to conform to CFR136 for the method for each target analyte of concern in the quality system matrices. All sample-processing steps of the analytical method shall be included in the determination of the LOD.

9.2.1.2. The validity of the LOD shall be confirmed by quantitative identification of the analyte(s) in a QC sample in each quality system matrix containing the analyte at no more than 1-3X the LOD for single analyte tests and 1-4X the LOD for multiple analyte tests. This verification must be performed on every instrument that is to be used for analysis of sample and reporting data. LOD verification Acceptance Criteria is detection (>0).

9.2.1.3. An LOD study is not required for any component for which spiking solutions or quality control samples are not available such as temperature, or, when test results are not to be reported to the LOD (versus the method reporting limit or working range of instrument calibration). Where an LOD study is not performed, the laboratory may not report a value below the Limit of Quantitation. Since the EPA Manual for Drinking Water 5th Edition requires MDL studies, the laboratory conducts MDL determinations for all drinking water methods where applicable. EEA does not report down to the LOD but reports down to the LOQ.

9.2.2. Limit of Quantitation (LOQ)

9.2.2.1. The laboratory shall determine the LOQ for each analyte of concern according to a defined, documented procedure. LOQ/MRL is 2-3x LOD/MDL. At a minimum, LOQ/MRL > LOD.

9.2.2.2. The LOQ study is not required for any component or property for which spiking solutions of quality control samples are not commercially available or otherwise inappropriate (e.g., pH).

9.2.2.3. As per TNI Std, the validity of the LOQ shall be confirmed by successful analysis of a QC sample containing the analytes of concern in each quality system matrix 1-2 times the claimed LOQ. A successful analysis is one where the recovery of each analyte is within the established test method acceptance criteria or client data quality objectives for accuracy. This single analysis is not required if the bias and precision of the measurement system is evaluated at the LOQ. EEA verifies the validity of the MRL/LOQ daily at the MRL level as per EPA Manual for DW 5^{th} edition.

9.2.2.4. Precision and Bias

Precision and bias measurements must evaluate the method across the analytical calibration range of the method. The laboratory must also evaluate precision and bias in the relevant quality system matrices and must process the samples through the entire measurement system for each analyte of interest [TNI-EL-V1M4 and V1M6-2009-1.5.3].

Examples of a systematic approach to evaluate precision and bias could be the following for non-standard methods:

9.2.2.4.1. Analyze QC samples in triplicate containing the analytes of concern at or near the limit of quantitation, at the upper-range of the calibration (upper 20%) and at a mid-range concentration. Process these samples on different days as three sets of samples through the entire measurement system for each analyte of interest. Each day one QC sample at each concentration is analyzed. A separate method blank shall be subjected to the analytical method along with the QC samples on each of the three days. (Note that the three samples of the MRL concentration can demonstrate sensitivity as well). For each analyte, calculate the mean recovery for each day, for each level over days, and for all nine samples. Calculate the relative standard deviation for each of the separate means obtained. Compare the standard deviations for the different days and the standard deviations for the different concentrations. If the different standard deviations are all statistically insignificant (e.g., F-test), then compare the overall mean and standard deviation with the established criteria from above.

9.2.2.4.2. A validation protocol such as the Tier I, Tier II, and Tier III requirements in US EPA Office of Water's Alternate Test Procedure (ATP) approval process.

9.2.2.5. Selectivity

The laboratory evaluates selectivity by following the checks established within the method, which may include mass spectral tuning, second column confirmation, ICP inter-element interference checks, chromatography retention time windows, sample blanks, spectrochemical absorption or fluorescence profiles, co-precipitation evaluations, and electrode response factors [TNI-EL-V1M4-2009-1.5.4].

9.2.3. Detection Limits

9.2.3.1. The method used in the quantitation of detection limits is as described in 40 CFR 136 Appendix B, which in summary is the analysis of at least seven replicates from which a statistically derived Method Detection Limit (MDL) is calculated. The replicates are determined over at least a 3 day period. This statistically derived limit is based on 3.143 times the standard deviation of 7 low concentration replicates (3-5 times the calculated detection limit). It is the laboratory's policy to be conservative when reporting a method detection limit on a non-detected sample.

9.2.3.2. Consequently, the laboratory has implemented the concept of minimum reporting levels (MRLs). The limit used on a laboratory report must be at or above the lowest standard associated with that analytical run. This ensures that all data reported as "detected" will have some degree of analytical precision associated with it. Data reported below these levels must be appropriately qualified. Copies of current MRLs for the laboratory are available upon request. An MRL can be no lower than the calculated MDL.

9.2.3.3. For newer methods, a Lowest Concentration Minimum Reporting Level (LCMRL) may be required before client samples may be run on the method, annually, and for any new analysts. The LCMRL is essentially a more strict verification of the MRL. See the appropriate method for the exact requirements of an LCMRL and its verification. Section 9.2.4 of EPA Method 524.3 details the requirements for the 524.3 LCMRL, for example.

9.3. ESTIMATION OF UNCERTAINTY

Estimation of uncertainty consists of the sum (combining the components) of the uncertainties of the numerous steps of the analytical process, including, but not limited to, sample plan variability, spatial and temporal sample variation, sample heterogeneity, calibration/calibration check variability, extraction variability, and weighing variability.

The laboratory estimates uncertainty using 2 times standard deviation calculated from 20 routine quality control samples with a guidance of <20% RSD. Refer to the Nonmethod 29 SOP for detailed Measurement Uncertainty procedures.

9.4. METHOD VALIDATIONS [TNI-EL-V1M3 to V1M7-2009-1.5]

9.4.1. The laboratory shall validate non-standard methods, laboratory-designed/developed methods, standard methods used outside their published scope, and amplifications and modifications of standard methods to confirm that the methods are fit for the intended use. The validation shall be as extensive as is necessary to meet the needs of the given application or field of application. The initial test method evaluation requirements given in V1M3 to V1M7 1.6 of TNI Standard 2009 and 2011 discussed in Section 4.4, MDL and IDC requirements for new analysts are done in validating new methods and non-standard methods [TNI-EL-V1M3 to V1M7-2009-1.5]. This is also applicable when an analyte not currently found on the laboratory's list of accredited analytes is added to an existing accredited test method. Initial evaluation must be performed for that analyte [TNI-EL-V1M4 and V1M6-2009-1.6.2.2.g]. The laboratory records the results obtained for the IDC, MDL, LOD and LOQ studies. The method is fit for the intended use when the results meet all the MDL and IDC criteria for the method.

9.4.2. The range and accuracy of the values obtainable from validated methods (e.g. the uncertainty of the results, detection limit, selectivity of the method, linearity, limit of repeatability and/or reproducibility, robustness against external influences and/or cross-sensitivity against interference from the matrix of the sample/test object), are assessed for the intended use, and relevant to the Client's needs [TNI-EL-V1M7-2009-1.4].

9.5. METHOD VALIDATION/MICROBIOLOGY

To demonstrate the suitability of a test method for its intended purpose, the laboratory meets the acceptance criteria by the EPA or State program requirements. Also, the laboratory must meet the following criteria as per TNI-EL-V1M5-2009-1.5.2 and 1.5.3:

9.5.1. Accepted (official) test methods or commercialized test kits for official methods from recognized national or international standards organizations do not require a specific validation. However to demonstrate proficiency with the test method prior to first use, the laboratory performs comparison to a method already approved for use in the laboratory, or by analyzing a minimum of ten spiked samples whose matrix is representative of those normally submitted to the laboratory, or by analyzing and passing one proficiency test series provided by an approved proficiency sample provider. The laboratory shall maintain this documentation as long as the method is in use and for at least 5 years past the date of last use [TNI-EL-V1M5-2009-1.5], or 10 years to meet Massachusetts, Hawaii, and New York requirements.

9.5.2. The laboratory participates in the proficiency test programs identified by NELAP [TNI-EL-V1M1-2009-4.1.1 and 4.2.1.a] or [TNI-EL-V1M2-2009-5.9.1.b][ISO/IEC

17025:2005(E)-5.9.1.b]. The results of these analyses are used to evaluate the ability of the laboratory to produce acceptable data.

9.6. METHODS USED/SCOPE OF TESTING

9.6.1. The analytical methods used by EEA can be grouped into three major categories: drinking water methods, wastewater methods, and methods for hazardous wastes and solid samples. The following tables provide method descriptions and method numbers for the methods used in these three major groups:

Table 9-1 Method Description for Drinking Water

Table 9-2 Method Description for Wastewater

Table 9-3 Method Description for Hazardous Waste

9.7. METHOD MODIFICATIONS

All method modifications are documented fully in individual SOPs. Methods are modified if and only if the original method goals for precision and accuracy have been met or better. Modifications are usually implemented due to available resources, or to expedite the process without sacrificing quality. Methods are validated prior to analyzing client samples. Validation is based on the method as described in the internal SOP. The validation includes an MDL study, an analyst precision and accuracy study, and subsequent review by the Technical Manager, Lab Director and Quality Manager.

9.8. REFERENCES

Ref	Method Description
1	These methods are available from USEPA, EMSL, Cincinnati, OH 45268. The identical methods were formerly in "Methods for Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983.
2	"Methods for the Determination of Metals in Environmental Samples - Supplement I," EPA-600/R-94-111, May 1994. Available at NTIS, PB 94-184942.
3a	USEPA "Methods for the Determination of Organic Compounds in Drinking Water - Supplement I". EPA-600/4-90-020, July 1990. (547, 551)
3b	USEPA "Methods for the Determination of Organic Compounds in Drinking Water - Supplement II." EPA-600/R-92-129, August 1992. (524.2, 548.1, 549.1)
3c	USEPA "Methods for the Determination of Organic Compounds in Drinking Water, Method 525.2, 504.1, and 508.1"
3d	USEPA “Methods for the Determination of Organic Compounds in Drinking Water, Supplement III (502.2, 504.1, 505, 507, 508, 524.2, 525.2, 531.1, 551.1), EPA/600/R-95/131, 08/95. For 1,2,3-TCP low level, CA DHS “Determination for 1,2,3-Trichloropropane in Drinking Water by Purge and Trap Gas Chromatography/ Mass Spectroscopy,” (524.2), 02/02.

4 Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, American Public Health Association, 1015 Fifteenth Street NW, Washington, D.C. 20005.

4a Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992, American Public Health Association, 1015 Fifteenth Street NW, Washington, D.C. 20005.

4b Standard Methods for the Examination of Water and Wastewater, 19th Edition, 1995, American Public Health Association, 1015 Fifteenth Street NW, Washington, D.C. 20005.

4c Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005, American Public Health Association, 800 I Street, NW, Washington, D.C. 20001.

4d Standard Methods for the Examination of Water and Wastewater, Online Edition, 2005, American Public Health Association, 800 I Street, NW, Washington, D.C. 20001.

4e Standard Methods for the Examination of Water and Wastewater, 22nd Edition, 2012, American Public Health Association, 800 I Street, NW, Washington, D.C. 20001.

5 Available from Books and Open-File Reports Section, U.S. Geological Survey, Federal Center, Box 25425, Denver, CO 80225-0425.

6 "Methods for the Determination of Inorganic Substances in Environmental Samples," EPA-600/R-93-100, August 1993. Available at NTIS, PB94-121811.

7 USEPA "Methods for Chemical Analysis of Water and Wastewater," EPA-600/4-79-020, 1983.

8 Method 100.2, "Determination of Asbestos Structure Over 10-mm In Length in Drinking Water," EPA-600/R-94-134, June 1994. Available at NTIS, PB 94-201902.

9 Industrial Method No. 129-71W, "Fluoride in Water and Wastewater," December 1972, and Method No. 380-75WE, "Fluoride in Water and Wastewater," February 1976, Technician Industrial Systems, Tarrytown, NY 10591.

10 40 CFR Parts 100, 136 to 141. July 1, 1995.

11 "Prescribed Procedures for Measurement of Radioactivity in Drinking Water", EPA-600/4-80-032 (1980), US EPA, August 1980.

12 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA SW-846, 2nd edition, revised April 1985 and 3rd edition, September 1986.

13 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA SW-846, Update III.

14 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA SW-846, Update II

14a Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA SW-846, Update I

14b Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA SW-846, Update IV

14c Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA SW-846, On-line

15 Methods for the Determination of Nonconventional Pesticides in Municipal and Industrial Wastewater – Volume 1 – EPA 821/R-93-010A. August 1993. Revision 1. Method 614. The Determination of Organophosphorus Pesticides in Municipal and Industrial Wastewater.

16 Method 300.1 Determination of Inorganic Anions in Drinking Water by Ion Chromatography, Revision 1.0 1997 (Stand Alone Method)

17 Federal Register, 12/1/99, USEPA 40 CFR Parts 141 & 143 National Primary & Secondary Drinking Water Regulations: Analytical Methods for Chemical & Microbiological Contaminants & Revisions to Laboratory Certification Requirements; Final Rule

17a Methods Update Rule, March 12, 2007, 40 CFR Parts 122, 136 and 141. Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; National Primary Drinking Water Regulations; and National Secondary Drinking Water Regulations; Analysis and Sampling Procedures; Final Rule.

17b Methods Update Rule, March 18, 2012, 40 CFR Parts 136, 260, 423, 430, and 435. Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; Analysis and Sampling Procedures; Final Rule.

18 Method 515.4 Determination of Chlorinated Acids in Drinking Water by Liquid-liquid Microextraction, Derivatization, And Fast Gas Chromatography with Electron Capture Detection, Revision 1.0, April, 2000, EPA 815-R-00-014

19 Method 531.2 Measurement of n-Methyl Carbamoyloximes and n-Methylcarbamates in Water by Direct Aqueous Injection – HPLC with Postcolumn Derivitization, Revision 1.0, September, 2001, EPA 815-B-01-002

20 USEPA "April 2000 draft – Method 1602." April, 2000.

21 EPA Method 522 Determination of 1,4-Dioxane in drinking water by solid phase extraction (SPE) and gas chromatography/mass spectrometry (GC/MS) with selected ion monitoring (SIM), Revision 1.0, September 2008, EPA/600/R-08/101

22 EPA Method 521 Determination of Nitrosamines in Drinking Water by Solid Phase Extraction and Capillary Column Gas Chromatography with Large Volume Injection and Chemical Ionization Tandem Mass Spectrometry (MS/MS) , Revision 1.0, September 2004, EPA/600/R-05/054

23 US ENVIRONMENTAL PROTECTION AGENCY. Jul 2001. Determination of Inorganic Oxyhalide Disinfection By-products in Drinking Water Using Ion Chromatography with the Addition of a Postcolumn Reagent for Trace Bromate Analysis, Draft Method 317.0, EPA/815/B-01/001. Technical Support Center Office of Ground Water and Drinking Water, Cincinnati, Ohio.

24 EPA Method 549.2 Determination of Diquat and Paraquat by High Performance Liquid Chromatography, Revision 1.0, June 1997

25 EPA Method 1613B Determination of 2,3,7,8-TCDD in Drinking Water by Capillary Column Gas Chromatography with Large Volume Injection and Electron Ionization Tandem Mass Spectrometry (EI/MS/MS), Version 1.0 Sept. 1994.

26 EPA Method 524.3, Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry. Version 1.0 June

2009

27 EPA Method 527 Determination of Selected Pesticides and Flame Retardants in Drinking Water by Solid Phase Extraction and Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS), Revision 1.0, April 2005

28 EPA Method 552.3 Determination of Haloacetic Acids and Dalapon in Drinking Water by Liquid-Liquid Microextraction, Derivatization, and Gas Chromatography with Electron Capture Detection, Revision 1.0

29 EPA Method 535 Measurement of Chloroacetanilide and Other Acetamide Herbicide Degradates in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS), Version 1.1, April 2005

30 EPA Method 529 Determination of Explosives and Related Compounds in Drinking Water by Solid Phase Extractions (SPE) and Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS), Revision 1.0, September, 2002

31 Method for the Determination of Radium-228 and Radium-226 in Drinking Water by Gamma-ray Spectrometry Using HPGE or Ge(Li) Detectors, December, 2004, Revision 1.2, Environmental Resource Center, Georgia Institute for Technology, Atlanta, GA.

Table 9-1 Method Description for Drinking Water

(A) Inorganics – Wet Chemistry – Drinking Water

Parameter/Method Name	Method Number	Method Description	Reference
Alkalinity	SM2320B	Titrimetric	4/4e
Ammonia	EPA350.1	Colorimetric	1
Bromate	EPA 300.0 / 300.1 / 317.0	Ion Chromatography	6/16/23
Bromide	EPA300.0/300.1	Ion Chromatography	6/16
Chloride	EPA300.0	Ion Chromatography	6
Chlorate	EPA 300.0/300.1	Ion Chromatography	6/16
Chlorite	EPA300.0/300.1 / 317.0	Ion Chromatography	6/16/23
Chromium VI (Dissolved)	EPA 218.6/ SM 3500 Cr-B	Ion Chromatography	2/4
Color	SM2120B	Visual	4
Conductivity	SM2510B	Wheatstone Bridge	4
Cyanide	SM4500CN-F,G	Selective Electrode Method	4
Cyanide	EPA335.4	Manual Distillation, Spectrophotometric	6
Fluoride	SM4500 F-C	Potentiometric - Ion Selection Electrode	4
Fluoride	EPA 300.0	Ion Chromatography	6
Foaming Agents/ Surfactant (MBAS)	SM5540C	Colorimetric	4
Nitrate/Nitrite	EPA300.0	Ion Chromatography	6
Nitrite/Nitrate + Nitrite	EPA 353.2	Automated Cadmium Reduction, RFA	1
Odor	SM2150B	Odor	4
Perchlorate	EPA 314.0 EPA 331	Ion Chromatography LCMS	6
pH	EPA 150.1/SM4500-HB	Electrometric	1/4
o-Phosphate	EPA 300.0	Ion Chromatography	6
o-Phosphate	SM4500 P-E EPA 365.1	Color, Ascorbic Acid	4/6
Residual Chlorine (Total/Free Chlorine)	SM4500 Cl-G	DPD Colorimetric/HaCH	4
Silica	EPA200.7	ICP	2
Dissolved Silica/Reactive Silica	SM 4500 SiO2C SM 4500 SiD	Molybdosilicate	4
Solids (TDS)	SM2540C	Gravimetric	4
Sulfate	EPA300.0	Ion Chromatography	6
Temperature	SM2550B	Thermometric	4
Total Organic Carbon(TOC)/ Dissolved Organic Carbon (DOC)	SM5310C	UV Persulfate	4

Parameter/Method Name	Method Number	Method Description	Reference
Turbidity	EPA180.1 SM 2130B	Nephelometric	6/4/4e
UV 254	SM5910B	Determination of UV absorbing organic constituents by UV absorption method at 254 nm	4
TOX (Total Organic Halogen) or Dissolved Organic Halogen (DOX)	SM 5320B	Adsorption-Pyrolysis-Titrimetric Method	4

(B) Inorganics – Metals – Drinking Water

Parameter/Method Name	Method Number	Method Description	Reference
Metals (except Hg)	EPA 200.7	ICP (Inductively Coupled Plasma)	2
Metals (except Hg)	EPA 200.8	ICPMS (Inductively Coupled Plasma Mass	2
Mercury	EPA 245.1	Manual Cold Vapor	2

(C) Microbiology/Microscopy Tests – Drinking Water

Parameter/Method Name	Method Number	Method Description	Reference
Drinking Water Source Enumeration (MTF)	SM9221B,C	Multiple Tube Fermentation (MTF)	4/4d
Drinking Water Source Enumeration/Colilert 24 hr & 8 hr	SM9223B	MMO-MUG Test/Colilert	4/4d
Fecal Coliforms/EC Medium	SM9221E	Multiple Tube fermentation (MTF) / EC Medium	4/4d
Heterotrophic Plate Count	SM9215B	Pour Plate Count	4/4d
Total Coliform & E. Coli	SM9223B	Colisure	4/4d
Total Coliforms	SM9221A, B	Multiple Tube Fermentation (MTF)	4/4d
Total Coliforms + --E. Coli / Present or Absent	SM9223B	MMO-MUG Test/Colilert	4/4d
Coliphage	EPA 1602	Coliphage	20
Asbestos	EPA 100.2	TEM (Transmission Electron Microscopy)	8

(D) Organics – Drinking Water

Parameter/Method Name	Method Number	Method Description	Reference
DBCP/EDB	EPA504.1	Microextraction, GC/ECD	3d
Organohalide Pesticides and Commercial Polychlorinated Biphenyl (PCB) Products in water by Microextraction and Gas Chromatography	EPA505	Microextraction, GC/ECD	3d

Parameter/Method Name	Method Number	Method Description	Reference
Chlorinated Herbicides	EPA515.4	GC, Electron Capture Detector (ECD)	18
Purgeable Organic Compounds/ Halogenated & Aromatic Volatiles/Trihalomethanes/Di-isopropyl Ether(DIPE),Tertiary Amyl Methyl Ether (TAME), Tert-Butyl ethyl ether (ETBE), TBA, CS2, MIBK 1,2,3-Trichloropropane (TCP)	EPA524.2 CA DHS 524.2-SIM	Purge and Trap capillary Column, GCMS	3d
Semi-Volatile Organics -- Acid/Base Neutrals including ThioBencarb	EPA525.2	Liquid Solid Extraction (LSE), capillary column, GCMS	3d
N-Methylcarbamoyloximes and N-Methylcarbamates	EPA531.2	HPLC with Fluorescence Detector	19
Glyphosate	EPA547	HPLC/Post Column Reactor - Fluorescence Detector	3a
Endothall	EPA548.1	GCMS, Liquid Solid Extraction (LSE)	3b
Diquat & Paraquat	EPA549.2	HPLC, Liquid Solid Extraction (LSE) UV Detector	24
Trihalomethanes & EDB/DBCP	EPA 551.1	GC, Electron Capture Detector (ECD), liquid liquid extraction	3d
Haloacetic Acids	SM6251B	GC, Electron Capture Detector (ECD)	4
1,4-Dioxane	EPA 522	GCMS, Solid Phase Extraction (SPE)	21
Nitrosamines	EPA 521	GCMS-MS, Solid Phase Extraction (SPE)	22
Dioxin	EPA 1613B	GC/EI/MS/MS, Solid Phase Extraction (SPE)	25
Volatile Organic Compounds	EPA 524.3	GC/MS	26
Selected Pesticides and Flame Retardants	EPA 527.0	GC/MS, Solid Phase Extraction (SPE)	27
Haloacetic Acids and Dalapon	EPA 552.3	GC, Electron Capture Detector	28
Chloroacetanilide and Other Acetamide Herbicide Degradates	EPA 535	LC/MS/MS, Solid Phase Extraction (SPE)	29
Explosives	EPA 529	GC/MS, Solid Phase Extraction (SPE)	30

(E) Radiochemistry – Drinking Water

Parameter/Method Name	Method Number	Method Description	Reference
Uranium	EPA 200.8	ICP MS	2

Parameter/Method Name	Method Number	Method Description	Reference
Gross Alpha	EPA900.0	Proportional Counting	11
Gross Beta	EPA900.0	Proportional Counting	11
Radium 226/228	Georgia Inst. Of Tech, rev 1.2	Gamma-ray Spectrometry Using HPGE Detector	31

Table 9-2 Method Description for Wastewater

(A) Inorganics – We Chemistry – Wastewater

Parameter/ Method Name	Method Number	Method Description	Reference
Alkalinity, Total (Bicarbonate, Carbonate, & Hydroxide)	SM2320B	Titrimetric, Potentiometric	4/4e
Ammonia	EPA350.1/SM 4500 NH3H and D (18th)	Colorimetric	1/4a
Biochemical Oxygen Demand (BOD)	SM5210B	BOD/Probe	4
Boron	EPA200.7	ICP	2
Bromide	EPA300.0	Ion Chromatography	6
Carbonaceous Biochemical Oxygen Demand (CBOD)	SM5210B	BOD/Probe with Nitrification Inhibitor	4
Chemical Oxygen Demand (COD)	EPA410.4, SM5220D	Colorimetric	1/4
Chloride	EPA300.0	Ion Chromatography	6
Chlorine, Total Residual	SM4500 Cl G	Spectrophotometric, DPD, HACH	4
Chromium VI	EPA 218.6/ SM3500D Cr-B	0.45 micron Filtration Followed by Colorimetric or Ion Chromatography	2/4
Color	SM2120B	Visual	4
Cyanide, Total	EPA 335.4	Manual Distillation followed by Auto Spectrophotometric	1
Cyanide	SM4500-CN F	Ion Selective Electrode	4
Cyanide, Amenable to Chlorination	SM 4500CN G	Automated Colorimetric after treatment	4
Dissolved Oxygen (DO)	SM 4500-OG	Membrane Electrode	4
Fluoride	SM4500 F-C	Ion Selective Electrode	4
Fluoride	EPA 300.0	Ion Chromatography	6
Foaming Agents/ Surfactant (MBAS)	SM5540C	Colorimetric	4

Parameter/ Method Name	Method Number	Method Description	Reference
Hardness	EPA 200.7/SM 2340B	Calculation Ca plus Mg as CO3-	2/4
Kjeldahl Nitrogen	EPA351.2	Colorimetric, Semi-auto block digester	1
Nitrate	EPA353.2 EPA300.0	Cadmium Reduction Ion Chromatography	1/6
Nitrite	EPA300.0 EPA 353.2	Ion Chromatography Cadmium Reduction	6/1
Total Residue	SM 2540B	Gravimetric	4
Orthophosphate	SM4500 P-E/PF, EPA 365.1, EPA300.0/HACH 8048	Manual Single Reagent Ion Chromatography	4/6
Perchlorate	EPA 300.0/314.0	Ion Chromatography	6
Phenols	EPA 420.1/420.4	Manual Distillation Followed by Colorimetric	1
pH	SM4500-HB	Electrometric	4
Phosphorus, Total	SM4500 PE EPA 365.1	Persulfate Digestion followed by Manual Colorimetric	4/6
Residue, Filterable (Total Dissolved Solids--TDS)	SM2540C	Gravimetric	4
Residue, Non-filterable (Total Suspended Solids--TSS)	SM2540D	Gravimetric	4
Residue, Settleable (Settleable Solids)	SM 2540F	ImHoff Cone	4
Residue, Volatile	EPA160.4	Gravimetric	1
Specific Conductance	EPA120.1/SM2510 B	Wheatstone Bridge	¼
Sulfate	EPA300.0	Ion Chromatography	6
Sulfide (Total & Soluble)	SM 4500S-2D	Colorimetric	4
Total Organic Carbon (TOC)	SM5310C	UV Persulfate	4
TOX (Total Organic Halogen) or Dissolved Organic Halogen (DOX)	SM5320B	Adsorption-Pyrolysis-Titrimetric Method	4
Turbidity	EPA 180.1 SM2130B	Nephelometric	6/4/4e

(B) Inorganic – Metals – Wastewater

Parameter/Method Name	Method Number	Method Description	Reference
Metals (except Hg)	EPA200.7 EPA200.8	Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP) Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	2
Mercury, Hg	EPA245.1	Digestion, Cold Vapor Manual	1
Silica Dissolved	SM4500SiO2C SM4500 SiD	Molybdosilicate	4/4b

(C) Microbiology/Microscopy Tests – Wastewater

Parameter/Method Name	Method Number	Method Description	Reference
Asbestos	EPA 100.2	Transmission Electron Microscopy	8
Total Coliforms By Multiple Tube Fermentation (MTF)	SM9221B	Multiple Tube Fermentation (MTF)	4/4d
Fecal Coliforms By Multiple Tube/EC	SM9221E	MTF (EC Medium)	4/4d
E. Coli	SM9223	Colisure	4/4d
Fecal Streptococci and Enterococci by MTF	SM9230B	Multiple Tube Fermentation (MTF)	4/4d
Heterotrophic Plate Count	SM9215B	Pour Plate Count	4/4d

(D) Organics – Wastewater

Parameter/Method Name	Method Number	Method Description	Reference
Halogenated/Aromatic Volatiles	EPA624	GC/MS	10
Semi-Volatiles Acid and Base/ Neutral Compounds	EPA625	GC/MS	10

(E) Radiochemistry – Wastewater

Parameter/Method Name	Method Number	Method Description	Reference
Gross Alpha	EPA900.0	Proportional Counting	11
Gross Beta	EPA900.0	Proportional Counting	11

Table 9-3 Method Description for Hazardous Waste (Aqueous)

(A) Inorganics – Wet Chemistry – Hazardous Waste (Aqueous)

Parameter/Method Name	Method Number	Method Description	Reference
Anions	EPA9056	Determination of Inorganic Anions by Ion Chromatography	14

Chromium VI	EPA7196A/7199	Colorimetric/Ion Chromatography	14a/13
Conductivity	EPA 9050A	Specific Conductance	13
Corrosivity	EPA 9040C	pH Electronic Measurement	13
Cyanide	EPA 9012B	Total and Amenable Cyanide (Automated Colorimetric, with Offline Distillation)	13
Fluoride	EPA 9214	Potentiometric Determination of Fluoride in Aqueous Samples with Ion-Selective Electrode	13
pH	EPA 9040B	pH Electronic Measurement	14
Solids (TDS)	SM 2540C	Gravimetric	4
Sulfide	EPA 9030B EPA 9034 SM 4500-S2-D	Acid-Soluble and Acid-Insoluble Sulfides: Distillation Titrimetric Procedure for Acid-Soluble and Acid-Insoluble Sulfides Colorimetric	13 13 4
Total Organic Carbon	EPA 9060A	Total Organic Carbon by Carbonaceous Analyzer	13
Total Organic Halides	EPA 9020 B	Absorption - Pyrolysis - Titrimetric Method	14
Total Phenolics	EPA 9066	Colorimetric, Automated 4-AAP with Distillation	14a

(B) Inorganics – Metals – Hazardous Waste (Aqueous)

Parameter/ Method Name	Method Number	Method Description	Reference
Aluminum, Al	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	13 14/14b
Antimony, Sb	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	13 14/14b
Arsenic, Ar	EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	14/14b
Barium, Ba	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	13 14/14b

Parameter/ Method Name	Method Number	Method Description	Reference
Beryllium, Be	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	13 14/14b
Boron, Br	EPA6010B	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP)	13
Cadmium, Cd	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	13 14/14b
Chromium, Cr	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	13 14/14b
Cobalt, Co	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	13 14/14b
Copper, Cu	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	13 14/14b
Iron, Fe	EPA6010B	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP)	13
Lead, Pb	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	13 14/14b
Magnesium, Mg	EPA6010B	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP)	13
Manganese, Mn	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	13 14/14b
Mercury, Hg	EPA7470A	Manual Cold Vapor/Solid or Semi Solid (CV)	14

Parameter/ Method Name	Method Number	Method Description	Reference
Molybdenum, Mo	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	13 14/14b
Nickel, Ni	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	13 14/14b
Potassium , K	EPA6010B	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP)	13
Selenium, Se	EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	14/14b
Silver, Ag	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	13 14/14b
Sodium, Na	EPA6010B	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP)	13
Strontium, Sr	EPA6010B	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP)	13
Thallium, Tl	EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP)	14/14b
Total Metals	EPA3010A	Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP Spectroscopy	14a
Tin, Sn	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	13 14/14b

Parameter/ Method Name	Method Number	Method Description	Reference
Titanium, Ti	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	13 14/14b
Vanadium, V	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma Emission Spectroscopy (ICP)	13 14/14b
Zinc, Zn	EPA6010B EPA6020,A	EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS) EPA3005A/3010A Acid Digestion, Inductively Coupled Plasma/Mass Spectrometry (ICPMS)	13 14/14b

(C) Organics – Hazardous Waste (Aqueous)

Parameter/Method Name	Method Number	Method Description	Reference
Halogenated Volatiles	EPA8260B	Purge & Trap, GC/MS	13
Aromatic Volatiles	EPA8260B	Purge & Trap, GC/MS	13
Semi-Volatile Organic Compounds (BNAs)	EPA8270C	EPA3550A Extraction, GC/MS	13
EDB/DBCP	EPA 8011	Microextraction, GC/ECD	14a
Purge and Trap for Aqueous Samples	EPA 5030C	Purge and Trap for Aqueous Samples	14c

10.0 PURCHASING SERVICES AND SUPPLIES/ MEASUREMENT TRACEABILITY

10.1. PURCHASING SERVICES AND SUPPLIES

10.1.1. Documented procedures for the purchase, receipt and storage of reagents and standards (consumable materials) used for the technical operations of the laboratory must be followed by all personnel as per TNI-EL-V1M2-2009-5.6.4.2. Refer to the Nonmethod 27 SOP for detailed procedures for Purchasing Services and Supplies.

10.1.2. Purchased supplies and services that affect the quality of environmental tests are of the required quality by using approved suppliers and products.

10.2. REAGENTS AND REFERENCE STANDARDS

10.2.1. All chemicals used by EEA are ACS Reagent Grade, or better. Wherever possible, standards are from sources that are traceable to the National Institute for Standards and Technology (NIST). The laboratory ensures the use of reagents of same or better purity than that specified in the method. Thus, the analyst checks the label of the container to verify that the purity of the reagents meets the requirements of the particular method. The purchased supplies and reagents that affect the quality of the tests are not used until they are inspected or otherwise verified as complying with requirements defined in the test method.

10.2.2. Procedures shall be in place to ensure prepared reagents meet the requirements of the test method [TNI-EL-V1M2-2009-5.6.4.2.e]. If the method does not specify reagent quality, at a minimum the laboratory uses analytical “Reagent Grade” or better quality for all reagents.

10.2.3. Calibration Standards

10.2.3.1. Stock standards are obtained from the EPA Repository, or suppliers traceable to NIST, for the organic compounds. The metal stock solutions are obtained from NIST traceable sources. Initial calibration verification standards are obtained from a second “Manufacturer or lot” if lot can be demonstrated from the manufacturer as prepared independently from other lots [TNI-EL-V1M4-2009-1.7.1.1.d]. Stock solutions for surrogate parameters and other inorganic compounds are made up by the analysts from the appropriate reagent grade chemical specified in the procedure.

10.2.3.2. Stock standards are utilized to make working standards of lower concentration, which are then used to make calibration standards for the analytical run. The holding periods of stock standards, working standards, and calibration standards for the different analyses are provided in Table 10-2.

10.2.3.3. Stock standards, working standards, and calibration standards are all prepared in accordance with the method procedure. A logbook is maintained for standards preparation providing the initials of the analyst preparing the standard, the date of preparation, the concentration made up, and the lot numbers and suppliers. Since only one set of working standards is prepared at a time, the date of an analytical run can be keyed to the date of the working standards preparation to provide traceability to the particular lots of reagents from which the calibration standards were derived.

10.2.3.4. Calibration standards are run at the beginning of each day's analysis and a single standard is run every 10 samples throughout the analysis and at the end of the run to check for instrument drift. This "check" standard can also be used as an additional measure of analytical precision in addition to the LCS. Beginning and ending check standards must be at varying concentration within the established calibration range. If an internal standard is used, one CCV check must be analyzed per batch and an ending CCV may not need to be run unless required by method.

10.2.3.5. At the beginning of each day of analysis, all instruments must be calibrated. The calibration standards used must encompass a range of low, mid and high level concentrations to determine the calibration curve. The low level standard must be at or below the MRL value, the high level standard must be at the high end of the calibration range range and the mid level standard must be approximately midway between the low and high concentrations. Calibration procedures vary for the different instrumental methods and are summarized on Table 11-1. Section 11.1 for some representative methods.

10.2.4. **Policy on Verification of Standards**

All information relating to standards preparation and verification must be documented in the Standards Preparation notebook for that analysis. All documentation required must be examined by the analyst and signed off by the section supervisor. All documentation for each group must be stored in a central location (i.e. the standards preparation room). For microbiology, performance checks including the organisms used, their culture collection reference, date of issue of specification, or statements assuring that the relevant batch meets the product specifications is verified [TNI-EL-V1M5-2009-1.7.3.6].

10.2.4.1. **Mixtures**

New standard mix preparations must be compared to the previous mix. The concentrations calculated for the new standard should be within 10% of the "true" value (or as per the specific SOP). If the new standard does not agree within 10%, a third standard must be prepared by a different analyst and compared to the previous two. The third standard should agree with either the "old" standard or the "new" standard. If the third standard agrees with the "old" standard the third standard is used as the "new" standard. If the third standard agrees with the "new" standard the "old" standard is discarded and both the "new" and third standards can be used. In both cases the "new" standard must be verified by comparing to a "known" reference standard before discarding the old standard. Note that for some methods it may not be possible for the new standard to agree within 10% (see the specific SOP).

A new calibration curve must be prepared analyzing both the new standard and a known reference sample. The calculated value must fall within the acceptance limits for the reference sample.

10.2.4.2. **Neat Compounds**

The identity and purity of any new bottle of neat material must be verified either by the method it will be used to monitor or, preferably, by a different method.

For Organics, a solution of the new neat material must be compared to the old standard as a check on identity and purity. Acceptance criteria are detailed in the previous Mixtures section. For inorganics the new stock standard must be compared to the old stock standard as a check on concentration.

10.3. DOCUMENTATION RECORDS OF REAGENTS AND STANDARDS

10.3.1. A logbook is maintained for all standards. Each log contains the date of fresh stock preparation, the manufacturer’s lot number and supplier, the preparer's initials, the weight of material and the final volume used to prepare the stock.

10.3.2. The laboratory shall retain records for all standards, reagents, reference materials and media including the manufacturer/vendor, the manufacturer’s Certificate of Analysis or purity (if supplied), the date of receipt, recommended storage conditions, and an expiration date after which the material shall not be used unless it is verified by the laboratory [TNI-EL-V1M2-2009-5.6.4.2].

10.3.3. Original containers (such as provided by the manufacturer or vendor) shall be verified and labeled with an expiration date [TNI-EL-V1M2-2009-5.6.4.2.b].

10.3.4. Records shall be maintained on standard and reference material preparation. These records shall indicate traceability to purchased stocks or neat compounds, reference to the method of preparation, date of preparation, expiration date and preparer’s initials.

10.3.5. Where traceability to NIST is not applicable, the laboratory shall provide satisfactory evidence of correlation of results, example participation in proficiency testing or independent analysis of reference standards and reference materials [TNI-EL-V1M2-2009-5.6.4.1].

10.3.6. All containers of prepared standards and reference materials must bear a unique identifier and expiration date, and be linked to documentation requirements in 10.3 above [TNI-EL-V1M2-2009-5.6.4.2.d].

10.3.7. All containers of prepared reagents must bear a preparation date. An expiration date shall be defined on the container or documented elsewhere as indicated in the laboratory's quality manual or SOP [TNI-EL-V1M2-2009-5.6.4.2.d and 5.9.3.a.vi].

10.4. REAGENT STORAGE AND DISPOSAL

10.4.1. Standards are stored in designated refrigerators or freezers. Samples/extracts/digestates are not stored in these refrigerators due to the potential for cross-contamination.

10.4.2. All reagents, solvents and reactive chemicals are stored in their original containers in appropriate cabinets or storage closets specifically designed for this use. See Table 10-1, for storage instruction. Date received and date opened must be recorded on each reagent container.

Table 10-1 Reagent and Standard Storage

Chemical	Method of Storage
Nitric Acid	Stored in original containers in cabinet designed for acid storage.
Hydrochloric Acid	Stored in original containers in cabinet designed for acid storage.
Sulfuric Acid	Stored in original containers in cabinet designed for acid storage.
Flammable Solvents	Stored in original containers in flammable storage cabinets.
Oxidizers	Stored separately from flammable in cabinet designed for oxidizers.
Ethyl Ether	Stored in original containers in flammable storage cabinets. New lots are tested for peroxides. Each bottle is tested before and after peroxide removal with an activated alumna column
Stock Standard Solutions	Stored in freezer at 0°C in unbroken ampoules
Working Standard Solutions	Stored in refrigerator at 4°C labeled with prep information and expiration date.
Reagent Chemicals	Stored in cabinets in air conditioned laboratory areas
Hazardous Chemicals	Any chemical which is a health toxin and a known carcinogen, is stored in a secured area with restricted access

Table 10-2 Standard Storage and Holding Periods for Stock and Working Standard Solutions

Analyte	Stock Standard	Source Storage	Working Standard	Storage	Calibration Standard
ICP Metals	Expiration date	RT	6 months	RT	1-month
ICPMS Metals	Expiration date	RT	6 months	RT	1-month
Volatile 524.2	Expiration date	FZ	Monthly	FZ	Monthly
BNA Compounds	3 months if opened	FZ	Monthly if opened	FZ	3 months
	Expiration date If sealed	FZ	6 months If sealed	FZ	
Pesticides/PCBs/HAAs					
505	Expiration date	FZ	6 months	RF	6 months
525.2	Expiration date	FZ	6 months	RF	6 months
535	Expiration date	RF	6 months	RF	Daily
HAA’s	2 months	FZ	2-Months	FZ	Daily
Inorganics					
300.0/300.1	6 Months	RF	Daily	RT	Daily
Nutrients	Semi-annually	RT	Monthly	RT	Daily
Phenol, Cyanide	Semi-annually	RT	Monthly	RT	Daily
TOX	Yearly	RT	Monthly	RT	Daily
TOC	Yearly	RF	6 Months	RF	Daily
NO2/Nitrate	1 Month	RF	Daily	RT	Daily
Chlorine	Yearly	RF	Daily	RT	Daily
UV 254	Yearly	RF	Monthly	RF	Daily
Microcystin	2 years	FZ	3 Months	RF	3 months
Cylindrospermopsin	1 year	RF	Daily	RF	Daily
Saxitoxin	10 months	RF	Daily	RF	Daily

* Bimonthly - every two months
* Biweekly - every two weeks

RT - Room Temperature
RF - Refrigerated at 4°C
FZ - Frozen at 0°C

Table 10-3 Sources of Standard Materials

Analysis	Vendor Source
ICAP/ICPMS Metals	JT-Baker
Volatile Gases	Ultra Scientific, EM Science Ampules
Volatiles	Ultra Scientific, EM Science Ampules
BNA Compounds	Ultra Scientific, Accu Standard, Absolute Standard
Pesticides/PCBs	Accu-Standards
Anions	EM Science/Baker, Fisher
Nutrients	EM Science/Baker
Phenol, Cyanide	EM Science/Baker
TOX,TOC	CPI
Radiochemistry	Eckert Ziegler/ Isotope Products

11.0 CALIBRATION PROCEDURES AND FREQUENCY

The production of analytical data of known, defensible and documented quality requires adherence to standardized procedures, which cover all aspects of laboratory operation. The following sections provide details of the standardized procedures relating to instrumentation calibration.

11.1. INITIAL INSTRUMENT CALIBRATION

Prior to use, every instrument must be calibrated according to a specified procedure found in the method-specific SOP. Table 12-1 lists all major laboratory equipment. Table 11-1 lists the minimum calibration frequency of use and the acceptance criteria for the various calibration techniques, on a method by method basis. Table 11-2 also summarizes the calibration methods and number of calibration standards that are used on an instrument basis. Table 11-3 lists the ion abundance tune criteria, which must be met during calibration, for mass spectroscopy methods such as 524.2 and 525.2. Calibration frequency and criteria included in the tables are only for representative test methods. Calibration procedures for other methods can be found in relevant SOPs.

Each instrument, and support equipment including reference standards of measurements such as Class S weights or equivalent weights, and traceable thermometers are marked and identified to indicate its calibration status such as "Calibration due date."

11.1.1. **Applicability**

11.1.1.1. The creation of this or any other policy is designed to be a guideline to ensure that all data are treated alike, and thus ensuring that data generated on any particular day of analysis are representative of the norm. The policies are not intended to be absolute criteria for the acceptance or rejection of any analytical data.

11.1.1.2. There is no substitute for the inherent familiarity that each analyst has with his or her specific analysis, and consequently their assessment of the data must be considered in cases where the acceptance criteria outlined in policy or SOPs cannot be achieved. Data generated in situations where one or more of the requirements outlined cannot be met will be reviewed on a case-by-case basis by the QA staff and the appropriate Technical Manager for acceptance. A detailed Quality Investigation Report (QIR) should have been completed and included in the data package to justify any deviation from policy or SOP protocols. Example of a QIR is shown in Figure 15-2.

11.1.2. **Linearity**

11.1.2.1. All calibrations should be linear unless otherwise defined in the specific SOP and allowed by the reference method. Many organic methods may allow or require the use of a quadratic fit for some compounds. Linearity here is defined as a calibration curve that meets the back-calculation criteria presented below, unless the SOP contains different criteria. Specific protocols outlined in a given SOP will always take precedence over generic policies outlined in this QA Manual.

11.1.2.1.1. Linear Regression

y = mx + b

Where:

y = Response A_x for External Standard or A_x/A_{is} for Internal Standard
x = Concentration C_x for external standard, or C_x/C_{is} for internal standard
m = Slope
b = Intercept

11.1.2.1.2. Linear Regression Statistical Equations

Slope (m) → $m = \frac{[(Swx_i y_i \times Sw) - (Swx_i \times Swy_i)]}{[(Sw \times Swx_i^2) - (Swx_i \times Swx_i)]}$

Intercept (b) → $b = y_{ave} - (m \times (x_{ave}))$

Correlation Coefficient (r) →

$$r = \frac{[(SW \times Swx_i y_i) - (Swx_i - Swy_i)]}{\sqrt{[Sw \times Swx_i^2) - (Swx \times Swx_i)] \times [(Sw \times Swy_i^2) - (Swy_i \times Swy_i)]}}$$

Coefficient of Determination (r^2) → $r^2 = r \times r$

Where:

n = number of x, y pairs
x_i = individual values for the independent variable
y_i = individual values for the dependent variable
w = weighting factor, for equal or no weighting w = 1
x_{ave} = average of the x values
y_{ave} = average of the y values
S = the sum of all the individual values

11.1.2.1.3. Quadratic Regression Equation

$y = ax^2 + bx + c$

Where:
y = Response A_x for external standard, or A_x/A_{is} for internal standard
x = Concentration Cx for external standard, or Cx/Cis for internal standard

11.1.2.1.4. Equation for Concentration

External Standard Equation → $C_x = \frac{(A_x - b)}{m}$

Internal Standard Equation → $C_x = \left(\frac{A_x/A_{is} - b}{m}\right) C_{is}$

11.1.2.2. If the method does not specify the acceptance criteria for the linear fit, the laboratory will establish a policy for acceptance criteria of 0.995 for correlation coefficient. The calibration curve is verified using any one of the following:

11.1.2.2.1. Coefficient of Determination (r^2)

$$r^2 = \frac{S(y_i - y_{ave})^2 - [{(n-1)}/{(n-p)} \times (S(y_i - Y_i)^2]}{S(y_i - y_{ave})^2}$$

Where:

y_i = individual values for each dependent variable
x_i = individual values for each dependent variable
y_{ave} = average of the y values
n = number of pairs of data
p = number of parameters in the polynomial equation (i.e., 3 for third order, 2 for second order

$$Y_i = \frac{\left\{\left[2a \times \left({C_x}/{C_{is}}\right)^2\right] - b^2 + b + (4ac)\right\}}{4a}$$

S = the sum of all the individual values

11.1.2.2.2. An initial calibration verification standard (ICV's) is immediately run after the curve. The standard is preferably obtained from a 2nd source or different lot if the lot can be demonstrated from the manufacturer as prepared independently from other lots [TNI-EL-V1M4-2009-1.7.1.1.d]. Concentrations that lie in the middle of the curve should have an acceptable recovery of ± 10% of the true value.

11.1.2.2.3. The linear curve will be acceptable if the curve meets the back-calculation criteria, i.e. back calculating the initial calibration standards against the developed model, with an acceptance criteria of ± 10 % recovery of the true value.

11.1.3. **Selection of Quantitation Technique (Organics)**

11.1.3.1. For organic analysis, a decision must be made during the validation process (and detailed in the SOP) as to whether an internal or external quantitation technique will be routinely employed.

11.1.3.2. The internal standard method of quantitation cannot be employed unless all of the following conditions are met:

11.1.3.2.1. The internal standard must be added post-extraction. For Method 525.2, it is added pre-extraction.

11.1.3.2.2. The internal standard must be added quantitatively.

11.1.3.2.3. Any analyte that is a target analyte using the method of interest may not be selected for use as the internal standard.

11.1.3.2.4. The concentration of the internal standard(s) must not exceed the calibration range of the method target analytes. In cases where the target analytes are associated with more than one calibration range (i.e. analytes "1-4" are calibrated from 1 to 10 µg/L, while analyte "5" is calibrated from 10 to 100 µg/L, and analytes "6-10" are calibrated from 2.5 to 25 µg/L), the concentration of the internal standard should be prepared at a level between the highest calibration standard of the highest and lowest absolute calibration range. (e.g. approximately 50 µg/L in the example given).

11.1.3.3. The use of internal standard quantitation is of greatest benefit in those methods subject to a great deal of injection variability, and thus a great deal of variability in the absolute mass injected onto the column(s) employed. The drawback to this technique for GC methods is that any compound that exhibits a similar retention time as the compound used for the internal standard will be identified as the internal standard, leading to erroneous quantitation. For this reason, the internal standard technique is most useful for GC/MS where deuterated analytes not naturally occurring can be detected and quantified.

11.1.4. **Selection of Calibration Method**

11.1.4.1. During the method validation process, a least square regression is initially tried as a calibration method. The responses from each of the calibration standards must then be input into the linear regression equation to determine whether or not the corresponding concentrations meet the acceptance criteria outlined below. If the acceptance criteria cannot be met using a linear regression, then a second order polynomial fit can be used to fit the data, with $r^2 \geq 0.99$ as the acceptance criteria. In the event that neither a simple linear regression nor a second order polynomial fit result in an equation which meets the calibration acceptance criteria, then the calibration range must be broken down into two or more smaller ranges. Each of the subsequent ranges must individually meet all of the requirements for a single calibration range. If a linear regression works, a single average response factor may be used if the calibration is linear through the origin and it is consistent with the referenced method.

11.1.4.2. As part of the validation process, the specific calibration range and calibration algorithm must be determined and documented in the SOP. Once determined in this manner, the same protocols must be followed each time the method is employed. This will ensure that data reduction is not performed differently on separate data sets or by different analysts.

11.1.5. **Minimum Number of Calibration Levels**

The calibration for linear fits must include a minimum of three initial calibration standards plus a blank unless specified otherwise in the SOP. Polynomial fits must include at least 5 standards. The minimum requirement for a NELAP Lab as per TNI-EL-V1M4-2009-1.7.1.1.j is: a minimum of three (3) standards (one of which is lowest quantitation limits, not including a blank or zero standard), if the reference method does not specify the minimum number of initial calibration standards.

11.1.6. **Selection of Calibration Levels**

11.1.6.1. To avoid weighting a calibration curve to create a better fit than is warranted, three standards must be included per order of magnitude of concentration of the calibration curve. For example 0.1, 0.5, 1.0, 5.0, 10.0 has 3 standards per order of magnitude (0.1, 0.5 and 1.0, and 1.0, 5.0 and 10.0).

11.1.6.2. The lowest calibration standard shall be the lowest concentration for which quantitative data are to be reported. Any data reported below the lower limit of quantitation is considered to have an increased quantitative uncertainty and is reported using either "J" flags or explained in the case narrative [TNI-EL-V1M4-2009-1.7.1.1.f].

11.1.6.3. The highest calibration standard shall be the highest concentration for which quantitative data are to be reported. Any data reported above the highest standard is considered to have an increased quantitative uncertainty and is reported using "E" flags or explained in the case narrative [TNI-EL-V1M4-2009-1.7.1.1.g].

11.1.6.4. Measured concentrations outside the working range are reported as having less certainty and are reported using "E" flags or explained in the case narrative. The lowest calibration standard must be above the limit of detection, usually at MRL level except for ICP that allows zero point and single point calibration. [TNI-EL-V1M4-2009-1.7.1.1.h].

11.1.6.5. A good approach to select calibration levels when the calibration range is expected to span at least one order of magnitude is to set the levels at 1 MRL, 5 MRL, and 10

MRL for a simple 3 point calibration. If more points are desired, then they would follow the same scheme, i.e. 50 MRL, 100 MRL.

11.1.7. **Calibration Analytical Sequence**

11.1.7.1. The calibration must progress from the analysis of the lowest to highest standard unless the instrumentation does not permit it or the method requires calibration from high to low. A blank must be analyzed after the highest calibration standard.

11.1.7.2. If the analysis requires an initial high standard to set the gain a blank must be run before starting with the low calibration standard unless the instrumentation does not permit it.

11.1.8. **Calibration Acceptance Criteria**

For linear fits, in general, the calculated value for standards (using the calibration curve or response factor) must be within 10% of the nominal value for mid-level standards. However, the value determined by the calibration curve for the lowest standard (conc. is at the MRL) must be within ± 50% of the true value or ± 25% of the true value if the lowest standard is >5X & <10X MRL. Accurate quantitation at the MRL level may require use of a second order fit or separation of the curve into multiple linear segments. Mid level standards (conc. > 10X MRL) should be within ± 10% of the true value. Relevant SOPs should be reviewed for the method and laboratory calibration verification specific criteria, which may be different from those stated here.

11.2. CONTINUING INSTRUMENT CALIBRATION

11.2.1. Continuing calibration (CC) is run as required by the method. Refer to specific SOPs to determine the frequency and acceptance criteria of continuing calibration verifications.

11.2.2. The continuing calibration standard must be near the mid-point of the calibration curve unless the method requires rotation of concentration levels.

11.2.3. The calculated value for the continuing calibration standard must be within control limits stated in the specific SOP.

11.2.4. Calibration shall be verified for each batch for each compound, element, or other discrete chemical species, except for multi-component analytes such as Aroclors, Chlordane, or Toxaphene where a representative chemical related substance or mixture can be used.

11.2.5. Instrument calibration verification must be performed:

11.2.5.1. At the beginning and end of each analytical batch (except, if an internal standard is used; only one verification needs to be performed at the beginning of the analytical batch). As per Standard Methods sections 1020 and 3020, run CCVs every 10 samples.

11.2.5.2. Whenever it is expected that the analytical system may be out of calibration or might not meet the verification acceptance criteria.

11.2.5.3. If the time period for calibration of the most previous calibration has expired, or

11.2.5.4. For analytical systems that contain a calibration verification requirement.

11.2.6. If the method does not specify criteria for the acceptance of a continuing instrument calibration, verification must be established, e.g., relative percent difference.

11.2.7. If the continuing instrument calibration verification results obtained are outside established acceptance criteria, corrective actions must be performed.

11.3. UNACCEPTABLE CONTINUING INSTRUMENT CALIBRATION VERIFICATIONS

11.3.1. If routine corrective action procedures fail to produce a second consecutive (immediate) calibration verification within acceptance criteria, then either the laboratory has to demonstrate acceptable performance after corrective action with two consecutive calibration verifications, or a new initial instrument calibration must be performed.

11.3.2. If the laboratory has not verified calibration, sample analyses may not occur until the analytical system is calibrated or calibration verified. If samples are analyzed using a system on which the calibration has not yet been verified the results shall be flagged.

11.3.3. If these criteria are not met, a second continuing calibration standard must be run (either freshly prepared or a second injection, as appropriate). No individual analyte can fail the CC criteria two consecutive times. If the criteria are still not met, a new initial calibration must be run and the new calibration curve verified. The laboratory qualifies the data with "V" flag if the sample data is associated with failed calibration verification.

11.3.4. As per TNI-EL-V1M4- 2009-1.7.2.e, data associated with an unacceptable calibration verification may be fully useable under the following special conditions:

11.3.4.1. If there was a high bias and there is a failed continuing calibration verification, the lab reports only data associated with samples that are non-detects.

11.3.4.2. If there was a low bias and there is a failed continuing calibration verification, the lab reports only data associated with samples that have a result greater than the maximum regulatory limit/decision level.

Table 11-1 Minimum Calibration Frequency and Acceptance Criteria

Analysis	Method	Calibration Technique	Acceptance Frequency	Criteria
Organohalide Pesticides and PCB products	505	Endrin Breakdown Initial Calibration	Daily beginning and end of analysis	< 20% degradation % RSD ≤20
		Cal Verification Std	beginning and end of analysis	80 – 120 %
		LRB	before start of analysis; each time set of samples extracted or reagents changed	< RL
		LFB	Every 20 samples (all samples extracted within a 24-hr period) points	%R = 70 – 130% Require control charts after 30 data
		MRL checks	Daily	50 – 150% Requires control charts after 30 data points
		LFM IDC, 7 LFBs QCS	Every 10 samples Initial set up, new analyst Quarterly	%R = 65-135 % ≤ 20 % RSD, 70 – 130 % R
Volatile Organics Including DIPE, TAME, ETBE Low level 1,2,3-TCP	524.2	BFB Sensitivity	Every 12 hours of operation	Ion abundance criteria (Table 11-3)
		Initial Calibration (7-pt)	Prior to analysis, or when CC fails	RSD ≤20 % / r≥0.995
		Continuing Calibration	After BFB tune and every 12 hours of operation and at the end of analytical batch (highly recommended by Method)	RF within 30% of the initial calibration
		Surrogate	added to CCV, every sample & all initial calibration stds. (Not required for TCP).	70-130 % Rec
		MS/MSD (upon client request)	Every 20 samples. (Not required for TCP).	70-130 % Rec.
		LCS/LFB	Every 20 samples Every 12 hrs or every 10 samples (TCP)	70-130 % Rec. 80-120 % Rec. (TCP)
		LFB Dup (TCP: can be used in place of Lab Duplicate)	Quarterly	RPD <20%
		Blank	Every 20 samples. Every 10 samples for TCP.	<MRL
		QCS (TCP)	Quarterly (TCP)	%R = 80-120% (TCP)
		MRL checks	Daily	± 50% of the true value
		Lab Duplicate (TCP)	1 per 10 samples (TCP)	% RPD < 20% (TCP)

Analysis	Method	Calibration Technique	Acceptance Frequency	Criteria
Volatile Organics	524.3	BFB Sensitivity	Prior to initial calibration	Refer to Table 1 in 524.3 SOP
		Initial Calibration (7-pt)	At the start of the analytical up or when CCV fails	Cal. Points ≤MRL: ±50% Other cal. Points: ±30%
		ICV/QCS	After initial calibration and quarterly	70-130% Rec
		Continuing Calibration Check	After every 10 field samples	%D for each analyte below MRL: ≤50% Above MRL: ≤30%
		LRB	1 per analytical batch	< ½ MRL
		Matrix Spike/LFSM	1 per analytical batch	70-130% Rec
		LFBD	At least quarterly	70-130% Rec RPD: <20%
		Surrogate	Every sample, QCs, DCCs	70-130% Rec
		Internal Standards	Every sample and calibration standards	±30% of most recent CCC ±50% of average response in ICAL
Semi- Volatiles Organics	525.2	DFTPP Sensitivity	At the beginning of each 12 hours that samples are analyzed	See Table 11-3
		Endrin/DDT Degradation Check	Daily, each 12 hours, before sample run	<20% breakdown
		Initial Calibration	Prior to analysis, when CC fails	< 30% RSD
		Continuing Calibration	Beginning of each 12 hours and every 12 hours that are analyzed and at the end of analytical batch (highly recommended) by Method)	70-130% Rec
		MS	5 % or 1 per sample set Extracted whichever is more frequent	70-130 % Rec
		LCS/ LFB	5 % or 1 per sample set Extracted whichever is more frequent	70-130 % Rec
		Method Blank	1 per sample extraction set	< RL
		Surrogates	added to each sample before extraction	% R =70-130%
		MRL Checks	Analyzed with each extraction batch	50 – 150% Requires control charts after 30 data points
		IS	added to each sample before extraction	area count must not decrease by >50 % from initial calibration and 30% from CCC.

Analysis	Method	Calibration Technique	Acceptance Frequency	Criteria
Trihalomethane /Chloral Hydrate/ Haloacetonitrile /EDB/DBCP	551.1	Initial calibration (Extracted)	Beginning of analysis	< 10 % RSD
		Lab Performance Check	Beginning of analysis	Table 7 of the method
		Endrin Breakdown	Beginning of analysis	< 20 %
		Calibration verification (CCV=LFB)	Before start of analysis, every 10th sample, and after the final sample analysis	% R = 80-120 % for 90 % analytes & 75-125 % for all analytes
		LRB (Lab Reagent Blank)	1 per extraction Batch	< ½ MRL
		LFB (Lab Fortified Blank)	Every 10 samples. (Not Required).	% R = 80-120 % for 90 % analytes & 75-125 % for all analytes
		LFM	every10 samples	80-120 %
		LFM/Duplicate	see sample duplicate	see sample duplicate
		Sample Duplicate	10 % or at least 1 per set, whichever is greater	RPD < 20 for 90 % of analytes, RPD <25% for all analytes
		Surrogate	All samples	80-120 %
		QCS	Quarterly	same as CCV
		IDC, 7 LFBs	Initial set up new analyst	R = 80-120 %, < 15 % RSD
		Stock solutions Verification; Outside Source.	every new lot	< 20% RPD
Volatile Organics	624	BFB Sensitivity	Prior to ICAL and calibration verification, every 12 hours of operation	Ion abundance criteria (Table 11-3)
		Initial Calibration	Prior to analysis, or when CC fails	RF <35 % RSD
		Continuing Calibration (QC Check Std)	After BRB tune, every 12 hours of operation	All analytes' %R must meet % R as specified in Table 5 of Method 624 (See SOP)
		Surrogate	added to CCV, every sample & all initial calibration stds.	%R as specified in SOP
		MS/MSD	Every 20 samples	All analytes' %R must meet % R as specified in Table 5 of Method 624
		MRL check	Daily, prior to sample analysis	50 – 150% Requires control charts after 30 data points
		LCS/LFB	Every 20 samples	All analytes' %R must meet % R as specified in Table 5 of Method 624

Analysis	Method	Calibration Technique	Acceptance Frequency	Criteria
Base Neutrals and Acids	625	DFTPP Sensitivity	Every 12 hours of operation	Ion abundance criteria (Table 11-3)
		Initial Calibration	Prior to analysis, when CC fails	All analytes <35% RSD
		Continuing Calibration (same as MRL Check)	Every 12 hours of operation	All analytes w/in ±20% Of the predicted response
		MS/LFM	Every 20 samples	All analytes' %R must meet % R as specified in Table 6 of the method
		LCS/LFB	Every 20 samples	All analytes' %R must meet % R as specified in Table 6 of the method
HAA	6251B	Calibration curve	each batch	<20%RSD or r ≥ 0.995
		Method Blank	1 per batch of 20 samples or less	< ½ MRL
		LCS/ LFB	1 per sample set Extracted or 20 samples	LCS: 80-120% Mid and High LFB : ±15%
		MRL check	1 per sample set extracted or 20 samples	50-150%
		MS/LFM	1 per 10 sample set extracted	Control Chart Limits updated annually
ICP Metals	200.7/ 6010	ICV	Following calibration	95-105% Rec, <3% RSD
		Method blank	Every 20 samples	< ½ MRL
		MS/MSD	Every 10 samples	70-130%, 75-125% (6010B)
		MRL Check	Beginning and end of the run	50 – 150%
		LCS/LFB	2 per batch of 20 samples	85-115%
ICPMS Metals	200.8/ 6020	Tuning Solution	At the start of QC program or after major maintenance or every 2 weeks	Good Performance: 0.75 amu peak width at 5% peak height Mass calibration: <0.1 amu from unit Mass Instrument stability: 5x run; <5% RSD
		Quality Control Sample(QCS)	Quarterly	90 –110%
		Initial Calibration Verification	Immediately following calibration	95–105% Rec
		Calibration blank	Each batch	< ½ MRL
		Linearity Check 5x CCV/upper limit of Calibration Range	Prior to sample sequence	90-110% Rec
		Replicate Integration	3 replicates	≤ 10% RSD at higher concentrations

Analysis	Method	Calibration Technique	Acceptance Frequency	Criteria
ICPMS Metals (con't.)	200.8/ 6020	Continuing Calibration Verification (CCV)	Every 10 samples	90-110 % Rec
		Minimum Report Limit (MRL), Check/CRDL	Beginning of analysis and end of the sample run	50-150%
		Laboratory Fortified Matrix (LFM)	Every 10 samples	70-130% Rec
		Laboratory Fortified Matrix (LFM) Duplicate	2 in every 20 samples	70-130% Rec 20% RPD
		LCS/LFB	One per batch of 20	85-115% Rec
		Internal Standards (IS)	Spike each sample, standard and blank	60-125% of the response in the calibration blank
		Method Blank	1- per batch of 20-samples	<1/2 MRL or <1/2 CRDL
		Instrument Blank	Prior to Calibration	< ½ MRL
Cr VI (Dissolved)	218.6/ 3500CrB	Initial Calibration	Daily at the beginning of each run	$r \geq 0.999$
		IPC(CCV)	1-per 10 samples	95-105 % Rec
		LRB (Lab Reagent Blank)	1-per 10 samples	< ½ MRL
		LFB/QCS	1-per batch of 20 samples	90-110% Rec (external source)
		LFM	1-per 10 samples	90-110% Rec
		LFMD	1-per batch of 20 samples	90-110% Rec (RPD <20%)
		MRL Check	Daily	50 – 150%
		QCS	Quarterly (see LFB)	90-110%
		LDR	Start of program	minimum 7 stds

Automated Wet Chemistry:

Analysis	Method	Calibration Technique	Acceptance Frequency	Criteria
Cyanide Fluoride Nitrate Nitrite Phenolics	335.4, 9012B SM4500F C 353.2, 300.0 300.1 420.1, 420.4	Linear Calibration curve (7-11 pt)	Each batch	$r \geq 0.995$ (correlation coefficient)
		Calibration blank	1-per 10 samples	< ½ MRL
		MRL check	Each batch	50 – 150%
		MS/MSD	Every 20 samples (Phenol 420.4 – every 10 samples)	Limits: Fl; 73-124% Phenol, CN, NO3 (353.2); 90-110% NO3, Phenol Low; 80-120%

Analysis	Method	Calibration Technique	Acceptance Frequency	Criteria
Cyanide Fluoride Nitrate Nitrite Phenolics (con't.)	335.4, 9012B SM4500F C 353.2, 300.0 300.1 420.1, 420.4	LCS/LFB	Every 20 samples (Phenol 420.4 – every 10 samples)	Method Limits: Fl; 81-116% CN, NO3, Phenol; 90-110% Phenol Low 80-120%
Residual Chlorine	SM 4500 Cl-G	LCS/LFB	Every 20 samples	85-115%Rec
		MS/LFM	Not Required	20 % RPD
		MRL check	1 per batch of 20 or less	50-150%
		Duplicate	Every 20 samples	<20 % RPD
Anions by IC	300.0/300.1/317	Calibration curve (7-11-pt)	Each batch	r ≥ 0.995 correlation
		Calibration blank	1-per 10 samples	< ½ MRL
		Method Blank	1- per batch of 20-samples	< ½ MRL
		MRL Check	At the beginning of the run	50-150%
		MS/MSD	Every 10 samples (MS); Every 20 samples	80-120 %
		LCS/LFB	Every 20 samples	90-110 %
Total Dissolved Solid	SM2540C	Method Blank	Each time used, 1 per batch	<MRL
		Weight Check	Reweigh till weight difference is <4% or <0.5mg	<4% or <0.5mg difference
		MRL Check	Daily	50-150%
Total Suspended Solids	SM2540D	Method Blank	1 per batch	<MRL
		MRL Check	Each batch	50-150%
Total Solids	SM 2540B	Method Blank	Every 10 samples	<MRL
Total Volatile Solids	160.4	LCS	1 per batch	Within certified range
pH	150.1/SM4500H+B	3 buffers	Each time used	± 0.1 pH unit of true value
Conductivity	120.1/SM 2510B	1 check solution	Each time used	± 1 % of true value
		MRL Check	Daily	50-150%
TOC	SM 5310C	Calibration curve (6-pt)	Every 6 months or until instrument drifts	r ≥ 0.995 correlation
		Blanks	At the beginning of batch and every 10 samples	< 0.250ppm

Analysis	Method	Calibration Technique	Acceptance Frequency	Criteria
TOC (con't.)	SM 5310C	MS/MSD	MS: Every 10 samples MSD: Every 20 samples/batch	80-120%
		LCS/LFB/CCV	At the beginning of batch and every 10 samples	90-110 %
		MRL Check	Daily	50-150%
		LCS1/MRL Check	Every batch	50-150%
		Lab Duplicate	All samples	≤10 % RPD (TOC ≥ 2.0 mg/L) ≤15% RPD (TOC < 2.0 mg/L)
UV 254	SM 5910B	Calibration curve (3-pt) Verification	Prior to analysis of samples	90-110 %
		Blank/UV absorbance @ 254	At the beginning of batch and after every 10 samples	< 0.004 units
		LCS/LFB UV absorbance @ 254 nm	At the beginning of analysis	Agrees within manufacturer's listed range
		MRL Check	Daily	50-150%
		Lab Duplicate	All samples analyzed in duplicate	≤10% RPD ≤15% RPD for low standards

NOTE: 1) Any deviations from the listed criteria are specified in the SOP.
2) Concentrations for all continuing calibrations are in the middle of the linear range.
3) For all other methods not listed in the Quality Manual, see calibration frequency and acceptance criteria in individual SOPs.

Table 11-2 Calibration Procedures

Instruments	Minimum # of Calibration Standards	Calibration Method
TOX	3 points standard (for precision only)	Titration
Anions, Nutrients (Ion Chromatography)		
Nitrate, NO3 Nitrite, NO2 Chloride, Cl2 Sulfate, SO4	11-points 11-points 7- points 10-points	Quadratic Quadratic Quadratic Quadratic
Phenol, Cyanide	5 point	Linear Regression
Fluoride	3 point minimum	Linear Regression (log)
pH	3 point	Slope
Radiation	5-6 points	Efficiency Curve
TOC (TOC Analyzer)	6 Point	Linear Regression
UV 254 (Spectronic 601) Spectrophotometer	3 Point	Efficiency Curve
524.2 (GCMS)	5-7 Points	Linear Regression
HAA (GC)	5 Point	Linear Regression

Note: For all other methods not listed in the Quality Manual, see calibration procedures in individual SOPs.

Table 11-3 Ion Abundance Criteria (Tune Criteria)

(A) BROMOFLUOROBENZENE (BFB) (524.2 and 624)

Mass	Ion Abundance Criteria
50	15 - 40% of mass 95
75	30 - 60% of mass 95 (624) ; 30-80 % mass 95 (524.2)
95	Base peak, 100% relative abundance
96	5 - 9% of mass 95
173	Less than 2% of mass 174
174	Greater than 50% of mass 95
175	5 - 9 % of mass 174
176	Greater than 95%, and less than 101% of mass 174
177	5 - 9% of mass 176

(B) DECAFLUOROTRIPHOSPHINE (DFTPP) (525.2)

Mass	Ion Abundance Criteria
51	10-80% of the Base Peak
68	Less than 2% of mass 69
70	Less than 2% of mass 69
127	10-80% of the base peak
197	Less than 2% of mass 198
198	Base Peak or >50% of 442
199	5 - 9% of mass 198
275	10 - 60% of the base peak
365	Greater than 1% of the base peak
441	Present, but less than mass 443
442	Base Peak or Greater than 50% of mass 198
443	15-24% of mass 442

Table 11-4 Initial Calibration Acceptance Criteria

Anions/Nutrients	Initial calibration value for standards must be within 10% of the nominal value. $r \geq 0.995$
GC	Initial Calibration RF <20% RSD or second order fit, continuing calibration. RF ≤ 20% Difference. Must meet specific method calibration criteria.
GCMS, EPA 524.2	Initial Calibration ≤ 20 % RSD, $r \geq 0.995$
HAAs	Initial Calibration correlation coefficient $r \geq 0.995$, < 20 % RSD
HPLC	Correlation coefficient must be ≥0.995 or 20% RSD
Metals	Initial calibration value for standards must be within 5% of the nominal value.
pH	Values for 4, 7, 10 buffers must be ± 0.1 pH unit of the nominal value
Radiation	Each calibration standard counts must be >10,000.
TOC	Initial calibration value for standards must be within 10% of the nominal value. $r \geq 0.995$
TOX	Initial calibration value for standards must be within 10% of the nominal value. $r \geq 0.995$
UV 254	Initial Calibration value for the standards must be within 10 % of the normal value.

12.0 EQUIPMENT

12.1. ANALYTICAL EQUIPMENT

12.1.1. All equipment is properly maintained, inspected, and cleaned.

12.1.2. Table 12-1 contains a list of the major analytical equipment used during sample preparation and analysis. For Microbiology, pressure cookers are not used for sterilization of growth media [TNI-EL-V1M5-2009-1.7.3.7.b.ii].

12.2. SUPPORT EQUIPMENT

12.2.1. Balances

Analysts are responsible for daily calibration verification checks of the analytical balances in the laboratory with Class S weights and annual calibrations of the drying ovens thermometer with an NIST traceable certified thermometer. Documentation of the balance and oven checks is maintained in the appropriate logbook. Reference certified thermometers are calibrated every five years. A yearly thermometer calibration check is done for all other thermometers and all thermometers are labeled showing any necessary correction to achieve true readings. Balances are calibrated annually and Class S-weights are calibrated every 5 years by an outside vendor. Copies of these balance and thermometer records are filed with the QA records for the laboratory. All Class S weights and traceable thermometer standards are used for calibration only and for no other purpose to ensure that the performance as reference standards are always valid.

Balance calibration is verified on the day of use prior to weighing samples, standards or reagents. If balance does not meet the acceptable criteria of ± 0.1 % or other vendor recommended limits, the analyst reports to QA that balance needs service. The instrument is labeled “out of service” until repaired. The Analyst records the problem and identifies corrective action, date of service, and if corrective action resolved the problem.

12.2.2. Temperature Monitoring

Refrigerators, incubators, temperature are monitored 2 times daily in at least 4 hour intervals. If the temperature measured is not meeting the acceptance criteria of 4± 2°C, analyst reports to the QA department. QA then monitors the temperature after 2 hours and more often if needed. If non-compliance is still observed, QA calls for service. The instrument is labeled “out of service” until repaired. QA records the problem identified, corrective action, date of service, if called, and if corrective action resolved the problem.

12.2.3. Pipets

Eppendorf pipette function verification is done on the day the standards are prepared for pipets used for the preparation of both the primary and secondary standards. Monthly frequency is done for pipets used either for the preparation of either the primary or secondary standards and for Class A pipets used for the preparation of the other set of standards. When used over a range of settings, the pipet is calibrated at the highest and lowest settings. If not meeting the acceptable range of ± 2 % of the set value, the analyst investigates and identifies the problem. The pipet is cleaned if needed and inspected for signs of wear or damages or for residual liquids that may have been sucked in the pipet. After the appropriate Corrective Action, the pipet is again calibrated. Corrective Action taken and problem identified is recorded. If corrective action did not resolve the problem, the analyst documents in the logbook that the pipet is off-line. The pipet is also labeled "out of service" until repaired.

12.2.4. **Microbiology Volumetric Equipment [TNI-EL-V1M5-2009-1.7.3.1.a.iii]**

Volumetric Equipment shall be calibrated as follows:

12.2.4.1. Equipment with movable parts such as automatic dispensers, dispensers/diluters, and mechanical hand pipettes shall be verified for accuracy quarterly.

12.2.4.2. Equipment such as filter funnels, bottles, non-class A glassware and other marked containers shall be calibrated once per lot prior to its use.

12.2.4.3. The volume of the disposable volumetric equipment such as sample bottles, disposable pipettes, and micropipette tips shall be checked once per lot.

12.2.5. **Glassware**

Table 12-2, contains the SOP for glassware cleaning. All class volumetric glassware is dried at room temperature rather than oven baked.

The washing and sterilization procedures for laboratory glassware are tested annually by testing glassware for inhibitory residues as shown in Standard Methods.

12.2.6. **Water Quality File**

The pure water system for EEA was assembled by US Filter in January 2003. It consists of reverse osmosis, mixed bed deionizers, ultraviolet disinfection, filtration, and an organic scavenger side stream return loop. The system is connected to a conductivity meter which signals when the mixed bed resin demineralizers need to be changed.

The quality of laboratory pure water is analyzed monthly for conductivity, pH, chlorine residual, TOC, and standard plate count and annually for water suitability ratio, inhibitory residue (annually, each time new lot of detergent and for new washing procedures), and trace metals (Pb, Cd, Cr, Cu, Ni, and Zn). Table 12-3 lists the acceptance criteria for these analytes. This data is recorded and submitted to the QA department. These reports are with the QA Department for review and maintained for ten years.

12.2.7. **Out of Service**

All major instruments if off line will be labeled “out of service” until repair.

12.3. PREVENTIVE MAINTENANCE

12.3.1. **Routine Maintenance Activities**

EEA carries maintenance contracts on all major laboratory equipment, under which much of the preventative maintenance is performed. Routine servicing, such as cleaning of rods, source, or detectors, is performed on a regular basis by the analyst. This type of service is performed according to the procedures and at the frequency specified by the manufacturer. Routine maintenance is done when instrument performance starts to degrade as demonstrated by a failure to meet one or more QC criteria, decreased ion sensitivity, degrading peak resolution, lowered response factors, or shifts in calibration curves. Activities that are performed on a routine basis can be found in the Instrument Maintenance Nonmethod14 SOP.

12.3.2. **Documentation**

Instrument maintenance logbooks are maintained for most major instruments. All repairs and any routine or non-routine maintenance activities are recorded in the logbooks. The date of the activity, the person performing it, and the nature of the activity are recorded. Expendable items for all major instruments are kept on hand to minimize downtime.

The following are documented in the instrument logbooks:

12.3.2.1. Name of the item of the equipment

12.3.2.2. Manufacturer’s name, type identification and serial number or other unique identification

12.3.2.3. Date received and date placed in service

12.3.2.4. Current location, where appropriate

12.3.2.5. Condition when received (e.g. new, used, reconditioned)

12.3.2.6. Copy of manufacturer’s instructions where available

12.3.2.7. Dates and results of calibrations and/or verifications and date of the next calibration and/or verification

12.3.2.8. Details of maintenance plan carried out to date and planned for the future

12.3.2.9. History of any damage, malfunction, modification or repair

12.3.2.10. Records of service calls

12.3.2.11. Calibration status for instrument that are calibrated outside the direct control of the laboratory are checked before use (after an instrument is returned from outside repair) [TNI-EL-V1M2-2009-5.5.9][ISO/IEC 17025:2005(E)-5.5.9].

12.3.3. **Contingency Plans**

12.3.3.1. An effort is made to have a functionally equivalent backup instrument available in case of a catastrophic instrument failure. Maintenance contracts are carried on the major instruments and generally provide for 24-48 hour response for repairs. If necessary, EEA has a list of qualified laboratories to subcontract work to, upon client approval.

12.3.3.2. In the event a holding time expires while the sample is in the custody of EEA, a project manager will call the client to inform them of this situation. Based on subsequent arrangements made between the lab and the client, fees for re-sampling and subsequent analysis may be incurred by the lab.

Table 12-1 Equipment (06/28/13)

Table 12-1 Equipment (06/28/13)

	Vendor	Model	Year Acquired	Detectors	Tests	Serial #
Microbiology	Thermo Scientific	Multiskan FC	2010	Photometer	microcystin, cylindrospermopsin, saxitoxin	357-00450T
	Zeiss		Unknown (this is very old)	Light Microscope	Algae Analysis	#1782
	Molecular Devices	Spectramax L Luminometer	2011		AOC Analysis	LU 03146
	Polytron	1300D	2012	Homogenizer	Microcystin	PF-809-0004-09-01

	Vendor	Model	Year Acquired	Detectors	Tests	Serial #
	Fluid Imaging	Flow Cam	2012	Flow Cytometer	Algae Analysis	5056
Metals	Agilent	7500CS	2011	ICP/MS	200.8	JP93200243
	Cetac	ASX-500 Model 510 Autosampler	2011	ICP/MS Autosampler	200.8	10047ASX
	Nelsab	Merlin M75 Chiller	2011	ICP/MS Chiller	200.8	107043069
	Perkin-Elmer	Elan DRC II	2003	ICP/MS	200.8 & Rare Earth Ele's	Q1280212
	Perkin-Elmer	ELAN 6000	1999	ICP/MS	200.8	3929707
	SeaFast3	Autosampler SC2DX	2009	N/A	Iodide/Iodate	X2DX-HS-TDP-16-100801
	SeaFast3	Nebulizer PC3-F	2009	N/A	Iodide/Iodate	PC3F-100701
	ESI	Autosampler SC2DX	2009	N/A	Speciation	X2DX-HS-TSP-16-100711
	ESI	Nebulizer PC3-F	2009	N/A	Speciation	PC3F-100505
	Optima	4300 DV	2003	ICP	200.7	077N2121801
	Perkin-Elmer	FIMS400	2000	Mercury Analyzer	Mercury	4605
	Environmental Express	Hot Block	2002	Digestion Block	Metals Prep	1763CEC1134
	Environmental Express	Hot Block	2005	Digestion Block	Metals Prep	3703CEC1784
	Environmental Express	Hot Block	2012	Digestion Block	Metals Prep	6974CECW3257

	Vendor	Model	Year Acquired	Detectors	Tests	Serial #
	Thermo	Lindberg/blue WB1130C-1		Mercury Digestion Water Bath	Mercury Prep	R12R-507226-RR
	Agilent	7500CE	2007	IPC/MS	200.8	JP51201349
Rad	Protean 8 channel	MPC9604	1998	Proportional Counter	Gross Alpha/Beta and Ra 228	83023
	Gamma Products Inc	T7500	2006	Proportional Counter	Gross Alpha/Beta and Ra 228	
	Beckman	6500	1993	Liquid Scintillation System	Radon	7067177
	Beckman Coulter	Allegra 6	2003	Benchtop Centrifuge	Ra 228	ALS02M09
	Linberg Blue	HP53025C	2001	Hot Plate	Gross Alpha/Beta	W01K-496436-WK
	Canberra, Inc	Gamma Spec	2010	High Purity Ge Detector	Ra 226 and Ra 228	9771
	Canberra, Inc	Gamma Spec	2013	High Purity Ge Detector	Ra 226 and Ra 228	10466
Ion Chromatography	Metrohm	881 Compact IC w/Conductivity Detector	2009	IC	Fluoride, Ammonia	3170
		887 UV/VIS	2010	IC-Detector UV/VIS	218.6	3146
		818 External Pump	2009	IC-Pump	218.6	10156
		858 Autosampler	2009	IC-Autosampler	All tests	2797
	Dionex	CD20	1998	IC-detector-CD20	300.0	98080693
		GP50	2004	IC-Pump-DX600 series	300.0	0402006
		LC20	1998	IC-Column Cabinet	300.0	98070159

	Vendor	Model	Year Acquired	Detectors	Tests	Serial #
	Dionex	AD25	2001	IC-detector-UV/VIS	218.6	00120138
		IP25	2000	IC-Pump- DX600 series	218.6	00120237
		LC10	1998	IC-Column Cabinet	218.6	98100540
	Dionex	IP25	1998	IC-Pump-DX600 Series	300.1/300.0	98120234
		ED40	2000	IC-Electrochemical Detector	300.1/300.0	96020230
		LC20	2000	IC-Column Cabinet	300.1/300.0	00110243
	Dionex	ICS2000	2005	IC w/Conductivity Detector	300.0	03080229
	Dionex	ICS3000	2006	IC w/Conductivity Detector	314/300.1/317	6030479
		VWD3400	2008	IC-UV/VIS Dectector	317	8004187
		GP40	1998	IC-Pump-DX500 Series	317	98070271
	Dionex	ICS3000	2007	IC w/Conductivity Detector	314/300.0/EDTA/NTA	06120153
	Dionex	ICS3000	2010	IC w/Conductivity Detector	300.0/300.1/317	07050797
		VWD3400	2010	IC-UV/VIS Detector	317	8022929
		GP40	2000	IC-Pump-DX500 Series	317	00120038
	ABSCIEX/ Dionex	API2000	2011	LCMS	331 mod	B5010208H
		Ultimate3000	2011	LCMS Pump	331 mod	8040461
		Ultimate3000	2011	LCMS Solvent Rack	331 mod	8040973

	Vendor	Model	Year Acquired	Detectors	Tests	Serial #
		Ultimate 3000	2011	LCMS AutoSampler	331 mod	8040943
	Dionex	ICS 1600	2012	IC w/Conductivity Detector	314	12090982
	Dionex	ICS 1600	2012	IC w/Conductivity Detector	UCMR 3 300.1	12090984
Inorganics	HACH	16500-10	1996	COD Digestor	COD	991000019578, 910404628
	COSA	TOX-100	2007	Coulometric	TOX	A7M-42726
	Sievers	AS-800	2003	UV-Persulfate	TOC, DOC	910404628
	HACH	DR/4000U (DR500)	2003	UV/VIS	UV 254	1225267116
	Mettler	Muli-7 Meter		pH/Ion Meter	pH/ISE, Fluoride, CNDW	1225267116
	HACH	DR/4000V	2002	Spectrophotometer	COD, R-SIO2, etc	0006V0000995
	HACH	DR/4000U	2005	Spectrophotometer	UV 254, COD, R-SiO2, Ferrous, Cr-VI.	9509U0000228
	WTW	OX1730P	2006	DO Meter/Probe	BOD, CBOD, DO	06440156
	Lachat	BD-46	1999	Block Digestor	TKN	1800-712
	Lachat	BD-48	2010	Block Digestor	TKN	1004-00000975
	YSI	YSI-5000	2010	DO Meter/Probe	BOD, CBOD, DO	10A101086
	HACH	DR2010	2010	Spectrophotometer	MBAS, oPO4, S2	99050001332
	OI Analyitcal	390 Autosampler	June 2011	Autosampler	Phenolics Low Level	021102A130

	Vendor	Model	Year Acquired	Detectors	Tests	Serial #
		FS3100		Analyzer Module		114831572
		A515000		Distillation Module		114815572
	Carone	2050-1		Circulator		03301120501288
	Sievers	5310C	2012	UV-Persulfate	TOC	12106054
Misc	Reliance Glass	Midi-Still	1998	Distillation	Cyanide/Phenol/Ammonia	NA
Misc	Olympus	BH-2	1192	Fluorescence Microscope	Protozoan	T2-105170
Misc	Orion	101	1990	Conductivity	Conductance	127
Misc	Hitachi-TEM	600AB	2000	X-Ray	Asbestos	542-50-03

	Type	Model	Year Acquired	Detectors	Tests	ID	Serial #
GC Systems	Varian	3800	2001	Dual ECDs	551.1 SODA	21	3800-02440
GC Systems	Varian	3800	2001	Dual ECDs	551.1 SODA	22	3800-08107
GC Systems	Varian	3800	2002	Dual ECDs	505	23	3800-08827
GC Systems	Agilent	3800	2003	Dual ECDs	HAA – 6251B	24	US10306042
GC Systems	Agilent	3800	2003	Dual ECDs	515.4	25	US10315085

	Type	Model	Year Acquired	Detectors	Tests	ID	Serial #
	Agilent	3800	2003	Dual ECDs	505	26	US10315084
	Varian	3800	2004	Dual ECDs	505	27	3800-11203
	Agilent	6890N	2005	Dual ECDs	N/A	28	US10427028
	Agilent	6890N	2005	Dual ECDs	551.1	29	US10440020
	Agilent	6890N	2005	Dual ECDs	HAA – 6251B/556	30	US10512068
	Agilent	6890N	2005	Dual ECDs	HAA – 6251B	31	CN10518044
	Agilent	6890N	2005	Dual ECDs	551.1	32	CN10505035
	Varian	3800	2006	Dual ECDs	504.1	33	3800-12789
	Agilent	6890N	2007	Dual ECDs	515.4	34	CN10706031
	Agilent	6890N	2007	Dual ECDs	551.1	35	CN10706032
	Agilent	6890N	2007	Dual ECDs	6251B (HAA)	36	CN10706030
GCMS Systems	HP	5890/5972	1997	VOA - MS	524.2, TCP Low	J	3118A02321
	HP	5890/5972	1995	VOA - MS	524.2, 624, 8260	H	3501A02407
	Varian Ion Trap w/ CI/MS	Saturn	2000	Semivoa - MS	SPME/6040D	ITS2	4654
	Varian Ion Trap	Saturn 2000	2001	Semivoa - MS	521/Nitrosamines, SPME, 522	ITS3	4635-9050
	Agilent	6890/5973	2003	MSD	524.2/624/8260/ 524.3	L	US33246003
	Agilent	5973/6890	2005	MS	524.2/624/8260	N	US4647377
	Agilent	5973/6890	2005	MS	524.2, UCMR3 524.3	P	US44647375
	Varian	CP 3800/4000	2009	GC/MS	Endothal/521	ITS6	4000-0488
	Agilent	6890N	2005	GC	525.2, 526, 527	M	CN10416008
	Agilent	5973 inert	2005	MS	525.2, 526, 527		US40610242

	Type	Model	Year Acquired	Detectors	Tests	ID	Serial #
	Agilent	6890N	2006	GC	EDC4	S	CN10534101
	Agilent	5975N	2006	MS	EDC4		US52420838
	Agilent	6890N	2005	GC	529	R	CN10517080
	Agilent	5973 inert	2005	MS	529	R	US44610770
	Agilent	6890N	2003	GC	525.2, 526, 527	K	CN10331006
	Agilent	5973N	2003	MS		K	US30945838
	Varian	CP-3800	2006	GC	521/Nitrosamines	ITS5	3800-12765
	Varian	4000CIMSM	2006	MS	521/Nitrosamines	ITS5	4000-00291
	Agilent	5975 6850	2007	GCMS GC	524.2, 624, 8260, 524.3	U	US65115374 CN10646018
	Varian	3800 320	2008 2008	GC MS/MS	1613B (Dioxin)	GC-QQQ-1	1204
	Agilent	5975	2011	GCMS	524 TCP LOW	X	US11179701
	Thermo	ISQ	2012	GCMS	524, 524.3	V	ISQ120827
	Thermo	ISQ	2012	GCMS	522	T	ISQ120935
LCMS	Dionex	U3000	2006	HPLC	CLO4, Acrylamide, EDCLC-2	LC-2	2240601
	Waters	Ultima Quattro	2004	MS/MS	CLO4, Acrylamide, EDC, 331	LCMS1	VB125
	Agilent	1200	2007	HPLC	CLO4, Acrylamide, EDC, 331	LC-1	DOOSM9-382M
	AB SCIEX	API 5000	2008	MS/MS	CLO4, Acrylamide, EDC	LCMS4	AG22860808
	Agilent	1200 SL	2007	HPLC	UCMR 3, EDC2, 532-LCMS	LCS-3	
	AB SCIEX	API 4000	2007	MS/MS	UCMR 3, EDC2, 532-LCMS	LCMS2	V20670708
	Thermo	TSQ Vantage	2012	MS/MS	UCMR 3, 537	LCMS5	TQU03178
	Thermo	TSQ Vantage	2012	MS/MS	UCMR 3, 539	LCMS6	TQU02731

	Type	Model	Year Acquired	Detectors	Tests	ID	Serial #
HPLC	Waters	2690	2004	HPLC	549.2, 555	HPLC4	DOOSM9-382M
	Dionex	P580	2001	Fluorescence	531.1, 531.2	P580	1530109
	Waters	2690/2487	1998	UV Detector	532, 549, 555	2	H96SM4168R
	Dionex	P680	2005	Fluorescence	547	P680	1000205

Table 12-2 Glassware Washing Procedures

Refer to the Nonmethod 16 SOP for detailed glassware cleaning procedures.

Table 12-3 Water Quality Parameters

Parameter	Acceptance Criteria
Ammonia	< 0.1 mg/L (monthly check)
Residual Chlorine	< 0.10 mg/L
TOC	< 1 mg/L
pH	5.5 - 7.5
EC	<2 µmhos/cm @ 25oC
	<2 µS (µsiemens/cm)
Trace Metals (Cd, Cr, Cu, Ni, Pb, Zn)	<0.05mg/L each collectively <0.1 mg/L
Bacteriological (HPC) Colony forming units/ml	<500 cfu (TNI < 10000 cfu/ml)
Bacteriological Quality of Reagent Water (Suitability Ratio or Ratio of Growth Rate)	0.8 - 3.00
Student’s t	< 2.78 for annual use test
Inhibitory Residue	<15% difference in average count

13.0 DOCUMENT MANAGEMENT/CONTROL OF RECORDS

13.1. ANALYTICAL DOCUMENTATION

A critical dimension of any quality assurance program is the ability to document what is occurring in the laboratory. Accordingly, EEA uses a number of forms to document various aspects of laboratory procedures. A discussion of these forms follows.

13.1.1. Analytical Data and Quality Control Forms

Printed forms are used by analysts to standardize the format of routine analyses. For analyses where forms are not available, the analyst records all required information in a notebook. The forms are designed to minimize calculation errors and provide a summary of all quality control data generated for the run.

Analysts are responsible for maintaining these forms. The QA group spot checks these forms periodically. These forms are actively maintained in hardcopy or electronically for a minimum period of 2 years and then stored electronically or stored in hardcopy offsite.

13.1.2. Chromatograms and Data Processing

Chromatograms and strip chart recordings are assigned unique alpha-numeric codes and backed-up on the server or an external hard drive. Information contained within the code includes; test, date and numerical sequence.

Computer records are stored by internal sample ID and test and therefore can be queried on this information.

Scanned hardcopy outputs of chromatograms and data processing are filed with the analytical data forms. Chromatograms and library searches are stored on magnetic tape and the information is retrievable upon client request.

13.1.3. Inventory Control Logs

Records are maintained on the purchase of laboratory supplies detailing the vendor, purchase order number, date of order, and date of receipt. Bottles of reagents are dated upon received so that the shelf life can be monitored.

13.1.4. Stock Standard Logs

A logbook is maintained for preparation of analytical stock standards for each group. Each log contains the date of fresh stock preparation, the lot number and supplier, the preparer's initials, and the weights used to prepare the stock.

13.1.5. Bacteriological Growth Media Log

Upon receipt of new microbiological media, the date received is noted upon the container. Media supplies are dated not only upon receipt but also when initially opened. A written record of quality control on media, materials, and equipment is logged into the Micro QC book. The record includes the results of the check, the initials of the individual performing the check, and the date. Media prepared in the lab is logged into the Prepared Media Log by the analyst. These records include media lot number, date of preparation, manufacturer and lot number, type and amount of media prepared, sterilization time and temperature, final pH, the analyst's initials, and expiration date.

13.1.6. Instrument Monitoring and Maintenance Logs

13.1.6.1. When in use, the operating temperatures of incubators, water baths, hot air ovens, and refrigerators are checked daily and recorded. Adjustments or service calls are made when required. Autoclave sterility checks, using ampules of bacterial spores, are made at least monthly, or whenever a problem is suspected but all items are autoclaved with sterility indicator tape. Records of the maintenance are maintained in equipment logs.

13.1.6.2. A separate maintenance logbook is maintained for each analytical instrument. These logs contain a record of routine maintenance as well as any repair work required during instrument set-up.

13.1.7. Corrective Action

The form, presented in Figure 15-2, requires documentation on the determination of the out-of-control event or variance, the diagnostics performed to bring the event back under control, and the manner in which re-establishment of control was demonstrated. A flow chart of QIR process can be found on Figure 15-3. The analyst and their supervisor sign the form electronically in STARLIMS and submit it to the QA department for review. Then, QA distributes the corrective action to the appropriate Project Manager so that the client may be contacted if necessary. The analysts keep hardcopies of original corrective action forms and file them with the appropriate raw data package.

13.2. CONTROL OF RECORDS

Figures 13-1 and 13-2 are examples of worksheets and notebooks used in data reduction.

13.2.1. General Records

13.2.1.1. The laboratory’s document control procedure includes identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. Quality records include reports from internal audits and management reviews as well as records of corrective and preventive actions. Records are in the form of hard copy or electronic media.

13.2.1.2. All records are required to be legible and are stored and retained in such a way that they are readily retrievable in facilities that provide a suitable environment to prevent damage or deterioration and to prevent loss. Records are retained for 5 years held secure and in confidence as per TNI-EL-V1M2-2009-4.13.1.3 and 4.13.3.b (ISO/IEC 17025:2005(E)-4.13.1.3 and 4.13.3.b), 10 years for Massachusetts, Hawaii, and New York samples.

13.2.1.3. The laboratory has implemented procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records by setting up level of security and/or designating appropriate personnel responsible for the security of the records.

13.2.1.4. The following information is documented as per TNI-EL-V1M2-2009-4.13.3.

13.2.1.4.1. The records include the identity of personnel involved in sampling, sample receipt, preparation, calibration, or testing.

13.2.1.4.2. All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

13.2.1.4.3. The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes by setting format for naming electronic files.

13.2.1.4.4. All changes to records are signed or initialed by responsible staff. The reason for the signature or initials is clearly indicated in the records such as “sampled by”, “prepared by”, or “reviewed by”.

13.2.1.4.5. All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent ink [TNI-EL-V1M2-2009-4.13.3.g].

13.2.1.4.6. Entries in records are not obliterated by methods such as erasures, overwritten files or markings. All corrections to record keeping errors are made by one line marked through the error. The individual making the correction signs (or initials) and date the correction. These criteria also apply to electronically maintained records [TNI-EL-V1M2-2009-4.13.2.3, 4.13.3.g.i (ISO/IEC 17025:2005(E)-4.13.2.3, 4.13.3.g.i). The laboratory keeps correspondence relating to lab activities for specific projects. Documentation includes email correspondence between the Project Manager and client.

13.2.2. **Technical Records**

13.2.2.1. The laboratory retains technical records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each test report issued, for a defined period. The record for each environmental test or calibration contains sufficient information to facilitate and to enable the environmental test to be repeated under conditions as close as possible to the original. The records include the identity of personnel responsible for the performance of each environmental test and checking of results.

13.2.2.2. Observations, data and calculations are recorded at the time they are made and are identifiable to the specific task.

13.2.2.3. When mistakes occur in records, each mistake is crossed out, not erased, made illegible or deleted, and the correct value entered alongside. All such alterations to records are initialed and dated by the person making the correction. In the case of records stored electronically, equivalent measures are taken to avoid loss or change of original data. When corrections are due to reasons other than transcription errors, the reason for the correction shall be documented [TNI-EL-V1M2-2009-4.13.3.g.ii].

13.2.2.4. Each report or documents issued shall include the name(s), function(s) and signature(s) or equivalent electronic identification of person(s) authorizing the report or documents, and date of issue. Use of computer password unique to each analyst and level of security prevents loss of original data and change of data.

13.3. DATA STORAGE

13.3.1. EEA maintains electronic report files for at least 10 years. The report files are organized alphabetically by client and contain a copy of the report sent to the client, custody information and scheduling information. Report files also include subcontractor reports. The scannable supporting raw data is scanned within six months and stored electronically in the EEA secured server. The non-scannable data (i.e. hardbound logbooks) are stored in a secured offsite storage for a total of 5 years for all states, except 10 years for Hawaii, Massachusetts, and New York. These files are centrally located and a custodian is assigned to maintain, retrieve, and copy files as needed.

13.3.2. Instrument raw data is stored on each instrument's computer. Data is backed-up to a network server or an external hard drive (Chromeleon is backed up to the network server and GCMS/LCMS is backed up to an external hard drive. If instruments are direct read and transcribed into notebooks, then the notebooks are stored in the lab until they are scanned and filed.

13.3.3. All raw data is organized by instrument or test, then chronologically. Logbooks such as sample custody or balance calibration are organized chronologically.

13.3.4. Electronic data from LIMS is stored on data tapes.

13.4. DOCUMENT CONTROL

13.4.1. Document Control procedures are implemented that allow for adequate documentation and control of specific documents. These procedures use a unique identification system that allows for tracking, training documentation, traceability of official copies and the time period the procedure or document was in force. Documents issued to all personnel in the laboratory as part of the Quality System (QS) shall be reviewed and approved for use to authorized personnel prior to use. The list will identify the current revision status to ensure that invalid or obsolete documents are not used. The document control procedures includes that the authorized editions of documents are accessible by the analysts and invalid or obsolete documents are promptly removed from use. All QS documents such as SOP, QM, logbooks are uniquely identified including the following:

- Date of issue and/or revision ID
- Page numbering
- Total number of pages or markings to signify end of documents.
- Issuing authorities [TNI-EL-V1M2-2009-4.3.3.1][ISO/IEC 17025:2005(E)-4.3.3.1]

13.4.2. To ensure that the QM and SOPs remained controlled documents, the master SOPs and QM (original official version of the SOP and QM) and copies of the SOP and QA Manual will be identified. The cover page of each copy will contain a unique identification indicating that the document is controlled copy ___ of ____ copies, initialed and dated by the Quality Manager or her designee in red ink. This ensures that the analyst is currently using the right update or version.

13.4.3. A SOP/Quality Manual Distribution Form will be prepared for each SOP/QM that will include the SOP/QM ID, control number, individual receiving the SOP/Quality Manual, and date of issue.

13.4.4. Record management system is also implemented for control of laboratory notebooks; instrument logbook; standard logbook; and records for data reduction validation storage and reporting. Laboratory archival system will also be implemented to laboratory books and logbooks.

13.4.5. Notebooks and Logbooks are assigned unique ID numbers for control of laboratory records. Upon completion of the book, the analyst returns the book to QA. A new number is assigned to the newly issued notebook. See Table 13-1 for the laboratory document control system for notebooks and logbooks.

13.4.6. Changes to documents shall be reviewed and approved by the same function that performed the original review unless specifically designated otherwise. The designated personnel shall have access to pertinent background information upon which to base their review and approval. Refer to the Nonmethod 25 SOP for detailed document control procedures.

13.5. DOCUMENT CHANGES TO CONTROLLED DOCUMENTS

13.5.1. All documents and/or changes issued to personnel in the laboratory are reviewed and approved for use by the Lab Director, Technical Director and Quality Manager prior to use. A master list or an equivalent document control procedure identifying the current revision status and distribution of documents in the laboratory are established and are readily available to preclude the use of invalid and/or obsolete documents.

13.5.2. Any changes/alterations to laboratory documents are tracked and properly identified. Amendments are clearly marked, dated and initialed and revised documents are formally re-issued immediately. Any obsolete documents are removed from corresponding binders are archived and stored in a secured place.

13.6. ARCHIVAL SYSTEM

An archival system is implemented for managing and removal of all outdated documentation. Records that are archived are Training Records for personnel no longer with the laboratory and Outdated Quality Manual/SOPs. Only current versions of the Quality Manual/SOPs are retained in the laboratory areas. All outdated versions of the Quality Manual/SOPs are returned to the Quality Manager for archiving. All outdated logbooks/work books are turned in to the supervisor for scanning and archiving. Please see 13.3.1 for more information. Refer to the Nonmethod 30 SOP for archiving procedures.

13.7. STANDARD OPERATING PROCEDURES (SOP)

13.7.1. Laboratories shall maintain SOPs that accurately reflect all phases of current laboratory activities such as assessing data integrity, corrective actions, and all test methods.

13.7.2. When an amendment to the SOP is needed, such as a minor update to the entire procedure, the laboratory will handwrite the update with initials and date of the person who made the change in the original copy of the SOP. Also, when a minor mistake is found in the SOP, the laboratory will strike the section with one line, date and initials of the person who does the change in the original copy of the SOP. For any of these minor updates, the analyst(s), supervisor and QA will be notified and they will be included in the next update of the SOP.

13.7.3. The following format must be used for all final technical SOPs.

13.7.3.1. **Header** - A header must be included in the upper right corner of each page of the SOP. The header must include the SOP reference name or number, the revision number, the date the revision began, page number and total number of pages.

13.7.3.2. **Cover Page -** The SOP cover page consists of a summary of the most recent revision information and the signatures of the Analyst, Technical Manager/Group Supervisor, Quality Manager, and Technical Director/Lab Director stating that they approved the SOP including the date that they read and signed the SOP. The approval, issue, and effective dates are included on the cover page. The effective date is two weeks after the approval date.

13.7.3.3. **Body**

13.7.3.3.1. **Title**

13.7.3.3.2. **Scope and Application** - A brief description of the types of matrices the method is applicable to as well as the regulatory programs that may be supported by the use of the method. This section is also used to indicate any special training or level of ability required to perform the method.

13.7.3.3.3. **Method Summary** - A brief description of the method, simple statement of analytical technique and any pre-treatment steps.

13.7.3.3.4. **Interferences** - This section should include any known interferences, as well as potential interferences, particularly for GC/conventional detector methods. It should also include any interferences that may be present as a result of improper sampling procedures, equipment cleaning or analytical technique must be listed here.

13.7.3.3.5. **Safety Considerations** - Specify any known or suspected carcinogens, mutagens, or teratogens among the standards or reagents used. Indicate that the SDS (safety data sheets) are available and where they are located. Each analyst is required to familiarize him/herself with the contents of the SDS before performing the analysis.

Each SOP includes reference to the Laboratory Chemical Hygiene Plan as per OSHA Standard 29 CFR 1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories-Final Rule.

13.7.3.3.6. **Instrumentation/Apparatus** - The instrumentation used, including specific columns employed for GC, LC, or GC/MS and whether or not there is a primary and confirmatory column.

13.7.3.3.7. **Reagents and Standards** - The sources of all standards and reagents are listed.

13.7.3.3.8. **Sample Collection, Preservation and Handling** - Indicate bottle type, preservative and volume necessary for analysis. Include holding times for standards.

13.7.3.3.9. **Calibration Procedure** - Detailed preparation instructions for each calibration, LCS or MS/MSD standard should be included. A table should be present to show how daily calibration and control standard solutions are prepared from working stock standards. Calibration frequency should be specified. Expiration information should be included for each type of standard prepared.

13.7.3.3.10. **Analytical Procedure** - Since the purpose of a SOP is to provide clear instruction to avoid loss of key information from one analyst to another, it is critical that this section be detailed enough that any analyst can anticipate and take appropriate corrective action in the event that a problem should arise.

13.7.3.3.11. **Quality Control Requirements** - This section should describe the components, concentrations, frequency, and acceptance criteria for the LCS or MS/MSD samples, as well as any other method specific QC requirements, such as tuning, blanks, or calibration requirements.

13.7.3.3.12. **Calculations** - All relevant calculations should be included, such as how instrument response relates to concentration, the calculation of response factors, etc.

13.7.3.3.13. **Method Performance** - The results of the initial method validation process should be included. The following information should be present:

- Statistically calculated MDLs (40 CFR Part 136 Appendix B),
- MDL spike levels, EEA’s MRLs, Accuracy for each compound (mean recovery of each compound determined from analysis of a minimum of 4 replicates spiked at 1-4x MRL (TNI-EL-V1M4-2009-1.6.2.2.a) when method does not specify the spike level for the IDC study), precision data (RSD of the 4 replicates).

13.7.3.3.14. **References** - A list of method references, such as the relevant 500 or 600 series method, the SW-846 methods (including revision number and date), or Standard Methods should be provided.

13.7.3.3.15. **Deviations from Referenced Methodology** - A review of the referenced method is carefully made and EEA will specify any areas in which our method does not conform to referenced method requirements. If any such deviations are noted, an explanation as to what alternative was used and why is described. There are two basic types of method modifications: (1) those that are hardware related and (2) those that are policy or procedural modifications.

13.7.3.3.16. **Method Detection Limit** - Laboratory procedures of conducting MDL studies and a copy of the initial MDL study will be included.

13.7.3.3.17. **Demonstration of Capability** - Laboratory procedures of conducting DOC studies and a copy of the initial DOC study will be included.

13.7.3.3.18. **Definitions** - Definitions will be referred to the Quality Manual since the Quality Manual includes a glossary section that defines all the terms used by the laboratory.

13.7.3.3.19. **Pollution Prevention** - Potential threat of the standards and reagents to the environment is addressed in the SOP.

13.7.3.3.20. **Waste Management** - In addition to the hazardous waste protocol discussed in the SOP, the following references where the information can be find are also included:

- The Lab Hazwaste Management Plan
- The federal hazardous waste management regulations –Resources Conservation and Recovery Act (RCRA)-Title 40 of the Code of Federal Regulations, Parts 260 through 270 (40 CFR 260-270)
- CA Hazardous Waste Control Law (HWCL)-CCR Title 22 where 40 CFR was duplicated into CCR Title 22

13.7.3.3.21. **Revisions** - Revisions are discussed including the dates when revisions are made and the appropriate section numbers where the revisions could be found.

13.7.3.3.22. **Attachments** - A copy of the bench sheet used for the analysis and where applicable, an example chromatogram of the standards, calculations and any other relevant attachments.

Table 13-1 Laboratory Document Control

	Control No.
Instrument Sequence Log Books and Instrument Run Logs	1-200
Maintenance Log Books	201-400
QC Log Books (pH, Micro air monitoring, travel blank, etc.)	401-600
Reagent Prep Books	601-800
Sample Prep/Extraction Books	801-1000
Sample Data Records	1001-1200
Standard Log Books	1201-1400
SOP Books	1401-1600
Support Equipment Log Books (Balance, Pipette, Refrigerator, Incubator, Thermometer, etc)	1601-1800
MSC.	1801-2000
Certification Books	2001-2200
Health and Safety	2401-2600

Figure 13-1 Sample Worksheet

Author: Nina Dude

Date : 1/10/2012

Original Run Filename: OM_1-10-2012_10-16-36PM.OMN created 1/10/2012 10:18:36 PM
Original Run Author's Signature: [Nina Dude]
Current Run Filename: OM_1-10-2012_10-16-36PM.OMN last modified 1/10/2012 11:12:37 PM
Current Run Author's Signature: [Nina Dude]
Description: Default New Run

633883

Sample	Rep.	Cup No.	Channel 1 PHENOL Conc. (mg/L)	Area (Vs)	Detection Time	MDF	
CalStd0.2 ppm	1	S1	0.200	1.35	1/10/2012@10:19:30 PM		
CalStd 0.1 ppm	1	S2	0.100	0.677	1/10/2012@10:21:00 PM		
CalStd 0.05 ppm	1	S3	0.0500	0.345	1/10/2012@10:22:29 PM		
CalStd 0.01 ppm	1	S4	0.0100	0.0846	1/10/2012@10:23:58 PM		
CalStd 0.005 ppm	1	S5	0.00500	0.0387	1/10/2012@10:25:28 PM		
CalBlank	1	S6	0.00	0.00161	1/10/2012@10:26:58 PM		
		DQM Test: Minimum Correlation Coefficient					
		Result:	0.99995 > 0.99500				
		Message	Calibration Passes				
		Action	Continue				
ICV 0.2ppm	1	1	0.201	1.35	1/10/2012@10:29:36 PM		1017.
	Known Conc:		100				
		DQM Test: > + Concentration Limit					
		Result:	0.201 < 0.220				
		Message	Pass				
		Action	None				
		DQM Test: < - Concentration Limit					
		Result:	0.201 > 0.180				
		Message	Pass				
		Action	None				
		Calibration:	Table/Fig. 1				
ICV 0.1ppm	1	2	0.101	0.683	1/10/2012@10:31:06 PM		1017.
	Known Conc:		0.100				
		DQM Test: > + Concentration Limit					
		Result:	0.101 < 0.110				
		Message	Pass				
		Action	None				
		DQM Test: < - Concentration Limit					
		Result:	0.101 > 0.0900				
		Message	Pass				
		Action	None				
ICB 0.0 ppm	1	6	-0.00123	2.46e-4	1/10/2012@10:32:35 PM		ND
	Known Conc:		0.00				
		DQM Test: > + Concentration Limit					
		Result:	-0.00123 < 0.0100				
		Message	ICB Passes				
		Action	None				
MRL 0.005 ppm	1	60	0.00517	0.0431	1/10/2012@10:34:06 PM		1037.
	Known Conc:		100				
LFB 0.08 ppm	1	7	0.0792	0.538	1/10/2012@10:35:36 PM		997.
	Known Conc:		0.0800				
		DQM Test: > + Concentration Limit					
		Result:	0.0792 < 0.0880				
		Message	Pass				
		Action	None				
		DQM Test: < - Concentration Limit					
		Result:	0.0792 > 0.0720				
		Message	LFB Passes				
		Action	Continue				
MBLANK	1	8	-3.10e-4	0.00642	1/10/2012@10:30:14 PM		ND
	Known Conc:		0.00				
		DQM Test: > + Concentration Limit					
		Result:	-3.10e-4 < 0.0100				
		Message	MBLANK Passes				
		Action	Continue				
LCS 0.08 ppm	1	9	0.0791	0.538	1/10/2012@10:40:51 PM		997.
	Known Conc:		0.0800				
		DQM Test: > + Concentration Limit					
		Result:	0.0791 < 0.0880				
		Message	Pass				
		Action	None				
		DQM Test: < - Concentration Limit					

Figure 13-2 Example Notebook

Referenced Methods: EPA 525.2

Start Date: 1/31/12	Init:	
Comp Date: 1/31/12	Init:	
QC'd:	Init:	

Solutions	Inj Vol (uL)	Exp. Date
IS Soln.		
Surr Soln.		
MRL Spk Soln		
LCS Soln.		
MS Soln.		

Room Temp: Chiller Temp:
Bath Temp: Heater Temp:

Batch# : 636820

Matrix: Water

Reagent H2O: ***Ultrapure*** mfg/lot LAB

Solvent	mfg/lot:
	mfg/lot:
	mfg/lot:
Salt:	mfg/lot:
	mfg/lot

Cartridge/Disk

Preservatives added to QC or unpreserved samples as needed.

	Group	Sample #	Client Code	Sample Source	Test Code	Vi (mL)	Vf (mL)	pH	Cl- ppm	Ext#
1	387095	201201310310	MIKE	Monrovia Tap Water	@ML525					
		QC64162001		LCS1 --						
		QC64162002		LCS2 --						
		Q064162003		MBLK --						
		Q064162004		MRL_CHK --						

Batch Comments

14.0 DATA REDUCTION, VALIDATION, AND REPORTING

The process of transforming raw analytical data into a finished report involves steps which are generally grouped into the categories of data reduction, data validation, and reporting. It involves mathematical modeling of the standard calibration curves, statistical analysis of the acquired data, calculations to account for preparation steps and dilution, verification of adherence to quality assurance procedures, and the generation of hardcopy output.

14.1. DATA REDUCTION

At EEA the analyst performing an analysis has the primary responsibility for reducing raw data. This process consists of converting raw data values into final, reportable values by comparing individual sample results to those obtained for calibration purposes and then accounting for any dilution or concentration procedures.

The extent to which raw data from the instrument needs to be mathematically processed varies depending on the analysis. For the following methods finished data is directly read from the instrument; pH, conductivity, spectrophotometric/colorimetric measurements (i.e.: Chemical Oxygen Demand (COD), Chromium VI, phenols, phosphorus, Methylene Blue Activated Substances (MBAS, or commonly known as surfactants), odor and presence/absence bacteriological tests. Other methods require mathematical calculations and in some cases, such as for pesticides by GC, qualitative assessment of actual presence.

Below is an outline of the data reduction techniques used by technology.

14.1.1. <u>GC AND GC/MS</u>

A data reduction software system is used to calculate target compound concentrations. These concentrations are calculated by multiplying the average response factor for the compound by the area count as determined by the instrument. Average response factors are determined through linear regression during initial calibration, and may only be used if the correlation criteria have been met. This assumes linearity of the calibration curve through the origin. If linearity is not established then a second order fit (logarithmic regression) may be used to determine response factors. Another alternative is to use single point calibration, which matches the area counts from a single calibration point to the area counts of the sample, upon which a sample concentration is determined. Single point calibration is rarely used.

In all cases data is reduced by the data reduction software. Programs for linear, logarithmic and single point calibrations are available on command. Sample dilution factors are entered into the data reduction software prior to analysis and calculated into the final result.

14.1.2. GC/MS

Reportable results are provided by the data reduction software for GC/MS analyses using linear average response factors, or 2nd order fits, as described, except for diluted samples. For diluted samples the result from the system is multiplied by the dilution factor. Reporting limits are adjusted manually as well.

All regressions and calibration calculations are performed by the system software.

14.1.3. METALS

ICP & ICPMS results are processed and transferred directly into the LIMS system. Dilution and calibration information is entered and processed by the ICP software prior to data transfer.

All other results are reportable directly off the system.

14.1.4. HPLC / IC / SPECTROPHOTOMETRIC / POTENTIOMETRIC

All results are reportable directly off the system software or directly read off instrument. The cell constant for the conductivity meter is 1. All samples and standards are allowed to come to room temperature prior to analysis. Temperature correction is not needed.

14.1.5. MICROBIOLOGY

The ability of an individual analyst to count colonies accurately shall be verified at least once per month, by having two or more analysts count colonies from the same plate on one positive sample. Counts must be within 10% difference to be acceptable [TNI-EL-V1M5-2009-1.7.3.2].

14.2. DATA VALIDATION

Upon completion of each analytical run, the analyst checks the raw data and QC to determine if the run is acceptable for submission. Data are entered into the LIMS either manually or by electronic data upload using files generated by data acquisition programs attached to instruments, which are then imported using the Data Capture Upload program (DCU) in STARLIMS. The data package is submitted to the Supervisor or Peer Analyst for review. The submitted package contains all relevant documentation such as chromatograms, instrument run logs, digestion logs, information about calibration or second source standards and reagents, other printed pages from the instruments, result summary sheets, and/or a checklist.
The Reviewer is responsible for verifying the validity of the data by determining if all quality control parameters have been analyzed and are within method acceptance limits, checking calculations, assessing the acceptability of chromatography, and addressing any inconsistencies in the data with the analyst. Deviations from the method should be

documented by the analyst and/or reviewer. The documentation should explain the deviation, any flags associated with the deviation and the acceptability of the data. The review includes a perusal of the supporting documentation to ensure that the documentation is present and is complete. Before the Reviewer or Validator approves the data in LIMS, data in the package is checked against the LIMS to ensure that there are no transcription errors, retests have been properly initiated, the appropriate flags have been added, and any comments regarding data/sample integrity have been added at the run/sample level.

When all results and calculations for a folder have been approved, an e-mail is sent to the Project Manager stating that the report has been released. The report components are merged and the entire package is reviewed by the project manager on-line. The electronic signature of the project manager is added to the cover page before the report is released to the client.

Any logbooks such as sample preparation, instrument maintenance, calibration, internal custody, and disposal are reviewed by the supervisor/manager of that group. Initials and date of review are written on the final page reviewed. The review will focus on completeness, accuracy, trends, opportunities for improvement, and compliance.

14.3. DATA REVIEW POLICY/CORRELATION OF RESULTS

All analytical data must be reviewed by a peer analyst qualified in that analysis or the group supervisor. Supervisors are ultimately responsible for the quality of reported results. Data review includes the following:

14.3.1. Checking all QC data against the QC criteria.

14.3.2. All the sample calculations must be checked. Samples which are spot checked must be marked by the reviewing analyst.

14.3.3. The analytical run sheet must be signed by the primary analyst and the reviewing peer analyst. Changes to records must be signed and initialed by responsible staff [TNI-EL-V1M2-2009-4.13.2.3][ISO/IEC 17025:2005(E)-4.13.2.3].

14.3.4. All secondary reviewers or Supervisors must check all data sheets. For inorganics and metals they must verify data entry for those samples by checking the database. The secondary reviewer or Supervisor must initial each run sheet they review. For organics, the secondary reviewer or Supervisor must cross check all reports for transcription error from bench sheets.

14.3.5. All Supervisors or designee must validate the data reported into the computer system. The data validation group then reviews and validates the final reports electronically. The reports are then printed and reviewed by the Project Manager.

14.3.6. As part of the annual internal audits, the Quality Manager or QA staff must spot check data sheets to insure that the peer reviews are being performed and that review process is traceable to the peer review.

14.3.7. Correlation of results for different characteristics of a sample (example Total Phosphate ≥ Orthophosphate or TKN ≥ NH3 [TNI-EL-V1M2-2009-5.9.1.e][ISO/IEC 17025:2005(E)-5.9.1.e]

14.4. DATA REPORTING

To meet the TNI report requirement, the laboratory provides the following information in the final test report:

14.4.1. A Title

14.4.2. Name/address of laboratory

14.4.3. Phone number and name of contact person

14.4.4. Unique identification of the certificate or report and unique identification of each page, and the total number of pages

14.4.5. Name and address of client, where appropriate and project name if applicable

14.4.6. Description and unambiguous identification of the tested sample including the client identification code

14.4.7. Identification of results derived from samples that did not meet TNI acceptance requirements such as improper container, holding time, or temperature [TNI-EL-V1M2-2009-5.10.3][ISO/IEC 17025:2005(E)-5.10.3].

14.4.8. Date of receipt of sample, date and time of sample collection, date(s) of performance test, and time of sample preparation and/or analysis if the required holding time for either activity is less than or equal to 72 hours [TNI-EL-V1M2-2009-5.10.2][ISO/IEC 17025:2005(E)-5.10.2].

14.4.9. Identification of the test method used, or unambiguous description of any non-standard method used.

14.4.10. Qualification of numerical results with "E1-E7" flags or appropriate data flags for values outside the working range.

14.4.11. Any deviations from, additions to or exclusions from the test method, and any other information relevant to a specific test, such as environmental conditions including the use of relevant data qualifiers and their meaning.

14.4.12. Measurement, examinations and derived results and identification of any failures (such as failed quality control). Radiochemistry results shall be reported with associated measurement uncertainty [TNI-EL-V1M6-2009-1.7.2.4.b].

14.4.13. Identification whether the data are calculated on dry weight or wet weight, reporting units and when required by method a statement of the estimated uncertainty of the test result.

14.4.14. Signature and title of the person(s) accepting responsibility for the content of the report and date of issue.

14.4.15. Clear identification of all data provided by outside sources (subcontracted laboratories, clients, Non-NELAP accredited work, etc.)

14.4.16. Clear indication of numerical results with values outside of quantitation limits. Test results provided by subcontracted laboratories are identified by subcontractor name or applicable accreditation number.

When the validation steps are completed, and the managers and supervisors have keyed in their initials in the appropriate LIMS field to reflect this, the report number is automatically transferred to an electronic listing in LIMS. Reports on this list are printed out daily. The reports are reviewed for correctness against the data in LIMS and signed off by the project manager prior to being copied for the files and delivery to the client. An example of an analysis report form is shown in Figure 14-1. A sample of a QC Report is shown in Figure 14-3. After the report is issued to the client, the laboratory reports remain unchanged. The report shall not be reproduced except in full, without the written approval of the laboratory [TNI-EL-V1M2-2009-5.10.2] [ISO/IEC 17025:2005(E)-5.10.2]. After issue of report, material amendments to the test report is done in the form of further document or data transfer including the statement "Supplement to test report, group number _____". For EEA revised report, cover page – report # xxxxxx'r'. Comment, report # xxxxxx'r' replaces the original test report. Also, amendments to the formal report must meet all the TNI reporting requirements. The laboratory notifies clients in writing of any event such as the identification of defective measurement or test equipment that casts doubt on the validity of results given in any test report or amendment to a report [TNI-EL-V1M2-2009-4.14.5]. The laboratory also ensures that the TNI reporting requirements are met for test results transmitted by telephone, telex, facsimile or other electronic or electromagnetic means and that all reasonable steps taken to preserve client confidentiality. Final laboratory report includes a statement in the cover page "Laboratory certifies that the test results meet all TNI requirements unless noted in the comments section or the Case Narrative".

If Client requires monthly reports of data that does not include all items listed in 14.4, the laboratory is still required to provide all information in standard TNI report format required by the Client for use in preparing such regulatory reports [TNI-EL-V1M2-2009-5.10.1] [ISO/IEC 17025:2005(E)-5.10.1].

Copies of all client reports are filed electronically in a centralized server by year and client name. Scanned files are maintained for 5 years, except Massachusetts, Hawaii, and New York clients which are maintained for 10 years.

14.5. ELECTRONIC TRANSMISSION OF RESULTS

In the case of transmission of environmental test results by telephone, facsimile or other electronic means, the laboratory ensures preservation of Client confidentiality by attaching a cover page that includes the following statement:

> "This transmission and/or attachments contain information which is confidential and/or privileged. The information is intended for the addressee only. If you are not the intended recipient, any dissemination, distribution or copying of this communication is prohibited. If you have received this communication in error, please notify and return the original communication to the sender" [TNI-EL-V1M2-2009-5.10.5, 5.4.7.2.b] [ISO/IEC 17025:2005(E)-5.10.5, 5.4.7.2b].

14.6. GOOD AUTOMATED LABORATORY PRACTICES (GALP)

The laboratory assures that all requirements of the TNI and ISO 17025 standards are complied with where computers or automated equipment are used for the capture, processing, manipulation, recording, reporting, storage or retrieval of test data.

Section 8.1 through 8.11 of the EPA document 2185 – GALP is adopted by the laboratory for its computer use even though GALP is not required by TNI standard requirements. The laboratory ensures that the computer software is adequate for use and documented. To protect the integrity of data entry or capture, data storage, data transmission and data processing, the laboratory establishes and implements procedures in compliance to good automated laboratory practices. In addition, appropriate procedures are established for computer and automated equipment to ensure proper functioning and are provided with the environmental and operating conditions necessary to maintain the integrity of calibration and test data. Also the laboratory establishes and implements appropriate procedures for the maintenance of security of data including the prevention of unauthorized access to and the unauthorized amendment of computer records. The laboratory LIMS system provides several levels of security. The first level is the entry of a password to initially log on to the computer, then the person must be designated as a qualified user of STARLIMS. Additionally, the department to which a person is assigned governs accesses to the various functions of the system. The system also provides for read – only access to results to further protect the data from unauthorized modification or deletion. See laboratory GALP SOP for the Implementation of Good Automated Laboratory Practices. Implementation of the GALP includes data point comparison and manual calculations to test LIMS accuracy to be done during the data package review by the Quality Assurance Unit (QAU) (QM section 16.1.2). LIMS Audit Report form will be completed to document results of the LIMS audit. The laboratory QA group will ensure that all corrective actions are done when deficiencies are observed.

14.7. STATE SPECIFIC REPORTING REQUIREMENTS

Massachusetts – All analytes that are reported to the state of Massachusetts must have a means to distinguish between the analytes for which EEA is certified, and the analytes for which EEA is not certified. To meet this requirement, EEA only sends final reports to the Massachusetts Department of Environmental Protection the analytes for which EEA is certified in Massachusetts. Please see section 3.9 for more information about the certifications that EEA holds.

14.8. MCL NOTIFICATIONS

At approximately 10pm each night the Laboratory's STARLIMS software runs a report called a "Hits Report". This report is sent to all Project Managers. Part of the information in this report is a notification of any hits that exceed MCL levels for all client samples analyzed and approved since the last Hits Report. The Project Manager is responsible for notifying their clients of any exceedance within 24 hours of obtaining valid data. Since the report is sent to all Project Managers, absent PMs will have their client's data checked by their backups in order to ensure that no notifications are missed.

Please see Section 3.10.9 of this QM for the requirements on notification for subcontracting clients.

Figure 14-1 Example Analysis Report Form

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formerly

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

Laboratory Report

for

MWH Laboratories
750 Royal Oaks Drive
Suite 100
Monrovia, CA 91106
Attention: Andora Effendi
Fax: (626) 386-1139

Date of Issue
08/21/2012
EUROFINS EATON
ANALYTICAL

ABC: Alma.B.Capati
Project Manager

NELAP ACCREDITED TNI LABORATORY
01114CA

Report: 405936
Project: WS
Group: WS PT

Laboratory certifies that the test results meet all **TNI NELAP** requirements unless noted in the Comments section or the Case Narrative. Following the cover page are Hits Reports, Comments, QC Summary, QC Report and Regulatory Forms. This report shall not be reproduced except in full, without the written approval of the laboratory.

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STATE CERTIFICATION LIST

State	Certification Number	State	Certification Number
Alabama	41060	Mississippi	Certified
Alaska	CA00006	Montana	Cert 0035
Arizona	AZ0778	Nevada	CA00006-2012-1
Arkansas	Certified	New Hampshire	2959-11
California – NELAP	01114CA	New Jersey	CA 008
California – ELAP	1422	New Mexico	Certified
Colorado	Certified	New York	11320
Connecticut	PH-0107	North Carolina	06701
Delaware	CA 006	North Dakota	R-009
Florida	E871024	Oregon	CA 200003-010
Georgia	947	Pennsylvania	68-565
Guam	11-004r	Rhode Island	01114CA
Hawaii	Certified	South Carolina	87016001
Idaho	Certified	South Dakota	Certified
Illinois	200033	Tennessee	TN02839
Indiana	C-CA-01	Texas	T104704230-11-2
Kansas	E-10268	Utah	Mont-1
Kentucky	90107	Vermont	VT0114
Louisiana	LA110022	Virginia	00210
Maine	CA0006	Washington	C363
Maryland	224	West Virginia	9943 C
Commonwealth of Northern Marianas Is.	MP0004	Wisconsin	998316660
Massachusetts	M-CA006	Wyoming	8TMS-L
Michigan	9906	EPA Region 5	Certified

750 Royal Oaks Dr., Ste 100, Monrovia, CA 91016 Tel (626) 386-1100 Fax (626) 386-1101 http://EatonAnalytical.com

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750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

Laboratory Hits
Report: 406838

MWH Laboratories
Andora Effendi
750 Royal Oaks Drive
Suite 100
Monrovia, CA 91106

Samples Received on:
08/17/2012

Analyzed	Analyte	Sample ID	Result	Federal MCL	Units	MRL
	201208170474	WS Inorganics				
08/15/2012 10:32	Nitrate + Nitrite as N by EPA		[illegible]	10	mg/L	0.10
08/15/2012 17:01	Nitrate as N by EPA		[illegible]		mg/L	0.10

SUMMARY OF POSITIVE DATA ONLY

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formerly MWH Laboratories

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Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

Laboratory Data
Report: 406808

MWH Laboratories
Andora Effendi
750 Royal Oaks Drive
Suite 100
Monrovia, CA 91106

Samples Received on:
08/17/2012

Prepared	Analyzed	QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
WS Inorganics (2012081704746)						**Sampled on 08/17/2012 0000**		
Sample Point ID: ERA WS 192 PT_Inorganics								
			EPA 353.2 - Nitrate as N by RFA (calc)					
08/18/2012	17:01	687929	(EPA 353.2)	Nitrate as N by RFA	4.2	mg/L	0.15	5
			EPA 353.2 - Nitrate + Nitrite as N by RFA					
08/18/2012	19:32	687296	(EPA 353.2)	Nitrate + Nitrite as N by RFA	4.2	mg/L	0.15	5

Rounding on totals after summation.
(c) - indicates calculated results

Figure 14-2 Example Analysis Report Form (Report Comment)

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Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

Laboratory Comments
Report: 408956

MWH Laboratories
Andora Effendi
750 Royal Oaks Drive
Suite 100
Monrovia, CA 91106

The Comments Report may be blank if there are no comments for this report.

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Figure 14-3 Example QC Report Form

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750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

Laboratory QC
Report: 406898

MWH Laboratories

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
QC Ref# 667266 - Nitrate + Nitrite as N by RFA by EPA 353.2						**Analysis Date: 08/18/2012**			
LCS1	Nitrate + Nitrite as N by RFA		1.0	1.06	mg/L	106	(90-110)		
LCS2	Nitrate + Nitrite as N by RFA		1.0	1.05	mg/L	105	(90-110)	20	0.95
MBLK	Nitrate + Nitrite as N by RFA			<0.05	mg/L				
MRL_CHK	Nitrate + Nitrite as N by RFA		0.05	0.0265	mg/L	53	(50-150)		
MS_201208200019	Nitrate + Nitrite as N by RFA	7.0	1.0	17.1	mg/L	102	(90-110)		
MS_201208200020	Nitrate + Nitrite as N by RFA	2.1	1.0	13.2	mg/L	110	(90-110)		
MSD_201208200019	Nitrate + Nitrite as N by RFA	7.0	1.0	14.5	mg/L	75	(90-110)	20	17
MSD_201208200020	Nitrate + Nitrite as N by RFA	2.1	1.0	12.8	mg/L	107	(90-110)	20	3.1
QC Ref# 667928 - Nitrate as N by RFA (calc) by EPA 353.2						**Analysis Date: 08/18/2012**			
LCS1	Nitrate as N by RFA		1.0	1.06	mg/L	106	(90-110)		
LCS2	Nitrate as N by RFA		1.0	1.05	mg/L	105	(90-110)	20	0.95
MBLK	Nitrate as N by RFA			<0.05	mg/L				
MRL_CHK	Nitrate as N by RFA		0.05	0.0265	mg/L	53	(50-150)		
MS_201208200018	Nitrate as N by RFA	2.1	1.0	13.2	mg/L	110	(90-110)		
MSD_201208200018	Nitrate as N by RFA	2.1	1.0	12.8	mg/L	107	(90-110)	20	3.1

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

Figure 14-4 Example QC Report Form (QC Summary)

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formerly MWH Laboratories

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Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

Laboratory
QC Summary: 406836

MWH Laboratories

QC Ref # 667266 - Nitrate + Nitrite as N by RFA — **Analysis Date: 08/19/2012**
201208170474 WS Inorganics — Analyzed by: MYH

QC Ref # 667626 - Nitrate as N by RFA (calc) — **Analysis Date: 08/19/2012**
201208170474 WS Inorganics — Analyzed by: MYH

15.0 CONTROL OF NON-CONFORMING WORK, CORRECTIVE ACTION, AND PREVENTIVE MEASURES

Corrective actions may be required when there is a failure to meet quality control acceptance criteria, or when internal or external audit samples are not acceptable. Quality control measures for which control limits are established and maintained include: LCS, duplicates, method blanks, surrogate recoveries, MS/MSD, MRLs, calibrations, continuing calibrations and sensitivity checks. Refer to the Nonmethod 28 SOP for Non-conforming work procedures.

15.1. CORRECTIVE ACTION PROCEDURES, BY METHOD

Specific corrective actions on a method-by-method basis can be found in the Table 15-1. This SOP lists the processes and flags used to qualify data for submittal to clients. Corrective action will be initiated as a result of findings from internal or external audits, not acceptable results from performance samples, large variation from split samples and inadequate quality as determined by data validation review.

15.2. CORRECTIVE ACTION PROCEDURES, ROOT CAUSE, PREVENTIVE MEASURES, DATA QUALIFIERS, AND REPORT COMMENTS

15.2.1. Selection and Implementation of Corrective Actions

Failure to meet criteria of the LCS, surrogate spikes, internal standards, continuing calibration standards, holding time exceedance, improperly preserved samples, method blank contamination are QC failures that trigger the generation corrective actions to identify the root cause of the problem. Root causes of the problem are documented in the Quality Investigation Report (QIR).

For instance, when a matrix spike failure occurs during trace metals analysis, the analyst first checks the %RSD for the multiple measurements to see if the %RSD is less than 20%. Then the calibration verification will be checked along the calibration blank, preparation blank, and the second source LCS standard recovery. The standards and reagents preparation and expiration dates are reviewed. Spiking solutions are verified to ensure that here are no errors made in calculations and in spiking. If the MS/MSD recoveries are outside the internal QC limits and all the associated QCs for the batch are acceptable, the RPD for MS/MSD recoveries should be checked. If the RPD is found to be within the 20% criteria, the unacceptable recoveries are annotated in the report as suspect due to matrix effect. If the concentration of the background is much higher than the spiking amount the report will be annotated also. If the RPD is outside the limits, the sample that was spiked is checked visually to see if the sample is homogenous, if the sample is homogenous the batch will be reanalyzed.

15.2.2. Documentation of Corrective Actions

15.2.2.1. All corrective action taken for all QC failures is documented by generating a Quality Investigation Report (QIR). All other corrective action taken is documented on a Corrective Action Report (CAR). See Figure 15-2 for an example QIR.

Additional information is documented about the QC failures in the bench by the analyst.

15.2.2.2. Results are flagged not only for quality control failures where QIRs have been generated but also for all other QC failures that have impact on the data quality of the result. All results are flagged if data is suspect or QC was not acceptable.

15.2.2.3. Data qualifiers are used by the laboratory in reporting analytical results to flag the user about the data. Some of the qualifiers below were requested by a specific client as required in the Project's Quality Assurance Plan to ensure that the Data Quality Objectives of the project are met.

15.2.2.4. Comments on the results are provided to the clients on the final report for QC nonconformance. In addition, any QC data exceeding QC acceptance criteria are underlined to flag the user about the QC failure and its impact to the data quality of the associated samples in the batch.

15.2.2.5. Depending on the significance of nonconformance, the Client is notified by the Project Manager and work recalled if necessary [TNI-EL-V1M2-2009-4.9.1.d] [ISO/IEC 17025:2005(E)-4.9.1.d]. The Client is notified immediately for possible re-sampling.

15.2.2.6. Where the identification of nonconformance or departure casts doubts on the laboratory's compliance with its own policies and procedures, or on its compliance with this Standard, the laboratory shall ensure that the appropriate areas of activity are audited [TNI-EL-V1M2-2009-4.11.5][ISO/IEC 17025:2005(E)-4.11.5].

15.2.3. **Monitoring of Corrective Action**

15.2.3.1. Corrective actions implemented are monitored if corrective actions are effective to remove problem [TNI-EL-V1M2-2009-4.11.4][ISO/IEC 17025:2005(E)-4.11.4].

15.2.3.2. QA monitors CARs and QIRs for trends and notifies the analyst and supervisor of the need to correct the problem and implement corrective action to prevent the problem from reoccurring.

15.2.4. **Preventive Measures**

15.2.4.1. QIRs require the analyst to document preventive measures to ensure that the problems will not re-occur [TNI-EL-V1M2-2009-4.12.1][ISO/IEC 17025:2005(E)-4.12.1].

15.2.4.2. Preventive action, rather than corrective action, aims at minimizing or eliminating inferior data quality or other non-conformance through scheduled maintenance and review, before the non-conformance occurs. Preventive action is generated when circumstances are identified where a quality failure or non-conformance is a possibility or where an opportunity is identified to strengthen the quality system.

15.2.4.3. Preventive action includes, but is not limited to, review of QC data to identify quality trends, regularly scheduled staff quality meetings, annual managerial reviews, running a new LIMS in tandem with the old system to assure at least one working system, and other actions taken to prevent problems.

15.2.4.4. All staff recommends preventive action procedures to the Quality Manager and management is responsible for implementing preventive action.

15.2.4.5. A preventive action record form is generated when an opportunity for improvement arises to record preventive action, record actions generated, and ensure actions are effective. See Figure 15-2 for the Preventive Action Form which is used to document actions required for improvement, name of requestor, responsible personnel to carry out implementation, and estimated completion date.

15.3. ESTABLISHING WARNING/ACTION LIMITS

The incorporation of quality control samples and reference materials into the laboratory quality control program is of little use in maintaining overall analytical quality control unless the laboratory has established acceptance criteria for these samples. Quality control samples falling outside of these criteria serve as flags to signal the production of unacceptable data which must be rerun or reported as suspect data if re-running is not an option due to expired holding times or lack of sample volume.

15.3.1. Approach to Setting Limits

For methods that do not specify acceptance limits, the lab establishes limits through control charts. These limits should be updated once a year. These limits are based upon historical recoveries of LCS samples associated with specific matrices (or where LCS samples are not utilized, they are based on spike recoveries or duplicate limits for matrix specific samples).

For those cases where insufficient historical information exists to set statistically meaningful LCS or matrix specific limits, EEA has set limits based on the expected performance of the analysis until historical limits can be calculated. These limits are then associated with specific control requirements to determine out of control events.

15.3.2. <u>Documentation of Limits</u>

15.3.2.1. Reagent Blanks - Reagent blank values must remain lower than the reported MRL (some methods require ½ or 1/3 MRL) for each analytical procedure. If an analyst notices an increase in the reagent blank which is beginning to approach this limit, the source of contamination must be investigated before further analyses are performed.

15.3.2.2. External Reference Samples - Recoveries on external reference samples must fall within the acceptance limits provided with the true values.

15.3.2.3. Internal and Surrogate Standards - As specified by the methods, internal standards are run with each of the calibration standards and the area counts are recorded on the same form as the response factors. Any standard that has an internal standard area count beyond ±50% of the average internal standard area count for all initial calibration standards must be rerun to meet these criteria. Any sample with an internal standard count beyond ±50% (or as stated in the particular SOP) of the average internal standard counts for the ICAL standards must be rerun. Surrogate standards must meet the recovery limits specified in the analytical method or established historical limits, which are updated periodically.

15.3.2.4. Blind Check Samples - The results of blind check sample analyses must fall within the acceptance criteria provided with the samples.

15.3.3. <u>LCS Control Limits</u>

EEA uses method acceptance limits for LCS limits in water matrix to assess analytical control. All analysts have received a copy of these acceptance limits and must ensure that their LCS sample results fall within the stated acceptable ranges. If specific control limits have not been provided for matrix spikes or duplicates, LCS criteria are used until sufficient data is generated to calculate historical limits for the MS/MSD samples for a particular matrix. Any samples associated with unacceptable LCS samples must be re-run unless other criteria are available to allow acceptance of the data without qualification. If a sample cannot be rerun due to exceeded holding times or lack of sufficient sample volume or weight, then the data must be qualified as estimated when reported to the client.

15.4. CONTROL CHARTS

EEA collects LCS and MS/MSD data in the LIMS computer system for generation of control chart data and limits. Data can be downloaded and plotted on charts to determine trends, which may indicate problems with the analysis, or out of control events.

EEA utilizes a Shewhart mean chart modified to percent recovery to monitor laboratory control sample bias. This procedure is referenced in the EPA Handbook for Analytical

Quality Control in Water and Wastewater Laboratories (EPA-600/4-79-019), March 1979, on pages 6-2 to 6-6. Precision is monitored with control charts, but is compared to absolute limits established by the lab based on method specified limits.

Control charts for LCS and MS data are generated with the LIMS software periodically based on a maximum of 30 data points. The control chart limits are re-calculated at least annually. If analysis parameters are changed significantly or method modifications are performed, control chart limits may be re-calculated more frequently. QA reviews the limits and charts to determine whether any of the data is out-of-control. If the control charts indicate an out-of-control event, appropriate corrective action is immediately taken to bring the analysis back into control. An example of the Shewhart percentage recovery control chart is presented in Figure 15-4.

15.5. PROCEDURES FOR DETERMINING AND REPORTING OUT-OF-CONTROL ANALYSES

15.5.1. Defining an Out-of-Control Analysis

An analysis is out-of-control whenever a quality control sample or parameter falls outside of acceptance limits. Quality control parameters are evaluated for their acceptability on a daily basis according to established acceptance limits and are also monitored with control charts to detect trends in variability, which are indicative of a shift in the methodology due to analytical error.

15.5.1.1. Criteria Used

15.5.1.1.1. Daily Quality Controls

The quality control parameters utilized by EEA were detailed in Section 11.1. All of these controls are evaluated on a daily basis and must pass the criteria detailed in this section. Each analyst is familiar with the criteria for his/her analyses and is responsible for insuring that all quality control parameters on the analytical run are acceptable. An analyst cannot enter his/her data into the laboratory computer until the data is reviewed and approved by an appropriately trained peer or supervisor. In addition, LCS and MS/MSD data are also entered into the computer and linked to specific batches.

LCS and MS/MSD results must fall within given acceptance limits. These limits are provided for water matrix. Reagent blanks must remain below the MRL established for each parameter. External reference samples must fall within the acceptance criteria provided with the true values. Internal and surrogate standards must meet the recoveries specified in the analytical procedure, if historical control chart based information is not available. A new working standard must be checked against the old reference standard to verify its accuracy and must fall within 10% of its true value. If this agreement is not met, a referee standard must be run. All standards must be traceable to primary standards.

Instrument calibrations must fall within acceptance criteria in order for runs to proceed. Table 11-4 summarizes the instrument's initial calibration acceptance criteria for each analysis.

In addition to monitoring daily QC parameters for acceptability, control charts are utilized and interpreted as described in Section 15.4.

15.5.1.1.2. Approaches to Control Chart Interpretation

The control charts generated by the LIMS System flags the analyst that there is a potential problem whenever seven or more consecutive points fall above or below the mean.

If the above situation is observed, the cause of the shift in mean or increased variability must be investigated, corrected, and documented prior to analyzing any more samples.

15.5.2. <u>Responding to an Out-of-Control Event</u>

It is important to have an operational system within EEA for recognizing out-of-control events as soon as they occur so the appropriate action can be taken to bring the analysis back into control. This will insure that no data gets reported from a period when the analysis was out-of-control.

15.5.2.1. Roles and Responsibilities

The analyst has primary responsibility for verifying that all daily QC parameters fall within the acceptance limits before submitting the data for review. Review at the analyst level enables most errors to be caught immediately and prevents reporting delays. Following the analyst's verification, the data is reviewed by an appropriately trained peer analyst or supervisor. All of the quality control parameters are reviewed for compliance with the acceptance criteria and the calculations on the raw data forms are checked for errors in data manipulation. If the reviewer notices a problem, the analyst is notified immediately and corrective action is taken. All samples associated with unacceptable quality control samples are rerun unless there is insufficient sample, in which case the client is notified by the Client Services group [TNI-EL-V1M2-2009-4.9.1][ISO/IEC 17025:2005(E)-4.9.1]. Every out of control event must be documented by filing a Quality Investigation Report (QIR). See Figures 15-2 and Figure 15-3.

The check of daily QC parameters indicates immediate problems with the data, but trends are only evident on the control charts. Both the analyst and the Group

Supervisor are responsible for reviewing either the data or control charts for pattern to see if any of the out-of-control events summarized in Section 15.5.1 have occurred. If so, the analyst must initiate corrective action before continuing with the analysis.

15.5.2.2. Defining Suspect Samples

Sample data is considered suspect if associated with unacceptable MS/MSD and LCS samples or part of an analytical run that had an unacceptable calibration or an external reference sample was out of an expected range. GC/MS data is considered suspect if the internal or surrogate standards were not recovered within the acceptable range. Sample data is also considered suspect if the reagent blank has substantially increased beyond normal range and exceeds any of the compound MRL's.

15.5.2.3. Ensuring that Suspect Data Are Not Reported

It is the ultimate responsibility of the Group Leader to ensure that suspect data are not reported. The laboratory procedures currently require that analysts may not enter their final data into the computer until their analytical data form and accompanying QC parameters have been reviewed and approved by an appropriately trained peer or supervisor. The QA Group performs periodic system audits to ensure that this procedure is working properly and prepares reports to lab management based on these audits.

15.5.2.4. Corrective Action

15.5.2.4.1. If the calibration fails, the analyst must determine whether the problem lies with the standard, the reagents, or an instrument malfunctions. This is usually determined by reviewing all of the calibration QC parameters and determining which specific parameters do not meet the criteria. For example: 1) the regression statistics and recalculated standards look fine, 2) there was little drift during the run, 3) the peaks appear satisfactory, 4) the reagent blank is low, but 5) the external reference sample was out of range, it is likely that the problem lies with the integrity of the standard used to make up the working standards and a new stock standard should be prepared.

15.5.2.4.2. If calibration appears acceptable but some of the duplicate and spiked samples are unacceptable, the analyst must determine whether there is a matrix problem interfering with the analysis or the preparatory digestion. If all of the unacceptable duplicates and spikes occur on a specific type of matrix, this is good evidence that there is a matrix interference problem. When a preparatory digestion is part of the procedure, the problem can be isolated to the digestion or the instrumental analysis by comparing the LCS, which was carried through the digestion to a LCS sample analyzed without digestion. If a matrix problem is indicated, the analyst must determine the most appropriate procedure for alleviating the interference such as diluting the sample, using standard additions, performing the analysis at a different wavelength, using a different GC column, or modifying the digestion procedure.

15.5.2.4.3. If an unacceptable result is obtained on a blind check sample, the problem must be isolated. To maintain the blind nature of the samples, the run containing the blind check sample is reviewed by the QA Group to determine if any of the quality control parameters were unacceptable or if the sample was run outside the optimum range of the calibration. If no apparent cause of error is found, a second check sample is submitted to determine whether the error occurred during preparation of the blind check sample.

15.5.2.4.4. If an out-of-control event is indicated by a shift or trend on a control chart, the following diagnostic strategy will be applied:

15.5.2.4.4.1. A shift in the mean of the percentage recovery chart could be caused by incorrect preparation of a standard or a reagent, contamination of the sample, incorrect instrument calibration, instrument component deterioration analyst error, dirty pipettes preventing proper drainage, or other preparatory steps.

15.5.2.4.4.2. A trend of the mean upward could be caused by deterioration of the standard or the reagents or a change in the extraction efficiency

15.5.2.4.4.3. A trend of the mean downward could be caused by concentration of the standard due to evaporation, deterioration of reagents, and a change in the extraction efficiency or instrument component failure

15.5.2.4.4.4. Increased variability could be caused by switching to a different analyst, deviation from the procedure, variable extraction efficiencies

15.5.2.4.4.5. A shift in the mean or increased variability can sometimes be caused by a sample load of an unusual matrix. If this is determined to be the cause of the problem, the analysis will not be considered out-of-control but the situation will be documented.

Figure 15-1 Data Qualifiers

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Data Qualifiers

Revised on 10/24/12 to add Microbiology flags.
Revised on 2/16/10, Based on AZ Data Flag 9/20/07 Rev.3.0 and Attachment A, "Guidance on the Usage of Data Qualifiers"

MWH List

Microbiology:

A1 = Too numerous to count.
A2 = Sample incubation period exceeded method requirement.
A3 = Sample incubation period was shorter than method requirement.
A4 = Target organism detected in associated method blank.
A5 = Incubator/water bath temperature was outside method requirements.
A6 = Target organism not detected in associated positive control.
A7 = Micro sample received without adequate headspace.
A8 = Plate count was outside the method's reporting range. Reported value is estimated.
AA = Insufficient sample received. Sample volume below 100 ml. Data not acceptable for compliance.
AB = Presumptive phase was cloudy without gas in the tube and transferred to confirmed phase. Data not acceptable for compliance.
AC = Sample volume over 100 ml. Excess sample was pipetted out. Data acceptable for compliance.

Method/ calibration blank:

Apply appropriate qualifier to affected analyte in the blank if target analyte is not detected at > RL in the samples. If analytes are detected, then all corresponding analytes for the associated samples should also be qualified.

B1 = Target analyte detected in method blank at or above the method reporting limit.
B2 = Non-target analyte detected in method blank and sample, producing interference.
B3 = Target analyte detected in calibration blank at or above the method reporting limit.
B4 = Target analyte detected in blank at or above method acceptance criteria.
B5 = Target analyte detected in method blank at or above the method reporting limit, but below trigger level or MCL.
B6 = Target analyte detected in calibration blank at or above the method reporting limit, but below trigger level or MCL.
B7 = Target analyte detected in method blank at or above method reporting limit. Concentration found in the sample was 10 times above the concentration found in the method blank. (No TNI Ref, Method Criteria)

BA = Target analyte detected in method blank at or above the laboratory minimum reporting limits (MRL), but analyte not present in the sample. (TNI QM Template 27.2.2.1)

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BE= Target analyte detected in method blank is at or above the method acceptance limits, but below the method reporting limit (MRL).
BF= Target analyte detected in method blank is at or above the method acceptance limits, but below the method reporting limit (MRL) and analyte not present in the sample.
BG = Target analyte detected in method blank (MB) is at or above the method acceptance limits, but below the method reporting limit (MRL). Sample concentration was 10 times above the concentration found in MB. (TNI – M4 #570)

Confirmation:

For methods that require qualitative confirmation. C3 applies to methods that require quantitative confirmation.

C1 = Confirmatory analysis not performed as required by the method.
C3 = Qualitative confirmation performed.
C4 = Confirmatory analysis was past holding time.
C5 = Confirmatory analysis was past holding time. Original result not confirmed.
C8 = Sample RPD between the primary and confirmatory analysis exceeded 40%. Per EPA Method 8000C, the lower value was reported as there was no evidence of chromatographic problems.

Dilution:

If all analytes are reported from the diluted sample, apply qualifier to the entire sample. Otherwise apply qualifier to each analyte that required dilution.

D1 = Sample required dilution due to matrix.
D2 = Sample required dilution due to high concentration of target analyte.
D4 = Minimum Reporting Limit (MRL) adjusted to reflect sample amount received and analyzed.
D5 = Minimum Reporting Limit (MRL) adjusted due to sample dilution; analyte was non-detect in the sample.
D6 = Minimum Reporting Limit (MRL) adjusted due to an automatic 10X dilution performed on this sample for the purpose of reporting traditional drinking water analytes for wastewater requirements.
DA = Sample dilution required due to insufficient sample.

Estimated concentration:

Appropriate qualifier must be used for any analyte result reported outside the calibration range. Affects data reported outside the calibration range or down to the MDL. E8 is only required if additional clarification is necessary.

E1 = Concentration estimated. Analyte exceeded calibration range. Reanalysis not possible due to insufficient sample.
E2 = Concentration estimated. Analyte exceeded calibration range. Reanalysis not performed due to sample matrix.

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E3 = Concentration estimated. Analyte exceeded calibration range. Reanalysis not performed due to holding time requirements.
E4 = Concentration estimated. Analyte was detected below laboratory minimum reporting limit (MRL).
E5 = Concentration estimated. Analyte was detected below laboratory minimum reporting limit (MRL), but not confirmed by alternate analysis.
E6 = Concentration estimated. Internal standard recoveries did not meet method acceptance criteria.
E7 = Concentration estimated. Internal standard recoveries did not meet laboratory acceptance criteria.
E8 = Analyte reported to MDL per project specification. Target analyte was not detected in the sample.
EA = Concentration estimated. Analyte was detected below laboratory minimum reporting limits but above laboratory method detection limits.
EB = Result estimated. Analyte exceeded the highest calibration standard as required by the EPA/SM method
ED = Result estimated. Analyte was detected outside of calibration range as specified by the EPA/SM method.

Hold time:

Qualify samples appropriately when method extraction and/ or analysis holding time have been exceeded.

H1 = Sample analysis performed past holding time. Data not acceptable for regulatory compliance
H2 = Initial analysis within holding time. Reanalysis for the required dilution was past holding time.
H3 = Sample was received and analyzed past holding time. Data not acceptable for regulatory compliance.
H4 = Sample was extracted past required extraction holding time, but analyzed within analysis holding time.
H5 = This test is specified to be performed in the field within 15 minutes of sampling; sample was received and analyzed past the regulatory holding time.
HA= Initial analysis within holding time. Reanalysis was past holding time.
HB = Sample was received within holding time, but holding time exceeded by the Lab. Sample was not analyzed.
HC = Sample was received past holding time and not analyzed.
HD = Sample was extracted past required extraction holding time, but analyzed within analysis holding time. Data not acceptable for regulatory compliance.

BOD/DBOD:

Qualifiers K4, K5, K6 & K8 indicate situations that may impact all results in an analytical run and should be used to qualify all affected samples as well as any affected quality control samples

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when reported. K3 was deleted because if the seed depletion was out, then the situation must be explained in the case narrative.

K1 = The sample dilutions set-up for the BOD/CBOD analysis did not meet the oxygen depletion criteria of at least 2 mg/L. Any reported result is an estimated value.
K2 = The sample dilutions set up for the BOD/CBOD analysis did not meet the criteria of a residual dissolved oxygen of at least 1 mg/L. Any reported result is an estimated value.
K5 = The dilution water D.O. depletion was > 0.2 mg/L.
K6 = Glucose/glutamic acid BOD/CBOD was below method acceptance criteria.
K7 = A discrepancy between the BOD and COD results has been verified by reanalysis of the sample for COD.
K8= Glucose/glutamic acid BOD/CBOD was above method acceptance levels.
KA = The seed depletion was outside the method and laboratory acceptance limits. The reported result is an estimated value.

Laboratory fortified blank/blank spike:

Appropriate qualifier must be applied to the affected analytes in the Laboratory fortified blank/blank spike and to all corresponding analytes in the associated samples.

L1 = The associated blank spike recovery was above laboratory acceptance limits.
L2 = The associated blank spike recovery was below laboratory acceptance limits.
L3 = The associated blank spike recovery was above method acceptance limits.
L4 = The associated blank spike recovery was below method acceptance limits.
LA = The associated blank spike recovery was above laboratory acceptance limits. Analyte is only qualitatively identified.
LB = The associated blank spike recovery was below laboratory acceptance limits. Analyte is only qualitatively identified.
LD = Associated blank spike recovery was within the marginal exceedence limits of the LCS.
LE = MRL Check recovery was above laboratory acceptance limits. (TNI M4 1.7.4.2)
LF = MRL Check recovery was below laboratory acceptance limits.
LG = MRL Check recovery was above method acceptance limits. (TNI M4 1.7.4.2)
LH = MRL Check recovery was below method acceptance limits.
LJ = The associated blank spike recovery was below method acceptance limits. This target analyte exceeded a maximum regulatory limit/decision level. (TNI M4 1.7.4.2)
LK = The associated blank spike recovery was above method acceptance limits. This target analyte was not detected in the sample. (TNI M4 1.7.4.2)

Matrix spike:

Appropriate qualifier must be applied to the affected analytes in the matrix spike and should also be added to all corresponding analytes in the associated spiked sample. If a batch spike recovery is outside of the acceptable range, it is permissible to only flag the sample that was spiked and not the other samples in the batch. As required in the Arizona Adopted Rules A.A.C. R9-14-617.F, clients must always be informed if the batch QC result is unacceptable whether one of their samples was spiked or not. The laboratory can choose how the unacceptable QC is

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reported to the client (e.g., cover letter or flag). The ADEQ policy 0154.000 can be accessed at http://www.azdeq.gov/function/business/download/spike8.pdf

M1 = Matrix spike recovery was high; the associated blank spike recovery was acceptable.
M2 = Matrix spike recovery was low; the associated blank spike recovery was acceptable.
M3 = The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to spike level. The associated blank spike recovery was acceptable. (EPADWM 5th ed)
M4 = The analysis of the spiked sample required a dilution such that the spike recovery calculation does not provide useful information. The associated blank spike recovery was acceptable.
M5 = Analyte concentration was determined by the method of standard addition (MSA).
M6 = Matrix spike recovery was high. Data reported per ADEQ policy 0154.000.
M7 = Matrix spike recovery was low. Data reported per ADEQ policy 0154.000.
MC = Matrix spike recovery was high; the associated blank spike recovery was acceptable. MS/MSD RPD met acceptance criteria
MD = Matrix spike recovery was low; the associated blank spike recovery was acceptable. MS/MSD RPD met acceptance criteria

General:

Use for events that cannot be described by the approved data qualifiers.

N1 = See case narrative.
N2 = See corrective action report.
N4 = The Minimum Reporting Limit (MRL) verification check did not meet the laboratory acceptance limit.
N5 = The Minimum Reporting Limit (MRL) verification check did not meet the method acceptance limit.
N6 = Data suspect due to quality control failure, reported per data user's request.

Sample Quality:

Flag samples with appropriate qualifier when sample quality may be potentially impacted or when method requirements were not met. The ADEQ policy 0154.000 can be accessed at http://www.azdeq.gov/function/business/download/spike8.pdf
The ADEQ policy 0155.000 can be accessed at
http://www.azdeq.gov/function/business/download/one_pt3.pdf

Q1 = Sample integrity was not maintained. See case narrative.
Q2 = Sample received with head space.
Q3 = Sample received with improper chemical preservation.
Q4 = Sample received and analyzed without chemical preservation.
Q5 = Sample received with inadequate chemical preservation, but preserved by the laboratory.
Q6 = Sample was received above recommended temperature.
Q7 = Sample inadequately dechlorinated.

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Q8 = Insufficient sample received to meet method QC requirements. Batch QC requirements satisfy ADEQ policies 0154.000 and 0155.000.
Q9 = Insufficient sample received to meet method QC requirements.
Q10 = Sample received in an inappropriate sample container.
Q11 = Sample is heterogeneous. Sample homogeneity could not be readily achieved using routine laboratory practices.
QA = Sample received with incomplete documentation (ID).
QB = Sample received with improper sample label (ISL).
QC = Sample received with signs of damage or contamination (SDC).
QD = Same day sample receipt / sampling time but sample was received with no signs of chilling (c). (SRNC).
QE = Sample was received above method required temperature. Data not acceptable for regulatory compliance.
QF = Sample received without sufficient head space for proper mixing according to the method.

RPD Duplicates:

For use with sample, matrix spike, LFB and LCS duplicates. Qualify all affected analytes. For MS/MSD or sample duplicates qualify only the original source sample.

R1 = RPD/RSD exceeded the method acceptance limit.
R2 = RPD/RSD exceeded the laboratory acceptance limit.
R4 = MS/MSD RPD exceeded the method acceptance limit. Recovery met acceptance criteria.
R5 = MS/MSD RPD exceeded the laboratory acceptance limit. Recovery met acceptance criteria.
R6 = LFB/LFBD RPD exceeded the method acceptance limit. Recovery met acceptance criteria.
R7 = LFB/LFBD RPD exceeded the laboratory acceptance limit. Recovery met acceptance criteria.
R8 = Sample RPD exceeded the method acceptance limit.
R9 = Sample RPD exceeded the laboratory acceptance limit.
RA= MS/MSD RPD exceeded the method acceptance limit. Recovery did not meet acceptance criteria.
RB = MS/MSD RPD exceeded the laboratory acceptance limit. Recovery did not meet acceptance criteria.
RC = Low precision due to analyte concentration close to the MRL.

Surrogate:

Qualify surrogates appropriately when they do not meet criteria. Surrogate failures in quality control samples will most likely require additional narration. S11 & S12 are used to qualify sample surrogates and only in cases where the Laboratory Fortified Blank/LCS has acceptable surrogate recoveries.

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S1 = Surrogate recovery was above laboratory acceptance limits, but within method acceptance limits.
S3 = Surrogate recovery was above laboratory acceptance limits, but within method acceptance limits. No target analytes were detected in the sample.
S4 = Surrogate recovery was above laboratory and method acceptance limits. No target analytes were detected in the sample.
S5 = Surrogate recovery w as below laboratory acceptance limits, but within method acceptance limits.
S6 = Surrogate recovery was below laboratory and method acceptance limits. Re-extraction and/or reanalysis confirms low recovery caused by matrix effect.
S7 = Surrogate recovery was below laboratory and method acceptance limits. Unable to confirm matrix effect.
S8 = The analysis of the sample required a dilution such that the surrogate recovery calculation does not provide any useful information. The associated blank spike recovery was acceptable.
S10 = Surrogate recovery was above laboratory and method acceptance limits.
S11 = Surrogate recovery was high. Data reported per ADEQ policy 0154.000.
S12 = Surrogate recovery was low. Data reported per ADEQ policy 0154.000.
SA = Surrogate recovery was above laboratory and method acceptance limits. Re-extraction and or re-analysis confirms high recovery caused by matrix effect.
SB = Surrogate recovery was above laboratory and method acceptance limits. Unable to confirm matrix effect.
SC = The analysis of the sample required a dilution such that the surrogate concentration was diluted below the laboratory acceptance criteria. The associated blank spike recovery was acceptable.
SD = Surrogate recovery was below laboratory internal limits. Re-extraction and/or reanalysis confirms low recovery caused by matrix effect. No method criteria for surrogate.
SE= Surrogate recovery was below laboratory internal limits. Unable to confirm matrix effect. No method criteria for surrogate.
SF = Surrogate recovery was above laboratory internal limits. Re-extraction and or re-analysis confirms high recovery caused by matrix effect. No method criteria for surrogate.
SG = Surrogate recovery was above laboratory internal limits. Unable to confirm matrix effect. No method criteria for surrogate.

Method/analyte discrepancies:

For use with methods or analytes that are not currently approved under the Environmental Laboratory Licensure Rules.

T4 = Tentatively identified compound. Concentration is estimated and based on the closest internal standard.
T5 = Laboratory not licensed for this parameter.
T6 = The reported result cannot be used for compliance purposes.
T7 = Incubator/Oven temperatures were not monitored as required during all days of use.

Calibration Verification:

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Appropriate qualifier must be applied to all affected analytes in any samples associated with the calibration verification. The ADEQ policy 0155.000 can be accessed at http://www.azdeq.gov/function/business/download/one_pt3.pdf

V1 = CCV recovery was above method acceptance limits. This target analyte was not detected in the sample.
V2 = CCV recovery was above method acceptance limits. This target analyte was detected in the sample. The sample could not be reanalyzed due to insufficient sample.
V3 = CCV recovery was above method acceptance limits. This target analyte was detected in the sample, but the sample was not reanalyzed.
V9 = CCV recovery was below method acceptance limits.
VA = Closing standard recovery was above laboratory limits. Closing standard not required by method.
VB = Closing standard recovery was below laboratory limits. Closing standard not required by method.
VC = CCV is high biased, ND data are reportable as per TNI M4 #402 1.7.2 e ii
VE = CCV is high biased; ND data are reportable per method.
VF = CCV recovery was below method acceptance limits. The sample could not be reanalyzed due to insufficient sample.
VG = CCV recovery was below method acceptance limits. The sample result exceeded a maximum regulatory limit/decision level. (TNI M4 #403)

Internal Standards

IC = CCV Internal Standard recovery was above laboratory and method limits.
ID = CCV Internal Standard recovery was below laboratory and method limits.
IE = Trip Blank Internal Standard recovery was above laboratory and method limits.
IF = Trip Blank Internal Standard recovery was below laboratory and method limits.

Field / trip blank

FA = Target analyte detected in trip blank above the laboratory minimum reporting limit (MRL).

MWH General

NA = The sample was not analyzed
NR = The sample was analyzed but the results not reported due to failure of QC to meet method acceptance limits.

Other States/Clients' Requirements

J = Analyte is positively identified, but tentatively quantified. The reported value is an estimate concentration of the analyte in the sample. The analyte was either detected between MDL and MRL or did not meet any one of the required QC criteria. (MA - CLO4 requirements)

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(San Bernardino J Flag)
JA = Detected, not quantified. Estimated Concentration.

(Metals J Flag)
JB = The reported result is a estimated value (e.g, matrix interference was observed or the analyte was detected at a concentration outside the quantitation range)

(LADWP DNQ Flag)
DN = Detected, not quantified. Estimated Concentration.

Table 15-1 Example Summary of Corrective Action Procedures

Analysis Method	Item	Control Limits	Acceptance Criteria	Corrective Action
Volatile Organics	624	Sensitivity check Ion abundance with BFB	Tune instrument, criteria, see Table 11-3	repeat
		Initial calibration	All analytes < 35% RSD	Re-calibrate instrument
		Continuing calibration (QC Check Standard)	All analytes must meet % R as specified in Table 5 of Method 624	Rerun continuing calibration
		Method blank	<MRL	Determine cause of blank problem, reprep set if necessary
		Spiked samples (MS/MSD)	All analytes must meet % R as specified in Table 5 of Method 624	If LCS is in control, qualify LFM data, reprep set if necessary
		Duplicates (Dup)	RPD < than control limits	Re-prep and reanalyze
		Laboratory control samples (LCS)	All analytes must meet % R as specified in Table 5 of Method 624	Re-analyze batch
		MRL Check	50-150%	MRL check high, flag data. Out low adjust MRL or repeat test.
		Surrogate recovery	% R as specified in SOP	Re-prep and reanalyze
Base/Neutral/Acid Extractable Organics	625 with DFTPP	Sensitivity check Ion abundance with BFB	Tune instrument, criteria, see Table 11-3	repeat
		Initial calibration	<35% RSD	Re-calibrate
		Continuing calibration	RF ± 20%	Rerun continuing calibration, is still out, re-calibrate instrument
		Method blank	<MRL	Investigate problem, reprep set if necessary
		Spiked samples/LFM	All analytes must meet % R as specified in Table 6 of the method	If LCS in control, qualify LFM data, Reprep set if necessary.
		Laboratory control samples (LFB)	All analytes must meet % R as specified in Table 6 of the method	Re-analyze batch
		Surrogate recovery	% R as specified in SOP	Re-prep and reanalyze
Cyanide	335.4/	Initial calibration	r≥0.995	Repeat ICAL

Analysis Method	Item	Control Limits	Acceptance Criteria	Corrective Action
	9012B	MRL Check	50-150%	MRL check high, flag data. Ok to report high biased ND data. Out low adjust MRL or repeat test.
Phenolics	420.1/ 420.4	Calibration blank	<MRL	Investigate problem, re-digest set if necessary
		Continuing calibration	±10% of the expected value	Rerun continuing calibration, is still out, re-calibrate instrument and rerun samples from last CCV.
		Method blank	<MRL	Investigate problem, re-digest set if necessary
		Laboratory control samples (LFB)	% R of analyte within control limits of the method (90-110) for regular phenol and 80%-120% for low level	Re-digest and re-analyze batch
		MRL Check	50-150%	MRL check high, flag data. Ok to report high biased ND data. Out low adjust MRL or repeat test.
		Spiked samples/LFM	%R (90-110) for regular phenol and (80-120) for low level	If LCS in control, qualify LFM data, Reprep set of samples if necessary.
		Duplicates (Dup)	RPD < than control limits	Re-prep and reanalyze
Total Dissolved Solids, TDS	SM 2540C	Balance check	Expected value within 0.01% of balance	Re-calibrate
		MRL Check	50-150%	MRL check high, flag data. Ok to report high biased ND data. Out low adjust MRL or repeat test.
		RPD for reweighing	<4% or <0.5mg difference	Reweigh till weight difference is <4% or <0.5mg
Total Suspended Solids, TSS	SM 2540D	Balance check	expected value within 0.01% of balance	Re-calibrate

Analysis Method	Item	Control Limits	Acceptance Criteria	Corrective Action
		MRL Check	50-150%	MRL check high, flag data. Ok to report high biased ND data. Out low adjust MRL or repeat test.
Total Solids, TS	SM 2540B	Balance check	expected value within 0.01% of balance	Re-calibrate
Total Volatile Residue, TV	160.4	Method blank	<MRL	Investigate root cause of blank problem. Reprep set if necessary.
Total Settleable Solids, TSS	SM 2540F			
pH	SM 4500 H+B/ EPA 150.1 (DW only)	3 buffers	within ±0.1 pH unit of true value	Re-calibrate instrument
		Duplicates	RPD < than control limits	Re-prep duplicates and reanalyze or flag if reported
		Laboratory control samples (LFB)	% R within control limits of the method	Re-analyze batch
Anions: Perchlorate BrO3, ClO2,ClO3, Cl,NO3, NO2, PO4,SO4	300.0/ 300.1/ 314/ 317	Calibration curve	r ≥ 0.995	Rerun calibration
		Continuing calibration Verification,/LCS/LFB	90-110 % Rec	Recalibrate, rerun last
		Spiked samples/LFM	Must meet 80-120 % R	If LFB in control, no action taken
		MRL Check	50-150%	MRL check high, flag data. Ok to report high biased ND data.Out low adjust MRL or repeat test.
		Method Blank	< ½ MRL	Identify and eliminate source of problem. Do not do further sample analysis until contamination problem is resolved.
Anions: Perchlorate BrO3,ClO2,ClO3,Cl,NO3, NO2, PO4, SO4	300.0/ 300.1/ 314/ 317	Method Blank	< ½ MRL	Repeat sample prep using another source of reagent if contamination is found to be due to the Reagents used.
TOC	SM	Calibration curve	r ≥ 0.995	Rerun calibration

Analysis Method	Item	Control Limits	Acceptance Criteria	Corrective Action
	5310C	Continuing calibration Verification, /LCS/LFB	90-110 % Rec	Recalibrate, rerun last 10 samples between the failing standard and the last standard meeting the acceptance
		MS/LFM	80-120 %	If LFB in control, no action taken
TOC (con't.)	SM 5310C	Method Blank	< 0.250ppm	Identify and eliminate source of problem. Do not do further sample analysis until contamination problem is resolved. Repeat sample prep using another source of reagent if contamination is found to be due to the Reagents used.
		Lab Duplicate	≤ 10% RPD (TOC ≥ 2.0 mg/L)	Reanalyze sample, if it cannot be reanalyzed, flag sample not meeting QC criteria.
			≤ 15% RPD (TOC < 2.0 mg/L)	
		MRL Check	50-150%	MRL check high, flag data. Ok to report high biased ND data.Out low adjust MRL or repeat test.
TOX	SM5320	Initial calibration Curve	r ≥0.995	Repeat ICAL
		Continuing calibration	±10% of the expected value	Rerun continuing calibration, is still out, re-calibrate instrument and rerun last 10 samples.
		Spiked samples/LFM	90-110% Rec	If LCS in control, qualify LFM data, Reprep set of samples if necessary.
		Method blank	< ½ MRL	Investigate problem, re-analyze set of samples if necessary
		Duplicates, (all samples)	RPD 15% (<100 ppb) RPD 10% (≥100 ppb)	Re-analyze to determine if matrix problem

Analysis Method	Item	Control Limits	Acceptance Criteria	Corrective Action
		Laboratory control samples (LFB)	±10% of the true value	Re-analyze batch
Mercury by Cold Vapor AAS	245.1/ 7470A/ 7471A	Initial calibration verification/IPC	± 5% of the expected value	Re-calibrate
Mercury by Cold Vapor AAS (con't.)	245.1/ 7470A/ 7471A	Continuing calibration	±10% of the expected value	Rerun continuing calibration, is still out, re-calibrate instrument and rerun last samples from last Calibration Check
		MRL Check	50-150%	MRL check high, flag data. Out low adjust MRL or repeat test.
		Method Blank	< ½ MRL	Investigate problem, re-digest set of samples if necessary
		Duplicates	RPD < 20%	Re-prep duplicates and re-analyze
		Spiked samples/LFM	70-130%	If LCS in control qualify LFM data, Reprep set of samples if necessary.
		Laboratory control samples (LFB)	85-115%	Re-prep and re-analyze batch
ICP Metals:	200.7/ 6010	Standard validation	± 5% of the expected value	Purchase new concentrates
		Initial calibration verification/IPC	95-105% Rec, RSD < 3%	Rerun calibration standards
		MRL Check	50-150%	MRL check high, flag data. Out low adjust MRL or repeat test.
ICPMS Metals	200.8	Calibration blank	<1/2 MRL	Investigate problem, re-run blank
		Continuing calibration verification	±10% of the expected value	Rerun standards, is still out, re-calibrate instrument and rerun samples from last CCV.
		Method blank	< ½ MRL	Investigate problem, re-digest set if necessary

Analysis Method	Item	Control Limits	Acceptance Criteria	Corrective Action
		Spiked samples/MS	70-130%	If LCS in control qualify LCS data, Reprep set of samples if necessary.
		Laboratory control samples (LCS)	85-115%	Re-prep and re-analyze batch
ICPMS Metals (cont.)	200.8	MRL Check	50-150%	MRL check high, flag data. Ok to report high biased ND data. Out low adjust MRL or repeat test.
Cr VI (Dissolved)	218.6	Initial Calibration	r≥ 0.999	Identify problem and rerun ICAL
		IPC (CCV)	95-105%	Perform another IPC. If failed again, recalibrate and reanalyze previous 10 samples
		LRB	< ½ MRL	Correct source of contamination and reanalyze sample.
		LFB/QCS (external source)	90-110 %	Procedure is out of control, identify source of problem and resolve before continuing analysis
		LFM	90-110%	If failed but LFB passed, problem is matrix related Flag unspiked sample as “suspect matrix”
		LFMD	90-110%/20% RPD	If failed but LFB passed, Problem is matrix related Flag unspiked sample
		QCS LDR	90-110% minimum 7stds	See LFB Start of Program
		MRL Check	50-150%	MRL check high, flag data. Ok to report high biased ND data. Out low adjust MRL or repeat test.

Analysis Method	Item	Control Limits	Acceptance Criteria	Corrective Action
HAAs	6251 B	Initial Calibration Curve	RSD< 20% r ≥ 0.995	If r < 0.995, use second order fit as calibration curve. Check for error if % RSD exceeds 30 %.
HAAs (con't.)	6251 B	Method blank	< ½ MRL	Identify and eliminate source of problem. Do not do further sample analysis until contamination problem is resolved. Repeat sample prep using another source of reagent if contamination is found to be due to the Reagents used.
		Laboratory control samples LCS/LFB/CCV)	LCS: 80-120% Rec Low ± 50% High ± 15%	If primary column results fail, use results from secondary. If both fail, re-analyze. If repeat fails, re-extract.
		LFM	Control chart limits updated annually	If LFB is in control, no action taken
		Surrogate recovery	70-130 % Rec	Re-analyze the samples
		MRL Check	50-150%	MRL check high, flag data. Ok to report high biased ND data. Out low adjust MRL or repeat test.
UV 254	SM 5910B	Calibration curve	90-110 % Rec.	Rerun Calibration
		Method blank	< 0.004 units	Identify and eliminate source of problem. Do not do further sample analysis until contamination problem is resolved. Repeat sample prep using another source of reagent if contamination is found to be due to the Reagents used.
		CCV(Low)	For 0.5mg/L, absorbance value between 0.008 to 0.010	Rerun continuing calibration, is still out,

Analysis Method	Item	Control Limits	Acceptance Criteria	Corrective Action
		CCV (Mid/High Verification)	For 6.0 mg/L, absorbance value between 0.079 to 0.097; 0.779 to 0.953 (for 60mg/L)	re-calibrate instrument and rerun last 10 samples between the failing standard and the last standard meeting the acceptance criteria.
UV 254 (con't.)	SM 5910B	LCS/LFB	Value within manufacturer's listed range	
		Lab Duplicate	≤ 10 % RPD ≤ 15% RPD for low standard	Reanalyze sample. If cannot be reanalyzed, flag not meeting QC criteria.
		MRL Check	50-150%	MRL check high, flag data. Ok to report high biased ND data. Out low adjust MRL or repeat test.
Residual Chlorine	SM 4500 Cl-G	LCS/LFB	85-115 %	Rerun standard. Prepare new standard, if needed.
		MRL Check	50-150%	MRL check high, flag data. Ok to report high biased ND data. Out low adjust MRL or repeat test.
		Duplicate	<20 % RPD	Reanalyze sample.
Organohalide Pesticides and PCB	505	Instrument Performance	CCV 70-130% Recovery	Determine the cause and eliminate the problem; if necessary, generate a new curve or set of cal factors to verify the decreased response before searching for problem source.
		Endrin breakdown	< 20 % degradation	Perform routine maintenance. Consistent breakdown suggests breakdown occurrence in instrument system; methodology is in control, correct for potential background concentration.

Analysis Method	Item	Control Limits	Acceptance Criteria	Corrective Action
		IDC	%R = 70-130% RSD ≤ 20 %	Source of problem identified and resolved before continuing analysis.
Organohalide Pesticides and PCB (con't.)	505	LFB	%R = 70-130% (need control charts after 30 data points per lab performance)	Source of problem identified and resolved before continuing analysis.
		Initial Calibration Curve	% RSD ≤ 20	Repeat test using a fresh cal std. If results still not agree, generate a new calibration curve.
		Continuing Calibration verification Standard	70-130 %	Reanalyze sample extracts for the suspected field sample analytes after acceptable cal is restored.
		LRB	< MRL	Determine source of contamination and eliminate interference before processing sample.
		LFM	% R = 65-135%	If lab performance is shown to be in control, problem is matrix-related, not system-related. Label result suspect/matrix to inform data user the results are suspect due to matrix effects.
		LFMD	not required 20 % RPD (initial guidance)	
		QCS	70 – 130 %	Done quarterly. Source of problem identified and resolved.
		MRL Check	50-150%	MRL check high, flag data. Ok to report high biased ND data. Out low adjust MRL or repeat test.
Volatiles, DIPE TAME, ETBE	524.2	Sensitivity check Ion abundance with BFB	Tune instrument, criteria, see Table 11-3 by GCMS	Retune Instrument. Ionizer may need to be cleaned before criteria can be met.

Analysis Method	Item	Control Limits	Acceptance Criteria	Corrective Action
		Initial calibration	≤ 20% RSD, r ≥ 0.995	Re-calibrate instrument. Prepare new standard and analyze.
Volatiles, DIPE TAME, ETBE (con't.)	524.2	Continuing calibration (QC Check Standard)	70-130%	Rerun continuing calibration. prepare new CCV std and re-analyze.
			80-120% (TCP)	
		Lab blank	< MRL	Reanalyze. If blank cannot be reanalyzed, flag associated data when samples have hits > MRL.
			< MRL (TCP)	(TCP: source of contamination investigated and measures taken to correct, minimize, or eliminate problem)
		Lab Duplicates (Dup)	< 20 % RPD	Re-prep and reanalyze
		Laboratory control samples (LCS/LFB)	70-130%	Re-analyze batch
			80-120% (TCP)	Problem resolved before additional samples may be reliably analyzed
		Surrogate recovery	80-120 % (initial demonstration of capability, IDOC) 70-130 % (CCV, samples)	Re-prep and reanalyze
		MRL Check	50-150%	MRL check high, flag data. Ok to report high biased ND data. Out low adjust MRL or repeat test.
Volatiles	524.3	BFB Sensitivity	Refer to Table 1 in 524.3 SOP	Optimize the instrument and reanalyze BFB tune
		Initial Calibration	Cal. Point ≤MRL: ±50% Other cal. points: ±30%	Re-calibrate instrument. Check for leaks and conduct repair and regular maintenance
		ICV/QCS	70-130% Rec	Re-run ICV, if out-of-control, correct the problem source then repeat ICAL

Analysis Method	Item	Control Limits	Acceptance Criteria	Corrective Action
		CCC	%D for each analyte below MRL: ≤50% Above MRL: ≤30%	Re-run CCC. If out-of-control, conduct maintenance and recalibrate
Volatiles (con't.)	524.3	LRB	< ½ MRL	Identify and eliminate affected batch, re-analyze associated samples
		Matrix Spike/LFSM LFSMD	70-130% Rec	If matrix effects are observed or suspected to be causing low recoveries and the LFSMD confirms this, analyze a lab fortified matrix sample for that matrix.
		LFBD	10-130% Rec RPD: <20%	If out of control, re-run LFBD and associated samples. Otherwise recalibrate.
		Surrogate	70-130% Rec	Check and optimize the instrument. Re-analyze out of control samples.
		Internal Standards (IS)	±30% of most recent CCC ±50% of average response in ICAL	Check and optimize the instrument. Re-analyze out of control samples.
Trihalomethanes /Chloral Hydrate/ Haloacetonitrile	551.1	Initial calibration curve (Extracted)	< 10 % RSD	recalibrate if fails criteria

Analysis Method	Item	Control Limits	Acceptance Criteria	Corrective Action
		Lab Performance Check	Table 7 of the method	Failed LPC, reevaluate the instrument system, if performance Criteria not met, install new column, correct column flows
		Endrin Breakdown	< 20 %	Perform routine maintenance In the injection port; replace injection port sleeve & all Associated seals & septa.
		Calibration Verification (CCV=LFB) (2 different conc. levels) (MLFB & HLFB)	% R = 80-120 % for 90 % of analytes	Reanalyze CCV. If failed again recalibrate & the previous samples reanalyzed or analytes out of acceptable range should be reported suspect to the data user.
Trihalomethanes /Chloral Hydrate/ Haloacetonitrile (con't.)	551.1	LRB	< ½ MRL	Determine source of contamination & eliminate the interference before processing samples
		LFB/CCV	% R = 80-120% for 90 % of analytes	Reanalyze CCV. If failed again recalibrate & the previous samples reanalyzed or analytes out of acceptable range should be reported suspect to the data user.
			75-125 % for all analytes	
		LFM	80-120%	When analyte recovery fails LFM criteria, a bias is concluded & analyte for that matrix is reported to the data user
		LFM/Duplicate	See Sample Duplicate	
		Sample Duplicate	RPD <20 for 90% of analytes, RPD <25% for all analytes	If failing, repeat analyses. Upon repeated failure, sampling must be repeated or analyte out of control must be reported as suspect to the data user.

Analysis Method	Item	Control Limits	Acceptance Criteria	Corrective Action
		Surrogate	80-120 % Recovery	Deviations in surrogate recovery may indicate a problem: Renalyze extract if extraction upon reanalysis, recovery is failing extract fresh sample. If not, data for all analytes from the sample should be reported as suspect.
		CCV Surrogate	80-120% Recovery	Recalibrate if fails criteria
		Sample Peak	Within the linear range of calibration curve	Dilute final extract and reanalyze

Note: Refer to individual SOPs for detailed corrective action procedures for all methods.

Figure 15-2 Preventive Action Record Form

Preventive Action Record
(ISO/IEC 17025 Section 4.12)

Date:
Log Number:
Regulatory Reference or Requirements:
Name of Requester:
Responsible Personnel
Department/Method:
Audit By:

Source: (check all that apply):

Annual Management Review___ Analysis of data ___ PT results ___

Trend and Risk Analysis ___ Other (explain)______________________________________

Opportunity for Improvement:

Preventive Action:

Prevention:

PAR Completion Due Date:

Responsible for Preventive Action (Print Name and Signature):

QA Review Signature:

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Follow-up of Preventive Action (2 to 3 months):

Date:

Status (open/closed):

Additional/Revised Preventive Action Needed:

New Due Date:

Date of Preventive Action Implementation:

Closing Date

Effectiveness of Preventive Action Taken:

Signature of Responsible Personnel as to the Completion of the PAR:

QA Signature:

Figure 15-3 Quality Investigation Report (QIR) Flow Chart

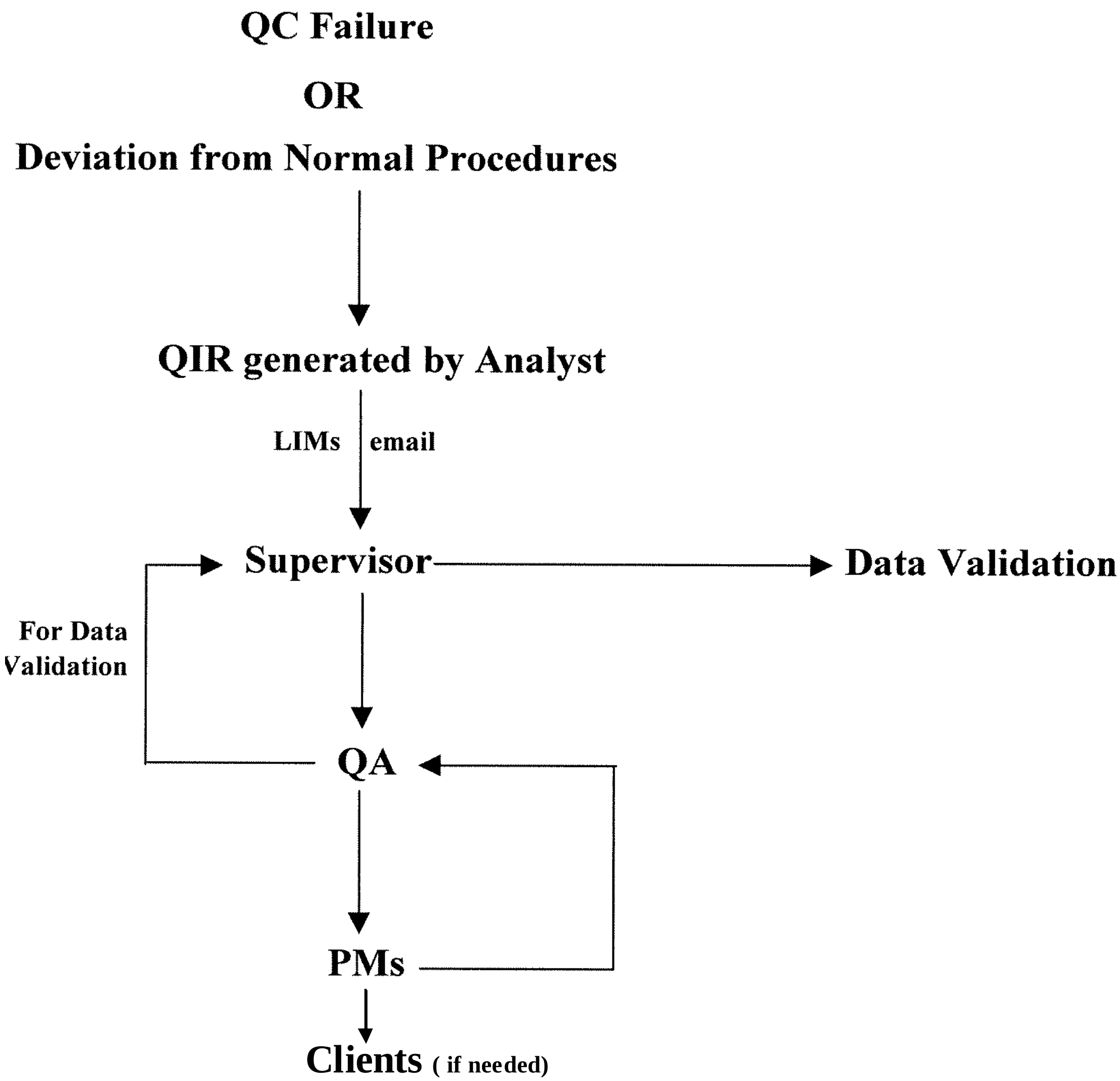
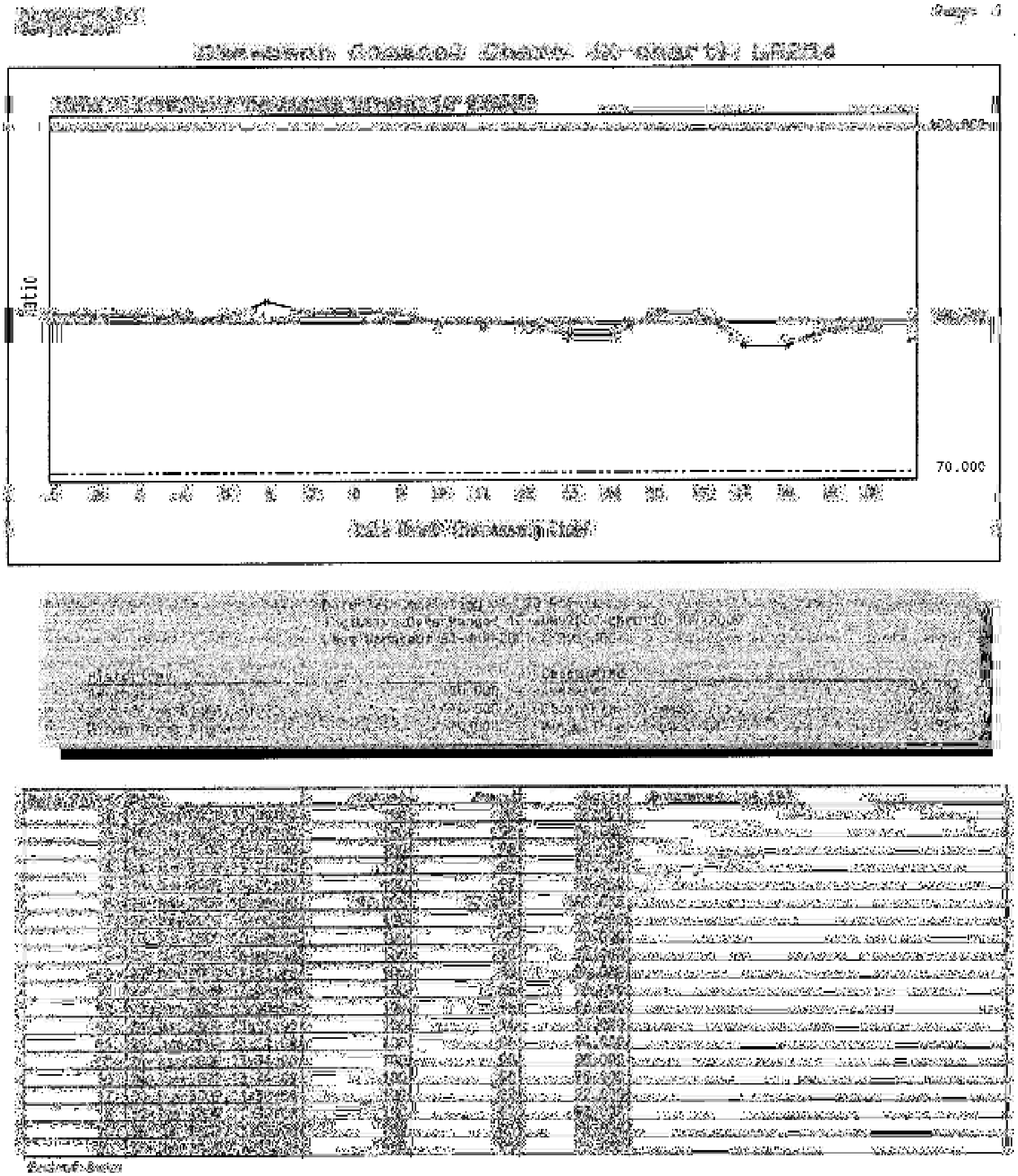


Figure 15-4 Example Surrogate Control Chart



16.0 PERFORMANCE AND SYSTEM AUDITS/MANAGEMENT REVIEW

The Quality Manager at EEA is not directly involved in the production of analytical data. The QA department is responsible for an ongoing program of internal system audits and performance evaluation samples, and for coordinating all external audits and PT samples. In addition, the QA department is responsible for maintaining state and agency certifications.

16.1. INTERNAL AUDITS

The audits are carried out by the Quality Manager or designee(s) who will be independent of the activity to be audited. Also, to develop a proactive program for the detection of improper, unethical or illegal actions, the Quality Manager or designee, during the internal audit procedure, includes the auditing of any improper, unethical or illegal action committed by the analyst or supervisor.

16.1.1. **Annual and Periodical Internal Audits**

16.1.1.1. The laboratory Quality Assurance Group conducts an annual lab internal audit to verify that its operations continue to comply with the requirements of the laboratory's quality system as per TNI-EL-V1M2-2009-4.14.1 and ISO/IEC 17025:2005(E)-4.14.1.

16.1.1.2. The laboratory, in accordance with a predetermined schedule and procedure, conducts internal audits, at least annually, of the activities to verify that the operations continue to comply with the requirements of the quality systems of TNI and ISO 17025 standards. The internal audit program addresses all elements of the quality system, including environmental testing and/or calibration activities. The Quality Manager plans and organizes audits as required by the schedule and requested by management. Such audits are carried out by the Quality Manager and trained QA staff who are independent of the activity to be audited. Personnel are trained not to audit their own activities except when it can be demonstrated that an effective audit will be carried out [TNI-EL-V1M2-2009-4.14.1][ISO/IEC 17025:2005(E)-4.14.1].

16.1.1.3. When audit findings cast doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's environmental test or calibration results, the laboratory takes timely corrective action, and notifies the clients in writing when the investigations show that the laboratory results are affected. The laboratory notifies the client promptly, in writing of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of the results given in any test report or test certificate or amendment to a report or certificate [TNI-EL-V1M2-2009-4.14.2][ISO/IEC 17025:2005(E)-4.14.2].

16.1.1.4. The area of activity audited, the audit findings, and corrective actions that arise from them are recorded [TNI-EL-V1M2-2009-4.14.3][ISO/IEC 17025:2005(E)-4.14.3].

The laboratory management ensures that these actions are discharge within the agreed time frame as indicated in the audit finding documentation. Corrective actions are required within 30-days after findings have been reported to the Technical Manager.

16.1.1.5. Follow up audit activities of the laboratory are conducted in 2 to 3 months to verify and record the implementation and effectiveness of the corrective action taken [TNI-EL-V1M2-2009-4.14.4][ISO/IEC 17025:2005(E)-4.14.4].

16.1.2. **Data Package Reviews**

16.1.2.1. As part of the annual internal audit, data package review is conducted annually by the Quality Manager or designee. At the start of the audit program, PT results obtained by using the drinking water, wastewater, hazardous waste methods are evaluated in order to have an objective assessment on the quality of the data generated by the lab. Annually several analytical methods i.e. at least one representative technology method from Wet Chem, Metals, Rad, GC, HPLC, GCMS, Asbestos and Microbiology are selected either from PT or client data reports for data package reviews. The laboratory ensures that at the end of the year, a representative method from each TNI list of technology for drinking water, wastewater, and hazardous waste analysis have been reviewed. Compliance with all required QC is evaluated. A data package review checklist is used to serve as guidelines during the data package review. A report on the results of the data package review is submitted to the supervisors and the Lab Director after the data package review for corrective actions.

16.1.2.2. In addition, a response to the findings and appropriate corrective action is implemented by the supervisors to ensure continuous compliance to all method requirements. Also, to develop a proactive program for the detection of improper, unethical or illegal actions, the Quality Manager or designee during the data package review includes the detection of any potential improper, unethical or illegal action by any of the lab personnel. The data integrity checklist from Arizona is used as a guideline for reviewing data packages.

16.2. EXTERNAL AUDITS

16.2.1. External System audits are performed by outside agencies such as the California Department of Public Health (at least every 2 and 1/2 years for TNI accreditation) and by other state agencies where EEA is certified.

16.2.2. External audits are also conducted by the State of Arizona every 1-2 years, and Wisconsin every three (3) years. All other TNI states recognize CA-DOH on-site assessment in accordance to TNI secondary accreditation program. All corrective action reports audit findings and audit responses are retained by the laboratory for a minimum of 5 years (TNI) and 10-years (Massachusetts, Hawaii and New York).

16.3. PERFORMANCE AUDITS

PT samples are used to provide a direct evaluation of the ability of the analytical systems to generate data that is consistent with the laboratories' stated objectives for accuracy and precision. EEA analyzes internal PT samples as part of the ongoing QA program, while external PT samples are analyzed as part of the certification and approval process for various state and federal agencies, as well as for other organizations.

16.3.1. **Internal Proficiency Testing Samples/Internal Check Sample Program**

Internal PT Program is conducted as part of the corrective action process for any PT reported as unacceptable and evaluated by the PT provider as "check for error" or did not pass the PT provider's warning limits. Internal QC samples are also provided as needed as part of the analyst's initial demonstration of capability. The QA group maintains a logbook of all blind PT samples for traceability of the true and reported values. A LIMS report is generated for each QC sample logged in the LIMS system. Problem areas are reviewed as soon as they surface; the probable cause is determined as expeditiously as possible and corrective action implemented. If a severe problem with the analysis is evident, the analysis is halted until the cause is found and corrected.

16.3.2. **External Proficiency Testing (PT) Samples**

16.3.2.1. External Proficiency Testing (PT) samples are analyzed twice a year as part of the NELAP accreditation and approval process for various state and federal agencies.

16.3.2.2. Blind PT samples are procured from NIST/TNI/ISO 17025 Approved PT Providers to include the following samples:

- Semi-annual Drinking Water PT Samples (WS series) Organic and Inorganic Samples, Coliform Microbe, HPC, and source water E.Coli
- Radiochemistry Gross Alpha, Beta , Radium 228 and Uranium PT samples
- Annual NPDES/DMR PT sample as required by EPA.
- Semi-annual Asbestos PT Samples
- Semi-annual Wastewater PT Samples (WP series)/NPDES Organic and Inorganic PT samples/Hazardous Waste (Aqueous matrices)

16.3.3. **Proficiency Testing Protocol**

16.3.3.1. **Frequency**

16.3.3.1.1. The laboratory participates in the PT program of a NIST approved PT provider twice in each calendar year.

16.3.3.1.2. The laboratory enrolls and participates in a proficiency-testing program (PT) for each analyte or interdependent analyte group using all routine drinking water methods. When new analytes are added to the certification, 2 successful PT studies must be performed at least “30 (for MA)” calendar days apart from closing date of one study to the shipment of another study for the same field of proficiency testing, at least 15 calendar days between the analysis dates of successive PT samples for the same accreditation, and will be completed within 18 months from the date the additional groups are added on the Laboratory Application. [TNI-EL-V1M1-2009-4.1.3].

16.3.3.2. **Laboratory Handling**

16.3.3.2.1. As per TNI Standard Volume 1, Module 1, PT samples are managed, analyzed and reported in the same manner as real routine samples by utilizing the same staff, methods as used for routine analysis of that analyte, procedures, equipment, facilities, and frequency of analysis.

16.3.3.2.2. The laboratory follows the proficiency testing provider’s instructions for preparing the proficiency-testing sample dilution (as needed) and analyzes the proficiency-testing sample as if it were a client sample.

16.3.3.2.3. The laboratory complies with the following prohibitions:

- Performing multiple analyses (replicates, duplicates) which are not normally performed in the course of analysis of routine samples;
- Performing increased frequency of quality control samples or initial and continuing calibrations which are not normally performed in the course of analysis of routine samples;
- Averaging the results of multiple analyses for reporting when not specifically required by the method; or
- Permitting anyone other than bona fide laboratory employees who perform the analyses on a day-to-day basis for the certified laboratory to participate in the generation of data or reporting of results.

16.3.3.2.4. The laboratory does not:

- Discuss the results of a proficiency testing audit with any other laboratory until after the deadline for receipt of results by the proficiency testing provider;
- Attempt to obtain the assigned value of any proficiency testing sample from the proficiency testing provider.
- Send proficiency testing samples or portions of samples to another laboratory to be tested; or
- Knowingly receive a proficiency-testing sample from another laboratory for analysis and fail to notify the department of the receipt of the other laboratory's sample within five business days of discovery.

16.3.3.2.5. The laboratory maintains a copy of all proficiency testing records, including analytical worksheets. The proficiency testing records include a copy of the authorized proficiency testing provider report forms used by the laboratory to record proficiency testing results.

16.3.3.2.6. The laboratory participates in Client/State sponsored PT programs. The director of the laboratory or representatives of the laboratory provides, if needed, an attestation statement stating that the laboratory followed the proficiency testing provider's instructions for preparing the proficiency testing sample and analyzed the proficiency testing sample as if it were a client sample.

16.3.3.3. **Not Acceptable PT Results**

16.3.3.3.1. If the laboratory fails a PT sample, a corrective action plan is submitted to CA DPH and other states requiring corrective action, such as Nevada, Washington, Mariana Islands, Guam, Virginia, Maryland, West Virginia, and Massachusetts, within 30-days after receipt of PT report.

16.3.3.3.2. Corrective Action Reports are generated when non-acceptable results are reported. Data reported by the laboratory not within the warning limits and flagged as “check for error” are also investigated to determine the root cause of the problems. Internal PT samples are provided to the analyst to determine if corrective action implemented was effective to resolve the problem. Acceptable results of the internal PT samples help the analyst to determine if the analysis is in control after the implementation of the corrective action.

16.3.3.3.3. Make-up PT or supplemental PT samples are also analyzed when the laboratory fails to maintain a record of passing two out of the most recent three PT studies and wishes to re-establish its history of successful performance. Analysis dates of make up PT studies must be at least 15 calendar days between analysis date. Since some states, such as Massachusetts requires at least 30-days apart, thus the Lab adopts the “30-days apart” requirement for Make-up samples from the closing date of one study to the shipment date of another study.

16.3.3.4. **Reporting**

16.3.3.4.1. The laboratory analyzes and reports the results of the proficiency-testing test by the deadline set by the proficiency-testing provider.

16.3.3.4.2. When the PT falls below the range of the analytical method, the laboratory reports “<MRL” and does not perform special procedures to determine the low level result [TNI-EL-V1M1-2009-5.2.1].

16.3.3.4.3. The laboratory reports the results of the proficiency testing test by the procedure specified by the proficiency-testing provider.

16.3.3.4.4. The laboratory notifies the approving states such as Wisconsin of the authorized proficiency testing program or programs in which it has enrolled for each analyte or interdependent analyte group.

16.3.3.4.5. The laboratory directs the proficiency-testing provider to send, either in hard copy or electronically, a copy of each evaluation of the laboratory's proficiency testing audit results to the state requiring the PT results. The laboratory allows the proficiency-testing provider to release all information necessary for the state to assess the laboratory's compliance to PT requirements.

16.3.3.5. **Remedial PT**

16.3.3.5.1. The certified laboratory participates in only one remedial proficiency-testing audit for an analyte or independent analyte group in any 12-month period to obtain or upgrade approval under this section, as per Massachusetts's PT requirements.

16.3.3.5.2. The laboratory directs the proficiency-testing provider to send, either in hard copy or electronically, a copy of each evaluation of the certified laboratory's remedial proficiency testing results to California, and all other NELAP and other non-NELAP states. The laboratory allows the proficiency-testing provider to release all information necessary for the state to assess the certified laboratory's compliance with this rule.

16.4. SYSTEM AUDITS AND MANAGEMENT REVIEW

In order to insure that the Quality Assurance program at the laboratory maintains a high profile, there are several mechanisms in place which insure that QA information is routinely conveyed to laboratory management. This includes an annual QA report, reports on internal and external PE samples, and verbal transmittal of QA information to the Laboratory Director and group supervisors during a weekly staff meeting.

16.4.1. System Audits

System audits are performed both by external agencies, and by the laboratory Quality Assurance Group. The focus of these audits is the overall analytical "system", from login to delivery of the finished reports. The purpose of the audits is to document compliance with specified methodology contained in the SOPs.

All audit and review findings and any corrective actions that arise from them shall be documented. The laboratory shall ensure that these actions are discharged within the agreed time frame.

16.4.2. Management Review

16.4.2.1. The Quality Manager prepares and submits an annual QA/QC report for the Laboratory Director and Technical Directors. This report describes all the quality assurance activities conducted during the year, including proficiency test sample results (both internal and external), holding time exceedances, de-briefing from external and internal systems audits, and a summary of all out of control events that required corrective action/preventive measures and the effectiveness of the initiated corrective action. Whenever any such quality assurance information impacts a specific analytical project, the events are immediately related to the Client Services Group, who is responsible for informing the client.

16.4.2.2. The annual QC report includes the outcome of recent internal audits, assessments by external bodies, the results of inter-laboratory comparisons of proficiency tests and corrective actions. The annual QC report also include a discussion of the lab certifications, the laboratory SOPs generated for the year including SOP updates, control charts, acceptance limits updates, Quality Manual updates and data review results.

16.4.2.3. The Laboratory Director and Technical Directors perform an annual managerial review of the laboratory quality system and its testing and calibration activities to ensure its continuing suitability and effectiveness. Any necessary changes or improvements in the quality system and laboratory operations are introduced during the annual managerial review. Thus, the Laboratory Director, Technical Directors, Quality Manager, and Technical Managers review the annual QC report, provide an overall assessment of all the QC activities stated in the annual QC report, and introduce any necessary changes or improvements in the quality system and laboratory operations. The annual managerial review also takes into account changes in the volume and type of work undertaken for the previous year and feedback from clients, complaints and other relevant factors, such as resources and staff training [TNI-EL-V1M2-2009-4.15.1][ISO/IEC 17025:2005(E)-4.15.1].

16.4.2.4. The QA Group conducts performance audits of the laboratory and also maintains a program of blind proficiency testing samples. Results of these blind performance samples are scored according to the methods criteria. In addition a debriefing to group leaders and the Laboratory Director is prepared by the QA group following each set of PT samples. Evaluations of any failures on external PT samples are prepared by Group Supervisors and summarized by the Quality Assurance Group for the certifying agencies, with copies conveyed to the Laboratory Director.

16.5. IMPROVEMENT

As per TNI-EL-V1M2-2009-4.10 (ISO/IEC 17025:2005(E)-4.10), improvement in the overall effectiveness of the laboratory management system is a result of the implementation of the various aspects of the laboratory's management system: quality policy (Section 3.2 – "Quality Policy") and objectives (Section 5.0 – "Quality Assurance Objectives"), internal audit practices (Section 16.1 – "Internal Audits"), the review and analysis of data (Section 6.0 – "Quality of Test Results"), the corrective and preventive action process (Section 15.0 – "Control of Non-Conforming Work, Corrective Action, and Preventive Measures"), and the annual management review of the quality management system (Section 16.4.2 – "Management Review") where the various aspects of the management/quality are summarized, and evaluated and plans for improvement are developed. See Figure 15-2 for the Preventive Action Form which is used to document actions required for improvement, name of requestor, responsible personnel to carry out implementation, and estimated completion date.

APPENDIX I

Arizona Certification and Approval

[illegible]

Arizona Department of Health Services

[illegible]

[illegible]

Tuesday, February 12 2013

Page [illegible]

AZ License: [illegible]

Lab Name: [illegible]

Program: SDW

Parameter	EPA Method	Billing Code	Cert Date
Chlorine Dioxide	[illegible]	[illegible]	[illegible]
Chloride	[illegible]	[illegible]	[illegible]
Chloride	[illegible]	[illegible]	[illegible]
Chloride	[illegible]	[illegible]	[illegible]
Chromium Total	[illegible]	[illegible]	[illegible]
Chromium Total	[illegible]	[illegible]	[illegible]
Chromium, Hexavalent	[illegible]	[illegible]	[illegible]
Cobalt	EPA 200.8	[illegible]	[illegible]
Color	[illegible]	[illegible]	[illegible]
Copper	[illegible]	[illegible]	[illegible]
Copper	[illegible]	[illegible]	[illegible]
Corrosivity	[illegible]	[illegible]	[illegible]
Cyanide	[illegible]	[illegible]	[illegible]
Cyanide	[illegible]	[illegible]	[illegible]
Cyanide	[illegible]	[illegible]	[illegible]
Cyanide	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Determination Of Selected Perfluorinated Alkyl Acids [illegible]	EPA 537	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Diquat	[illegible]	[illegible]	[illegible]
Diquat And Paraquat - Additional	[illegible]	[illegible]	[illegible]
EDB/DBCP	[illegible]	[illegible]	[illegible]
Endothall	[illegible]	[illegible]	[illegible]
Explosives And Related Compounds - Additional	[illegible]	[illegible]	[illegible]
Fecal Coliform	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Gross Alpha	[illegible]	[illegible]	[illegible]
Gross Beta	[illegible]	[illegible]	[illegible]
Haloacetic Acids & Dalapon	[illegible]	[illegible]	[illegible]
Hardness	EPA 200.7, CALC	[illegible]	[illegible]
Hardness	[illegible]	[illegible]	[illegible]
Heterotrophic Plate Count	[illegible]	[illegible]	[illegible]
Hydrogen Ion (pH)	[illegible]	[illegible]	[illegible]

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AZ License: **AZ0778** **Lab Name: Eurofins Eaton Analytical, Inc.**

Program **SDW**

Parameter	EPA Method	Billing Code	Cert Date
Hydrogen Ion (Ph)	SM 4500-H B	NIA2	11/30/97
Iron	EPA 200.7	MTL3	11/24/93
Lead	EPA 200.8	MTL1	12/19/94
Magnesium	EPA 200.7	MTL3	09/26/94
Manganese	EPA 200.7	MTL3	11/24/93
Manganese	EPA 200.8	MTL1	12/19/94
Mercury	EPA 245.1	MTL5	08/16/93
Molybdenum	EPA 200.8	MTL1	05/22/12
Nickel	EPA 200.7	MTL3	01/10/94
Nickel	EPA 200.8	MTL1	12/19/94
Nitrate	EPA 300.0	NIIIA1	11/24/93
Nitrate	EPA 353.2	NIB1	04/02/98
Nitrite	EPA 300.0	NIIIA1	01/10/94
Nitrite	EPA 353.2	NIIB4	12/11/02
Nitrosamines By Ms/Ms - Additional	EPA 521	OC37	08/20/09
Odor	SM 2150B	NIA4	10/29/03
Organics By Gc/Ms	EPA 525.2 (2.0)	OC8	02/22/06
Organics By Gc/Ms - Additional	EPA 525.2 (2.0)	OC10	12/05/06
Orthophosphate	EPA 365.1	NIIB4	11/17/95
Orthophosphate	SM 4500-P E	NIIB4	04/06/96
Orthophosphate	SM 4500-P F	NIIB4	03/20/08
Perchlorate	EPA 314.0	NIB1	03/30/01
Perchlorate	EPA 331.0	NIIIA1	10/23/08
Pesticides & Flame Retardants By Gc/Ms - Additional	EPA 527	OC8	08/20/09
Pesticides And Pcbs By Gc	EPA 505 (2.1)	OC8	04/03/03
Pesticides And Pcbs By Gc - Additional	EPA 505 (2.1)	OC10	10/23/08
Radium 226	GAMMARAY HPGE GE(LI)	RADIO	10/28/11
Radium 228	GAMMARAY HPGE GE(LI)	RADIO	10/28/11
Residue, Filterable (Tds)	SM 2540C	NIA2	04/06/96
Selenium	EPA 200.8	MTL1	12/19/94
Silica	EPA 200.7	MTL3	11/17/95
Silica	SM 4500-SI D	MISC2	11/08/02
Silica	SM 4500-SIO2C	MISC2	03/24/08
Silver	EPA 200.7	MTL3	11/24/93
Silver	EPA 200.8	MTL1	11/17/95
Sodium	EPA 200.7	MTL3	09/26/94
Specific Conductance	SM 2510B	NIA2	04/06/96
Strontium	EPA 200.7	MTL3	11/24/93
Strontium	EPA 200.8	MTL1	05/22/12

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Program **SDW**

Parameter	EPA Method	Billing Code	Cert Date
Sulfate	EPA 300.0	NIIIA1	11/24/93
Surfactant (Mbas)	SM 5540C	NIIA1	07/15/96
Thallium	EPA 200.8	MTL1	12/19/94
Total Coliforms & E. Coli By Colilert	SM 9223B	MIC3	04/02/98
Total Coliforms By Mtf	SM 9221B & C	MIC1	12/23/97
Turbidity, Ntu: Nephelometric	EPA 180.1	NIA2	02/10/98
Uranium	EPA 200.8	MTL1	09/08/04
Uv Absorbing Organic Constituents	SM 5910B	NIB1	07/10/99
Vanadium	EPA 200.8	MTL1	05/22/12
Vocs By Gc/Ms	EPA 524.2 (4.1)	OC8	01/15/03
Vocs By Gc/Ms	EPA 524.3 (1.0)	OC8	10/28/11
Vocs By Gc/Ms-Additional	EPA 524.2 (4.1)	OC10	10/23/08
Vocs By Gc/Ms-Additional	EPA 524.3 (1.0)	OC10	10/28/11
Zinc	EPA 200.7	MTL3	11/24/93
Zinc	EPA 200.8	MTL1	12/19/94

Total Licensed Parameters in this Program: 123

Program **WW**

Parameter	EPA Method	Billing Code	Cert Date
Alkalinity, Total	SM 2320B	NIA1	04/02/98
Aluminum	EPA 200.7	MTL3	04/02/98
Aluminum	EPA 200.8	MTL1	04/02/98
Ammonia	EPA 350.1	NIIB1	12/23/97
Antimony	EPA 200.7	MTL3	04/02/98
Antimony	EPA 200.8	MTL1	04/02/98
Arsenic	EPA 200.8	MTL1	04/02/98
Barium	EPA 200.7	MTL3	04/02/98
Barium	EPA 200.8	MTL1	04/02/98
Base/Neutrals And Acids Excluding Pesticides	EPA 625	OC8	05/09/94
Beryllium	EPA 200.7	MTL3	04/02/98
Beryllium	EPA 200.8	MTL1	04/02/98
Biochemical Oxygen Demand	SM 5210B	DEM1	11/30/97
Boron	EPA 200.7	MTL3	04/02/98
Bromide	EPA 300.0	NIIIA1	04/02/98
Cadmium	EPA 200.7	MTL3	04/02/98
Cadmium	EPA 200.8	MTL1	04/02/98
Calcium	EPA 200.7	MTL3	04/02/98
Carbon, Total Organic (Toc)	SM 5310C	MISC1	04/02/98
Chemical Oxygen Demand	EPA 410.4	DEM3	12/23/97
Chemical Oxygen Demand	SM 5220D	DEM3	10/27/03
Chloride	EPA 300.0	NIIIA1	04/02/98

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Tuesday, February 12 2013

AZ License: **AZ0778** **Lab Name: Eurofins Eaton Analytical, Inc.**

Program **WW**

Parameter	EPA Method	Billing Code	Cert Date
Chlorine Residual Total	SM 4500-CL G	NIA2	04/02/98
Chlorine Total Residual	HACH 8167	NIA2	10/23/08
Chlorine, Free	HACH 8021	NIA2	10/23/08
Chromium Total	EPA 200.7	MTL3	04/02/98
Chromium Total	EPA 200.8	MTL1	04/02/98
Chromium, Hexavalent	EPA 218.6, R 3.3	MTL1	11/20/07
Chromium, Hexavalent	SM 3500-CR D	MTL8	02/07/98
Cobalt	EPA 200.7	MTL3	04/02/98
Cobalt	EPA 200.8	MTL1	04/02/98
Color	SM 2120B	NIA4	07/20/97
Copper	EPA 200.7	MTL3	04/02/98
Copper	EPA 200.8	MTL1	04/02/98
Cyanide Amenable To Chlorination	SM 4500-CN G	MISC2	10/16/07
Cyanide, Total	EPA 335.4	MISC2	10/16/07
Cyanide, Total	SM 4500CN-F	MISC2	10/16/07
Fluoride	EPA 300.0	NIIIA1	10/20/09
Fluoride	SM 4500-F B	NIB3	12/23/97
Fluoride	SM 4500-F C	NIB3	12/23/97
Gross Alpha	EPA 900	RADIO	10/18/99
Gross Beta	EPA 900	RADIO	10/18/99
Hardness	EPA 200.7	MTL3	10/23/08
Hardness	SM 2340B	MTL8	04/02/98
Hydrogen Ion (Ph)	SM 4500-H B	NIA2	03/10/98
Iron	EPA 200.7	MTL3	04/02/98
Kjeldahl Nitrogen	EPA 351.2	NIIB4	11/30/97
Lead	EPA 200.8	MTL1	04/02/98
Magnesium	EPA 200.7	MTL3	04/02/98
Manganese	EPA 200.7	MTL3	04/02/98
Manganese	EPA 200.8	MTL1	04/02/98
Mercury	EPA 245.1	MTL5	04/02/98
Molybdenum	EPA 200.7	MTL3	04/02/98
Molybdenum	EPA 200.8	MTL1	04/02/98
Nickel	EPA 200.7	MTL3	04/02/98
Nickel	EPA 200.8	MTL1	04/02/98
Nitrate	EPA 300.0	NIIIA1	04/02/98
Nitrate-Nitrite (As N)	EPA 353.2	NIB1	12/23/97
Nitrite	EPA 353.2	NIIB4	10/16/07
Nitrite (As N)	EPA 300.0	NIIIA1	04/02/98
Orthophosphate	EPA 365.1	NIIB4	03/20/08
Orthophosphate	HACH 8048	NIIB1	12/05/06
Orthophosphate	SM 4500-P E	NIIB4	11/20/07

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Program **WW**

Parameter	EPA Method	Billing Code	Cert Date
Orthophosphate	SM 4500-P F	NIIB4	03/20/08
Oxygen, Dissolved	SM 4500-O G	NIA12	10/25/04
Phenols	EPA 420.1	MISC5	12/11/02
Phosphorus, Total	EPA 365.1	NIIB4	04/26/99
Phosphorus, Total	SM 4500-P E	NIIB4	10/25/04
Phosphorus, Total	SM 4500-P F	NIIB4	01/16/99
Potassium	EPA 200.7	MTL3	04/02/98
Purgeables	EPA 624	OC8	05/09/94
Residue Nonfilterable	SM 2540D	NIIA1	11/30/97
Residue Total	SM 2540B	NIIA1	12/05/06
Residue Volatile	EPA 160.4	NIIA1	10/27/03
Residue, Filterable	SM 2540C	NIA2	12/23/97
Residue, Settleable Solids	SM 2540F	NIIA1	12/11/02
Selenium	EPA 200.8	MTL1	04/02/98
Semivolatile Organic By Gc/Ms	EPA 1625B	OC8	11/06/01
Silica, Dissolved	EPA 200.7	MTL3	09/02/03
Silica, Dissolved	SM 4500-SI D	MISC2	11/08/02
Silica, Dissolved	SM 4500-SIO2C	MISC2	10/23/08
Silver	EPA 200.7	MTL3	04/02/98
Silver	EPA 200.8	MTL1	04/02/98
Sodium	EPA 200.7	MTL3	04/02/98
Specific Conductance	EPA 120.1	NIA2	12/11/02
Specific Conductance	SM 2510B	NIA2	12/23/97
Strontium	EPA 200.7	MTL3	11/17/95
Sulfate	EPA 300.0	NIIIA1	04/02/98
Sulfide	SM 4500-S D	MISC2	12/05/06
Surfactants (Mbas)	SM 5540C	NIIA1	07/10/99
Thallium	EPA 200.7	MTL3	04/02/98
Thallium	EPA 200.8	MTL1	04/02/98
Tin	EPA 200.7	MTL3	10/18/99
Tin	EPA 200.8	MTL1	10/23/08
Titanium	EPA 200.7	MTL3	10/23/08
Titanium	EPA 200.8	MTL1	10/23/08
Total Coliforms By Mtf	SM 9221B	MIC1	04/02/98
Turbidity, Ntu	EPA 180.1	NIA2	02/08/98
Turbidity, Ntu	SM 2130B	NIA2	02/08/98
Vanadium	EPA 200.7	MTL3	04/02/98
Vanadium	EPA 200.8	MTL1	04/02/98
Zinc	EPA 200.7	MTL3	04/02/98
Zinc	EPA 200.8	MTL1	04/02/98

[illegible]

Instruments	Quantity	Status
[illegible]	[illegible]	[illegible]
GAS CHROMATOGRAPH/MASS SPECTROMETER	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
MERCURY ANALYZER	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Software

[illegible]

[illegible]

PERKIN ELMER [illegible]

[illegible]

[illegible]

VARIAN MS WORKSTATION - GC/MS

[illegible]

FID / ECD

[illegible]

[illegible]

[illegible]

[illegible]

Arizona
Department of
Health Services

ENVIRONMENTAL LABORATORY LICENSE

Issued to:

Laboratory Director: **Ed Wilson**
Owner/Representative: **Ed Wilson**

Eurofins Eaton Analytical, Inc.
AZ0778

is in compliance with Environmental Laboratory's applicable standards for the State of Arizona and maintains on file a List of Parameters for which the laboratory is certified to perform analysis.

PERIOD OF LICENSURE FROM: 12/15/2012 TO: 12/14/2013

GREAT SEAL OF THE STATE OF ARIZONA 1912

Steven D. Baker, Chief
Office of Laboratory Licensure & Certification
Bureau of State Laboratory Services

APPENDIX II

Glossary
EEA Vendor List

Appendix II: Glossary

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents.

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents.

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator.

Analyst: The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation).

Audit: A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives.

Batch: Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one (1) to twenty (20) environmental samples of the same quality systems matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be twenty-four (24) hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed twenty (20) samples.

Bias: The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.

Calibration: A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards.

Calibration Blank (CB): A volume of reagent water fortified with the same matrix as the calibration standards, but without the analytes, internal standards, or surrogates analytes.

Calibration Curve: The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response.

Calibration Standard (CAL): A solution prepared from the primary dilution standard solution and stock standard solutions of the internal standards and surrogate analytes. The CAL solutions are used to calibrate the instrument response with respect to analyte concentration.

Chain of Custody Form: Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses. See also Legal Chain of Custody Protocols.

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to: Second column confirmation, Alternate wavelength, Derivatization, Mass spectral interpretation, Alternative detectors, or Additional cleanup procedures.

Data Reduction: The process of transforming the number of data items by arithmetic or statistical calculation, standard curves, and concentration factors, and collating them into a more useful form.

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision.

Dissolved Analyte: The concentration of analyte in an aqueous sample that will pass through a 0.45 µm membrane filter assembly prior to sample acidification (Section 11.1).

Dissolved Phosphorus (P-D): All of the phosphorus present in the filtrate of a sample filtered through a phosphorus-free filter of 0.45 micron pore size and measured by the persulfate digestion procedure.

Dissolved Orthophosphate (P-D ortho): As measured by the direct colorimetric analysis procedure.

Dissolved Hydrolyzable Phosphorus (P-D, hydro): As measured by the sulfuric acid hydrolysis procedure and minus predetermined dissolved orthophosphates.

Dissolved Organic Phosphorus (P-D, org): As measured by the persulfate digestion procedure, and minus dissolved hydrolysable phosphorus and orthophosphate

Estimated Detection Limit (EDL): Defined as either the MDL or a level of compound in a sample yielding a peak in the final extract with a signal to noise (S/N) ratio of approximately five, whichever is greater.

External Standard (ES): A pure analyte(s) that is measured in an experiment separate from the experiment used to measure the analyte(s) in the sample. The signal observed for a known quantity of the pure external standard(s) is used to calibrate the instrument response for the corresponding analyte(s). The instrument response is used to calculate the concentrations of the analyte(s) in the sample.

Field Duplicates (FD1 and FD2): Two separate samples collected at the same time and place under identical circumstances and treated exactly the same throughout field and laboratory procedures. Analyses of FD1 and FD2 give a measure of the precision associated with sample collection, preservation and storage, as well as with laboratory procedures. Since laboratory duplicates cannot be analyzed, the collection and analysis of field duplicates for this method is critical.

Field Reagent Blank (FRB): An aliquot of reagent water or other blank matrix that is placed in a sample container in the laboratory and treated as a sample in all respects, including shipment to the sampling site, exposure to sampling site conditions, storage, preservation, and all analytical procedures. The purpose of the FRB is to determine if method analytes or other interferences are present in the field environment.

Finding: An assessment conclusion referenced to a laboratory accreditation standard and supported by objective evidence that identifies a deviation from a laboratory accreditation standard requirement.

Holding Times: The maximum time that can elapse between two (2) specified activities.

Instrument Performance Check Solution (IPC): A solution of one or more method analytes surrogates, internal standards, or other test substances used to evaluate the performance of the instrument system with respect to a defined set of criteria.

Instrument Detection Limit (IDL): The concentration equivalent to the analyte signal which is equal to three times the standard deviation of a series of 10 replicate measurements of the calibration blank signal at the same wavelength (Table 1.)

Internal Standard: Pure analyte(s) added to a sample, extract, or standard solution in known amount(s) and used to measure the relative responses of other method analytes that are components of the same sample or solution, and as a reference for evaluating and controlling the precision and bias of the applied analytical method. The internal standard must be an analyte that is not a sample component.

Laboratory Reagent Blank (LRB): An aliquot of reagent water or other blank matrices that are treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents, internal standards, and surrogates that are used with other samples. The LRB is used to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or the apparatus.

Linear Calibration Range (LCR): The concentration range over which the instrument response is linear.

Laboratory Duplicates (LD1 and LD2): Two aliquots of the same sample taken in the laboratory and analyzed separately with identical procedures. Analyses of LD1 and LD2 indicates precision associated with laboratory procedures, but not with sample collection, preservation, or storage procedures.

Laboratory Fortified Blank (LFB): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes and taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

Laboratory Fortified Sample Matrix (LFM): An aliquot of an environmental sample to which known quantities of the method analytes are added in the laboratory. The LFM is analyzed exactly like a sample, and its purpose is to determine whether the sample matrix contributes bias to the analytical results. The background concentrations of the analytes in the sample matrix must be determined in a separate aliquot and the measured values in the LFM corrected for background concentrations.

Linear Dynamic Range (LDR): The concentration range over which the instrument response to an analyte is linear.

Laboratory Performance Check Solution (LPC): A solution of selected method analytes, surrogate(s), internal standard(s), or other test substances used to evaluate the performance of the instrument system with respect to a defined set of method criteria.

Limit of Detection (LOD): The estimated minimum amount of analyte in a given matrix that an analytical process can reliably detect, but not necessarily quantitated as an exact value. The LOD may be expressed as:

$$LOD = 3.3 * SD / S$$

where:
SD = the standard deviation of the response
S = the slope of the calibration curve

Limit of Quantitation (LOQ): Also known as Minimum Reporting Level (MRL). The minimum levels, concentrations, or quantities of an analyte that can be quantitatively determined with suitable precision and accuracy.

Linear Calibration Range (LCR): The concentration range over which the instrument response is linear.

Material Safety Data Sheet (MSDS): Written information provided by vendors concerning a chemical's toxicity, health hazards, physical properties, fire, and reactivity data including storage, spill, and handling precautions.

Method Detection Limit (MDL): The minimum concentration of an analyte that can be identified, measured, and reported with 99% confidence that the analyte concentration is greater than zero (Section 9.2.4 and Table 4.). Procedural Standard Calibration - A calibration method where aqueous calibration standards are prepared and processed (e.g., purged, extracted, and/or derivatized) in exactly the same manner as a sample. All steps in the process from addition of sampling preservatives through instrumental analyses are included in the calibration. Using procedural standard calibration compensates for any inefficiencies in the processing procedure.

Matrix: The substrate of a test sample.

Matrix Duplicate: A replicate matrix prepared in the laboratory and analyzed to obtain a measure of precision.

Matrix Spike : A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method: A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Minimum Reporting Level (MRL): Also known as Limit of Quantitation (LOQ). The lowest amount of analyte in a sample that can be quantitatively determined with suitable precision and accuracy.

National Institute of Standards and Technology (NIST): A federal agency of the US Department of Commerce's Technology Administration that is designed as the United States national metrology institute (NMI).

Plasma Solution: A solution that is used to determine the optimum height above the work coil for viewing the plasma (Sections 7.15 and 10.2.3).

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.

Preservation: Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis.

Primary Calibration Standard (PCAL): A suspension prepared from the primary dilution stock standard suspension. The PCAL suspensions are used to calibrate the instrument response with respect to analyte concentration.

Primary Dilution Standard Solution (PDS): A solution of several analytes prepared in the laboratory from stock standard solutions and diluted as needed to prepare calibration solutions and other needed analyte solutions. The following forms, when sufficient amounts of phosphorus are present in the sample to warrant such consideration, may be calculated:

Insoluble Phosphorus (P-I) = (P) - (P-D).

Insoluble Orthophosphate (P-I, ortho) = (P, ortho) - (P-D, ortho).

Insoluble Hydrolyzable Phosphorus (P-I, hydro) = (P, hydro) - (P-D, hydro).

Insoluble Organic Phosphorus (P-I, org) = (P, org) - (P-D, org).

All phosphorus forms shall be reported as P, mg/L, to the third place.

Pro-forma: Forms

Procedural Standard Calibration: A calibration method where aqueous calibration standards are prepared and processed (e.g., purged, extracted, and/or derivatized) in exactly the same

manner as a sample. All steps in the process from addition of sampling preservatives through instrumental analyses are included in the calibration. Using procedural standard calibration compensates for any inefficiency in the processing procedure.
Procedure: A specified way to carry out an activity or process. Procedures can be documented or not.

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories.

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within the specified acceptance criteria.

Protocol: A detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) which must be strictly followed.

Quality Assurance: An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.

Quality Control: The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring that the results are of acceptable quality.

Quality Control Sample (QCS): A solution of method analytes of known concentrations which is used to fortify an aliquot of LRB or sample matrix. The QCS is obtained from a source external to the laboratory and different from the source of calibration standards. It is used to check either laboratory or instrument performance.

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance (QA) and quality control (QC) activities.

Raw Data: The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records.

Reference Material: Material or substance one or more of whose property values are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Reference Standard: Standard used for the calibration of working measurement standards in a given organization or at a given location.

Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.

Secondary Calibration Standards (SCAL): Commercially prepared, stabilized sealed liquid or gel turbidity standards calibrated against properly prepared and diluted formazin or styrene divinylbenzene polymers.

Selectivity: The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system.

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest.

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies.

Standard Operating Procedures (SOPs): A written document that details the method for an operation, analysis, or action, with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks.

Stock Standard Suspension (SSS): A concentrated suspension containing the analyte prepared in the laboratory using assayed reference materials or purchased from a reputable commercial source. Stock standard suspension is used to prepare calibration suspensions and other needed suspensions.

Solid Sample: For the purpose of this method, a sample taken from material classified as either soil, sediment or sludge.

Spectral Interference Check (SIC) Solution: A solution of selected method analytes of higher concentrations, which is used to evaluate the procedural routine for correcting known interelement spectral interferences with respect to a defined set of method criteria.

Standard Addition: The addition of a known amount of analyte to the sample in order to determine the relative response of the detector to an analyte within the sample matrix. The relative response is then used to assess either an operative matrix effect or the sample analyte concentration.

Stock Standard Solution (SSS): A concentrated solution containing one or more method analytes prepared in the laboratory using assayed reference materials or purchased from a reputable commercial source

Surrogate Analyte (SA): A pure analyte(s), which is extremely unlikely to be found in any sample, and which is added to a sample aliquot in known amount(s) before extraction or other processing and is measured with the same procedures used to measure other sample components. The purpose of the SA is to monitor method performance with each sample.

Technology: A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Total Recoverable Analyte: The concentration of analyte determined either by "direct analysis" of an unfiltered acid preserved drinking water sample with turbidity of <1 NTU , or by analysis of the solution extract of a solid sample or an unfiltered aqueous sample following digestion by refluxing with hot dilute mineral acid(s) as specified in the method.

Total Phosphorus (P): All of the phosphorus present in the sample regardless of forms, as measured by the persulfate digestion procedure.

Total Orthophosphate (P-ortho): Inorganic phosphorus [(PO)] in the 4 -3 sample as measured by the direct colorimetric analysis procedure.

Total Hydrolyzable Phosphorus (P-hydro): Phosphorus in the sample as measured by the sulfuric acid hydrolysis procedure and minus predetermined orthophosphates. This hydrolyzable phosphorus includes polyphosphates [(P O) , (P O) , etc.] plus some organic 2 7 3 10-4 –5 phosphorus.

Total Organic Phosphorus (P-org): Phosphorus (inorganic plus oxidizable organic) in the sample as measured by the persulfate digestion procedure, and minus hydrolyzable phosphorus and orthophosphate.

Traceability: The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project.

Tuning Solution: A solution which is used to determine acceptable instrument performance prior to calibration and sample analyses.

Water Sample: For the purpose of this method, a sample taken from one of the following sources: drinking, surface, ground, storm runoff, industrial or domestic wastewater.

Verification: Confirmation by examination and objective evidence that specified requirements have been met.

Appendix II: EEA's Vendor List

Supplier	Address	Used by	Intended Use
Abraxis	54 Steamwhistle Dr Warminster, PA 18974	Microbiology	Cylindrospermopsin, Saxitoxin Supplies
Absolute Standards, Inc.	P. O. Box 5585 Hamden, Ct. 06518-0585	GCMS Lab, Inorganic Lab, HPLC/LCMS Lab	Standards
AccuStandard	125 Market Street New Haven, Ct. 06513	GCMS Lab, GC. HPLC/LCMS Lab	Standards
AF Murphy Die & Machine Co.	430 Hancock St Quincy, MA 02171	Inorganic Lab	Radiochemistry Planchetts
Agilent Technologies	Chemical Analysis Group 2850 Centerville Rd. Wilmington, De. 19808	GCMS Lab, GC Lab	Supplies, instrument maintenance, repair, technical support
Altech Associates, Inc.	P.O. Box 23 Deerfield, IL 60015	Inorganic Lab	Chemicals
American Type Culture Collection	12301 Parklawn Lane Rockville, Me. 20852	Microbiology Lab	Bacterial Controls
Anchem Scientific	104 Marty Dr. Suite 3 Buffalo, MN 55313	Inorganic Lab	
Beckman Instruments, Inc.	2500 Harbor Blvd., E-20-D Fullerton, Ca. 92634	Inorganic Lab	Instrument maintenance, repair, technical support
Biomerieux Industry	595 Anglum Rd Hazelwood, MO 63042	Microbiology Lab	BactID Supplies
Canberra Industries, Inc.	800 Research Parkway Meriden, Connecticut 06450	Radiochemistry Lab	Gamma Spectrometer Instrument Tech Support
Chem Service, Inc.	660 Tower Lane P. O. Box 310 West Chester, Pa. 19380	GC Lab	Reagents, supplies
Cole Parmer Instrument Co.	Dept CH 10464 Palatine, IL 60055	Inorganic Lab	Supplies
Cosa Instruments Corporation	84G Horseblock Road Yaphank, NY 11980	Inorganic Lab	Supplies
CPI International	P. O. Box 1290 Suisun City, Ca. 94585-1290	Inorganic Lab	Standards, Reagents
Crescent Chemical Co., Inc.	1324 Motor Parkway Hauppauge, NY 11788	Inorganic Lab	Standards, Reagents
Dionex Corporation	1228 Titan Way Sunnyvale, Ca. 94088-3603	Inorganic Lab, HPLC Lab, GC	Instrument maintenance, repair, technical support

Appendix II: EEA's Vendor List

Supplier	Address	Used by	Intended Use
Envirologix	500 Riverside Industrial Parkway Portland, Maine 04103-1486	Microbiology	Asbestos Supplies
Environmental Express LTD	490 Wando Park Blvd. P. O. Box 669 Mt. Pleasant, SC. 29464	Inorganic Lab	Standards, reagents, supplies
Environmental Resource Associates	6000 West 54th Avenue Arvada, CO 80002	Inorganic Lab	Standards
Fisher Scientific	Dept. LA21160 Pasadena, CA 91185	Inorganic Lab	Chemicals, Supplies
Full Spectrum Analytics, Inc.	5635 West Las Positas Blvd. #403 Pleasanton, Ca. 94588	GCMS Lab, GC Lab, Inorganic Lab	Instrument maintenance, repair, technical support
GE Analytical	13256 Collections Center Dr. Chicago, IL 60693	Inorganic Lab (TOC Instrument)	
GI Plastek	5 Wickers Drive Wolfeboro, NH 03894-4323	Radiochemistry Lab	Ra228 discs and plates
Glass Expansion Inc.	4 Barlows Landing, Unit #2 Pocasset, MA 02559	Inorganic Lab	Supplies
Greenwater Labs	205 Zeagler Drive Suite 302 Palatka, FL 32177	Microbiology	Toxin Standards
Hach Company	P. O. Box 389 Denver, Co. 80539	GC Lab, Inorganic Lab	Reagents, supplies
High Purity Standards	P.O. Box 41727 Charleston, SC 29423	Inorganic Lab	Standards
IDEXX Distribution Corporation	6100 E. Shellby Dr. Memphis, Tn. 38141-7602	Microbiology Lab	Microbiological media
Inorganic Ventures	195 Lehigh Ave. Ste 4 Lakewood, NJ 08701	Inorganic Lab	Supplies, Standards
Isotope Products Laboratories	1800 North Keystone Street Burbank, Ca. 91504	Inorganic Lab	Standards
Lab Safety Supply - WI	P.I. Box 5004 Janesville, WI 53547	Inorganic Lab, Health and Safety Department	Safety equipment
Lachat Instruments	5566 Collections Center Dr Chicago, IL 60693	Inorganic Lab	Supplies
Man-Tech Associates Inc.	600 Main St. Tonawanda, NY 14150	Inorganic Lab	Supplies
McBain Instruments	9601 Variel Ave. Chatsworth, Ca. 91311-4914	Microbiology Lab	Instrument maintenance, repair

Appendix II: EEA's Vendor List

Supplier	Address	Used by	Intended Use
Metrohm USA	6555 Pelican Creek Circle Riverview FL, 33578	Inorganic Lab	IC instrument
Miele Professional	9 Independence Way Princeton, NJ 08540	Dishwashing	Supplies
NSI Solutions	7212 ACC Blvd Raleigh NC, 27617	Inorganic Lab	Standards
National Research Council Canada	1200 Montreal Rd M-58 Ottawa, Ontario KIA 0R6 Canada	Inorganic Lab	CRMs
OI Analytical	P. O. Box 9010 151 Graham Road College Station, Tx. 77842-0440	GCMS Lab	Instrument maintenance, repair, technical support, supplies, chemicals
Perkin Elmer	761 Main Ave. Norwalk, Ct. 06859-0001	Inorganic Lab	Instrument maintenance, repair, technical support
Phenomenex	411 Madrid Avenue Torrance, CA 90501	HPLC/LCMS Lab	Supplies
Pickering Laboratories, Inc	1280 Space Park Way Mountain View, CA 94043	HPLC/LCMS Lab	Instrument supplies
Precision Glassblowing	14775 E. Hinsdale Ave. Centennial, CO 80112	Inorganic Lab, Microbiology	Supplies
Protean Instrument Corporation	P. O. Box 1008 260 Grand Street Lenoir City, Tn. 37771-1008	Inorganic Lab	Instrument maintenance, repair, technical support
Protocol Analytical Supplies, Inc.	472 Lincoln Blvd. Middlesex, NJ 08846	GCMS Lab	Standards
Restek Corporation	Penn Eagle Industrial Park 110 Benner Circle Bellefonte, Pa. 16823-8812	GC Lab, HPLC Lab, GCMS Lab	Reagents, supplies
Scientific Instrument, SIS	1027 Old York Road Ringoes, NJ 08551-1039	GCMS Lab	Supplies
SCP Science	348 Route 11 Champlain, NY 12919	Inorganic Lab	Standards, Supplies
SEAL Analytical, Inc	1492 Mequon Road Mequon, WI 53092	Inorganic Lab	Supplies
Sigma_Aldrich, Inc.	P. O. Box 952968 St. Louis, Mo. 63195-2968	Inorganic Lab, GCMS Lab, GC	Standards, Reagents, supplies

Appendix II: EEA's Vendor List

Supplier	Address	Used by	Intended Use
Spectrum Laboratories, Inc. dba	755 Jersey Ave. New Brunswick, NJ 08901	Inorganic Lab	Supplies
STS, Inc	541N Main St. 104-353 Corona, CA 92880	Microbiology	Autoclave Maintenance and Supplies
Ted Pella	4595 Mountain Lakes Blvd Redding, CA 96003-1448	Microbiology	Asbestos Supplies
Tekmar Company	7143 East Kemper Road Cincinnnati, Oh. 45249	GCMS Lab	Instrument maintenance, repair, technical support, supplies, chemicals
T.G. Scientific Glass	23041 La Cadena Dr. Laguna Hills, CA 92653	GCMS Lab	Supplies
Davis Inotek	5730 Ayala Ave. Irwindale, Ca. 91703	Quality Assurance Department	Calibration of reference thermometers
Thermo Optek Corporation	Service Operations Drawer CS 100623 Atlanta, Ga. 30384-0623	Inorganic Lab, GCMS Lab	Instrument maintenance, repair, technical support
Ultra Scientific	250 Smith Street North Kingstown, RI 02852-7723	Inorganic Lab, GCMS Lab, GC Lab, HPLC Lab, QA Department	Standards, supplies, reagents
Varian	Chromatography Systems 2700 Mitchell Drive Walnut Creek, Ca. 94598	GC Lab, GCMS Lab	Instrument maintenance, repair, technical support, supplies, chemicals
VWR Scientific Products Corporation*	P. O. Box 640169 Pittsburgh, Pa. 15264-0169	Inorganic Lab, GCMS Lab, GC Lab, QA Department, Microbiology, HPLC/LCMS Lab	Standards, reagents, supplies, standard thermometers
Waters Corporation	34 Maple Street Milford, MA 01757	HPLC/LCMS Lab	Instrument Supplies
Watson Brothers, Inc.	1235 South Victory Blvd. Burbank, Ca. 91502	Quality Assurance Department	Maintenance and calibration of the laboratory's balances and S class weights
WestAir Gases and Equipment		All Labs	Reagents, Supplies

*VWR supplies EEA with reagents, standards and supplies from many companies, including but not limited to the following:
JT Baker, Mallinckrodt, Difco, Becton Dickinson, Ricca, Gelman, J & W Scientific, Ultra Scientific, EM Science

Supplier	**Address**	**Used by**	**Intended Use**
Post Security		Facilities Management	Fire alarm panel maintenance
Iron Mountain	P.O. Box 65017 Charlotte, NC 28265-0017	All Departments	Archiving and off-site data storage
MOE Plumbing		Facilities Management	Building maintenance
Post Alarm		Facilities Management	Building security, escorts
Viking Refrigeration	1770 East Cypress Covina, CA 91724	Facilities Management	Refrigerator maintenance
DuraCold	1551 S. Primrose Lane Monrovia, CA 91016	Facilities Management, Sample Control Department	Walk-in coolers, storage refrigerator maintenance
Westway Electrical Systems		Facilities Management	Building maintenance

QUALITY ASSURANCE MANUAL

Quality Assurance/Quality Control Policies and Procedures

Pace Analytical Services – Pittsburgh

1638 Roseytown Road, Suites 2,3 and 4, Greensburg, Pennsylvania 15601

Phone: 724-850-5600

CORPORATE APPROVAL

Steve A. Vanderboom
President/CEO
1800 Elm Street, Suite 200
Minneapolis, MN 55414 (612) 607-1700

Date 9-9-13

Richard M. Henson
Corporate Director of Quality
1800 Elm Street, Suite 200
Minneapolis, MN 55414 (612) 607-1700

Date 09/09/2013

LOCAL APPROVAL

Laboratory General Manager
724-850-5600

09/09/13
Date

Laboratory Senior Quality Manager
724-850-5630

09/09/13
Date

Effective Date is the date of the last signature.

Administrative Business Manager
(724)-850-5600

09/09/13
Date

Client Services Manager
(724)-850-5600

09/09/13
Date

Additional Signatures:

Signature	Title	Date
	Semivolatile Supervisor	09/09/13
	Inorganic Manager	09/09/13
	Volatile Supervisor	09/09/13
	Radiochemistry Manager	09/09/13

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1.0. INTRODUCTION AND ORGANIZATIONAL STRUCTURE

"Working together to protect our environment and improve our health"
Pace Analytical Services Inc. - Mission Statement

1.1. Introduction to PASI

1.1.1. Pace Analytical Services, Inc. (PASI) is a privately held, full-service analytical testing firm operating a nationwide system of laboratories. PASI offers extensive services beyond standard analytical testing, including: bioassay for aquatic toxicity, air toxics, industrial hygiene testing, explosives, dioxins and coplanar PCB's by high resolution mass spectroscopy , radiochemical analyses, product testing, pharmaceutical testing, field services and mobile laboratory capabilities. PASI has implemented a consistent Quality System in each of its laboratories and service centers. In addition, the company utilizes an advanced data management system that is highly efficient and allows for flexible data reporting. Together, these systems ensure data reliability and superior on-time performance. This document defines the Quality System and QA/QC protocols.

1.1.2. Our goal is to combine our expertise in laboratory operations with customized solutions to meet the specific needs of our customers.

1.2. Statement of Purpose

1.2.1. To meet the business needs of our customers for high quality, cost-effective analytical measurements and services.

1.3. Quality Policy Statement and Goals of the Quality System

1.3.1. PASI management is committed to maintaining the highest possible standard of service for our customers by following a documented quality system. The overall objective of this quality system is to provide reliable data of known quality through adherence to rigorous quality assurance policies and quality control procedures as documented in this Quality Assurance Manual.

1.3.2. All personnel within the PASI network are required to be familiar with all facets of the quality system relevant to their position and implement these policies and procedures in their daily work. This daily focus on quality is applied with initial project planning, continued through all field and laboratory activities, and is ultimately included in the final report generation.

1.3.3. PASI management demonstrates its commitment to quality by providing the resources, including facilities, equipment, and personnel to ensure the adherence to these documented policies and procedures and to promote the continuous improvement of the quality system. All PASI personnel must comply with all current applicable state, federal, and industry standards (e.g., TNI and DOD), and are required to perform all tests in accordance with stated methods and customer requirements. When required, personnel shall also comply with the requirements for NQA-1/10CFR50, Appendix B when performing safety related tests on materials used for nuclear facilities.

1.4. Core Values

1.4.1. Integrity- Pace personnel are required to abide by the PASI Code of Ethics and all Pace employees must go through Data Integrity/Ethics training upon initial orientation and as an annual refresher.

1.4.2. Value Employees- Pace management views employees as our most important asset and communicates to them the relevance and importance of their activities within their job functions and how they contribute to the achievement of the objectives of the quality management system.

1.4.3. Know Our Customers- Pace makes every effort to know our customers and address their sampling and analytical needs. More information on this item can be found in section 2.0.

1.4.4. Honor Commitments- Pace labs focus on making solid commitments with regards to quality, capacity, and agreed upon turnaround time to our customers.

1.4.5. Flexible Response To Demand- Pace labs are equipped with both the material and personnel resources to enable them to be responsive to the demands of customers when situations or projects need change.

1.4.6. Pur**sue Opportunities-** Pace is committed to pursuing opportunities for the growth of the company by constantly exploring markets and areas where we can expand.

1.4.7. **Continuously Improve-** Pace has committed much time and effort into establishing a continuous improvement program where company personnel meet on a regular basis to share ideas in cost reduction, production improvement and standardization in order to develop best practices. This information, as well as company financial and production metrics, are tracked, evaluated, and shared with each Pace facility.

1.5. Code of Ethics

1.5.1. PASI’s fundamental ethical principles are as follows:

1.5.1.1. Each PASI employee is responsible for the propriety and consequences of his or her actions;

1.5.1.2. Each PASI employee must conduct all aspects of Company business in an ethical and strictly legal manner, and must obey the laws of the United States and of all localities, states and nations where PASI does business or seeks to do business;

1.5.1.3. Each PASI employee must reflect the highest standards of honesty, integrity and fairness on behalf of the Company with customers, suppliers, the public, and one another.

1.5.1.4. Each PASI employee must recognize and understand that our daily activities in environmental laboratories affect public health as well as the environment and that environmental laboratory analysts are a critical part of the system society depends upon to improve and guard our natural resources:

1.5.2. Strict adherence by each PASI employee to this Code of Ethics and to the Standards of Conduct is essential to the continued vitality of PASI and to continue the pursuit of our common mission to protect our environment and improve our health.

1.5.3. Failure to comply with the Code of Ethics and Standards of Conduct will result in disciplinary action up to and including termination and referral for civil or criminal prosecution where appropriate. An employee will be notified of an infraction and given an opportunity to explain, as prescribed under current disciplinary procedures.

1.5.4. Any Pace employee can contact corporate management to report an ethical concern by calling the anonymous hotline at 612-607-6431.

1.6. Standards of Conduct

1.6.1. Data Integrity

1.6.1.1. The accuracy and integrity of the analytical results and its supporting documentation produced at PASI are the cornerstones of the company. Lack of data integrity is an assault on our most basic values putting PASI and its employees at grave financial and legal risk and will not be tolerated. Therefore, employees are to accurately prepare and maintain all technical records, scientific notebooks, calculations, and databases. Employees are prohibited from making false entries or misrepresentations of data for any reason.

1.6.1.2. Managerial staff must make every effort to ensure that personnel are free from any undue pressures that may affect the quality or integrity of their work including commercial, financial, over-scheduling, and working condition pressures.

1.6.2. Confidentiality

1.6.2.1. PASI employees must not use or disclose confidential or proprietary information except when in connection with their duties at PASI. This is effective over the course of employment and for an additional period of two years thereafter.

1.6.2.2. Confidential or proprietary information, belonging to either PASI and/or its customers, includes but is not limited to test results, trade secrets, research and development matters, procedures, methods, processes and standards, company-specific techniques and equipment, marketing and customer information, inventions, materials composition, etc.

1.6.3. Conflict of Interest

1.6.3.1. PASI employees must avoid situations that might involve a conflict of interest or could appear questionable to others. The employee must be careful in two general areas:

1.6.3.1.1. Participation in activities that conflict or appear to conflict with the employees' PASI responsibilities.

1.6.3.1.2. Offering or accepting anything that might influence the recipient or cause another person to believe that the recipient may be influenced to behave or in a different manner than he would normally. This includes bribes, gifts, kickbacks, or illegal payments.

1.6.3.2. Employees are not to engage in outside business or economic activity relating to a sale or purchase by the Company. Other problematic activities include service on the Board of Directors of a competing or supplier company, significant ownership in a competing or supplier company, employment for a competing or supplier company, or participation in any outside business during the employee's work hours.

1.6.4. **Compliance**

1.6.4.1. All employees are required to read, understand, and comply with the various components of the standards listed in this document. As confirmation that they understand their responsibility, each employee is required to sign an acknowledgment form annually that then becomes part of the employee's permanent record. Employees will be held accountable for complying with the Quality Systems as summarized in the Quality Assurance Manual.

1.7. Laboratory Organization

1.7.1. The PASI Corporate Office centralizes company-wide accounting, business development, financial management, human resources development, information systems, marketing, quality, safety, and training activities. PASI's Director of Quality is responsible for assisting the development, implementation and monitoring of quality programs for the company. See Attachment IIB for the Corporate Organizational structure.

1.7.2. Each laboratory within the system operates with local management, but all labs share common systems and receive support from the Corporate Office.

1.7.3. A Senior General Manager (SGM) oversees all laboratories and service centers in their assigned region. Each laboratory or facility in the company is then directly managed by an SGM, a General Manager (GM), an Assistant General Manager (AGM), or an Operations Manager (OM). Quality Managers (QM) or Senior Quality Managers (SQM) at each laboratory report directly to the highest level of local laboratory management, however named, that routinely makes day-to-day decisions regarding that facility's operations. The QMs and SQMs will also receive guidance and direction from the corporate Director of Quality.

1.7.4. The SGM, GM, AGM or OM, or equivalent functionality in each facility, bears the responsibility for the laboratory operations and serves as the final, local authority in all matters. In the absence of these managers, the SQM/QM serves as the next in command. He or she assumes the responsibilities of the manager, however named, until the manager is available to resume the duties of their position. In the absence of both the manager and the SQM/QM, management responsibility of the laboratory is passed to the Technical Director, provided such a position is identified, and then to the most senior department manager until the return of the lab manager or SQM/QM. The most senior department manager in charge may include the Client Services Manager or the Administrative Business Manager at the discretion of the SGM/GM/AGM/OM.

1.7.5. A Technical Director who is absent for a period of time exceeding 15 consecutive calendar days shall designate another full-time staff member meeting the qualifications of the technical director to temporarily perform this function. The laboratory SGM/GM/AGM/OM or SQM/QM has the authority to make this designation in the event the existing Technical Director is unable to do so. If this absence exceeds 35 consecutive calendar days, the primary accrediting authority shall be notified in writing.

1.7.5.1. The laboratory manager or SrQM/QM will assume the responsibilities of the Technical Director if there are no qualified personnel who can fulfill the position requirements.

1.7.6. The SQM/QM has the responsibility and authority to ensure the Quality System is implemented and followed at all times. In circumstances where a laboratory is not meeting the established level of quality or following the policies set forth in this Quality Assurance Manual, the SQM/QM has the authority to halt laboratory operations should he or she deem such an action necessary. The SQM/QM will immediately communicate the halting of operations to the SGM/GM/AGM/OM and keep them posted on the progress of corrective actions. In the event the SGM/GM/AGM/OM and the SQM/QM are not in agreement as to the need for the suspension, the Chief Operating Officer and Director of Quality will be called in to mediate the situation.

1.7.6.1. The SGM, GM, AGM or OM will assume the responsibilities of the QM/SQM in their absence. In the absence of both the lab manager and the SQM/QM, Quality System responsibility of the laboratory is passed to the Technical Director, provided such a position is identified, and then to the most senior department manager until the return of the lab manager or SQM/QM.

1.7.7. The technical staff of the laboratory is generally organized into the following functional groups:

- Organic Sample Preparation
- Wet Chemistry Analysis
- Metals Analysis
- Volatiles Analysis
- Semi-volatiles Analysis
- Radiochemical Analysis
- Microbiology

1.7.8. Appropriate support groups are present in each laboratory. The actual organizational structure for PASI Pittsburgh is listed in Attachment IIA. In the event of a change in SGM/GM/AGM/OM, SQM/QM, or any Technical Director, the laboratory will notify its accrediting authorities and revise the organizational chart in the Quality Assurance Manual (QAM) within 30 days. For changes in Department Managers or Supervisors or other laboratory personnel, no notifications will be sent to the laboratory's accrediting agencies; changes to the organizational chart will be updated during or prior to the annual review process. Changes or additions in these key personnel will also be noted by additional signatures on the QAM, as applicable. In any case, the QAM will remain in effect until the next scheduled revision.

1.8. Laboratory Job Descriptions

1.8.1. Senior General Manager

- Oversees all functions of all the operations within their designated region;
- Oversees the development of local GMs/AGMs/OMs within their designated region;

- Oversees and authorizes personnel development including staffing, recruiting, training, workload scheduling, employee retention and motivation;
- Oversees the preparation of budgets and staffing plans for all operations within their designated region;
- Ensures compliance with all applicable state, federal and industry standards;
- Works closely with Regional Sales Management.

1.8.2. **General Manager**

- Oversees all functions of their assigned operations;
- Authorizes personnel development including staffing, recruiting, training, workload scheduling, employee retention and motivation;
- Prepares budgets and staffing plans;
- Monitors the Quality Systems of the laboratory and advises the SQM/QM accordingly;
- Ensures compliance with all applicable state, federal and industry standards.

1.8.3. **Assistant General Manager / Operations Manager**

- In the absence of the SGM/GM, performs all duties as listed above for the SGM or GM;
- Oversees the daily production and quality activities of all departments;
- Manages all departments and works with staff to ensure department objectives are met;
- Works with all departments to ensure capacity and customer expectations are accurately understood and met;
- Works with SGM/GM to prepare appropriate budget and staffing plans for all departments;
- Responsible for prioritizing personnel and production activities within all departments;
- Performs formal and informal performance reviews of departmental staff.

1.8.4. **Senior Quality Manager**

- Provides quality oversight for multiple laboratories where there is not a local quality manager or for labs where there are multiple and separately distinct quality systems in the same facility;
- Responsible for implementing, maintaining and improving the quality system while functioning independently from laboratory operations. Reports directly to the highest level of local laboratory facility management, however named, that routinely makes day-to-day decisions regarding laboratory operations, but receives direction and assistance from the Corporate Director of Quality;
- Ensures that communication takes place at all levels within the lab regarding the effectiveness of the quality system and that all personnel understand their contributions to the quality system;
- Monitors Quality Assurance/Quality Control activities to ensure that the laboratory achieves established standards of quality (as set forth by the Corporate Quality office). The Quality Manager is responsible for reporting the lab's level of compliance to these standards to the Corporate Director of Quality on a quarterly basis;

- Maintains records of quality control data and evaluates data quality;
- Conducts periodic internal audits and coordinates external audits performed by regulatory agencies or customer representatives;
- Reviews and maintains records of proficiency testing results;
- Maintains the document control system;
- Assists in development and implementation of appropriate training programs;
- Provides technical support to laboratory operations regarding methodology and project QA/QC requirements;
- Maintains certifications from federal and state programs;
- Ensures compliance with all applicable state, federal and industry standards;
- Maintains the laboratory training records, including those in the Learning Management System (LMS), and evaluates the effectiveness of training;
- Monitors correctives actions;
- Maintains the currency of the Quality Manual.

1.8.5. Quality Manager

- Responsible for implementing, maintaining and improving the quality system while functioning independently from laboratory operations. Reports directly to the highest level of local laboratory facility management, however named, that routinely makes day-to-day decisions regarding laboratory operations, but receives direction and assistance from the Corporate Director of Quality. They may also report to a Senior Quality Manager within the same facility;
- Ensures that communication takes place at all levels within the lab regarding the effectiveness of the quality system and that all personnel understand their contributions to the quality system;
- Monitors Quality Assurance/Quality Control activities to ensure that the laboratory achieves established standards of quality (as set forth by the Corporate Quality office). The Quality Manager is responsible for reporting the lab's level of compliance to these standards to the Corporate Director of Quality on a quarterly basis;
- Maintains records of quality control data and evaluates data quality;
- Conducts periodic internal audits and coordinates external audits performed by regulatory agencies or customer representatives;
- Reviews and maintains records of proficiency testing results;
- Maintains the document control system;
- Assists in development and implementation of appropriate training programs;
- Provides technical support to laboratory operations regarding methodology and project QA/QC requirements;
- Maintains certifications from federal and state programs;
- Ensures compliance with all applicable state, federal and industry standards;
- Maintains the laboratory training records, including those in the Learning Management System (LMS), and evaluates the effectiveness of training;
- Monitors correctives actions;
- Maintains the currency of the Quality Manual.

1.8.6. Quality Analyst

- Assists the SQM/QM in the performance of quality department responsibilities as delegated by the SQM/QM;
- Assists in monitoring QA/QC data;
- Assists in internal audits;
- Assists in maintaining training records;
- Assists in maintaining the document control system.

1.8.7. Technical Director

- Monitors the standards of performance in quality assurance and quality control data;
- Monitors the validity of analyses performed and data generated;
- Reviews tenders, contracts and QAPPs to ensure the laboratory can meet the data quality objectives for any given project;
- Serves as the manager of the laboratory in the absence of the SGM/GM/AGM/OM and SQM/QM;
- Provides technical guidance in the review, development, and validation of new methodologies.

1.8.8. Administrative Business Manager

- Responsible for financial and administrative management for the entire facility;
- Provides input relative to tactical and strategic planning activities;
- Organizes financial information so that the facility is run as a fiscally responsible business;
- Works with staff to confirm that appropriate processes are put in place to track revenues and expenses;
- Provide ongoing financial information to the SGM/GM/AGM/OM and the management team so they can better manage their business;
- Utilizes historical information and trends to accurately forecast future financial positions;
- Works with management to ensure that key measurements are put in place to be utilized for trend analysis—this will include personnel and supply expenses, and key revenue and expense ratios;
- Works with SGM/GM/AGM/OM to develop accurate budget and track on an ongoing basis;
- Works with entire management team to submit complete and justified capital budget requests and to balance requests across departments;
- Works with project management team and administrative support staff to ensure timely and accurate invoicing.

1.8.9. Client Services Manager

- Oversees all the day to day activities of the Client Services Department which includes Project Management and, possibly, Sample Control;

- Responsible for staffing and all personnel management related issues for Client Services;
- Serves as the primary senior consultant to customers on all project related issues such as set up, initiation, execution and closure;
- Performs or is capable of performing all duties listed for that of Project Manager.

1.8.10. **Project Manager**

- Coordinates daily activities including taking orders, reporting data and analytical results;
- Serves as the primary technical and administrative liaison between customers and PASI;
- Communicates with operations staff to update and set project priorities;
- Provides results to customers in the requested format (verbal, hardcopy, electronic, etc.);
- Works with customers, laboratory staff, and other appropriate PASI staff to develop project statements of work or resolve problems of data quality;
- Responsible for solicitation of work requests, assisting with proposal preparation and project initiation with customers and maintain customer records;
- Mediation of project schedules and scope of work through communication with internal resources and management;
- Responsible for preparing routine and non-routine quotations, reports and technical papers;
- Interfaces between customers and management personnel to achieve customer satisfaction;
- Manages large-scale complex projects;
- Supervises less experienced project managers and provide guidance on management of complex projects;
- Arranges bottle orders and shipment of sample kits to customers;
- Verifies login information relative to project requirements and field sample Chains-of-Custody.

1.8.11. **Project Coordinator**

- Responsible for preparation of project specifications and provides technical/project support;
- Coordinates project needs with other department sections and assists with proposal preparation;
- Prepares routine proposals and invoicing;
- Responsible for scanning, copying, assembling and binding final reports;
- Other duties include filing, maintaining forms, process outgoing mail, maintaining training database and data entry.

1.8.12. **Department Manager/Supervisor**

- Oversees the day-to-day production and quality activities of their assigned department;

- Ensures that quality assurance and quality control criteria of analytical methods and projects are satisfied;
- Assesses data quality and takes corrective action when necessary;
- Approves and releases technical and data management reports;
- Ensures compliance with all applicable state, federal and industry standards.

1.8.13. **Group Supervisor/Leader**

- Trains analysts in laboratory operations and analytical procedures;
- Organizes and schedules analyses with consideration for sample holding times;
- Implements data verification procedures by assigning data verification duties to appropriate personnel;
- Evaluates instrument performance and supervises instrument calibration and preventive maintenance programs;
- Reports non-compliance situations to laboratory management including the SQM/QM.

1.8.14. **Laboratory Analyst**

- Performs detailed preparation and analysis of samples according to published methods and laboratory procedures;
- Processes and evaluates raw data obtained from preparation and analysis steps;
- Generates final results from raw data, performing primary review against method criteria;
- Monitors quality control data associated with analysis and preparation. This includes examination of raw data such as chromatograms as well as an inspection of reduced data, calibration curves, and laboratory notebooks;
- Reports data in LIMS, authorizing for release pending secondary approval;
- Conducts routine and non-routine maintenance of equipment as required;
- Performs or is capable of performing all duties associated with that of Laboratory Technician.

1.8.15. **Laboratory Technician**

- Prepares standards and reagents according to published methods or in house procedures;
- Performs preparation and analytical steps for basic laboratory methods;
- Works under the direction of a Laboratory Analyst on complex methodologies;
- Assists Laboratory Analysts on preparation, analytical or data reduction steps for complex methodologies;
- Monitors quality control data as required or directed. This includes examination of raw data such as chromatograms as well as an inspection of reduced data, calibration curves, and laboratory notebooks.

1.8.16. **Field Technician**

- Prepares and samples according to published methods, PASI Quality Assurance Manual and/or customer directed sampling objectives;
- Capable of the collection of representative environmental or process related air samples;
- Use computer software to compile, organize, create tables, create graphics and write test reports;
- Reviews project documentation for completeness, method compliance and contract fulfillment;
- Train less experienced environmental technicians and provide guidance on sampling and analysis;
- Responsible for project initiation and contact follow-up;
- Develop sampling plans and prepare test plan documents.

1.8.17. **Field Analyst**

- Analyzes field samples according to published methods, PASI Quality Assurance Manual and/or customer directed sampling objectives,
- Capable of the collection and analysis of representative environmental or process related air samples,
- Proficient in a variety of analytical tests; specifically on-site gas-phase organic and inorganic compounds by extractive fourier transform infrared spectroscopy (FTIR),
- Train less experienced staff and provide guidance on FTIR sampling and analysis,
- Assist in reporting tasks and project management responsibilities, and
- Perform back-up support for manager tasks such as reporting needs and customer concerns.

1.8.18. **Sample Management Personnel**

- Signs for incoming samples and verifies the data entered on the Chain of custody forms;
- Enters the sample information into the Laboratory Information Management System (LIMS) for tracking and reporting;
- Stages samples according to EPA requirements;
- Assists Project Managers and Coordinators in filling bottle orders and sample shipments.

1.8.19. **Systems Administrator or Systems Manager**

- Assists with the creation and maintenance of electronic data deliverables (EDDs);
- Coordinates the installation and use of all hardware, software and operating systems;
- Performs troubleshooting on all aforementioned systems;
- Trains new and existing users on systems and system upgrades;
- Maintains all system security passwords;
- Maintains the electronic backups of all computer systems.

1.8.20. Radiation Safety/Chemical Hygiene Officer

- Maintains the laboratory Radiation Safety Manual;
- Maintains the laboratory Chemical Hygiene Plan;
- Plans and implements safety policies and procedures;
- Maintains safety records;
- Organizes and/or performs safety training;
- Performs safety inspections and provides corrective/preventative actions;
- Assists personnel with safety issues.

1.8.21. Program Director/Hazardous Waste Coordinator (or otherwise named)

- Evaluates waste streams and helps to select appropriate waste transportation and disposal companies;
- Maintains complete records of waste disposal including waste manifests and state reports;
- Assists in training personnel on waste-related issues such as waste handling and storage, waste container labeling, proper satellite accumulation, secondary containment, etc.;
- Conducts a weekly inspection of the waste storage areas of the laboratory.

1.9. Training and Orientation

1.9.1. Training for Pace employees is managed through a web-based Learning Management System. After a new employee has been instructed in matters of human resources, they are given instructional materials for the LMS and a password for access.

1.9.2. A new hire training checklist is provided to the new employee that lists training items for the employee to work through either independently on LMS or with their supervisor or trainer. The training items that can be completed independently include:

- Reading through applicable Standard Operating Procedures;
- Reviewing the Quality Manual and Chemical Hygiene Plan;
- Core training modules such as quality control indicators, basic laboratory skills, etc.;
- Quality Systems training including traceability of measurements, method calibration, calibration verification, accuracy, precision and uncertainty of measurements, corrective actions, documentation, and root cause analysis;
- Data Integrity/Ethics training.

1.9.3. The new employee's Department Supervisor provides the employee with a basic understanding of the role of the laboratory within the structure of PASI and the basic elements of that individual's position. Supervised training uses the following techniques:

- Hands-on training
- Training checklists/worksheets
- Lectures and training sessions
- Method-specific training

- Conferences and seminars
- Short courses
- Specialized training by instrument manufacturers
- Proficiency testing programs.
- On-line courses

1.9.4. Group Supervisors/Leaders are responsible for providing documentation of training and proficiency for each employee under their supervision. The employee's training file indicates what procedures an analyst or a technician is capable of performing, either independently or with supervision. The files also include documentation of continuing capability, which are fully detailed in Section 3.4. Training documentation files for each person are maintained by the Quality Office either in hardcopy format or within the LMS.

1.9.5. All procedures and training records are maintained and available for review during laboratory audits. These procedures are reviewed/updated periodically by laboratory management. Additional information can be found in SOP S-ALL-Q-020 **Training and Employee Orientation** or its equivalent revision or replacement.

1.10. Data Integrity System

1.10.1. The data integrity system at PASI provides assurances to management that a highly ethical approach is being applied to all planning, training and implementation of methods. Data integrity is crucial to the success of our company and Pace Analytical is committed to creating and maintaining a culture of quality throughout the organization. To accomplish this goal, PASI has implemented a data integrity system that encompasses the following four requirements:

1.10.1.1. A data integrity training program: standardized training is given to each new employee and a yearly refresher is presented to all employees. Key topics addressed by this training include:

1.10.1.1.1. Need for honesty and transparency in analytical reporting

1.10.1.1.2. Process for reporting data integrity issues

1.10.1.1.3. Specific examples of unethical behavior and improper practices

1.10.1.1.4. Documentation of non-conforming data that is still useful to the data user

1.10.1.1.5. Consequences and punishments for unethical behavior

1.10.1.1.6. Examples of monitoring devices used by management to review data and systems

1.10.1.2. Signed data integrity documentation for all employees: this includes a written quiz following the Ethics training session and written agreement to abide by the Code of Ethics and Standards of Conduct explained in the employee manual.

1.10.1.3. In-depth, periodic monitoring of data integrity including peer data review and validation, internal raw data audits, proficiency testing studies, etc.

1.10.1.4. Documentation of any review or investigation into possible data integrity infractions. This documentation, including any disciplinary actions involved, corrective actions taken, and notifications to customers must be retained for a minimum of five years.

1.10.2. PASI management makes every effort to ensure that personnel are free from any undue pressures that affect the quality of their work including commercial, financial, over scheduling, and working condition pressures.

1.10.3. Corporate management also provides all PASI facilities a mechanism for confidential reporting of data integrity issues that ensures confidentiality and a receptive environment in which all employees are comfortable discussing items of ethical concern. The anonymous message line is monitored by the Corporate Director of Quality who will ensure that all concerns are evaluated and, where necessary, brought to the attention of executive management and investigated. Any Pace employee can contact corporate management to report an ethical concern by calling the anonymous hotline at 612-607-6431.

1.11. Laboratory Safety

1.11.1. It is the policy of PASI to make safety and health an integral part of daily operations and to ensure that all employees are provided with safe working conditions, personal protective equipment, and requisite training to do their work without injury. Each employee is responsible for his/her own safety as well as those working in the immediate area by complying with established company rules and procedures. These rules and procedures as well as a more detailed description of the employees' responsibilities are contained in the corporate Safety Manual and Chemical Hygiene Plan.

1.12. Security and Confidentiality

1.12.1. Security is maintained by controlled access to laboratory buildings. Exterior doors to laboratory buildings remain either locked or continuously monitored by PASI staff. Keyless door lock access cards that are broken are replaced, in instances where access cards are not returned to the laboratory upon termination, the access cards are disabled. Posted signs direct visitors to the reception office and mark all other areas as off limits to unauthorized personnel. All visitors, including PASI staff from other facilities, must sign the Visitor's Logbook maintained by the receptionist. A staff member will accompany them during the duration of their stay on the premises unless the SGM/GM/AGM/OM, SQM/QM, or Technical Director specify otherwise. In this instance, the staff member will escort the visitor back to the reception area at the end of his/her visit where he/she signs out. The last staff member to leave their department for the day must ensure that all outside access points to that area are secure.

1.12.2. Additional security is provided where necessary, (e.g., specific secure areas for sample, data, and customer report storage), as requested by customers, or cases where national security is of concern. These areas are lockable within the facilities, or are securely offsite. Access is limited to specific individuals or their designees. Security of sample storage areas is the responsibility of the Sample Receiving. Security of samples and data during analysis and data reduction is the responsibility of Group Supervisors. Security of customer report archives is the responsibility of the Client Services Manager. These secure areas are locked whenever these individuals or their designees are not present in the facility.

1.12.3. Access to designated laboratory sample storage locations is limited to authorized personnel only. Provisions for lock and key access are provided. No samples are to be removed without proper authorization. If requested by customer or contract, samples are not to be removed from secure storage areas without filling out an associated internal chain of custody.

1.12.4. Standard business practices of confidentiality are applied to all documents and information regarding customer analyses. Specific protocols for handling confidential documents are described in PASI SOPs. Additional protocols for sample identification by internal laboratory identification numbers only are implemented as required under contract specific Quality Assurance Project Plans (QAPPs).

1.12.5. All information pertaining to a particular customer, including national security concerns will remain confidential. Data will be released to outside agencies only with written authorization from the customer or where federal or state law requires the company to do so.

1.13. Communications

1.13.1. Management within each lab bears the responsibility of ensuring that appropriate communication processes are established and that communication takes place regarding the effectiveness of the management/quality system. These communication processes may include email, regular staff meetings, senior management meetings, etc.

1.13.2. Corporate management bears the responsibility of ensuring that appropriate communication processes are established within the network of facilities and that communication takes place at a company-wide level regarding the effectiveness of the management/quality systems of all Pace facilities. These communication processes may include email, quarterly continuous improvement conference calls for all lab departments, and annual continuous improvement meetings for all department supervisors, quality managers, client services managers, and other support positions.

2.0. SAMPLE CUSTODY

2.1. Sampling Support

2.1.1. Each individual PASI laboratory provides shipping containers, properly preserved sample containers, custody documents, and field quality control samples to support field-sampling events. Guidelines for sample container types, preservatives, and holding times for a variety of methods are listed in Attachment VIII. Note that all analyses listed are not necessarily performed at all PASI laboratories and there may be additional laboratory analyses performed that are not included in these tables. Customers are encouraged to contact their local Pace Project Manager for questions or clarifications regarding sample handling. PASI - Pittsburgh may provide pick-up and delivery services to their customers when needed.

2.2. Field Services

2.2.1. Pace Analytical has a large Field Services Division which is based in their Minneapolis facility as well as limited field service capabilities in some of our other facilities. Field Services provides comprehensive nationwide service offerings including:

- Stack Testing
- Ambient Air
- CEM Certification Testing
- Air Quality Monitoring
- Onsite Analytical Services- FTIR and GC
- Real-time Process Diagnostic/Optimization Testing
- Wastewater, Groundwater and Drinking Water Monitoring
- Storm Water and Surface Water Monitoring
- Soil and Waste Sampling
- Mobile Laboratory Services

2.2.2. Field Services operates under the PASI Corporate Quality System, with applicable and necessary provisions to address the activities, methods, and goals specific to Field Services. All procedures and methods used by Field Services are documented in Standard Operating Procedures and Procedure Manuals.

2.3. Project Initiation

2.3.1. Prior to accepting new work, the laboratory reviews its performance capability. The laboratory confirms that sufficient personnel, equipment capacity, analytical method capability, etc., are available to complete the required work. Customer needs, certification requirements, and data quality objectives are defined and the appropriate sampling and analysis plan is developed to meet the project requirements by project managers or sales representatives. Members of the management staff review current instrument capacity, personnel availability and training, analytical procedures capability, and projected sample load. Management then informs the sales and client services personnel whether or not the laboratory can accept the new project via written correspondence, email, and/or daily operations meetings.

2.3.2. The laboratory maintains records of all such reviews, including discussions with customers. Routine analytical project documentation of quotes, notes, dates, initials, and/or recordings is maintained in a project folder by project management. Conditions for new and more complex contracts are determined by the SGM/GM/AGM/OM and sales representatives. Quality Management is consulted on technical requirements and operations staff provides input on volume capacities. Evidence of these reviews is maintained in the form of awarded Request for Proposals (RFPs), signed quotes or contracts, and a Customer Relationship Management (CRM) database. If a review identifies a potential mismatch between customer requirements and laboratory capabilities and/or capacities, Pace will specify its level of commitment by listing these exceptions to the requirements within the RFP, quote or contract.

2.3.3. Additional information regarding specific procedures for reviewing new work requests can be found in SOP PGH-C-033 **Review of Analytical Requests** or its equivalent revision or replacement.

2.4. Chain of Custody

2.4.1. A chain of custody (COC) provides the legal documentation of samples from time of collection to completion of analysis. PASI has implemented Standard Operating Procedures to ensure that sample custody traceability and responsibility objectives are achieved for every project.

2.4.2. Field personnel or client representatives must complete a chain of custody for all samples that are received by the laboratory. The importance of completeness of COCs is stressed to the samplers and is critical to efficient sample receipt and to insure the requested methods are used to analyze the correct samples.

2.4.3. If sample shipments are not accompanied by the correct documentation, the Sample Receiving department notifies a Project Manager. The Project Manager then obtains the correct documentation/information from the customer in order for analysis of samples to proceed.

2.4.4. The sampler is responsible for providing the following information on the chain of custody form:

- Customer project name
- Project location or number
- Field sample number/identification
- Date and time sampled
- Sample matrix
- Preservative
- Requested analyses
- Sampler signature
- Relinquishing signature
- Date and time relinquished
- Sampler remarks as needed
- Custody Seal Number if present
- Regulatory Program Designation
- The state where the samples were collected to ensure all applicable state requirements are met.

- Turnaround time requested
- Purchase order number

2.4.5. The COC is filled out completely and legibly with indelible ink. Errors are corrected by drawing a single line through the initial entry and initialing and dating the change. All transfers of samples are recorded on the chain of custody in the "relinquished" and "received by" sections. All information except signatures is printed.

2.4.6. Additional information can be found in PGH-C-001 **Sample Management** or its equivalent revision or replacement.

2.5. Sample Acceptance Policy

2.5.1. In accordance with regulatory guidelines, PASI complies with the following sample acceptance policy for all samples received.

2.5.2. If the samples do not meet the sample receipt acceptance criteria outlined below, the laboratory is required to document all non-compliances, contact the customer, and either reject the samples or fully document any decisions to proceed with analyses of samples which do not meet the criteria. Any results reported from samples not meeting these criteria are appropriately qualified on the final report.

2.5.3. All samples must:

- Have unique customer identification that is clearly marked on durable waterproof labels affixed to the sample containers that match the chain of custody.
- Have clear documentation on the chain of custody related to the location of the sampling site with the time and date of sample collection.
- Have the sampler's name and signature.
- Have all requested analyses clearly designated on the COC.
- Have clear documentation of any special analytical or data reporting requirements.
- Be in appropriate sample containers with clear documentation of the preservatives used.
- Be correctly preserved unless the method allows for laboratory preservation.
- Be received within holding time. Any samples with hold times that are exceeded will not be processed without prior customer approval.
- Have sufficient sample volume to proceed with the analytical testing. If insufficient sample volume is received, analysis will not proceed without customer approval.
- Be received within appropriate temperature ranges - not frozen but ≤6°C (See Note 1), unless program requirements or customer contractual obligations mandate otherwise (see Note 2). The cooler temperature is recorded directly on the COC and the SCUR. Samples that are delivered to the laboratory immediately after collection are considered acceptable if there is evidence that the chilling process has been started. For example, by the arrival of the samples on ice. If samples arrive that are not compliant with these temperature requirements, the customer will be notified. The analysis will NOT proceed unless otherwise directed by the customer. If less than 72 hours remain in the hold time for the analysis, the analysis may be started while the customer is contacted to avoid missing the hold time. Data associated with any

deviations from the above sample acceptance policy requirements will be appropriately qualified.

Note 1: Temperature will be read and recorded based on the precision of the measuring device. For example, temperatures obtained from a thermometer graduated to 0.1°C will be read and recorded to ±0.1°C. Measurements obtained from a thermometer graduate to 0.5°C will be read to ±0.5°C. Measurements read at the specified precision are not to be rounded down to meet the ≤6°C limit

Note 2: Some microbiology methods allow sample receipt temperatures of up to 10°C. Consult the specific method for microbiology samples received above 6°C prior to initiating corrective action for out of temperature preservation conditions.

Note 3: Biological Tissue Samples must be received frozen at $\leq 0\ ^{o}C$.

2.5.4. Upon sample receipt, the following items are also checked and recorded:

- Presence of custody seals or tapes on the shipping containers;
- Sample condition: Intact, broken/leaking, bubbles in VOA samples;
- Sample holding time;
- Sample pH and residual chlorine when required;
- Appropriate containers.

2.5.5. Samples for drinking water analysis that are improperly preserved, or are received past holding time, are rejected at the time of receipt, with the exception of VOA samples that are tested for pH at the time of analysis.

2.5.6. Additional information can be found in PGH-C-001 **Sample Management** or its equivalent revision or replacement.

2.6. Sample Log-in

2.6.1. After sample inspection, all sample information on the chain of custody is entered into the Laboratory Information Management System (LIMS). This permanent record documents receipt of all sample containers including:

- Customer name and contact
- Customer number
- Pace Analytical project number
- Pace Analytical Project Manager
- Sample descriptions
- Due dates
- List of analyses requested
- Date and time of laboratory receipt
- Field ID code
- Date and time of collection
- Any comments resulting from inspection for sample rejection

2.6.2. All samples received are logged into the LIMS within one working day of receipt. Sample login may be delayed due to customer clarification of analysis needed, corrective actions for sample receipt non-conformance, or other unusual circumstances. If the time collected for any sample is unspecified and Pace is unable to obtain this information from the customer, the laboratory will use 12:01 as the time sampled. All hold times will be based on this sampling time and qualified accordingly if exceeded.

2.6.3. For DoD work, if the time of the sample collection is not provided, the laboratory must assume the most conservative time of day. This is defined as 12:01am.

2.6.4. The Laboratory Information Management System automatically generates a unique identification number for each sample created in the system. The LIMS sample number follows the general convention of 30XXXXX-YYY. The first two numbers (30) designates the project as a PASI-Pittsburgh project, the last three digits (YYY) are used to designate the individual sample numbers, and the digits XXXXX (Where the "X's" are sequential numbers generated by the LIMS) identify the project number. This unique identification number is placed on each sample container as a durable label and becomes the link between the laboratory's sample management system and the customer's field identification; and will be a permanent reference number for all future interactions.

2.6.5. Current division codes are noted below. These division codes are used primarily for accounting purposes and LIMS sample identifications. More division codes may be added without updating this document.

10 = Minnesota/Montana	35 = Florida
92 = Asheville and Charlotte	20 = Gulf Coast
60 = Kansas	30 = Pittsburgh
50 = Indianapolis	40 = Green Bay
12 = Virginia/Duluth MN	17 = Pace Life Sciences
51 = Columbus	65 = Schenectady, NY
75 = Dallas	36 = South Florida
55 = Pace Analytical Energy Services CA	56 = Pace Analytical Energy Services Pittsburgh

2.6.6. Sample labels are printed from the LIMS and affixed to each sample container.

2.6.7. Samples with hold times that are near expiration date/time may be sent directly to the laboratory for analysis at the discretion of the Project Manager and/or SGM/GM/AGM/OM.

2.6.8. Additional information can be found in PGH-C-001 Sample Management or its equivalent revision or replacement.

2.7. Sample Storage

2.7.1. Storage Conditions

2.7.1.1. Samples are stored away from all standards, reagents, or other potential sources of contamination. Samples are stored in a manner that prevents cross contamination. Volatile samples are stored separately from other samples. All sample fractions, extracts, leachates, and other sample preparation products are stored in the same manner as actual samples or as specified by the analytical method.

2.7.1.2. Storage blanks, consisting of two 40mL aliquots of reagent water, are stored with volatile samples and are used to measure cross-contamination acquired during storage. If applicable, laboratories must have documented procedures and criteria for evaluating storage blanks, appropriate to the types of samples being stored.

2.7.1.3. Additional information can be found in S-ALL-Q-018 **Monitoring Storage Units.**

2.7.2. **Temperature Monitoring**

2.7.2.1. Samples are taken to the appropriate storage location immediately after sample receipt and check-in procedures are completed. All sample storage areas are located in limited access areas and are monitored to ensure sample integrity.

2.7.2.2. The temperature of each refrigerated storage area is maintained at ≤6°C unless state or program requirements differ. The temperature of each freezer storage area is maintained at <-10oC unless state or program requirements differ. The temperature of each storage area is checked and documented each day of use (each calendar day). If the temperature falls outside the acceptable limits, the following corrective actions are taken and appropriately documented:

- The temperature is rechecked after two hours to verify temperature exceedance. Corrective action is initiated and documented if necessary.
- The SQM/QM and/or laboratory management are notified if the problem persists.
- The samples are relocated to a proper environment if the temperature cannot be maintained after corrective actions are implemented.
- The affected customers are notified.
- Documentation is provided on analytical report.

Additional information can be found in S-ALL-Q-018 **Monitoring Storage Units.**

2.7.3. **Hazardous Materials**

2.7.3.1. Pure product or potentially heavily contaminated samples must be tagged as "hazardous" or "lab pack" and stored separately from other samples.

2.7.3.2. Clients must properly label all samples that contain radioactivity. These samples are screened by the Radiation Safety Officer and if noted to be of concern this information is communicated to the necessary laboratory personnel. Any samples with levels of radiation that are noted to be of concern will be placed into a separate storage area of the laboratory to prevent cross-contamination.

2.7.4. **Foreign/Quarantined Soils**

2.7.4.1. Depending on the soil disposal practices of the laboratory, foreign soils and soils from USDA regulated areas are adequately segregated to enable proper sample disposal. The USDA requires these samples to be incinerated or sterilized by an approved treatment procedure. Additional information regarding USDA regulations and sample handling can be found in applicable local laboratory SOPs.

2.7.4.2. Additional information on sample storage can be found in PGH-C-001 Sample Management or its equivalent revision or replacement and in PGH-C-017 Waste Handling and Management.

2.8. Sample Protection

2.8.1. PASI laboratory facilities are operated under controlled access protocols to ensure sample and data integrity. Visitors must register at the front desk and be properly escorted at all times.

2.8.2. Samples are removed from storage areas by designated personnel and returned to the storage areas, if necessary, immediately after the required sample quantity has been taken.

2.8.3. Upon customer request, additional and more rigorous chain of custody protocols for samples and data can be implemented. For example, some projects may require internal chain-of-custody protocols.

2.8.4. Additional information can be found in PGH-C-001 **Sample Management** or its equivalent revision or replacement.

2.9. Subcontracting Analytical Services

2.9.1. Every effort is made to perform all analyses for PASI customers within the laboratory that receives the samples. When subcontracting to a laboratory other than the receiving laboratory, whether inside or outside the PASI network, becomes necessary, a preliminary verbal communication with that laboratory is undertaken. Customers are notified in writing of the laboratory's intention to subcontract any portion of the testing to another laboratory. Work performed under specific protocols may involve special considerations.

2.9.2. Prior to subcontracting samples to a laboratory outside Pace Analytical, the potential sub-contract laboratory will be pre-qualified by verifying that the subcontractor meets the following criteria:

- All certifications required for the proposed subcontract are in effect,
- Sufficient professional liability and other required insurance coverage is in effect, and
- Is not involved in legal action by any federal, state, or local government agency for data integrity issues and has not been convicted in such investigation at any time during the past 5 years.

2.9.3. The contact and preliminary arrangements are made between the PASI Project Manager and the appropriate subcontract laboratory personnel. The specific terms of the subcontract laboratory agreement include:

- Method of analysis
- Number and type of samples expected
- Project specific QA/QC requirements
- Deliverables required
- Laboratory certification requirement
- Price per analysis
- Turn-around time requirements

2.9.4. Chain-of-custody forms are generated for samples requiring subcontracting to other laboratories. Sample receiving personnel re-package the samples for shipment, create a transfer chain of custody form and record the following information:

- Pace Analytical Laboratory Number
- Matrix
- Requested analysis
- Special instructions regarding turnaround, required detection or reporting limits, or any unusual information known about the samples or analytical procedure.
- Signature in "Relinquished By"

2.9.5. All subcontracted sample data reports are sent to the PASI Project Manager. Pace will provide a copy of the subcontractor's report to the client when requested.

2.9.6. Any Pace Analytical work sent to other labs within the PASI network is handled as subcontracted work and all final reports are labeled clearly with the name of the laboratory performing the work. Any non-TNI work is clearly identified. PASI will not be responsible for analytical data if the subcontract laboratory was designated by the customer.

2.9.7. Additional information can be found in PGH-C-008 Subcontracting Samples or its equivalent revision or replacement.

2.9.8. Subcontracted labs used for DoD work must be accredited by DoD or its designated representatives. Subcontracted labs must receive project specific approval from the DoD client before any samples are analyzed. These requirements also apply to the use of any laboratory under the same corporate umbrella, but at a different facility or location.

2.10. Sample Retention and Disposal

2.10.1. Samples, extracts, digestates, and leachates must be retained by the laboratory for the period of time necessary to protect the interests of the laboratory and the customer.

2.10.2. Unused portions of samples are retained by each laboratory based on program or customer requirements for sample retention and storage. The minimum sample retention time is 45 days from receipt of the samples. Samples requiring thermal preservation may be stored at ambient temperature when the hold time is expired, the report has been delivered, and/or allowed by the customer, program, or contract. Samples requiring storage beyond the minimum sample retention time due to special requests or contractual obligations may be stored at ambient temperature unless the laboratory has sufficient capacity and their presence does not compromise the integrity of other samples.

2.10.3. After this period expires, non-hazardous samples are properly disposed of as non-hazardous waste. The preferred method for disposition of hazardous samples is to return the excess sample to the customer. If it is not feasible to return samples, or the customer requires PASI to dispose of excess samples, proper arrangements will be made for disposal by an approved contractor.

2.10.4. Additional information can be found in PGH-C-017 Waste Handling and Management and PGH-C-001 Sample Management or their equivalent revisions or replacements.

3.0. ANALYTICAL CAPABILITIES

3.1. Analytical Method Sources

3.1.1. PASI laboratories are capable of analyzing a full range of environmental samples from a variety of matrices, including air, surface water, wastewater, groundwater, soil, sediment, biota, and other waste products. The approved valid editions of methodologies are applied from regulatory and professional sources including EPA, ASTM, USGS, NIOSH, Standard Methods, and State Agencies. Section 11 is a representative listing of general analytical protocol references. PASI discloses in writing to its customers and regulatory agencies any instances in which modified methods are being used in the analysis of samples.

3.1.2. In the event of a customer-specific need, instrumentation constraint or regulatory requirement, PASI laboratories reserve the right to use valid versions of methods that may not be the most recent edition available.

3.2. Analytical Method Documentation

3.2.1. The primary form of PASI laboratory documentation of analytical methods is the Standard Operating Procedure (SOP). SOPs contain pertinent information as to what steps are required by an analyst to successfully perform a procedure. The required contents for the SOPs are specified in the company-wide SOP for Preparation of SOPs (S-ALL-Q-001).

3.2.2. The SOPs may be supplemented by other training materials that further detail how methods are specifically performed. This training material will undergo periodic, documented review along with the other Quality System documentation.

3.3. Analytical Method Validation

3.3.1. In some situations, PASI develops and validates methodologies that may be more applicable to a specific problem or objective. When non-standard methods are required for specific projects or analytes of interest, or when the laboratory develops or modifies a method, the laboratory validates the method prior to applying it to customer samples. Method validity is established by meeting criteria for precision and accuracy as established by the data quality objectives specified by the end user of the data. The laboratory records the validation procedure, the results obtained and a statement as to the usability of the method. The minimum requirements for method validation include evaluation of sensitivity, quantitation, precision, bias, and selectivity of each analyte of interest.

3.3.1.1. Exceptionally permitting departures from documented policies and procedures or from standard specifications

3.3.1.1.1. Departures must be evaluated and approved by the Department Supervisor/Manager and/or the Quality Manager prior to implementation. Minor departures (i.e. Surrogate or Spike failures) may be addressed in the specific analytical SOP's.

3.3.1.1.2. The evaluation should include determination of effects of the changes made to the policy, procedure or specification and the need for additional QC to show validation of the changes (i.e. MDL's, DOC's).

3.3.1.1.3. Evaluation should include a review of any agency or client requirements for the prior approval of changes to policies, procedures or specifications and the process for securing these approvals.

3.3.1.1.4. Departures must be fully documented in the laboratory records and in the final reports using case narratives.

3.3.2. When the laboratory implements new methods, develops new methods, or adds a new analyte of interest to a method, at the very minimum the method is validated for sensitivity even in instances where a method detection study may not apply. The laboratory also tries to procure and analyze a performance test (PT) sample however there may be instances where no such sample is obtainable. In these instances the laboratory either consults with other vendors (that may not be actual PT providers) to procure the necessary sample or the laboratory itself may make a blind matrix spike for the laboratory to analyze.

3.3.2.1. At a minimum, the laboratory may conduct a three concentration/three standard approach by spiking at least three samples at three different concentration levels. Those levels must include one sample at 1-3 times the sensitivity level, (or 2-4 times if it's a multi-analyte test), one at ten times the sensitivity level and one at a concentration in-between those two levels.

3.3.2.1.1. The samples should be spiked at these levels and carried through the entire procedure.

3.3.2.1.2. In the case of radiological samples it is not acceptable to spike at one level and then allow for half-lives to pass for the lower concentration levels.

3.3.2.1.3. The demonstration of capability described below may be used for one of the above mentioned levels providing it is within the desired spiking range.

3.3.2.1.4. The sensitivity level must have a positive detection; the other levels may be evaluated by percent recovery.

3.3.2.1.5. The above reference method validation is performed when applicable regardless as to the certification or accreditation status of the method for the laboratory

3.4. Demonstration of Capability (DOC)

3.4.1. Analysts complete an initial demonstration of capability (IDOC) study prior to performing a method or when there is a change in instrument type, personnel, or test method, or at any time that a method has not been performed by the laboratory or analyst in a 12-month period. The mean recovery and standard deviation of each analyte, taken from 4 replicates of a quality control standard is calculated and compared to method criteria (if available) or established laboratory criteria for evaluation of acceptance. Each laboratory maintains copies of all demonstrations of capability, including those that fail acceptance criteria and corresponding raw data for future reference and must document the acceptance criteria prior to the analysis of the DOC. Demonstrations of capability are verified on an annual basis.

3.4.2. For Continuing Demonstrations of Capability, the laboratories may use Performance Testing (PT) samples in lieu of the 4-replicate approach listed above. For methods or procedures that do not lend themselves to the "4-replicate" approach, the demonstration of capability requirements will be specified in the applicable SOP.

3.4.3. Demonstration of Capability studies for radiological drinking water methods must be performed at a concentration that is above the MDC and below the MCL for the target parameter. [Required in the EPA Manual for the Certification of Laboratories for Drinking Waters Chapter VI section 1.5]

3.4.4. Additional information can be found in SOP S-ALL-Q-020 **Training and Employee Orientation** or its equivalent revision or replacement.

3.5. Regulatory and Method Compliance

3.5.1. PASI understands that expectations of our customers commonly include the assumption that laboratory data will satisfy specific regulatory requirements. Therefore PASI attempts to ascertain, prior to beginning a project, what applicable regulatory jurisdiction, agency, or protocols apply to that project. This information is also required on the chain of custody submitted with samples.

3.5.2. PASI makes every effort to detect regulatory or project plan inconsistencies, based upon information from the customer, and communicate them immediately to the customer in order to aid in the decision making process. PASI will not be liable if the customer chooses not to follow PASI recommendations.

3.5.3. It is PASI policy to disclose in a forthright manner any detected noncompliance affecting the usability of data produced by our laboratories. The laboratory will notify customers within 30 days of fully characterizing the nature of the nonconformance, the scope of the nonconformance and the impact it may have on data usability.

3.5.4. When PASI-PGH develops and implements methods or tests that are not certified or accredited, PASI-PGH will document with footnotes or in a written statement within the case narrative of the final report that the tests are for informational purposes only and are not to be used for compliance or regulatory decisions. In instances where the parameter accreditation is not available the need to specify will be determined on a client by client basis.

4.0. QUALITY CONTROL PROCEDURES

Quality control data is analyzed and where they are found to be outside pre-defined criteria, planned action is taken to correct the problem in order to prevent incorrect results from being reported. Quality control samples are to be processed in the same manner as client samples.

4.1. Method Blank

4.1.1. A method blank is used to evaluate contamination in the preparation/analysis system and is processed through all preparation and analytical steps with its associated samples.

4.1.2. A method blank is processed at a minimum frequency of one per preparation batch (see glossary section of this document for further clarification of the definition of batch). In the case of a method that has no separate preparation step, a method blank is processed with no more than 20 samples of a specific matrix performed by the same analyst, using the same method, standards, and reagents.

4.1.3. The method blank consists of a matrix similar to the associated samples that is known to be free of analytes of interest. Method blanks are not applicable for certain analyses, such as pH, conductivity, flash point and temperature

4.1.4. Each method blank is evaluated for contamination. The source of any contamination is investigated and documented corrective action is taken when the concentration of any target analyte is detected above the reporting limit and is greater than 1/10 of the amount of that analyte found in any associated sample. Some labs, due to client requirements, etc., may have to evaluate their method blanks down to ½ the reporting limit as opposed to the reporting limit itself. Corrective actions for blank contamination may include the re-preparation and re-analysis of all samples (where possible) and quality control samples. Data qualifiers must be applied to results that are considered affected by contamination in a method blank.

4.1.5. For DoD samples, the method blank will be considered to be contaminated if: 1) The concentration of any target analyte in the blank exceeds 1/2 the reporting limit and is greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit whichever is greater; 2) The concentration of any common laboratory contaminant in the blank exceeds the reporting limit and is greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit whichever is greater or 3) The blank result otherwise affects the sample results as per the test method requirements or the project-specific objectives. If the method blank is contaminated as described above, then the laboratory shall reprocess affected samples in a subsequent preparation batch, except when sample results are below the LOD. If insufficient sample volume remains for reprocessing, the results shall be reported with appropriate data qualifiers.

4.1.6. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.1.7. Method blanks are only applicable to batches processed to report client data. Batches used for screening purposes may contain more than 20 samples and may not have an associated MB.

4.2. Laboratory Control Sample

4.2.1. The Laboratory Control Sample (LCS) is used to evaluate the performance of the entire analytical system including preparation and analysis.

4.2.2. An LCS is processed at a minimum frequency of one per preparation batch. In the case of a method that has no separate preparation step, an LCS will be processed with no more than 20 samples of a specific matrix performed by the same analyst, using the same method, standards, and reagents.

4.2.3. The LCS consists of a matrix similar to the associated samples that is known to be free of the analytes of interest that is then spiked with known concentrations of target analytes.

4.2.4. The LCS contains all analytes specified by a specific method or by the customer or regulatory agency, which may include full list of target compounds, with certain exceptions. These exceptions may include analyzing only specific Aroclors when PCB analysis is requested or not spiking with all EPA Appendix IX compounds when a full Appendix IX list of compounds is requested. However, the lab must ensure that all target components in its scope of accreditation are included in the spike mixture for the LCS over a two (2) year period. In the absence of specified components, the laboratory will spike the LCS with the following compounds:

- For multi-peak analytes (e.g. PCBs, technical chlordane, toxaphene), a representative standard will be processed.
- For methods with long lists of analytes, a representative number of target analytes may be chosen. The following criteria is used to determine the number of LCS compounds used:
  - For methods with 1-10 target compounds, the laboratory will spike with all compounds
  - For methods with 11-20 target compounds, the laboratory will spike with at least 10 compounds or 80%, whichever is greater
  - For methods with greater than 20 compounds, the laboratory will spike with at least 16 compounds.

4.2.5. The LCS is evaluated against the method default or laboratory-derived acceptance criteria. For those methods that require laboratory-derived limits, method default control limits may be used until the laboratory has a minimum of 20, but preferably greater than 30, data points from which to derive internal acceptance criteria. Any compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Any associated sample containing an 'out-of-control' compound must either be re-analyzed with a successful LCS or reported with the appropriate data qualifier. When the acceptance criteria for the LCS are exceeded high, and there are associated samples that are non-detects, then those non-detects can be reported with data qualifiers, or when the acceptance criteria are exceeded low, those associated sample results may be reported if they exceed the maximum regulatory limit/decision level with data qualifiers.

4.2.6. For LCSs containing a large number of analytes, it is statistically likely that a few recoveries will be outside of control limits. This does not necessarily mean that the system is out of control, and therefore no corrective action would be necessary (except for proper documentation). TNI has allowed for a minimum number of marginal exceedances, defined as recoveries that are beyond the LCS control limits (3X the standard deviation) but less than the marginal exceedance limits (4X the standard deviation). The number of allowable exceedances depends on the number of compounds in the LCS. If more analyte recoveries exceed the LCS control limits than is allowed (see below) or if any one analyte exceeds the marginal exceedance limits, then the LCS is considered non-compliant and corrective actions are necessary. The number of allowable exceedances is as follows:

- >90 analytes in the LCS- 5 analytes
- 71-90 analytes in the LCS- 4 analytes
- 51-70 analytes in the LCS- 3 analytes
- 31-50 analytes in the LCS- 2 analytes
- 11-30 analytes in the LCS- 1 analyte
- <11 analytes in the LCS- no analytes allowed out)

Refer to laboratory SOPs for details of LCS criteria and marginal exceedance limits.

4.2.7. A matrix spike (MS) can be used in place of a non-compliant LCS in a batch as long as the MS passes the LCS acceptance criteria (this is a TNI allowance). When this happens, full documentation must be made available to the data user. If this is not allowed by a customer or regulatory body, the associated samples must be rerun with a compliant LCS (if possible) or reported with appropriate data qualifiers.

4.2.8. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.2.9. For Department of Defense projects, the laboratory is not allowed to have any target analytes that exceed DoD LCS control limits. In the case of LCS failures, the laboratory is required to reanalyze the associated samples with an acceptable LCS for all target compounds if there is sufficient sample remaining. The laboratory must make every effort to take the appropriate corrective actions and resolve any anomalies regarding LCSs for Department of Defense projects. All LCS failures must be accounted for in project case narratives. See applicable method SOPs for further corrective action.

4.2.10. Laboratory Control Samples are only applicable to batches processed to report client data. Batches used for screening purposes may contain more than 20 samples and may not have an associated LCS.

4.3. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

4.3.1. A matrix spike (MS) is used to determine the effect of the sample matrix on compound recovery for a particular method. The information from these spikes is sample or matrix specific and is not used to determine the acceptance of an entire batch unless the MS is actually used as the LCS.

4.3.2. A Matrix Spike/Matrix Spike Duplicate (MS/MSD) set is processed at a frequency specified in a particular method or as determined by a specific customer request. This frequency will be specified in the applicable method SOP or customer QAPP. In the absence of such requirements, an MS/MSD set is routinely analyzed once per every 20 samples per matrix per method.

4.3.3. The MS and MSD consist of the sample matrix that is then spiked with known concentrations of target analytes. Laboratory personnel spike customer samples that are specifically designated as MS/MSD samples or, when no designated samples are present in a batch, randomly select samples to spike that have adequate sample volume or weight. Spiked samples are prepared and analyzed in the same manner as the original samples and are selected from different customers if possible.

4.3.4. The MS and MSD contain all analytes specified by a specific method or by the customer or regulatory agency. In the absence of specified components, the laboratory will spike the MS/MSD with the same number of compounds as previously discussed in the LCS section. However, the lab must ensure that all targeted components in its scope of accreditation are included in the spike mixture for the MS/MSD over a two (2) year period.

4.3.5. The MS and MSD are evaluated against the method or laboratory derived criteria. Any compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance, not on MS/MSD recoveries. The spike recoveries give the data user a better understanding of the final results based on their site specific information.

4.3.6. A matrix spike and sample duplicate will be performed instead of a matrix spike and matrix spike duplicate when specified by the customer or method.

4.3.7. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.3.8. For DoD work, each non-radiochemistry preparation batch of samples must contain an associated MS and MSD (or sample duplicate) using the same matrix collected for the specific DoD project. For radiochemical analyses, tests that do not incorporate the use of a carrier or tracer for yield assessment must contain an associated MS and MSD (or sample duplicate) using the same matrix collected for the specific DOD project. Gamma spectroscopy analyses are excluded from the MS/MSD requirement as the test does not require chemical processing of samples for analysis. If adequate sample material is not available, then the lack of MS/MSDs shall be noted in the case narrative. Additional MS/MSDs may be required on a project-specific basis. The MS/MSD must be spiked with all target analytes with the exception of PCB analysis, which is spiked per the method. The concentration of the spiked compounds shall be at or below the midpoint of the calibration range or at the appropriate concentration of concern. Multiple spiked samples may need to be prepared to avoid interferences.

4.3.9. For DoD work, the results of all MS/MSD must be evaluated using the same acceptance criteria used for the LCS.

4.3.10. Matrix Spike/Matrix Spike Duplicate samples are only applicable to batches processed to report client data. Batches used for screening purposes may contain more than 20 samples and may not have an associated MS/MSD.

4.4. Sample Duplicate

4.4.1. A sample duplicate is a second portion of sample that is prepared and analyzed in the laboratory along with the first portion. It is used to measure the precision associated with preparation and analysis. A sample duplicate is processed at a frequency specified by the particular method or as determined by a specific customer.

4.4.2. The sample and duplicate are evaluated against the method or laboratory derived criteria for relative percent difference (RPD). Any duplicate that is outside of these limits is considered to be 'out of control' and must be qualified appropriately.

4.4.3. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.4.4. Sample Duplicates are only applicable to batches processed to report client data. Batches used for screening purposes may contain more than 20 samples and may not have an associated sample duplicate.

4.5. Surrogates

4.5.1. Surrogates are compounds that reflect the chemistry of target analytes and are typically added to samples for organic analyses to monitor the effect of the sample matrix on compound recovery.

4.5.2. Surrogates are added to each customer sample (for organics), method blank, LCS, MS, and calibration standard prior to extraction or analysis. The surrogates are evaluated against the method or laboratory derived acceptance criteria or against project-specific acceptance criteria specified by the client, if applicable. Any surrogate compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Samples with surrogate failures are typically re-extracted and/or re-analyzed to confirm that the out-of-control value was caused by the matrix of the sample and not by some other systematic error. An exception to this would be samples that have high surrogate values but no reportable hits for target compounds. These samples would be reported, with a qualifier, because the implied high bias would not affect the final results. For methods with multiple surrogates, documentation regarding acceptance and associated compounds will be found in the individual method SOPs.

4.5.3. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.6. Internal Standards

4.6.1. Internal Standards are method-specific analytes added to every standard, method blank, laboratory control sample, matrix spike, matrix spike duplicate, sample, and calibration standard at a known concentration, prior to analysis for the purpose of adjusting the response factor used in quantifying target analytes. At a minimum, the laboratory will follow method specific guidelines for the treatment of internal standard recoveries as they are related to the reporting of data.

4.6.2. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.7. Field Blanks

4.7.1. Field blanks are blanks prepared at the sampling site in order to monitor for contamination that may be present in the environment where samples are collected. These field quality control samples are often referenced as field blanks, rinsate blanks, or equipment blanks. The laboratory analyzes these field blanks as normal samples and informs the customer if there are any target compounds detected above the reporting limits.

4.8. Trip Blanks

4.8.1. Trip blanks are blanks that originate from the laboratory as part of the sampling event and are used to monitor for contamination of samples during transport. These blanks accompany the empty sample containers to the field and then accompany the collected samples back to the laboratory. These blanks are routinely analyzed for volatile methods where ambient background contamination is likely to occur.

4.9. Limit of Detection (LOD)

4.9.1. PASI laboratories are required to use a documented procedure to determine a limit of detection for each analyte of concern in each matrix reported. All sample processing steps of the preparation and analytical methods are included in this determination including any clean ups. For any test that does not have a valid LOD, sample results below the limit of quantitation (LOQ) cannot be reported.

4.9.2. The LOD is initially established for the compounds of interest for each method in a clean matrix with no target analytes present and no interferences at a concentration that would impact the results. The LOD is then determined every time there is a change in the test method that affects how the test is performed or when there has been a change in the instrument that affects the sensitivity. If required by customer, method or accreditation body, the LOD will be re-established annually for all applicable methods.

4.9.3. Unless otherwise noted, the method used by PASI laboratories to determine LODs is based on the Method Detection Limit (MDL) procedure outlined in 40 CFR Part 136, Appendix B. Where required by regulatory program or customer, the above referenced procedure will be followed.

4.9.4. Where specifically stated in the published method, LODs or MDLs will be performed at the listed frequency.

4.9.5. The validity of the LOD must be shown by detection (a value above zero) of the analytes in a QC sample in each quality system matrix. The QC sample must contain the analyte at no more than 3X the LOD for a single analyte test and 4X the LOD for multiple analyte tests. This verification must be performed on each instrument used for sample analysis and reporting of data. The validity of the LOD must be verified as part of the LOD determination process. This verification must be done prior to the use of the LOD for sample analysis.

4.9.6. An LOD study is not required for any analyte for which spiking solutions or quality control samples are not available such as temperature.

4.9.7. The LOD, if required, shall be verified annually for each quality system matrix, technology and analyte. In lieu of performing full LOD (MDL) studies annually, the laboratory can verify the LOD (MDL) on an annual basis, providing this verification is fully documented and does not contradict other customer or program requirements that the laboratory must follow. The requirements of this verification are:

- The spike concentration of the verification must be no more than 3X times the LOD for single analyte tests and 4X the LOD for multiple analyte tests.
- The laboratory must verify the LOD on each instrument used for the reporting of sample data.
- The laboratory must be able to identify all target analytes in the verification standard (distinguishable from noise).
- Radiological tests do not have to perform LOD studies; however drinking water tests should have annual sensitivity tests of DOCs at a concentration between the required detection limit and the MCL.

4.9.8. DoD definition for LOD- The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate is 1%.

4.9.9. For DOD, the LOD is set at the concentration used to verify the MDL. This verification is required on a quarterly basis for all targets and must be at concentration that is between the MDL and reporting limit concentrations.

4.9.10. Additional information can be found in SOP PGH-C-035 Determination of LOD and LOQ or its equivalent revision or replacement.

4.10. Limit of Quantitation (LOQ)

4.10.1. A limit of quantitation (LOQ) for every analyte of concern must be determined. For PASI laboratories, this LOQ is referred to as the RL, or Reporting Limit. This RL is based on the lowest calibration standard concentration that is used in each initial calibration. Results below this level are not allowed to be reported without qualification since the results would not be substantiated by a calibration standard. For methods with a determined LOD, results can be reported out below the LOQ but above the LOD if they are properly qualified (e.g., J flag).

4.10.2. The LOQ must be higher than the LOD.

4.10.3. To verify the LOQ, the laboratory will prepare a sample in the same matrix used for the LCS. The sample will be spiked with each target analyte at a concentration equivalent to the RL or 2X the RL. This sample must undergo the routine sample preparation procedure including any routine sample cleanup steps. The sample is then analyzed and the recovery of each target analyte determined. The recovery for each target analyte must meet the laboratories current control limits for an LCS. The annual LOQ verification is not required if the LOD was determined or verified annually on that instrument.

4.10.4. For DoD approved methods, the LOQ and LOD shall be verified quarterly and valid LOQ must be in place prior to sample analysis.

4.10.5. Additional information can be found in SOP PGH-C-035 **Determination of LOD and LOQ** or its equivalent revision or replacement.

4.11. Estimate of Analytical Uncertainty

4.11.1. PASI laboratories can provide an estimation of uncertainty for results generated by the laboratory. The estimate quantifies the error associated with any given result at a 95% confidence interval. This estimate does not include bias that may be associated with sampling. The laboratory has a procedure in place for making this estimation. In the absence of a regulatory or customer-specific procedure, PASI laboratories base this estimation on the recovery data obtained from the Laboratory Control Spikes. The uncertainty is a function of the standard deviation of the recoveries multiplied by the appropriate Student's t Factor at 95% confidence. Additional information pertaining to the estimation of uncertainty and the exact manner in which it is derived are contained in the SOP S-ALL-Q-031 **Estimation of Measurement Uncertainty** or its equivalent revision or replacement.

4.11.2. The measurement of uncertainty is provided only on request by the customer, as required by specification or regulation and when the result is used to determine conformance within a specification limit.

4.11.3. Radiological tests often report uncertainty and the manner in which it is derived are in accordance with Multi-Agency Radiological Laboratories Analytical Protocols Manual (MARLAP) and Evaluation of Measurement Data – Guide to the Expression of Uncertainty in Measurement (GUM). The means by which these criteria are applied can be found in the method SOPs.

4.12. Proficiency Testing (PT) Studies

4.12.1. PASI laboratories participate in the TNI defined proficiency testing program. PT samples are obtained from NIST approved providers and analyzed and reported at a minimum of two times per year for the relevant fields of testing per matrix.

4.12.2. PASI-Pittsburgh uses ERA for most of the environmental PT samples. PASI-PGH uses other TNI approved PT providers for those cases where PT samples are not available from ERA. PASI-PGH also participates in the MAPEP radiochemistry studies for nondrinking water matrices. Results of the studies are submitted to the appropriate state agencies as required to maintain and/or acquire accreditation and/or certification.

4.12.3. The laboratory initiates an investigation whenever PT results are deemed 'unacceptable' by the PT provider. All findings and corrective actions taken are reported to the SQM/QM or their designee. A corrective action plan is initiated and this report is sent to the appropriate state accreditation agencies for their review. Additional PTs will be analyzed and reported as needed for certification purposes.

4.12.4. PT samples are treated as typical customer samples, utilizing the same staff, methods, equipment, facilities, and frequency of analysis. PT samples are included in the laboratory's normal analytical processes and do not receive extraordinary attention due to their nature.

4.12.5. Comparison of analytical results with anyone participating in the same PT study is prohibited prior to the close of the study.

4.12.6. Additional information can be found in SOP PGH-C-031 **Proficiency Testing Program** or its equivalent revision or replacement.

4.13. Rounding and Significant Figures

4.13.1. In general, the PASI laboratories report data to no more than three significant digits. Therefore, all measurements made in the analytical process must reflect this level of precision. In the event that a parameter that contributes to the final result has less than three significant figures of precision, the final result must be reported with no more significant figures than that of the parameter in question. The rounding rules listed below are descriptive of the LIMS and not necessarily of any supporting program such as Excel.

4.13.2. Data is compared to the reporting limits and MDLs to determine if qualifiers are needed before the rounding step occurs.

4.13.3. **Rounding:** PASI-Pittsburgh follows the odd / even guidelines for rounding numbers:

- If the figure following the one to be retained is less than five, that figure is dropped and the retained ones are not changed (with three significant figures, 2.544 is rounded to 2.54).
- If the figure following the ones to be retained is greater than five, that figure is dropped and the last retained one is rounded up (with three significant figures, 2.546 is rounded to 2.55).
- If the figure following the ones to be retained is five and if there are no figures other than zeros beyond that five, then the five is dropped and the last figure retained is unchanged if it is even and rounded up if it is odd (with three significant figures, 2.525 is rounded to 2.52 and 2.535 is rounded to 2.54).

4.13.4. **Significant Digits**

4.13.4.1. PASI-Pittsburgh follows the following convention for reporting to a specified number of significant figures. Unless specified by federal, state, or local requirements or on specific request by a customer, the laboratory reports:

Values > 10 – Reported to 3 significant digits
Values ≤ 10 – Reported to 2 significant digits

4.14. Retention Time Windows

4.14.1. When chromatographic conditions are changed, retention times and analytical separations are often affected. As a result, two critical aspects of any chromatographic method are the determination and verification of retention times and analyte separation. Retention time windows must be established for the identification of target analytes. The retention times of all target analytes in all calibration verification standards must fall within the retention time windows. If an analyte falls outside the retention time window in an ICV or CCV, new absolute retention time windows must be calculated, unless instrument maintenance fixes the problem. When a new column is installed, a new retention time window study must be performed.

4.14.2. One process for the production of retention time windows: Make 3 injections of all single component or multi-component analytes over a 72-hour period. Record the retention time in minutes for each analyte and surrogate to 3 decimal places. Calculate the mean and standard deviation of the three absolute retention times for each target analyte and surrogate. For multi-component analytes, choose 3-5 major peaks and calculate the mean and standard deviation for each of the peaks. If the standard deviation of the retention times of a target analyte is 0.000, the lab may use a default standard deviation of 0.01. The width of the retention time window for each analyte and surrogate and major peak in a multi-component analyte is defined as +/- 3 times the standard deviation of the mean absolute retention time established during that 72-hour period or 0.03 minutes, whichever is greater.

4.14.3. The center of the retention time window is established for each analyte and surrogate by using the absolute retention times from the CCV at the beginning of the analytical shift. For samples run with an initial calibration, use the retention time of the mid-point standard of the initial calibration curve.

4.14.4. For more information, please reference the local facility's analytical SOPs.

5.0. DOCUMENT MANAGEMENT AND CHANGE CONTROL

5.1. Document Management

5.1.1. Additional information can be found in SOP PGH-C-029 **Document Control and Management** or its equivalent revision or replacement. Information on Pace's policy for electronic signatures can also be found in this SOP.

5.1.2. Pace Analytical Services, Inc. has an established procedure for managing documents that are part of the quality system. The list of managed documents includes, but is not limited to, Standard Operating Procedures (both technical and non-technical), Quality Assurance Manuals, quality policy statements, training documents, work-processing documents, charts, posters, memoranda, notices, forms, software, and any other procedures, tables, plans, etc. that have a direct bearing on the quality system (including applicable data records and non-technical documents).

5.1.3. A master list of all managed documents is maintained at each facility identifying the current revision status and distribution of the controlled documents. This establishes that there are no invalid or obsolete documents in use in the facility. All documents are reviewed periodically and revised if necessary. Obsolete documents are systematically discarded or archived for audit or knowledge preservation purposes. Copies of all quality systems documentation provided to DoD for review must be in English.

5.1.4. Each managed document is uniquely identified to include the date of issue, the revision identification, page numbers, the total number of pages and the issuing authorities. For complete information on document numbering, refer to SOP S-ALL-Q-003 Document Numbering.

5.1.5. SOPs, specifically, are available to all laboratory staff via the Learning Management System (LMS) which is a secure repository that is accessed through an internet portal. As a local alternative to the hard copy system of controlled documents, secured electronic copies of controlled documents may be maintained on the laboratory's local server. These document files can be read and printed. The most current version is always in the Learning Management system and in the local network directory. The QA department and the administrator have full access to the system. Other requirements for this system are as follows:

- Electronic documents must be readily accessible to all facility employees.
- All hardcopy SOPs must be obtained from the Quality Department. Electronic copies of SOPs are available for use in the Laboratory's network drive.

5.1.6. **Quality Assurance Manual (QAM):** The Quality Assurance Manual is the company-wide document that describes all aspects of the quality system for PASI. The base QAM template is distributed by the Corporate Quality Department to each of the SQMs/QMs. The local management personnel modify the necessary and permissible sections of the base template and submit those modifications to the Corporate Director of Quality for review. Once approved and signed by both the CEO and the Director of Quality; the SGM/GM/AGM/OM, the SQM/QM, and any Technical Directors sign the Quality Assurance Manual. Each SQM/QM is then in charge of distribution to employees, external customers or regulatory agencies and maintaining a distribution list of controlled document copies. The Quality Assurance Manual template is reviewed on an annual basis by all of the PASI SQMs/QMs and revised accordingly by the Director of Quality.

5.1.7. **Standard Operating Procedures (SOPs)**

5.1.7.1. SOPs fall into two categories: company-wide documents and facility specific documents. Company-wide SOPs start with the prefix S-ALL- and local SOPs start with the individual facility prefix.

5.1.7.2. The purpose of the company-wide SOPs is to establish policies and procedure that are common and applicable to all PASI facilities. Company-wide SOPs are document-controlled by the corporate quality office and signed copies are distributed to all of the SQMs/QMs. The local management personnel sign the company-wide SOPs. The SQM/QM is then in charge of distribution to employees, external customers, or regulatory agencies and maintaining a distribution list of controlled document copies.

5.1.7.3. Local PASI facilities are responsible for developing facility-specific SOPs applicable to their respective facility. The local facility develops these facility-specific SOPs based on the corporate-wide SOP template. This template is written to incorporate a set of minimum method requirements and PASI best practice requirements. The local facilities may add to or modify the corporate-wide SOP template provided there are no contradictions to the minimum method or best practice requirements. Facility-specific SOPs are controlled by the applicable SQM/QM according to the corporate document management policies.

5.1.7.4. SOPs are reviewed every two years at a minimum although a more frequent review may be required by some state or federal agencies or customers. If no revisions are made based on this review, documentation of the review itself is made by the addition of new signatures on the cover page. If revisions are made, documentation of the revisions is made in the revisions section of each SOP and a new revision number is applied to the SOP. This provides a historical record of all revisions.

5.1.7.5. All copies of superseded SOPs are removed from general use and the original copy of each SOP is archived for audit or knowledge preservation purposes. This ensures that all PASI employees use the most current version of each SOP and provides the SQM/QM with a historical record of each SOP.

5.1.7.6. Additional information can be found in SOP S-ALL-Q-001 Preparation of SOPs or its equivalent revision or replacement.

5.1.7.7. For DoD approval, all technical SOPs are reviewed for accuracy and adequacy annually and whenever method procedures change and updated as appropriate. All such reviews are documented and made available for assessment. Non-technical SOPs that are not required elements of the quality system are considered administrative SOPs and are not required to be reviewed annually. Drinking water SOPs for Rad methods are required to be reviewed annually.

5.1.8. **Other Documentation:**

5.1.8.1. All training documents and or document designed to help aid in the implementation of SOPs or regulatory guidance shall be submitted to the Quality Department to be evaluated for possible distribution as a controlled document.

5.1.8.2. Any documents used to track, evaluate or otherwise document instrument, reagents or standard conditions/performance should be submitted to the Quality Department to be evaluated for distribution as a controlled document.

5.1.8.3. Spreadsheets used to evaluate or produce client results must be locked and secured by the Quality and IT Departments. All spreadsheets must be validated and approved by the QA and/or IT Department. All copies of superseded spreadsheets are removed from general use and the original copy of each spreadsheet is archived for audit or knowledge preservation purposes. Use of archived spreadsheets or the unauthorized alterations of locked and secured spreadsheets on the network is strictly prohibited.

5.2. Document Change Control

5.2.1. Changes to managed documents are reviewed and approved in the same manner as the original review. Any revision to a document requires the approval of the applicable signatories. After revisions are approved, a revision number is assigned and the previous version of the document is officially retired. Copies may be kept for audit or knowledge preservation purposes.

5.2.1.1. Archived copies of controlled documents are marked as RETIRED by the QA Department including the date they were retired and the initials of the person who archived the document. The hardcopy document is then segregated from the current controlled documents in the QA files.

5.2.1.2. Electronic copies of the archived documents are moved to the ARCHIVE file folder in the Quality Department section of the network.

5.2.2. All controlled copies of the previous document are replaced with controlled copies of the revised document and the superseded copies are destroyed or archived. All affected personnel are advised that there has been a revision and any necessary training is scheduled.

5.3. Management of Change

5.3.1. The process for documenting necessary changes within the laboratory network are not typically handled using the corrective or preventive action system as outlined in section 9.0. Management of Change is a proactive approach to dealing with change to minimize the potential negative impact of systematic change in the laboratory and to ensure that each change has a positive desired outcome. This process will primarily be used for the implementation of large scale projects and information system changes as a means to apply consistent systems or procedures within the laboratory network. The request for change is submitted by the initiator and subsequently assigned to an individual or team for development and planning. The final completion of the process culminates in final approval and verification that the procedure was effectively implemented. Additional information can be found in SOP S-ALL-Q-036 **Management of Change** or its equivalent revision or replacement.

6.0. EQUIPMENT AND MEASUREMENT TRACEABILITY

Each PASI facility is equipped with sufficient instrumentation and support equipment to perform the relevant analytical testing or field procedures performed by each facility. Support equipment includes chemical standards, thermometers, balances, disposable and mechanical pipettes, etc. This section details some of the procedures necessary to maintain traceability and to perform proper calibration of instrumentation and support equipment. See Attachment III for a list of equipment currently used at the PASI-Pittsburgh facility.

6.1. Standards and Traceability

6.1.1. Each PASI facility retains all pertinent information for standards, reagents, and chemicals to assure traceability to a national standard. This includes documentation of purchase, receipt, preparation, and use.

6.1.2. Upon receipt, all purchased standard reference materials are recorded into a standard logbook or database and assigned a unique identification number. The entries include the facility's unique identification number, the chemical name, manufacturer name, manufacturer's identification numbers, receipt date, and expiration date. Vendor's certificates of analysis for all standards, reagents, or chemicals are retained for future reference.

6.1.3. Subsequent preparations of intermediate or working solutions are also documented in a standard logbook or database. These entries include the stock standard name and lot number, the manufacturer name, the solvents used for preparation, the solvent lot number and manufacturer, the preparation steps, preparation date, expiration dates, preparer's initials, and a unique PASI identification number. This number is used in any applicable sample preparation or analysis logbook so the standard can be traced back to the standard preparation record. This process ensures traceability back to the national standard.

6.1.4. All prepared standard or reagent containers include the PASI identification number, the standard or chemical name, the date of preparation, the date of expiration, the concentration with units, and the preparer's initials. This ensures traceability back to the standard preparation logbook.

6.1.5. For containers that are too small to accommodate labels that list all of the above information associated with a standard, the minimum required information will be PASI standard ID, concentration, and expiration date. This assures that no standard will be used past its assigned expiration date.

6.1.6. If a second source standard is required to verify an existing calibration or spiking standard, this standard must be obtained from a different manufacturer or from a different lot unless client specific QAPP requirements state otherwise.

6.1.7. Additional information concerning standards and reagent traceability can be found in the SOP SOT-ALL-Q-025 **Standard and Reagent Management and Traceability** or its equivalent revision or replacement.

6.2. General Analytical Instrument Calibration Procedures (Organic and Inorganic)

6.2.1. All support equipment and instrumentation are calibrated or checked before use to ensure proper functioning and verify that the laboratory's requirements are met. All calibrations are performed by, or under the supervision of, an experienced analyst at scheduled intervals against either certified standards traceable to recognized national standards or reference standards whose values have been statistically validated. All radionuclide sources shall be validated by counting the sources or dilutions of the sources and documenting that the results are within the established acceptance criteria.

6.2.2. Calibration standards for each parameter are chosen to establish the linear range of the instrument and must bracket the concentrations of those parameters measured in the samples. The lowest calibration standard is the lowest concentration for which quantitative data may be reported. Data reported below this level is considered to have less certainty and must be reported using appropriate data qualifiers or explained in a narrative. The highest calibration standard is the highest concentration for which quantitative data may be reported. Data reported above this level is considered to have less certainty and must be reported using appropriate data qualifiers or explained in the narrative. Any specific method requirement for number and type of calibration standards supersedes the general requirement. Instrument and method specific calibration criteria are explained within the specific analytical standard operating procedures for each facility.

6.2.2.1. Radiological calibrations may follow one of several methodologies based on technology of the counting; these can include efficiency curves, energy calibrations and quench curves. The various calibrations should ensure that the range chosen encompasses the activities expected in the client samples.

6.2.3. Results from all calibration standards analyzed must be included in constructing the calibration curve with the following exceptions:

6.2.3.1. The lowest level calibration standard may be removed from the calibration as long as the remaining number of concentration levels meets the minimum established by the method and standard operating procedure. For multi-parameter methods, this may be done on an individual analyte basis. The reporting limit must be adjusted to the lowest concentration included in the calibration curve;

6.2.3.2. The highest level calibration standard may be removed from the calibration as long as the remaining number of concentration levels meets the minimum established by the method and standard operating procedure. For multi-parameter methods, this may be done an individual analyte basis. The upper limit of quantitation must be adjusted to the highest concentration included in the calibration curve;

6.2.3.3. Multiple points from either the high end or the low end of the calibration curve may be excluded as long as the remaining points are contiguous in nature and the minimum number of levels remains as established by method or standard operating procedure. The reporting limit or quantitation range, whichever is appropriate, must be adjusted accordingly;

6.2.3.4. Results from a concentration level between the lowest and highest calibration levels can only be excluded from an initial calibration curve for a documentable and acceptable cause with approval from the responsible department supervisor and the local SQM/QM or their designee. An acceptable cause is defined as an obvious sample introduction issue that resulted in no response or a documented response that is less than the lowest standard used in the ICAL. A suspected incorrectly prepared standard is not considered to be an acceptable cause. The results for all analytes are to be excluded and the point must be replaced by re-analysis. Re-analysis of this interior standard must occur within the same 12-hour tune time period for GC/MS methodologies and within 8 hours of the initial analysis of that standard for non-GC/MS methodologies. All samples analyzed prior to the re-analyzed calibration curve point must be re-analyzed after the calibration curve is completed and re-processed against the final calibration curve.

6.2.4. Instrumentation or support equipment that cannot be calibrated to specification or is otherwise defective is clearly labeled as out-of-service until it has been repaired and tested to demonstrate it meets the laboratory's specifications. All repair and maintenance activities including service calls are documented in the maintenance log. Equipment sent off-site for calibration testing is packed and transported to prevent breakage and is in accordance with the calibration laboratory's recommendations.

6.2.5. In the event that recalibration of a piece of test equipment indicates the equipment may have been malfunctioning during the course of sample analysis, an investigation is performed. The results of the investigation along with a summary of the information reviewed are documented and maintained by the quality manager. If the investigation indicates sample results have been impacted, the customer is notified within 30 days. This allows for sufficient investigation and review of documentation to determine the impact on the analytical results. Instrumentation found to be consistently out of calibration is either repaired and positively verified or taken out of service and replaced.

6.2.6. Raw data records are retained to document equipment performance. Sufficient raw data is retained to reconstruct the instrument calibration and explicitly connect the continuing calibration verification to the initial calibration.

6.2.7. **General Organic Calibration Procedures**

6.2.7.1. Calibration standards are prepared at a minimum of five concentrations for organic analyses (unless otherwise stipulated in the method).

6.2.7.2. Initial calibration curves are evaluated against appropriate statistical models as required by the analytical methods. Curves that do not meet the appropriate criteria require corrective action that may include re-running the initial calibration curve. Rounding to meet initial calibration criteria is not allowed, that is, 15.3 cannot be rounded down to meet a $\leq$ 15% RSD requirement. This also applies to linear and non-linear fit requirements. All initial calibrations are verified with an initial calibration verification standard (ICV) obtained from a second manufacturer or second lot from the same manufacturer if that lot can be demonstrated as prepared independently from other lots prior to the analysis of samples. Sample results are quantitated from the initial calibration unless otherwise required by regulation, method, or program.

6.2.7.3. The calibration curve is verified by the analysis of a mid-level continuing calibration verification (CCV) standard during the course of sample analysis. This standard is from the same source as the initial calibration unless otherwise specified in the source method to be from an alternate source material. Rounding to meet continuing calibration criteria is not allowed. Continuing calibration verification is performed at the beginning and end of each analytical batch except if an internal standard is used, then only one verification at the beginning of the batch is needed, whenever it is expected that the analytical system may be out of calibration, if the time period for calibration has expired, or for analytical systems that have specific calibration verification requirements. This verification standard must meet acceptance criteria in order for sample analysis to proceed.

6.2.7.4. In the event that the CCV does not meet the acceptance criteria, a second CCV may be injected as part of the diagnostic evaluation and corrective action investigation. If the second CCV is acceptable, the analytical sequence may be continued. If both CCVs fail, the analytical sequence is terminated and corrective action is initiated. Sample analysis cannot begin until after documented corrective action has been completed and either two consecutive passing CCVs have been analyzed or the instrument has successfully passed a new initial calibration. All samples analyzed since the last compliant CCV are re-analyzed for methodologies utilizing external calibration.

6.2.7.4.1. For DoD labs: the lab must re-analyze CCVs and all samples analyzed since the last successful calibration verification. If re-analysis is not possible, the lab must notify the client prior to reporting data associated with a non-compliant CCV. If these data are reported, the data must be qualified and explained in the case narrative. If the lab routinely analyzes two CCVs, then both CCVs must be evaluated. If either CCV fails, the lab must perform all required corrective actions and re-analyze all samples since the last acceptable calibration verification.

6.2.7.5. When instruments are operating unattended, autosamplers may be programmed to inject consecutive CCVs as a preventative measure against CCV failure with no corrective action. In this case, both CCVs must be evaluated to determine potential impact to the results. A summary of the decision tree and necessary documentation are listed below:

- If both CCVs meet the acceptance criteria, the analytical sequence is allowed to continue without corrective action. The 12 hour clock begins with the injection of the second CCV.
- If the first CCV does not meet the acceptance criteria and the second CCV is acceptable, the analytical sequence is continued and the results are reported.
- If the first CCV meets the acceptance criteria and the second CCV is out of control, the samples after the out of control CCV must be re-analyzed in a compliant analytical sequence.
- If both CCVs are out of control, all samples since the last acceptable CCV must be re-analyzed in a compliant analytical sequence.

6.2.7.6. Some analytical methods require that samples be bracketed by passing CCVs analyzed both before and after the samples. This is specific to each method but, as a general rule, all external calibration methods require bracketing CCVs. Most internal standard calibrations do not require bracketing CCVs.

6.2.7.7. Some analytical methods require verification based on a time interval; some methods require a frequency based on an injection interval. The type and frequency of the calibration verifications is dependent on both the analytical method and possibly on the quality program associated with the samples. The type and frequency of calibration verification will be documented in the method specific SOP employed by each laboratory.

6.2.8. General Inorganic Calibration Procedures

6.2.8.1. The instrument is initially calibrated with standards at multiple concentrations to establish the linearity of the instrument's response. A calibration blank is also included. Initial calibration curves are evaluated against appropriate statistical models as required by the analytical methods. Rounding to meet initial calibration criteria is not allowed. This also applies to linear and non-linear fit requirements. The number of calibration standards used depends on the specific method criteria or customer project requirements, although normally a minimum of three standards is used.

6.2.8.2. The ICP and ICP/MS can be standardized with a zero point and a single point calibration if:

- Prior to analysis, the zero point and the single point calibration are analyzed and a linear range has been established,
- Zero point and single point calibration standards are analyzed with each batch
- A standard corresponding to the LOQ is analyzed with the batch and meets the established acceptance criteria
- The linearity is verified at the frequency established by the method or manufacturer.

6.2.8.3. All initial calibrations are verified with an initial calibration verification standard (ICV) obtained from a second manufacturer or second lot from the same manufacturer if the lot can be demonstrated as prepared independently from other lots prior to the analysis of samples. Sample results are quantitated from the initial calibration unless otherwise required by regulation, method, or program.

6.2.8.4. During the course of analysis, the calibration curve is periodically verified by the analysis of calibration verification standards (CCV). A calibration verification standard is analyzed within each analytical batch at method/program specific intervals to verify that the initial calibration is still valid. The CCV is also analyzed at the end of the analytical batch.

6.2.8.5. A calibration blank is also run with each calibration verification standard to verify the cleanliness of the system. All reported results must be bracketed by acceptable CCVs. Instrument and method specific calibration acceptance criteria are explained within the specific analytical standard operating procedures for each facility.

6.2.8.6. Interference check standards are also analyzed per method requirements and must meet acceptance criteria for metals analyses.

6.2.9. Radiological Equipment

6.2.9.1. Radiological Equipment should be calibrated at the appropriate frequency and whenever the equipment undergoes maintenance. In the case of liquid scintillation counters the equipment shall be recalibrated when a significant move has taken place.

6.2.9.2. Calibrations can vary with equipment; in the case of gas flow proportional counters standards that range the expected residue range for gross alpha and beta shall be used, with efficiency curves developed to encompass the range of client sample residues. Any samples outside of this range shall be evaluated and the aliquot changed to accommodate the curve if necessary. Beta emitters, or isotopes that are shown to have less than a 2% efficiency change with residue that are known to not experience self attenuation may be calibrated by using a least 3 standards of known activity and comparing the efficiency results to ensure all agree to a relative standard deviation of less than 5%.

6.2.9.3. Quench factors for liquid scintillation counters shall be prepared by adding varied amounts of quenching agent. Any sample displaying a quench factor outside of the curve shall be evaluated. If the quench factors are shown to not vary in efficiency by greater than 2% then an efficiency calibration can be established using at least 3 standards of known activity and comparing the efficiency results to ensure all agree to a relative standard deviation of less than 5%.

6.2.9.4. Cross talk factors must also be evaluated when samples are known to contain ore than one beta or an alpha and beta emitter.

6.2.9.5. All detectors must pass various daily tests depending upon the technology. The criteria of these various tests should be known to the analyst. Any detector that does not pass the daily check must be re-checked. If the daily test fails a second time the detector must be taken out of service for that day. Any detector that fails two daily checks must be evaluated and serviced if required. In most instances two passing daily checks are required to put a detector back into service

6.3. Support Equipment Calibration Procedures

6.3.1. All support equipment is calibrated or verified at least annually using NIST traceable references over the entire range of use. The results of calibrations or verifications must be within the specifications required or the equipment will be removed from service until repaired. The laboratory maintains records to demonstrate the correction factors applied to working thermometers.

6.3.2. On each day the equipment is used, balances, ovens, refrigerators (those used to keep samples and standards at required temperatures), freezers, and water baths are checked in the expected use range with NIST traceable references in order to ensure the equipment meets laboratory specifications and these checks are documented appropriately.

6.3.3. **Analytical Balances**

6.3.3.1. Each analytical balance is calibrated or verified at least annually by a qualified service technician. The calibration of each balance is verified each day of use with weights traceable to NIST bracketing the range of use. Calibration weights are ASTM Class 1 or other class weights that have been calibrated against a NIST standard weight and are re-certified every 5 years at a minimum against a NIST traceable reference. Some accrediting agencies may require more frequent checks. If balances are calibrated by an external agency, verification of their weights must be provided. All information pertaining to balance maintenance and calibration is recorded in the individual balance logbook and/or is maintained on file in the Quality department.

6.3.4. **Thermometers**

6.3.4.1. Certified, or reference, thermometers are maintained for checking calibration of working thermometers. Reference thermometers are provided with NIST traceability for initial calibration and are re-certified, at a minimum, every 3 years with equipment directly traceable to NIST.

6.3.4.2. Working thermometers are compared with the reference thermometers annually according to corporate metrology procedures. Each thermometer is individually numbered and assigned a correction factor based on the NIST reference source. In addition, working thermometers are visually inspected by laboratory personnel prior to use and temperatures are documented.

6.3.4.3. Laboratory thermometer inventory and calibration data are maintained in the Quality department.

6.3.5. **pH/Electrometers**

6.3.5.1. The meter is calibrated before use each day, using fresh buffer solutions. The range of pH that is used for calibration should bracket the pH measurements of the samples analyzed.

6.3.6. **Spectrophotometers**

6.3.6.1. During use, spectrophotometer performance is checked at established frequencies in analysis sequences against initial calibration verification (ICV) and continuing calibration verification (CCV) standards.

6.3.7. **Mechanical Volumetric Dispensing Devices**

6.3.7.1. Mechanical volumetric dispensing devices including bottle top dispensers (those that are critical in measuring a required amount of reagent), pipettes, and burettes, excluding Class A volumetric glassware, are checked for accuracy on a quarterly basis. Glass microliter syringes are checked for accuracy prior to initial use and reverified annually.

6.3.7.2. Additional information regarding calibration and maintenance of laboratory support equipment can be found in SOP PGH-C-032 **Support Equipment** or its equivalent revision or replacement.

6.4. Instrument/Equipment Maintenance

6.4.1. The objectives of the Pace Analytical maintenance program are twofold: to establish a system of instrument care that maintains instrumentation and equipment at required levels of calibration and sensitivity, and to minimize loss of productivity due to repairs.

6.4.2. The Operations Manager and/or department manager/supervisors are responsible for providing technical leadership to evaluate new equipment, solve equipment problems, and coordinate instrument repair and maintenance. Analysts have the primary responsibility to perform routine maintenance.

6.4.3. To minimize downtime and interruption of analytical work, preventative maintenance is routinely performed on each analytical instrument. Up-to-date instructions on the use and maintenance of equipment are available to staff in the department where the equipment is used.

6.4.4. Department manager/supervisors are responsible for maintaining an adequate inventory of spare parts required to minimize equipment downtime. This inventory includes parts and supplies that are subject to frequent failure, have limited lifetimes, or cannot be obtained in a timely manner should a failure occur.

6.4.5. All major equipment and instrumentation items are uniquely identified to allow for traceability. Equipment/instrumentation is, unless otherwise stated, identified as a system and not as individual pieces. The laboratory maintains equipment records that include the following:

- The name of the equipment and its software

- The manufacturer's name, type, and serial number
- Approximate date received and date placed into service
- Current location in the laboratory
- Condition when received (new, used, etc.)
- Copy of any manufacturer's manuals or instructions
- Dates and results of calibrations and next scheduled calibration (if known)
- Details of past maintenance activities, both routine and non-routine
- Details of any damage, modification or major repairs

6.4.6. All instrument maintenance is documented in maintenance logbooks that are assigned to each particular instrument or system.

6.4.7. The maintenance log entry must include a summary of the results of that analysis and verification by the analyst that the instrument has been returned to an in-control status. In addition, each entry must include the initials of the analyst making the entry, the dates the maintenance actions were performed, and the date the entry was made in the maintenance logbook, if different from the date(s) of the maintenance.

6.4.7.1. Return to control after maintenance may be demonstrated by the successful analysis of one or more QC samples depending upon the nature of the initial instrument problem.

6.4.8. Any equipment that has been subjected to overloading or mishandling, or that gives suspect results, or has been shown to be defective, is taken out of service and clearly identified. The equipment shall not be used to analyze customer samples until it has been repaired and shown to perform satisfactorily.

7.0. CONTROL OF DATA

Analytical results processing, verification, and reporting are procedures employed that result in the delivery of defensible data. These processes include, but are not limited to, calculation of raw data into final concentration values, review of results for accuracy, evaluation of quality control criteria and assembly of technical reports for delivery to the data user.

All analytical data undergo a well-defined, well-documented multi-tier review process prior to being reported to the customer. This section describes procedures used by PASI for translating raw analytical data into accurate final sample reports as well as PASI data storage policies.

7.1. Analytical Results Processing

7.1.1. When analytical, field, or product testing data is generated, it is either recorded in a bound laboratory logbook (e.g., Run log or Instrument log) or copies of computer-generated printouts that are appropriately labeled and filed. These logbooks and other laboratory records are kept in accordance with each facility's Standard Operating Procedure for documentation storage and archival. If the laboratory chooses to minimize or eliminate its paper usage, these records can be kept on electronic media. In this case, the laboratory must ensure that there are sufficient redundant electronic copies so no data is lost due to unforeseen computer issues.

7.1.2. The primary analyst is responsible for initial data reduction and review. This includes confirming compliance with required methodology, verifying calculations, evaluating quality control data, noting non-conformances in logbooks or as footnotes or narratives, and uploading analytical results into the LIMS. The primary analyst must be clearly identified in all applicable logbooks, spreadsheets and LIMS fields.

7.1.3. The primary analyst then compiles the initial data package for verification. This compilation must include sufficient documentation for data review. It may include standard calibrations, chromatograms, manual integration documentation, electronic printouts, chain of custody forms, and logbook copies.

7.1.4. Some agencies or customers require different levels of data reporting. For these special levels, the primary analyst may need to compile additional project information, such as initial calibration data or extensive spectral data, before the data package proceeds to the verification step.

7.2. Data Verification

7.2.1. Data verification is the process of examining data and accepting or rejecting it based on pre-defined criteria. This review step is designed to ensure that reported data are free from calculation and transcription errors, that quality control parameters are evaluated, and that any non-conformances are properly documented.

7.2.2. Analysts performing the analysis and subsequent data reduction have primary responsibility for quality of the data produced. The primary analyst initiates the data verification process by reviewing and accepting the data, provided QC criteria have been met for the samples being reported. Data review checklists, either hardcopy or electronic, are used to document the data review process. The primary analyst is responsible for the initial input of the data into the LIMS. The primary analyst and reviewer must be clearly identified on all applicable data review checklists.

7.2.3. The completed data package is then sent to a designated qualified reviewer (this cannot be the primary analyst). The following criteria have been established to qualify someone as a data reviewer. To perform secondary data review, the reviewer must:

7.2.3.1. Have a current Demonstration of Capability (DOC) study on file and have an SOP acknowledgement form on file for the method/procedure being reviewed; or, See Note

7.2.3.2. Have a DOC on file for a similar method/technology (i.e., GC/MS) and have an SOP acknowledgment form on file for the method/procedure being reviewed; or, See Note

7.2.3.3. Supervise or manage a Department and have an SOP acknowledgment form on file for the method/procedure being reviewed; or,

7.2.3.4. Have significant background in the department/methods being reviewed through education or experience and have an SOP acknowledgment form on file for the method/procedure being reviewed.

7.2.4. **Note:** Secondary reviewer status must be approved personally by the SQM/QM or SGM/GM/AGM/OM in the event that this person has no prior experience on the specific method or general technology.

7.2.5. This reviewer provides an independent technical assessment of the data package and technical review for accuracy according to methods employed and laboratory protocols. This assessment involves a quality control review for use of the proper methodology and detection limits, compliance to quality control protocol and criteria, presence and completeness of required deliverables, and accuracy of calculations and data quantitation. The reviewer validates the data entered into the LIMS and documents approval of manual integrations.

7.2.6. Once the data have been technically reviewed and approved, authorization for release of the data from the analytical section is indicated by initialing and dating the data review checklist or otherwise initialing and dating the data (or designating the review of data electronically). The Operations or Project Manager examines the report for method appropriateness, detection limits and QC acceptability. Any deviations from the referenced methods are checked for documentation and validity, and QC corrective actions are reviewed for successful resolution.

7.2.7. Additional information regarding data review procedures can be found in SOP S-ALL-Q-037 Data Review or its equivalent revision or replacement, as well as in SOP PGH-C-030 Manual Integration or its equivalent revision or replacement.

7.2.8. The Data Checker program will process validated data for a given project against a set of pre-determined requirements and known chemistry relationships. The program creates a report that includes a series of warnings and errors for any requirement or condition determined to be suspect or incorrect. These warnings and error counts are displayed on the "Project Inquiry by Client" screen and on the final Data Checker reports. For projects that have any number of warnings or errors, the Data Checker report will provide a message that identifies the source and condition of the error or warning. A report is generated that is reviewed by the Project Manager. Any warnings and errors are evaluated. All errors are addressed prior to the final report being generated. Data Checker is not applied to radiological reports due to the limitation of the LIMS.

7.2.9. At a minimum, at least 10% of all DoD projects analyzed at PASI-PGH are reviewed by the Quality department. This 10% review can be done after the data have been submitted to the clients. See SOP S-ALL-Q-011 (or equivalent replacement), **Audits and Inspections**, for full Quality department final report and raw data review requirements.

7.3. Data Reporting

7.3.1. Data for each analytical fraction pertaining to a particular PASI project number are delivered to the Project Manager for assembly into the final report. All points mentioned during technical and QC reviews are included in a case narrative if there is potential for data to be impacted.

7.3.2. Final reports are prepared according to the level of reporting required by the customer and can be transmitted to the customer via hardcopy or electronic deliverable. A standard PASI final report consists of the following components:

7.3.2.1. A title which designates the report as “Final Report”, “Laboratory Results”, “Certificate of Results”, etc.;

7.3.2.2. Name and address of laboratory (or subcontracted laboratories, if used);

7.3.2.3. Phone number and name of laboratory contact to where questions can be referred;

7.3.2.4. A unique identification number for the report. The pages of the report shall be numbered and a total number of pages shall be indicated;

7.3.2.5. Name and address of customer and name of project;

7.3.2.6. Unique identification of samples analyzed as well as customer sample IDs;

7.3.2.7. Identification of any sample that did not meet acceptable sampling requirements of the relevant governing agency, such as improper sample containers, holding times missed, sample temperature, etc.;

7.3.2.8. Date and time of collection of samples, date of sample receipt by the laboratory, dates of sample preparation and analysis, and times of sample preparation and analysis when the holding time for either is 72 hours or less;

7.3.2.9. Identification of the test methods used;

7.3.2.10. Identification of sampling procedures if sampling was conducted by the laboratory;

7.3.2.11. Deviations from, additions to, or exclusions from the test methods. These can include failed quality control parameters, deviations caused by the matrix of the sample, etc., and can be shown as a case narrative or as defined footnotes to the analytical data;

7.3.2.12. Identification of whether calculations were performed on a dry or wet-weight basis;

7.3.2.13. Reporting limits used;

7.3.2.14. Final results or measurements, supported by appropriate chromatograms, charts, tables, spectra, etc.;

7.3.2.15. A signature and title, electronic or otherwise, of person accepting responsibility for the content of the report;

7.3.2.16. Date report was issued;

7.3.2.17. A statement clarifying that the results of the report relate only to the samples tested or to the samples as they were received by the laboratory;

7.3.2.18. If necessary, a statement indicating that the report must not be reproduced except in full, without the written approval of the laboratory;

7.3.2.19. Identification of all test results provided by a subcontracted laboratory or other outside source;

7.3.2.20. Identification of results obtained outside of quantitation levels.

7.3.3. In addition to the requirements listed above, final reports shall also contain the following items when necessary for the interpretation of results:

7.3.3.1. Deviations from, additions to, or exclusions from the test method, and information on specific test conditions, such as environmental conditions;

7.3.3.2. Where relevant, a statement of compliance/non-compliance with requirements and/or specifications (e.g., the TNI standard);

7.3.3.3. Where applicable, a statement on the estimated uncertainty of measurement; information on uncertainty is needed in test reports when it is relevant to the validity or application of the test results, when a customer's instruction so requires, or when the uncertainty affects compliance to a specification limit;

7.3.3.4. Where appropriate and needed, opinions and interpretations, which may include opinions on the compliance/non-compliance of the results with requirements, fulfillment of contractual requirements, recommendations on how to use the results, and guidance to be used for improvement;

7.3.4. For DoD , in reference to item 7.3.2.8 listed above, both date and time of preparation and analysis are considered essential information, regardless of the length of the holding time, and shall be included as part of the laboratory report.

7.3.5. Any changes made to a final report shall be designated as "Revised" or equivalent wording. The laboratory must keep sufficient archived records of all laboratory reports and revisions. For higher levels of data deliverables, a copy of all supporting raw data is sent to the customer along with a final report of results. When possible, the PASI facility will provide electronic data deliverables (EDD) as required by contracts or upon customer request.

7.3.6. Customer data that requires transmission by telephone, telex, facsimile or other electronic means undergoes appropriate steps to preserve confidentiality.

7.3.7. The following positions are the only approved signatories for PASI final reports:

- Senior General Manager
- General Manager
- Assistant General Manager
- Senior Quality Manager
- Quality Manager
- Client Services Manager
- Project Manager
- Project Coordinator

7.4. Data Security

7.4.1. All data including electronic files, logbooks, extraction/digestion/distillation worksheets, calculations, project files and reports, QA and Administrative records/data and any other information used to produce the technical report are maintained secured and retrievable by the PASI facility.

7.5. Data Archiving

7.5.1. All records compiled by PASI are maintained legible and retrievable and stored secured in a suitable environment to prevent loss, damage, or deterioration by fire, flood, vermin, theft, and/or environmental deterioration. Records are retained for a minimum of five years unless superseded by federal, state, contractual, and/or accreditation requirements. These records may include, but are not limited to, customer data reports, calibration and maintenance of equipment, raw data from instrumentation, quality control documents, observations, calculations, and logbooks. These records are retained in order to provide for possible historical reconstruction including sampling, receipt, preparation, analysis, and personnel involved. TNI-related records will be made readily available to accrediting authorities. Access to archived data is documented and controlled by the SQM/QM or a designated Data Archivist.

7.5.2. Records that are computer generated have either a hard copy or electronic write protected backup copy. Hardware and software necessary for the retrieval of electronic data is maintained with the applicable records. Archived electronic records are stored protected against electronic and/or magnetic sources.

7.5.3. In the event of a change in ownership, accountability or liability, reports of analyses performed pertaining to accreditation will be maintained by the acquiring entity for a minimum of five years. In the event of bankruptcy, laboratory reports and/or records will be transferred to the customer and/or the appropriate regulatory entity upon request.

7.6. Data Disposal

7.6.1. Data that has been archived for the facility's required storage time may be disposed of in a secure manner by shredding, returning to customer, or utilizing some other means that does not jeopardize data confidentiality. Records of data disposal will be archived for a minimum of seven years unless superseded by federal, contractual, and/or accreditation requirements. Data disposal includes any preliminary or final reports that are disposed.

8.0. QUALITY SYSTEM AUDITS AND REVIEWS

8.1. Internal Audits

8.1.1. Responsibilities

8.1.1.1. The SQM/QM is responsible for designing and/or conducting internal audits in accordance with a predetermined schedule and procedure. Since internal audits represent an independent assessment of laboratory functions, the auditor must be functionally independent from laboratory operations to ensure objectivity. The auditor must be trained, qualified, and familiar enough with the objectives, principles, and procedures of laboratory operations to be able to perform a thorough and effective evaluation. The SQM/QM evaluates audit observations and verifies the completion of corrective actions. In addition, a periodic corporate audit will be conducted. The corporate audits will focus on the effectiveness of the Quality System as outlined in this manual but may also include other quality programs applicable to an individual laboratory.

8.1.2. Scope and Frequency of Internal Audits

8.1.2.1. The complete internal audit process consists of the following four sections:

- Raw Data Review audits- conducted according to a schedule per local SQM/QM. A certain number of these data review audits are conducted per quarter to accomplish this yearly schedule;
- Quality System audits- considered the traditional internal audit function and includes analyst interviews to help determine whether practice matches method requirements and SOP language;
- Final Report reviews;
- Corrective Action Effectiveness Follow-up.

8.1.2.2. Internal systems audits are conducted yearly at a minimum. The scope of these audits includes evaluation of specific analytical departments or a specific quality related system as applied throughout the laboratory.

8.1.2.3. Where the identification of non-conformities or departures cast doubt on the laboratory's compliance with its own policies and procedures, the lab must ensure that the appropriate areas of activity are audited as soon as possible. Examples of system-wide elements that can be audited include:

- Quality Systems documents, such as Standard Operating Procedures, training documents, Quality Assurance Manual, and all applicable addenda
- Data records and non-technical documents
- Personnel and training files.
- General laboratory safety protocols.
- Chemical handling practices, such as labeling of reagents, solutions, and standards as well as all associated documentation.
- Documentation concerning equipment and instrumentation, calibration/maintenance records, operating manuals.
- Sample receipt and management practices.
- Analytical documentation, including any discrepancies and corrective actions.

- General procedures for data security, review, documentation, reporting, and archiving.
- Data integrity issues such as proper manual integrations.

8.1.2.4. When the operations of a specific department are evaluated, a number of additional functions are reviewed including:

- Detection limit studies
- Internal chain of custody documentation
- Documentation of standard preparations
- Quality Control limits and Control charts

8.1.2.5. Certain projects may require an internal audit to ensure laboratory conformance to site work plans, sampling and analysis plans, QAPPs, etc.

8.1.2.6. A representative number of data audits are completed annually. Findings from these data audits are handled in the same manner as those from other internal and external audits.

8.1.2.7. The laboratory, as part of their overall internal audit program, ensures that a review is conducted with respect to any evidence of inappropriate actions or vulnerabilities related to data integrity. Discovery and reporting of potential data integrity issues are handled in a confidential manner. All investigations that result in findings of inappropriate activity are fully documented, including the source of the problem, the samples and customers affected the impact on the data, the corrective actions taken by the laboratory, and which final reports had to be re-issued. Customers must be notified within 30 days after the data investigation is completed and the impact to final results is assessed.

8.1.3. Internal Audit Reports and Corrective Action Plans

8.1.3.1. Additional information can be found in SOP S-ALL-Q-011 **Internal and External Audits** or its equivalent revision or replacement.

8.1.3.2. A full description of the audit, including the identification of the operation audited, the date(s) on which the audit was conducted, the specific systems examined, and the observations noted are summarized in an internal audit report. Although other personnel may assist with the performance of the audit, the SQM/QM writes and issues the internal audit report identifying which audit observations are deficiencies that require corrective action.

8.1.3.3. When audit findings cast doubt on the effectiveness of the operations or on the correctness of validity of the laboratory’s environmental test results, the laboratory will take timely corrective action and notify the customer in writing within three business days, if investigations show that the laboratory results may have been affected.

8.1.3.4. Once completed, the internal audit report is issued jointly to the SGM/GM/AGM/OM and the manager(s)/supervisor(s) of the audited operation at a minimum. The responsible manager(s)/supervisor(s) responds within 14 days with a proposed plan to correct all of the deficiencies cited in the audit report. The SQM/QM may grant additional time for responses to large or complex deficiencies (not to exceed 30 days). Each response must include timetables for completion of all proposed corrective actions.

8.1.3.5. The SQM/QM reviews the audit responses. If the response is accepted, the SQM/QM uses the action plan and timetable as a guideline for verifying completion of the corrective action(s). If the SQM/QM determines that the audit response does not adequately address the correction of cited deficiencies, the response will be returned for modification.

8.1.3.6. To complete the audit process, the SQM/QM performs a re-examination of the areas where deficiencies were found to verify that all proposed corrective actions have been implemented. An audit deficiency is considered closed once implementation of the necessary corrective action has been audited and verified. This is usually within 60-90 days after implementation. If corrective action cannot be verified, the associated deficiency remains open until that action is completed.

8.2. External Audits

8.2.1. PASI laboratories are audited regularly by regulatory agencies to maintain laboratory certifications and by customers to maintain appropriate specific protocols.

8.2.2. Audit teams external to the company review the laboratory to assess the effectiveness of systems and degree of technical expertise. The SQM/QM and other QA staff host the audit team and assist in facilitation of the audit process. Generally, the auditors will prepare a formalized audit report listing deficiencies observed and follow-up requirements for the laboratory. In some cases, items of concern are discussed during a debriefing convened at the end of the on-site review process.

8.2.3. The laboratory staff and supervisors develop corrective action plans to address any deficiencies with the guidance of the SQM/QM. The SGM/GM/AGM/OM provides the necessary resources for staff to develop and implement the corrective action plans. The SQM/QM collates this information and provides a written response to the audit team. The response contains the corrective action plan and expected completion dates for each element of the plan. The SQM/QM follows-up with the laboratory staff to ensure corrective actions are implemented and that the corrective action was effective.

8.3. Quarterly Quality Reports

8.3.1. The SQM/QM is responsible for preparing a quarterly report to management summarizing the effectiveness of the laboratory Quality Systems. This status report will include:

- Overview of quality activities for the quarter
- Certification status
- Proficiency Testing study results
- SOP revision activities
- Internal audit (method/system) findings
- Manual integration audit findings (Mintminer)
- Raw Data and Final Report review findings
- MDL activities
- Other significant Quality System items

8.3.2. The Corporate Director of Quality utilizes the information from each laboratory to make decisions impacting the quality program compliance of the company as a whole. Each SGM/GM/AGM/OM utilizes the quarterly report information to make decisions impacting Quality Systems and operational systems at a local level.

8.3.3. Additional information can be found in SOP S-ALL-Q-014 **Quarterly Quality Report** or its equivalent revision or replacement.

8.4. Annual Managerial Review

8.4.1. A managerial review of Quality Systems is performed on an annual basis at a minimum. This allows for assessing program effectiveness and introducing changes and/or improvements.

8.4.2. The managerial review must include the following topics of discussion:

- Suitability of quality management policies and procedures
- Manager/Supervisor reports
- Internal audit results
- Corrective and preventive actions
- External assessment results
- Proficiency testing studies
- Sample capacity and scope of work changes
- Customer feedback, including complaints
- Recommendations for improvement,
- Other relevant factors, such as quality control activities, resources, and staffing.

8.4.3. This managerial review must be documented for future reference by the SQM/QM and copies of the report are distributed to laboratory staff. Results must feed into the laboratory planning system and must include goals, objectives, and action plans for the coming year. The laboratory shall ensure that any actions identified during the review are carried out within an appropriate and agreed upon timescale. These Reviews may take place as separate events with separate reports.

8.5. Customer Service Reviews

8.5.1. As part of the annual managerial review listed previously, the sales staff is responsible for reporting on customer feedback, including complaints. The acquisition of this information is completed by performing surveys.

8.5.2. The sales staff continually receives customer feedback, both positive and negative, and reports this feedback to the laboratory management in order for them to evaluate and improve their management system, testing activities and customer service.

8.5.3. In addition, the labs must be willing to cooperate with customers or their representatives to clarify customer requests and to monitor the laboratory's performance in relation to the work being performed for the customers. This cooperation may include providing the customer reasonable access to relevant areas of the lab for the witnessing of tests being performed; or the preparation of samples or data deliverables to be used for verification purposes.

8.5.4. Customer service is an important aspect to Pace's overall objective of providing a quality product. Good communication should be provided to the customer's throughout projects. The lab should inform the customer of any delay or major deviations in the performance of analytical tests.

9.0. CORRECTIVE ACTION

Additional information can be found in SOP S-ALL-Q-012 **Corrective and Preventive Actions** or its equivalent revision or replacement.

During the process of sample handling, preparation, and analysis, or during review of quality control records, or during reviews of non-technical portions of the lab, certain occurrences may warrant the necessity of corrective actions. These occurrences may take the form of analyst errors, deficiencies in quality control, method deviations, or other unusual circumstances. The Quality System of PASI provides systematic procedures for the documentation, monitoring, completion of corrective actions, and follow-up verification of the effectiveness of these corrective actions. This can be done using PASI's LabTrack system or other system that lists among at a minimum, the deficiency by issue number, the deficiency source, responsible party, root cause, resolution, due date, and date resolved.

9.1. Corrective Action Documentation

9.1.1. The following items are examples of sources of laboratory deviations or non-conformances that warrant some form of documented corrective action:

- Internal Laboratory Non-Conformance Trends
- PE/PT Sample Results
- Internal and External Audits
- Data or Records Review (including non-technical records)
- Client Complaints
- Client Inquiries
- Holding Time violations

9.1.2. Documentation of corrective actions may be in the form of a comment or footnote on the final report that explains the deficiency (e.g., matrix spike recoveries outside of acceptance criteria) or it may be a more formal documentation (either paper system or computerized spreadsheet). This depends on the extent of the deficiency, the impact on the data, and the method or customer requirements for documentation.

9.1.3. The person who discovers the deficiency or non-conformance initiates the corrective action documentation on the Non-Conformance Corrective/ Preventive Action report and/or LabTrack. The documentation must include the affected projects and sample numbers, the name of the applicable Project Manager, the customer name, and the sample matrix involved. The person initiating the corrective action documentation must also list the known causes of the deficiency or non-conformance as well as any corrective/preventative actions that they have taken. Preventive actions must be taken in order to prevent or minimize the occurrence of the situation.

9.1.4. In the event that the laboratory is unable to determine the cause, laboratory personnel and management staff will start a root cause analysis by going through an investigative process. During this process, the following general steps must be taken into account: defining the non-conformance, assigning responsibilities, determining if the condition is significant, and investigating the root cause of the nonconformance. General non-conformance investigative techniques follow the path of the sample through the process looking at each individual step in detail. The root cause must be documented within LabTrack or on the Corrective/Preventive Action Report.

9.1.5. After all the documentation is completed, the routing of the Corrective/Preventive Action Report and /or LabTrack will continue from the person initiating the corrective action, to their immediate supervisor or the applicable Project Manager and finally to the SQM/QM, if applicable, who may be responsible for final review and signoff of corrective/preventive actions.

9.1.6. In the event that analytical testing or results do not conform to documented laboratory policies or procedures, customer requirements, or standard specifications, the laboratory shall investigate the significance of the non-conformance and document appropriate corrective actions. The proper level of laboratory management will review any departure from these requirements for technical suitability. These departures are permitted only with the approval of the SGM/GM/AGM/OM or the SQM/QM. Where necessary, Project Management will notify the customer of the situation and will advise of any ramifications to data quality (with the possibility of work being recalled). The procedures for handling non-conforming work are detailed in SOP S-ALL-Q-012 **Corrective and Preventive Actions** or its equivalent revision or replacement.

9.2. Corrective Action Completion

9.2.1. Internal Laboratory Non-Conformance Trends

9.2.1.1. There are several types of non-conformance trends that may occur in the laboratory that would require the initiation of a corrective action report. Laboratories may choose to initiate a corrective action for all instances of one or more of these categories if they so choose, however the intent is that each of these would be handled according to its severity; one time instances could be handled with a footnote or qualifier whereas a systemic problem with any of these categories may require an official corrective action process. These categories, as defined in the Corrective Action SOP are as follows:

- Login error
- Preparation Error
- Contamination
- Calibration Failure
- Internal Standard Failure
- LCS Failure
- Laboratory accident
- Spike Failure
- Instrument Failure
- Final Reporting error

In the event that product testing of nuclear facility equipment results in a noncompliance it must be evaluated to determine if it is a 10CFR50 Appendix B/NQA-1 reportable non-conformance. All such instances must be documented and brought to the Project Manager and Quality Departments attention for resolution and reporting to the client and/or proper authorities.

9.2.2. PE/PT Sample Results

9.2.2.1. Any PT result assessed as "not acceptable" requires an investigation and applicable corrective actions. The operational staff is made aware of the PT failures and they are responsible for reviewing the applicable raw data and calibrations and list possible causes for error. The SQM/QM reviews their findings and initiates another external PT sample or an internal PT sample to try and correct the previous failure. Replacement PT results must be monitored by the SQM/QM and reported to the applicable regulatory authorities.

9.2.3. **Internal and External Audits**

9.2.3.1. The SQM/QM is responsible for documenting all audit findings and their corrective actions. This documentation must include the initial finding, the persons responsible for the corrective action, the due date for responding to the auditing body, the root cause of the finding, and the corrective actions needed for resolution. The SQM/QM is also responsible for providing any back-up documentation used to demonstrate that a corrective action has been completed.

9.2.4. **Data Review**

9.2.4.1. In the course of performing primary and secondary review of data or in the case of raw data reviews (e.g., by the SQM/QM), errors may be found which require corrective actions. Any finding that affects the quality of the data requires some form of corrective action, which may include revising and re-issuing of final reports.

9.2.5. **Client Complaints**

9.2.5.1. Project Managers are responsible for issuing corrective action forms, when warranted, for customer complaints. As with other corrective actions, the possible causes of the problem are listed and the form is passed to the appropriate analyst or supervisor for investigation. After potential corrective actions have been determined, the Project Manager reviews the corrective action form to ensure all customer needs or concerns are being adequately addressed.

9.2.6. **Client Inquiries**

9.2.6.1. When an error on the customer report is discovered, the Project Manager is responsible for initiating a formal corrective action form that describes the failure (e.g., incorrect analysis reported, reporting units are incorrect, or reporting limits do not meet objectives). The Project Manager is also responsible for revising the final report if necessary and submitting it to the customer.

9.2.7. **Holding Time Violations**

9.2.7.1. In the event that a holding time has been missed, the analyst or supervisor must complete a formal corrective action form. The Project Manager and the SQM/QM must be made aware of all holding time violations.

9.2.7.2. The Project Manager must contact the customer in order that appropriate decisions are made regarding the hold time excursion and the ultimate resolution is then documented and included in the customer project file. The SQM/QM includes a list of all missed holding times in their Quarterly Report to the corporate quality office.

9.3. Preventive Action Documentation

9.3.1. Pace laboratories can take advantage of several available information sources in order to identify needed improvements in all of their systems including technical, managerial, and quality. These sources may include:

- Management Continuous Improvement Plan (CIP) metrics which are used by all production departments within Pace. When groups compare performance across the company, ways to improve systems may be discovered. These improvements can be made within a department or laboratory-wide.
- Annual managerial reviews- part of this TNI-required and NVLAP-required review is to look at all processes and procedures used by the laboratory over the past year and to determine ways to improve these processes in the future.
- Quality systems reviews- any frequent checks of quality systems (monthly logbook reviews, etc.) can uncover issues that can be corrected or adjusted before they become a larger issue.

9.3.2. When improvement opportunities are identified or if preventive action is required, the laboratory can develop, implement, and monitor preventive action plans.

10.0. GLOSSARY

The source of some of the definitions is indicated previous to the actual definition (e.g., TNI, DoD).

3P Program	The Pace Analytical continuous improvement program that focuses on Process, Productivity, and Performance. Best Practices are identified that can be used by all PASI labs.
Acceptance Criteria	TNI and DoD- Specified limits placed on characteristics of an item, process, or service defined in requirement documents.
Accreditation	TNI and DoD- The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.
Accrediting Authority	DoD- The Territorial, State or Federal agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation.
Accrediting (or Accreditation) Body	DoD- Authoritative body that performs accreditation.
Accuracy	TNI and DoD- The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator.
Aliquot	DoD- A discrete, measured, representative portion of a sample taken for analysis.
Analysis Code (Acode)	All the set parameters of a test, such as Analytes, Method, Detection Limits and Price.
Analysis Sequence	A compilation of all samples, standards and quality control samples run during a specific amount of time on a particular instrument in the order they are analyzed.
Analyst	TNI and DoD- The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.
Analyte	DoD- The specific chemicals or components for which a sample is analyzed; it may be a group of chemicals that belong to the same chemical family, and which are analyzed together.
Analytical Uncertainty	TNI- A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.
Assessment	TNI - The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its system to defined criteria (to the standards and requirements of laboratory accreditation). DoD- The evaluation process used to measure the performance or effectiveness of a system and its elements against specific criteria. Note: In this standard (DoD), assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation, peer review, inspection, or surveillance.
Atomic Absorption Spectrometer	Instrument used to measure concentration in metals samples.
Atomization	DoD- A process in which a sample is converted to free atoms.

Audit	TNI- A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives. DoD- A systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity.
Background	Radiation which is due to sources other than the source of interest (samples) in a measurement of radiation and which is detected by the measuring apparatus.
Batch	TNI and DoD- Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same quality systems matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed 20 samples.
Bias	TNI- The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).
Blank	TNI and DoD- A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.
Blind Sample	DoD- A sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.
BNA (Base Neutral Acid compounds)	A list of semi-volatile compounds typically analyzed by mass spectrometry methods. Named for the way they can be extracted out of environmental samples in an acidic, basic or neutral environment.
BOD (Biochemical Oxygen Demand)	Chemical procedure for determining how fast biological organisms use up oxygen in a body of water.
Calibration	TNI and DoD- A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. 1) In calibration of support equipment, the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI); 2) In calibration according to test methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.

Calibration Curve	TNI- The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. DoD- The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response.
Calibration Method	DoD- A defined technical procedure for performing a calibration.
Calibration Range	DoD- The range of values (concentrations) between the lowest and highest calibration standards of a multi-level calibration curve. For metals analysis with a single-point calibration, the low-level calibration check standard and the high standard establish the linear calibration range, which lies within the linear dynamic range.
Calibration Standard	TNI- A substance or reference material used for calibration. DoD- A substance or reference material used to calibrate an instrument.
Certified Reference Material (CRM)	TNI- Reference material accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute. DoD- A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body.
Chain of Custody	DoD- An unbroken trail of accountability that verifies the physical security of samples, data, and records.
Chain of custody Form (COC)	TNI and DoD- Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and type of containers; the mode of collection, the collector, time of collection; preservation; and requested analyses.
Chemical Oxygen Demand (COD)	A test commonly used to indirectly measure the amount of organic compounds in water.
Client (referred to by ISO as Customer)	DoD- Any individual or organization for whom items or services are furnished or work performed in response to defined requirements and expectations.
Code of Federal Regulations (CFR)	A codification of the general and permanent rules published in the Federal Register by agencies of the federal government.
Comparability	An assessment of the confidence with which one data set can be compared to another. Comparable data are produced through the use of standardized procedures and techniques.
Completeness	The percent of valid data obtained from a measurement system compared to the amount of valid data expected under normal conditions. The equation for completeness is: % Completeness = (Valid Data Points/Expected Data Points)*100
Confirmation	TNI and DoD- Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to: second-column confirmation; alternate wavelength; derivatization; mass spectral interpretation; alternative detectors; or additional cleanup procedures.
Conformance	DoD- An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements.

Congener	DoD- A member of a class of related chemical compounds (e.g., PCBs, PCDDs).
Consensus Standard	DoD- A standard established by a group representing a cross-section of a particular industry or trade, or a part thereof.
Continuing Calibration Blank (CCB)	A blank sample used to monitor the cleanliness of an analytical system at a frequency determined by the analytical method.
Continuing Calibration Check Compounds (CCC)	Compounds listed in mass spectrometry methods that are used to evaluate an instrument calibration from the standpoint of the integrity of the system. High variability would suggest leaks or active sites on the instrument column.
Continuing Calibration Verification	DoD- The verification of the initial calibration that is required during the course of analysis at periodic intervals. Continuing calibration verification applies to both external and internal standard calibration techniques, as well as to linear and non-linear calibration models.
Continuing Calibration Verification (CCV) Standard	Also referred to as a CVS in some methods, it is a standard used to verify the initial calibration of compounds in an analytical method. CCVs are analyzed at a frequency determined by the analytical method.
Continuous Emission Monitor (CEM)	A flue gas analyzer designed for fixed use in checking for environmental pollutants.
Contract Laboratory Program (CLP)	A national network of EPA personnel, commercial labs, and support contractors whose fundamental mission is to provide data of known and documented quality.
Contract Required Detection Limit (CRDL)	Detection limit that is required for EPA Contract Laboratory Program (CLP) contracts.
Contract Required Quantitation Limit (CRQL)	Quantitation limit (reporting limit) that is required for EPA Contract Laboratory Program (CLP) contracts.
Control Chart	A graphic representation of a series of test results, together with limits within which results are expected when the system is in a state of statistical control (see definition for Control Limit)
Control Limit	A range within which specified measurement results must fall to verify that the analytical system is in control. Control limit exceedances may require corrective action or require investigation and flagging of non-conforming data.
Corrective Action	DoD- The action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation in order to prevent recurrence.
Corrective and Preventative Action (CAPA)	The primary management tools for bringing improvements to the quality system, to the management of the quality system's collective processes, and to the products or services delivered which are an output of established systems and processes.
Data Audit	DoD- A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e. that they meet specified acceptance criteria).
Data Quality Objective (DQO)	Systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use or end user.

Data Reduction	TNI- The process of transforming the number of data items by arithmetic or statistical calculation, standard curves, and concentration factors, and collating them into a more usable form. DoD- The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form.
Daily Background Checks	Measurement of the background radiation on each detector/instrument to determine if they are low enough for sample analysis. Backgrounds that are elevated may result in detectors/instruments being taken out of service until maintenance is performed or the backgrounds are within specifications.
Definitive Data	DoD- Analytical data of known quality, concentration and level of uncertainty. The levels of quality and uncertainty of the analytical data are consistent with the requirements for the decision to be made. Suitable for final decision-making.
Demonstration of Capability	TNI- A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. DoD- A procedure to establish the ability of the analyst to generate acceptable accuracy.
Detection Limit (DL)	DoD- The smallest analyte concentration that can be demonstrated to be different than zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate is 1%.
Diesel Range Organics (DRO)	A range of compounds that denote all the characteristic compounds that make up diesel fuel (range can be state or program specific).
Digestion	DoD- A process in which a sample is treated (usually in conjunction with heat) to convert the sample to a more easily measured form.
Document Control	DoD- The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.
Dry Weight	The weight after drying in an oven at a specified temperature.
Duplicate (also known as Replicate or Laboratory Duplicate)	DoD- The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results of duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory.
Electron Capture Detector (ECD)	Device used in GC methods to detect compounds that absorb electrons (e.g., PCB compounds).
Electronic Data Deliverable (EDD)	A summary of environmental data (usually in spreadsheet form) which clients request for ease of data review and comparison to historical results.
Eluent	DoD- A solvent used to carry the components of a mixture through a stationary phase.
Elute	DoD- To extract, specifically, to remove (absorbed material) from an absorbent by means of a solvent.
Elution	DoD- A process in which solutes are washed through a stationary phase by movement of a mobile phase.
Environmental Data	DoD- Any measurements or information that describe environmental processes, locations, or conditions; ecological or health effects and consequences; or the performance of environmental technology.

Environmental Monitoring	DoD- The process of measuring or collecting environmental data.
Environmental Sample	A representative sample of any material (aqueous, non-aqueous, or multimedia) collected from any source for which determination of composition or contamination is requested or required. Environmental samples can generally be classified as follows: • Non Potable Water (Includes surface water, ground water, effluents, water treatment chemicals, and TCLP leachates or other extracts) • Drinking Water - Delivered (treated or untreated) water designated as potable water • Water/Wastewater - Raw source waters for public drinking water supplies, ground waters, municipal influents/effluents, and industrial influents/effluents • Sludge - Municipal sludges and industrial sludges. • Soil - Predominately inorganic matter ranging in classification from sands to clays. • Waste - Aqueous and non-aqueous liquid wastes, chemical solids, and industrial liquid and solid wastes
Equipment Blank	A sample of analyte-free media used to rinse common sampling equipment to check effectiveness of decontamination procedures.
Facility	A distinct location within the company that has unique certifications, personnel and waste disposal identifications.
False Negative	DoD- An analyte incorrectly reported as absent from the sample, resulting in potential risks from their presence.
False Positive	DoD- An item incorrectly identified as present in the sample, resulting in a high reporting value for the analyte of concern.
Field Blank	A blank sample prepared in the field by filling a clean container with reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken.
Field Measurement	Determination of physical, biological, or radiological properties, or chemical constituents that are measured on-site, close in time and space to the matrices being sampled/measured, following accepted test methods. This testing is performed in the field outside of a fixed-laboratory or outside of an enclosed structure that meets the requirements of a mobile laboratory.
Field of Accreditation	TNI- Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.
Finding	TNI- An assessment conclusion referenced to a laboratory accreditation standard and supported by objective evidence that identifies a deviation from a laboratory accreditation standard requirement. DoD- An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding may be positive or negative and is normally accompanied by specific examples of the observed condition. Note: For DoD, the finding must be linked to a specific requirement.

Flame Atomic Absorption Spectrometer (FAA)	Instrumentation used to measure the concentration of metals in an environmental sample based on the fact that ground state metals absorb light at different wavelengths. Metals in a solution are converted to the atomic state by use of a flame.
Flame Ionization Detector (FID)	A type of gas detector used in GC analysis where samples are passed through a flame which ionizes the sample so that various ions can be measured.
Gas Chromatography (GC)	Instrumentation which utilizes a mobile carrier gas to deliver an environmental sample across a stationary phase with the intent to separate compounds out and measure their retention times.
Gas Chromatograph/ Mass Spectrometry (GC/MS)	In conjunction with a GC, this instrumentation utilizes a mass spectrometer which measures fragments of compounds and determines their identity by their fragmentation patterns (mass spectra).
Gasoline Range Organics (GRO)	A range of compounds that denote all the characteristic compounds that make up gasoline (range can be state or program specific).
Graphite Furnace Atomic Absorption Spectrometry (GFAA)	Instrumentation used to measure the concentration of metals in an environmental sample based on the absorption of light at different wavelengths that are characteristic of different analytes.
High Pressure Liquid Chromatography (HPLC)	Instrumentation used to separate, identify and quantitate compounds based on retention times which are dependent on interactions between a mobile phase and a stationary phase.
Holding Time	TNI- The maximum time that can elapse between two specified activities. 40 CFR Part 136- The maximum time that samples may be held prior to preparation and/or analysis as defined by the method and still be considered valid or not compromised. For sample prep purposes, hold times are calculated using the time of the start of the preparation procedure. DoD- The time elapsed from the time of sampling to the time of extraction or analysis, or from extraction to analysis, as appropriate.
Homogeneity	The degree to which a property or substance is uniformly distributed throughout a sample.
Homologue	DoD- One in a series of organic compounds in which each successive member has one more chemical group in its molecule than the next preceding member. For instance, methanol, ethanol, propanol, butanol, etc., form a homologous series.
Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)	Analytical technique used for the detection of trace metals which uses plasma to produce excited atoms that emit radiation of characteristic wavelengths.
Inductively Coupled Plasma- Mass Spectrometry (ICP/MS)	An ICP-AES that is used in conjunction with a mass spectrometer so that the instrument is not only capable of detecting trace amounts of metals and non-metals but is also capable of monitoring isotopic speciation for the ions of choice.
Infrared Spectrometer (IR)	An instrument that uses infrared light to identify compounds of interest.

Initial Calibration (ICAL)	The process of analyzing standards, prepared at specified concentrations, to define the quantitative response relationship of the instrument to the analytes of interest. Initial calibration is performed whenever the results of a calibration verification standard do not conform to the requirements of the method in use or at a frequency specified in the method.
Initial Calibration Blank (ICB)	A blank sample used to monitor the cleanliness of an analytical system at a frequency determined by the analytical method. This blank is specifically run in conjunction with the Initial Calibration Verification (ICV) where applicable.
Initial Calibration Verification (ICV)	DoD- A standard obtained or prepared from a source independent of the source of the standards for the initial calibration. Its concentration should be at or near the middle of the calibration range. It is done after the initial calibration.
Inspection	DoD- An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic.
Instrument Blank	DoD- A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination.
Instrument Detection Limits (IDLs)	Limits determined by analyzing a series of reagent blank analyses to obtain a calculated concentration. IDLs are determined by calculating the average of the standard deviations of three runs on three non-consecutive days from the analysis of a reagent blank solution with seven consecutive measurements per day.
Interference, spectral	DoD- Occurs when particulate matter from the atomization scatters incident radiation from the source or when the absorption or emission from an interfering species either overlaps or is so close to the analyte wavelength that resolution becomes impossible.
Interference, chemical	DoD- Results from the various chemical processes that occur during atomization and later the absorption characteristics of the analyte.
Internal Standards	TNI and DoD- A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method.
Intermediate Standard Solution	Reference solutions prepared by dilution of the stock solutions with an appropriate solvent.
International System of Units (SI)	DoD- The coherent system of units adopted and recommended by the General Conference on Weights and Measures.
Ion Chromatography (IC)	Instrumentation or process that allows the separation of ions and molecules based on the charge properties of the molecules.
Isomer	DoD- One of two or more compounds, radicals, or ions that contain the same number of atoms of the same element but differ in structural arrangement and properties. For example, hexane (C6H14) could be n-hexane, 2-methylpentane, 3-methylpentane, 2,3-dimethylbutane, 2,2-dimethylbutane.
Laboratory	DoD- A body that calibrates and/or tests.

Laboratory Control Sample (LCS)	TNI and DoD- (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes and taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to evaluate the performance of all or a portion of the measurement system.
Laboratory Duplicate	DoD- Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently.
Laboratory Information Management System (LIMS)	A computer system that is used to maintain all sample information from sample receipt, through preparation and analysis and including sample report generation.
LabTrack	Database used by Pace Analytical to store and track corrective actions and other laboratory issues.
Learning Management System (LMS)	A training database used by Pace Analytical to train their employees. This system is a self-paced system which is capable of tracking all employee training requirements and documentation.
Legal Chain-of-Custody Protocols	TNI- Procedures employed to record the possession of samples from the time of sampling through the retention time specified by the client or program. These procedures are performed at the special request of the client and include the use of a Chain-of-Custody Form that documents the collection, transport, and receipt of compliance samples by the laboratory. In addition, these protocols document all handling of the samples within the laboratory.
Limit(s) of Detection (LOD)	TNI- A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility. DoD- The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate is 1%.
Limit(s) of Quantitation (LOQ)	TNI- The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. DoD- The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.
Laboratory Information Management System (LIMS)	A computer system that is used to maintain all sample information from sample receipt, through preparation and analysis and including sample report generation.
Learning Management System (LMS)	A web-based database used by the laboratories to track and document training activities. The system is administered by the corporate training department and each laboratory's learn centers are maintained by a local administrator.
Lot	A quantity of bulk material of similar composition processed or manufactured at the same time.
Management	DoD- Those individuals directly responsible and accountable for planning, implementing, and assessing work.
Management System	DoD- System to establish policy and objectives and to achieve those objectives.

Manager (however named)	DoD- The individual designated as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual.
Matrix	TNI and DoD- The substrate of a test sample.
Matrix Duplicate	TNI- A replicate matrix prepared in the laboratory and analyzed to obtain a measure of precision.
Matrix Spike (MS) (spiked sample or fortified sample)	TNI- A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency. DoD- A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.
Matrix Spike Duplicate (MSD) (spiked sample or fortified sample duplicate)	TNI and DoD- A replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.
Maximum Contaminant Level (MCL)	The maximum allowable concentration of a contaminant in a drinking water sample (Primary Drinking Water Standards)
Measurement System	TNI and DoD- A test method, as implemented at a particular laboratory, and which includes the equipment used to perform the test and the operator(s).
Method	TNI- A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.
Method Blank	TNI and DoD- A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.
Method Detection Limit (MDL)	DoD- One way to establish a Detection Limit; defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.
Method of Standard Additions	DoD- A set of procedures adding one or more increments of a standard solution to sample aliquots of the same size in order to overcome inherent matrix effects. The procedures encompass the extrapolation back to obtain the sample concentration.
Minimum Detectable Activity (MDA)	The lowest amount of activity that can be detected with a certain degree of confidence by an analytical method
Minimum Detection Concentration (MDC)	The lowest concentration of contaminant that can be detected with a certain degree of confidence by an analytical method

MintMiner	Program used by Pace Analytical to review large amounts of chromatographic data to monitor for errors or data integrity issues.
Mobile Laboratory	TNI- A portable enclosed structure with necessary and appropriate accommodation and environmental conditions for a laboratory, within which testing is performed by analysts. Examples include but are not limited to trailers, vans, and skid-mounted structures configured to house testing equipment and personnel.
National Institute of Standards and Technology (NIST)	TNI- A federal agency of the US Department of Commerce's Technology Administration that is designed as the United States national metrology institute (or NMI).
National Pollutant Discharge Elimination System (NPDES)	A permit program that controls water pollution by regulating point sources that discharge pollutants into U.S. waters.
Negative Control	DoD- Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.
Nitrogen Phosphorus Detector (NPD)	A detector used in GC analyses that utilizes thermal energy to ionize an analyte. With this detector, nitrogen and phosphorus can be selectively detected with a higher sensitivity than carbon.
Nonconformance	DoD- An indication or judgment that a product or service has not met the requirement of the relevant specifications, contract, or regulation; also the state of failing to meet the requirements.
Not Detected (ND)	The result reported for a compound when the detected amount of that compound is less than the method reporting limit.
Performance Audit	DoD- The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.
Performance Based Measurement System (PBMS)	An analytical system wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner.
Photo-ionization Detector (PID)	An ion detector which uses high-energy photons, typically in the ultraviolet range, to break molecules into positively charged ions.
Polychlorinated Biphenyls (PCB)	A class of organic compounds that were used as coolants and insulating fluids for transformers and capacitors. The production of these compounds was banned in the 1970's due to their high toxicity.
Positive Control	DoD- Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.
Post-Digestion Spike	A sample prepared for metals analyses that has analytes spike added to determine if matrix effects may be a factor in the results.
Power of Hydrogen (pH)	The measure of acidity or alkalinity of a solution.
Practical Quantitation Limit (PQL)	Another term for a method reporting limit. The lowest reportable concentration of a compound based on parameters set up in an analytical method and the laboratory's ability to reproduce those conditions.
Precision	TNI and DoD- The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.

Preservation	TNI- Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis. DoD- Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.
Procedure	TNI- A specified way to carry out an activity or process. Procedures can be documented or not.
Proficiency Testing	TNI and DoD- A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.
Proficiency Testing Program	TNI and DoD- The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories.
Proficiency Testing Sample (PT)	TNI- A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within the specified acceptance criteria. DoD- A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria.
Protocol	TNI and DoD- A detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) that must be strictly followed.
Quality Assurance (QA)	TNI- An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client. DoD- An integrated system of activities involving planning, quality control, quality assessment, reporting, and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.
Quality Assurance Manual (QAM)	A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.
Quality Assurance Project Plan (QAPP)	DoD- A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved.
Quality Control (QC)	TNI- The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring that the results are of acceptable quality. DoD- The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of the users.

Quality Control Sample (QCS)	TNI- A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control. DoD- A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking.
Quality Manual	TNI and DoD- A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.
Quality System	TNI and DoD- A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance and quality control activities.
Quality System Matrix	TNI and DoD- These matrix definitions are to be used for purposes of batch and quality control requirements: • **Air and Emissions**: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device • **Aqueous**: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, groundwater effluents, and TCLP or other extracts. • **Biological Tissue**: Any sample of a biological origin such as fish tissue, shellfish or plant material. Such samples shall be grouped according to origin. • **Chemical Waste**: A product or by-product of an industrial process that results in a matrix not previously defined. • **Drinking Water**: Any aqueous sample that has been designated a potable or potentially potable water source. • **Non-aqueous liquid**: Any organic liquid with <15% settleable solids • **Saline/Estuarine**: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake. • **Solids**: Includes soils, sediments, sludges, and other matrices with >15% settleable solids.
Quantitation Range	DoD- The range of values in a calibration curve between the LOQ and the highest successively analyzed initial calibration standard. The quantitation range lies within the calibration range.
Radiological Sample	A representative sample of any material (e.g., aqueous, non-aqueous, or multi-media) collected from any source which is analyzed for radiological parameters.

Random Error	The EPA has established that there is a 5% probability that the results obtained for any one analyte will exceed the control limits established for the test due to random error. As the number of compounds measured increases in a given sample, the probability for statistical error also increases.
Raw Data	TNI- The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records. DoD- Any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted.
Reagent Blank (method reagent blank)	DoD- A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps.
Reagent Grade	Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents that conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.
Reference Material	TNI- Material or substance one or more of whose property values are sufficiently homogenized and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. DoD- A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.
Reference Standard	TNI- Standard used for the calibration of working measurement standards in a given organization or at a given location. DoD- A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived.
Reference Toxicant	DoD- The toxicant used in performing toxicity tests to indicate the sensitivity of a test organism and to demonstrate the laboratory's ability to perform the test correctly and obtain consistent results.
Relative Percent Difference (RPD)	A measure of precision defined as the difference between two measurements divided by the average concentration of the two measurements.

Reporting Limit (RL)	The level at which method, permit, regulatory and customer-specific objectives are met. The reporting limit may never be lower than the Limit of Detection (i.e. statistically determined MDL). Reporting limits are corrected for sample amounts, including the dry weight of solids, unless otherwise specified. There must be a sufficient buffer between the Reporting Limit and the MDL. DoD- A client-specified lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.
Reporting Limit Verification Standard (or otherwise named)	A standard analyzed at the reporting limit for an analysis to verify the laboratory's ability to report to that level.
Representativeness	A quality element related to the ability to collect a sample reflecting the characteristics of the part of the environment to be assessed. Sample representativeness is dependent on the sampling techniques specified in the project work plan.
Requirement	DoD- Denotes a mandatory specification; often designated by the term "shall".
Retention Time	DoD- The time between sample injection and the appearance of a solute peak at the detector.
Sample	DoD- Portion of material collected for analysis, identified by a single, unique alphanumeric code. A sample may consist of portions in multiple containers, if a single sample is submitted for multiple or repetitive analysis.
Sample Condition Upon Receipt Form (SCURF)	Form used by Pace Analytical sample receiving personnel to document the condition of sample containers upon receipt to the laboratory (used in conjunction with a COC).
Sample Delivery Group (SDG)	A unit within a single project that is used to identify a group of samples for delivery. An SDG is a group of 20 or fewer field samples within a project, received over a period of up to 14 calendar days. Data from all samples in an SDG are reported concurrently.
Sample Receipt Form (SRF)	Letter sent to the client upon login to show the tests requested and pricing.
Sample Tracking	Procedures employed to record the possession of the samples from the time of sampling until analysis, reporting and archiving. These procedures include the use of a Chain of custody Form that documents the collection, transport, and receipt of compliance samples to the laboratory. In addition, access to the laboratory is limited and controlled to protect the integrity of the samples.
Sampling	TNI- Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.
Selective Ion Monitoring (SIM)	A mode of analysis in mass spectrometry where the detector is set to scan over a very small mass range, typically one mass unit. The narrower the range, the more sensitive the detector.
Selectivity	TNI- The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system. DoD- The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances.

Sensitivity	TNI and DoD- The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest.
Serial Dilution	The stepwise dilution of a substance in a solution.
Shall	DoD- Denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification as long as the requirement is fulfilled.
Should	DoD- Denotes a guideline or recommendation whenever noncompliance with the specification is permissible.
Signal-to-Noise Ratio	DoD- The signal carries information about the analyte, while noise is made up of extraneous information that is unwanted because it degrades the accuracy and precision of an analysis and also places a lower limit on the amount of analyte that can be detected. In most measurements, the average strength of the noise is constant and independent of the magnitude of the signal. Thus, the effect of noise on the relative error of a measurement becomes greater and greater as the quantity being measured (producing the signal) decreases in magnitude.
Spike	DoD- A known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.
Standard (Document)	TNI and DoD- The document describing the elements of a laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies.
Standard (Chemical)	DoD- Standard samples are comprised of a known amount of standard reference material in the matrix undergoing analysis. A standard reference material is a certified reference material produced by US NIST and characterized for absolute content, independent of analytical test method.
Standard Blank (or Reagent Blank)	A calibration standard consisting of the same solvent/reagent matrix used to prepare the calibration standards without the analytes. It is used to construct the calibration curve by establishing instrument background.
Standard Method	DoD- A test method issued by an organization generally recognized as competent to do so.
Standard Operating Procedure (SOP)	TNI- A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks. DoD- A written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks.
Standard Reference Material (SRM)	DoD- A certified reference material produced by the US NIST or other equivalent organization and characterized for absolute content, independent of analytical method.
Statement of Qualifications (SOQ)	A document that lists information about a company, typically the qualifications of that company to compete on a bid for services.

Stock Standard	A concentrated reference solution containing one or more analytes prepared in the laboratory using an assayed reference compound or purchased from a reputable commercial source.
Supervisor	DoD- The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses.
Surrogate	DoD- A substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them for quality control purposes.
Systems Audit	An on-site inspection or assessment of a laboratory's quality system.
Target Analytes	DoD- Analytes specifically named by a client (also called project-specific analytes).
Technical Director	DoD- Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory.
Technology	TNI- A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.
Test	DoD- A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate.
Test Method	DoD- An adoption of a scientific technique for performing a specific measurement as documented in a laboratory SOP or as published by a recognized authority.
Test Methods for Evaluating Solid Waste, Physical/ Chemical (SW-846)	EPA Waste's official compendium of analytical and sampling methods that have been evaluated and approved for use in complying with RCRA regulations.
Total Petroleum Hydrocarbons (TPH)	A term used to denote a large family of several hundred chemical compounds that originate from crude oil. Compounds may include gasoline components, jet fuel, volatile organics, etc.
Toxicity Characteristic Leaching Procedure (TCLP)	A solid sample extraction method for chemical analysis employed as an analytical method to simulate leaching of compounds through a landfill.
Traceability	TNI- The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical conditions or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project. DoD- The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.

Tracer	A substance that is added to the client and QC samples in a radiological test. The substance is radioactive and has the same chemistry and characteristics as the radioactive substance being analyzed.
Training Document	A training resource that provides detailed instructions to execute a specific method or job function.
Trip Blank	This blank sample is used to detect sample contamination from the container and preservative during transport and storage of the sample. A cleaned sample container is filled with laboratory reagent water and the blank is stored, shipped, and analyzed with its associated samples.
Tuning	DoD- A check and/or adjustment of instrument performance for mass spectrometry as required by the method.
Ultraviolet Spectrophotometer (UV)	Instrument routinely used in quantitative determination of solutions of transition metal ions and highly conjugated organic compounds.
Uncertainty Measurement	The parameter associated with the result of a measurement that characterized the dispersion of the values that could be reasonably attributed to the measurand (i.e. the concentration of an analyte).
Validation	DoD- The confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.
Verification	TNI and DoD- Confirmation by examination and objective evidence that specified requirements have been met. Note: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment. The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.
Whole Effluent Toxicity (WET)	The aggregate toxic effect to aquatic organisms from all pollutants contained in a facility's wastewater (effluent).
Work Cell	DoD- A well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented.

11.0. REFERENCES

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11.2. "Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods." SW-846.

11.3. "Methods for Chemical Analysis of Water and Wastes", EPA 600-4-79-020, 1979 Revised 1983, U.S. EPA.

11.4. U.S. EPA Contract Laboratory Program Statement of Work for Organic Analysis.

11.5. U.S. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis.

11.6. "Standard Methods for the Examination of Water and Wastewater." Current Edition APHA-AWWA-WPCF.

11.7. "Annual Book of ASTM Standards", Section 4: Construction, Volume 04.04: Soil and Rock; Building Stones, American Society of Testing and Materials.

11.8. "Annual Book of ASTM Standards", Section 11: Water and Environmental Technology, American Society of Testing and Materials.

11.9. "NIOSH Manual of Analytical Methods", Third Edition, 1984, U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health.

11.10. "Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water", U.S. EPA, Environmental Monitoring and Support Laboratory – Cincinnati (September 1986).

11.11. Quality Assurance of Chemical Measurements, Taylor, John K.; Lewis Publishers, Inc. 1987.

11.12. Methods for Non-conventional Pesticides Chemicals Analysis of Industrial and Municipal Wastewater, Test Methods, EPA-440/1-83/079C.

11.13. Environmental Measurements Laboratory (EML) Procedures Manual, HASL-300, US DOE, February, 1992.

11.14. Requirements for Quality Control of Analytical Data, HAZWRAP, DOE/HWP-65/R1, July, 1990.

11.15. Requirements for Quality Control of Analytical Data for the Environmental Restoration Program, Martin Marietta, ES/ER/TM-16, December, 1992.

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11.17. National Environmental Laboratory Accreditation Conference, Constitution, Bylaws, and Standards. Most recent version.

11.18. ISO/IEC 17025:2005, General requirements for the competence of testing and calibration laboratories.

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12.0. REVISIONS

The PASI Corporate Quality Office files both a paper copy and electronic version of a Microsoft Word document with tracked changes detailing all revisions made to the previous version of the Quality Assurance Manual. This document is available upon request. All revisions are summarized in the table below.

Document Number	Reason for Change	Date
Quality Assurance Manual 16.0	Section 2.6.5: added VM/Duluth. Sections 2.7.1.3 and 2.7.2.2: added SOT references. Section 4.1.2: added parenthetical phrase directing the reader to the glossary section. Section 4.1.3: added language from old section 4.1.4 and deleted language in order to match current practices. Section 4.1.4: .reworded for clarity. Also added last sentence in red text to allow labs to insert additional method blank requirements. Sections 4.1.7, 4.2.9, 4.4.4, and 6.2.7.8: revised wording per updated Ohio VAP requirements. Sections 4.5.2 and 4.6.1: added 'calibration standard' to list of QC items that require the addition of surrogates and internals. Also added red letter text for additional lab-specific information. Section 4.10.3: fixed LOQ verification language to match TNI standard (V1M4, section 1.5.2.2.c). Old section 4.12.2: deleted. Covered in reference in current section 4.12.5. Section 6.2.3: moved language that had been in the 'organic calibration only' section to this general calibration section. The language in this section applies to both organic and inorganic tests. Section 6.2.7.3: added clarification statement regarding the calibration verification standard. Section 6.3.7.1: reworded for clarity and added red letter text for calibration of micro-liter syringes. Section 7.2.5: added language specifying secondary reviewer documents approval of manual integrations. Section 7.2.7: added reference to the Manual Integration SOP. Section 7.2.8: added new red-letter text language to match Data Checker SOP. Section 7.2.9: added new red-letter text language to comply with DoD QSM 4.2. Section 8.3.1: deleted items in order to match current SOP S-ALL-Q-014. Added red-letter text to the following sections for Ohio VAP labs: 2.5.2.1, 4.5.2.1, 4.6.3, and 7.6.2. Attachment VI: added red letter text under title to satisfy AZ state requirement. Attachment VIII, Analyte Chart: changed holding times expressed as '6 Months' to '180 Days' to match actual practice as defined by LIMS acodes. Attachment VIII, Analyte Chart: added explanation under the header to explain the holding times expressed in the chart.	05Feb2013
Quality Assurance	Updated the QAM to current Template to reflect the procedures used	09/09/13

Document Number	Reason for Change	Date
Manual 16.0	at the PASI-PGH laboratory including additions for radiochemistry and DOD QSM. Added page for Additional signatures (managers and technical directors) Section 1: 10CFR50/NQA1 Reference added (1.3), defining QA Requirements (1.6.1.3), assignment of deputies (1.7.4-1.7.7), minor additions to job descriptions, Addition of radiation safety officer (1.8.20), additional definition for confidentiality (DOD) (1.12.4). Section 2: DOD time definition (2.6.3), Project and ID definition for PGH (2.6.4), Identification of radioactive samples by clients (2.7.3.2). Section 3: Exceptionally permitting departures (3.3.1.1), Sensitivity evaluation for new methods (3.3.2), Drinking water evaluation for DOCs (3.4.3). Section 4: MB evaluation for DOD (4.1.5), LCS evaluation for DOD (4.2.9), MS evaluation for DOD (4.3.8), drinking water evaluation for DOC's (4.9.7), LOD definition by DOD (4.9.8), LOD/LOQ verification frequency for DOD (4.10.4), Radchem uncertainty (4.11.3), ERA PT's (4.12.2). Section 5: DOD Annual reviews for SOPS (5.1.7.7), Other Documentation (5.1.8), Document changes (5.2.1.1-5.2.1.2 and 5.2.2). Section 6: Rad calibration verifications (6.2.1), Rad instrument calibrations (6.2.2.1), DOD QSM requirement for failed CCVs (6.2.7.4.1), Radiological Equipment (6.2.9), Return to control (6.4.7.1). Section 7: Data Checker (7.2.8), frequency for review of DOD projects (7.2.9), Date & time requirements for DOD (7.3.2.8.1). Section 8: client notification requirement (8.1.3.3), QA System Review SOP reference added (8.4.4). Section 9: 10CFR50/NQA1 reporting requirements (9.2.1.1). Section 10: Added definitions for radiochemistry terms. Attachments: Added referenced information for the PASI-PGH lab Updated SOP list and Equipment list.	

ATTACHMENT I- QUALITY CONTROL CALCULATIONS

PERCENT RECOVERY (%REC)

$$\%REC = \frac{(MSConc - SampleConc)}{TrueValue} * 100$$

NOTE: The SampleConc is zero (0) for theLCS and Surrogate Calculations

PERCENT DIFFERENCE (%D)

$$\%D = \frac{MeasuredValue - TrueValue}{TrueValue} * 100$$

where:
TrueValue = Amount spiked (can also be the $\overline{CF}$ or $\overline{RF}$ of the ICAL Standards)
Measured Value = Amount measured (can also be the CF or RF of the CCV)

PERCENT DRIFT

$$\%Drift = \frac{CalculatedConcentration - TheoreticalConcentration}{TheoreticalConcentrtion} * 100$$

RELATIVE PERCENT DIFFERENCE (RPD)

$$RPD = \frac{|(R1 - R2)|}{(R1 + R2)/2} * 100$$

where:
R1 = Result Sample 1
R2 = Result Sample 2

CORRELATION COEFFICIENT (R)

$$CorrCoeff = \frac{\sum_{i=1}^{N} W_i * (X_i - \overline{X}) * (Y_i - \overline{Y})}{\sqrt{\left(\sum_{i=1}^{N} W_i * (X_i - \overline{X})^2\right) * \left(\sum_{i=1}^{N} W_i * (Y_i - \overline{Y})^2\right)}}$$

With:		
	N	Number of standard samples involved in the calibration
	i	Index for standard samples
	Wi	Weight factor of the standard sample no. i
	Xi	X-value of the standard sample no. i
	X(bar)	Average value of all x-values
	Yi	Y-value of the standard sample no. i
	Y(bar)	Average value of all y-values

ATTACHMENT I- QUALITY CONTROL CALCULATIONS (CONTINUED)

STANDARD DEVIATION (S)

$$S = \sqrt{\sum_{i=1}^{n} \frac{(X_i - \overline{X})^2}{(n-1)}}$$

where:
n = number of data points
X_i = individual data point
$\overline{X}$ = average of all data points

AVERAGE ($\overline{X}$)

$$\overline{X} = \frac{\sum_{n=1}^{i} X_i}{n}$$

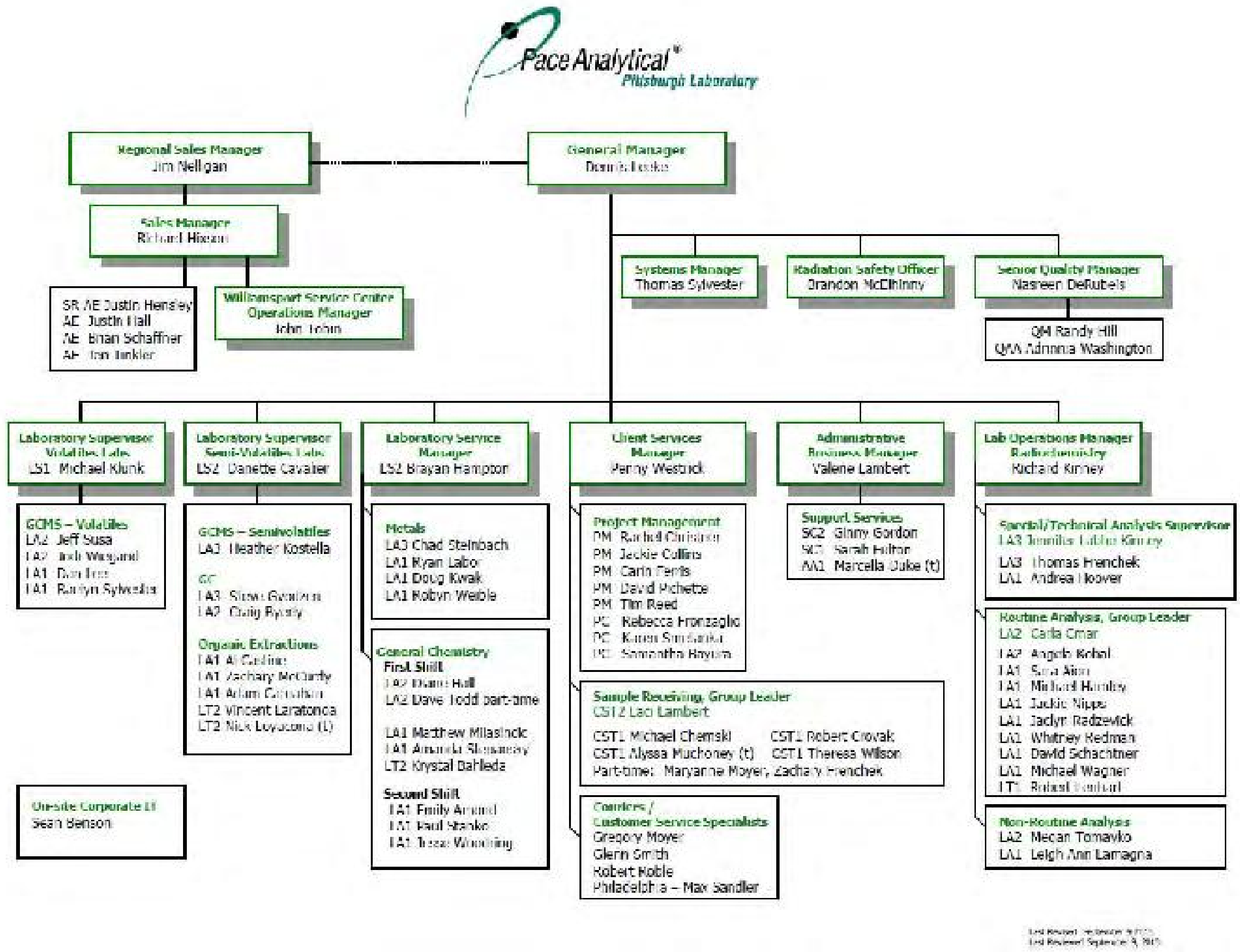
where:
n = number of data points
X_i = individual data point

RELATIVE STANDARD DEVIATION (RSD)

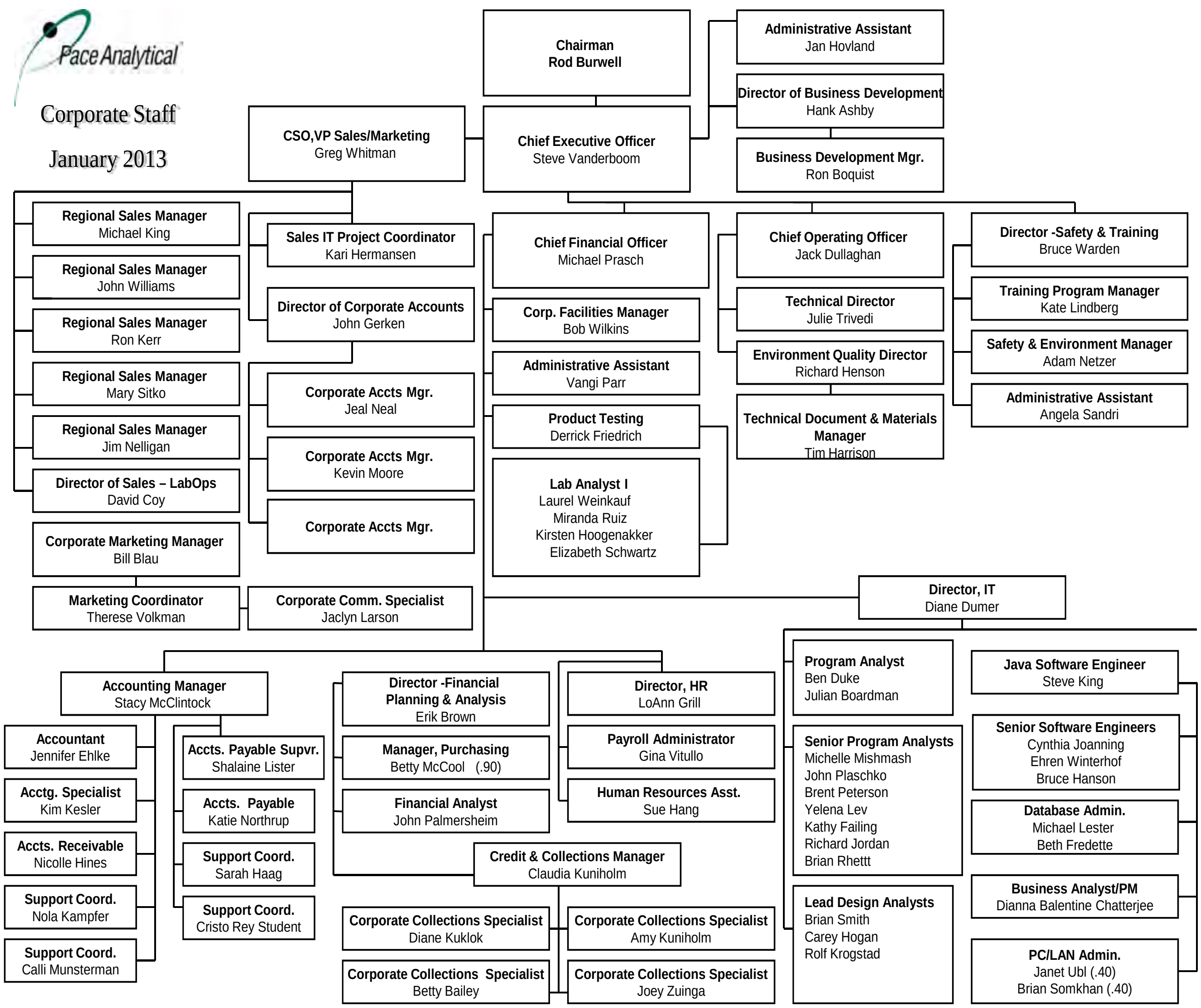
$$RSD = \frac{S}{\overline{X}} * 100$$

where:
S = Standard Deviation of the data points
$\overline{X}$ = average of all data points

ATTACHMENT IIA- LABORATORY ORGANIZATIONAL CHART (CURRENT AS OF ISSUE DATE)



ATTACHMENT IIB- CORPORATE ORGANIZATIONAL CHART (CURRENT AS OF ISSUE DATE)



ATTACHMENT III- EQUIPMENT LIST (CURRENT AS OF ISSUE DATE)

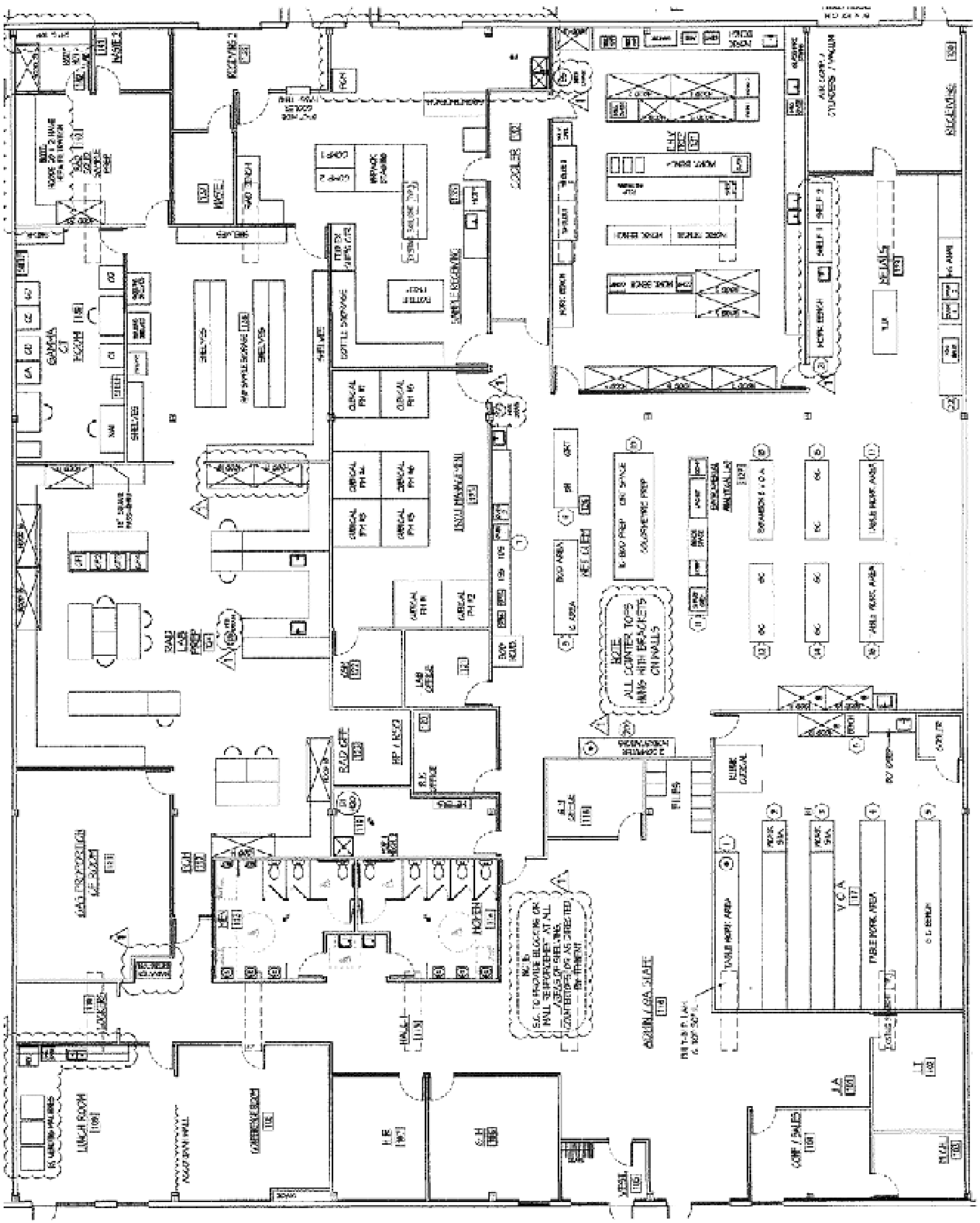
Equipment List for PASI Pittsburgh

Instrument	Manufacturer	Model No.	Instrument ID	Dept./Test
GC/MS				
	Hewlett-Packard	5973	MSS1	Semivoa (full scan)
	Hewlett-Packard	5973	MSS2	Semivoa (SIM)
	Hewlett-Packard	5973	MSS3	Semivoa (SIM)
	Hewlett-Packard	5973	MSV1	Volatiles (soils)
	Hewlett-Packard	5973	MSV2	Volatiles (water)
	Hewlett-Packard	5973	MSV3	Volatiles (water)
	Hewlett-Packard	5973	MSV4	Volatiles (extra vol)
	Hewlett-Packard	5975	MSV5	Volatiles (soil)
GC				
	Hewlett-Packard	5890A	GC 6	PCB/Herbs
	Hewlett-Packard	5890A	GC 2	Pest/PCBs
	Hewlett-Packard	5890 Series II	GC 3	Pest
	Hewlett-Packard	5890A	GC 7	TPH/DRO
	Hewlett-Packard	5890 Series II	GC 5	TPH/DRO
	Hewlett-Packard	5890 Series II	GC 1	GRO (Volatiles)
ICP				
	Thermo Analytical	6500	ICP-2	Metals
	Thermo Analytical	6500	ICP-3	Metals
Mercury Analyzer				
	Cetak	M-6100	Hg-2	Metals
Automated Spectrophotometers				
	Lachat	QuickChem 8000		Wet Chem
	Lachat	8500		Wet Chem
	SmartChem	Discreet Analyzer		Wet Chem
Total Organic Carbon				
	OI Analytical	1030		Wet Chem
Spectrophotometers				
	Milton Roy	Spectronic 21D		Wet Chem
	Hach	DR5000		Wet Chem
pH meter				
	Thermo Scientific	Orion 4 Star		Wet Chem
	Accumet	Model 50		Wet Chem
	Accumet	AR 50		Wet Chem
Solid Phase Extractor				
	Horizon	SPE-Dex 3000XL	1 and 2	Wet Chem
Ion Chromatograph				
	Dionex	LC20		Wet Chem
	Dionex	ICS-1100		Wet Chem
Microwave Extractor				
	Mars	230/60		Organic Prep
Turbo-Vap Concentration Workstations				

Equipment List for PASI Pittsburgh

Instrument	Manufacturer	Model No.	Instrument ID	Dept./Test
	Zymark/Caliper Lifesciences	TurboVap II	1 - 4	Organic Prep
Dissolved Oxygen Probe				
	Hach	HQ44Od (controller) LDO (probe)		Wet Chem
Auto Clave				
	Thermo Scientific	Sterile Max		Wet Chem (Micro)
Carbon/Sulfur Analyzer				
	LECO	CS-200		RadioChem
Gamma Spectrometer				
HPGe 10%	Canberra	IGC-4019	A (15647)	RadioChem
HPGe 40% w/Be shield	Ortec	GX5019	B (15648)	RadioChem
HPGe 60%	Canberra	GC-6022	C (OOS)	RadioChem
HPGe 20%	Canberra	GR-3521	D	RadioChem
HPGe 100%	Ortec	GEM100P4ST	1 (19623)	RadioChem
HPGe 120%	Ortec	GEM120-P4-10B-RB-ST	3	
HPGe 150%	Ortec	GEM100S	2 (19625)	RadioChem
Canberra	NaI	Unispec	1-4	RadioChem
Gas Flow Proportional Counter				
	Berthold (10 Detectors)	LB770	1-10 (15641)	Radiochem
	Protean (28 Detectors)	MPC-9604	11-38	Radiochem
Liquid Scintillation Counter				
Packard	Benchtop LSC	Tri-Carb 2100TR	1	Radiochem
Packard	Benchtop LSC	Tri-Carb 2900TR	2	Radiochem
Parckard	Benchtop LSC	Tri-Carb 2550 TR/LL	3	Radiochem
Alpha Spectrometer				
Canberra	Canberra	Alpha Analyst	1-24 (15645)	Radiochem
Oxford-Tennelec	Tennelec	Alpha Oasis	25-40 (15679)	Radiochem
Alpha Scintillation Counters				
	Ludlum	Model 2000 Scaler	A-D	RadioChem/Ra-226
Lucas Cells	Rocky Mountain Glassworks		1, 2, 4, 5, 7-9, 11, 13-15, 17-20, 22, 23, 25, 27, 29-31, 33-38, 40-43, 45, 47, 52, 53, 57-67, 71, 72-79, 82-123	RadioChem (102 total)
Kinetic Phosphorescence Analyzer				
Chemchek	KPA	KPA-11		RadioChem/Uranium
	KPA	KPA-11		RadioChem/Uranium
Pulverizer				
	Fritch	Pulverisette		RadioChem/Grinder
	Across International	RPQ-T Gear Drive		RadioChem/Rock Pulverizer

ATTACHMENT IV- LABORATORY FLOOR PLAN (CURRENT AS OF ISSUE DATE)



ATTACHMENT V- LABORATORY SOP LIST (CURRENT AS OF ISSUE DATE)

Lab Area	PACE SOP No.	Document Name
AD	PGH-C-001	Sample Management
AD	PGH-C-008	Subcontracting Analytical Services
AD	PGH-C-009	Glassware Washing
AD	PGH-C-012	Customer Complaints
AD	PGH-C-016	Data Packages
AD	PGH-C-017	Waste Handling and Management
AD	PGH-C-025	PADEP-MA MCL Violation Reporting
AD	PGH-C-027	DI Water Quality & Suitability
AD	PGH-C-028	Bottle Prep
AD	S-ALL-C-002	Bottle Order Database
AD	S-ALL-PGH-Q-037	Data Review Pittsburgh Addendum
AD	S-ALL-Q-037	Data Review Process (See Also Data Review Addendum)
GC	PGH-O-004	Diesel Range Organics (DRO) by EPA 8015B & 8015D
GC	PGH-O-006	Polychlorinated Biphenyls (608)
GC	PGH-O-009	Polychlorinated Biphenyls (8082-8082A)
GC	PGH-O-010	Sulfur Cleanup
GC	PGH-O-017	Sulfuric Acid Cleanup
GC	PGH-O-019	ETPH (Connecticut Method)
GC	PGH-O-021	OC Pesticide Analysis by GC (608)
GC	PGH-O-024	EDB & DBCP
GC	PGH-O-026	OC Pesticide Analysis by GC (8081A-8081B)
MT	PGH-M-008	Determination of Metals by ICP (200.7 and 6010B)
MT	PGH-M-011	Mercury Prep (Aq)
MT	PGH-M-012	Mercury Prep (Solid & Semi-solid)
MT	PGH-M-013	ICP Sample Digestion (Solids)
MT	PGH-M-014	Microwave Digestion of Organic Wastes
MT	PGH-M-015	ICP Sample Digestion (Aqueous)
MT	PGH-M-017	Mercury Analysis by CVAA Cetac
OX	PGH-M-003	TCLP/ZHE Extraction Procedure
OX	PGH-M-016	Measurement of Percent Moisture in Soils and Solids
OX	PGH-O-002	Extraction of PCBs from Wipes
OX	PGH-O-007	Solid Phase Extraction of TCLP for SemiVoa Compounds.
OX	PGH-O-011	Extraction of Organic Waste
OX	PGH-O-020	CT-ETPH
OX	PGH-O-022	Microwave Extraction of Organic Parameters
OX	PGH-O-028	Separatory Funnel Extraction
OX	PGH-O-034	SPLP & ZHE Extraction (1312)
OX	PGH-O-036	ASTM Leach Extraction
PO	PGH-L-001	Error Correction Policy
PO	PGH-L-005	Commercial Dedication of Services and Supplies for Safety Projects
QA	PGH-C-020	Logbook of Logbooks
QA	PGH-C-022	Spreadsheet Validation
QA	PGH-C-023	Archiving Laboratory Documents
QA	PGH-C-026	Control Charts & Acceptance Limits
QA	PGH-C-029	Document Control and Management
QA	PGH-C-030	Manual Integrations
QA	PGH-C-031	PT Program

Lab Area	PACE SOP No.	Document Name
QA	PGH-C-032	Support Equipment
QA	PGH-C-033	Review of Analytical Requests
QA	F-PGH-C-034	Internal COC Work Instruction
QA	S-ALL-Q-001	Preparation of Standard Operating Procedures
QA	S-ALL-Q-003	Document Numbering Procedure
QA	PGH-C-035	MDL/LOD
QA	PGH-C-036	Purchase of Laboratory Supplies
QA	PGH-C-037	Standard and Reagent Management and Traceability
QA	PGH-C-038	Receipt and Storage of Laboratory Supplies
QA	S-ALL-Q-009	Laboratory Documentation
QA	S-ALL-Q-011	Internal and External Audits
QA	S-ALL-Q-012	Corrective Actions/Preventative Actions (Rev 2 Addendum)
QA	S-ALL-Q-014	Quality System Review
QA	S-ALL-Q-018	Monitoring Storage Units
QA	S-ALL-Q-020	Orientation and Training Procedures
QA	S-ALL-Q-021	Sample Homogenization and Sub-sampling
QA	S-ALL-Q-022	3P Program: Continuous Process Improvement
QA	S-ALL-Q-025	Standard and Reagent Management and Traceability
QA	S-ALL-Q-027	Evaluation and Qualification of Vendors
QA	S-ALL-Q-028	Use and Operations of Lab Track System
QA	S-ALL-Q-029	MintMiner Data File Review
QA	S-ALL-Q-030	Data Checker
QA	S-ALL-Q-031	Estimation of Measurement Uncertainty
QA	S-ALL-Q-035	Data Recall
QA	S-ALL-Q-036	Management of Change
R	PGH-R-001	Analysis of samples for Gross Alpha and Gross Beta
R	PGH-R-002	Gas Flow Proportional Counter Instrument Operations
R	PGH-R-003	Analysis of Water Samples for Ra-228 Content
R	PGH-R-004	Analysis of Water Samples for Total Alpha Radium
R	PGH-R-005	Analysis of Water Samples for Sr89/90 Content
R	PGH-R-006	Analysis of Samples for Total Uranium in Drinking Water
R	PGH-R-007	Analysis of Water Samples for Ra-226 Content
R	PGH-R-008	Analysis of Samples for Alpha Emitting Actinides and Pu-241
R	PGH-R-010	Sr-89/90 by Extraction Chromatography
R	PGH-R-013	Ni-59/Ni-63 Analysis
R	PGH-R-014	Analysis of Iron-55
R	PGH-R-015	Analysis of samples for Technetium-99
R	PGH-R-017	Glassware Cleaning
R	PGH-R-018	Radioactive Standards Preparation
R	PGH-R-020	Alpha Spectroscopy Instrument Operation
R	PGH-R-021	Tritium in Water - Distillation
R	PGH-R-022	Liquid Scintillation Counting
R	PGH-R-023	Gamma Spec Instrument Operations
R	PGH-R-024	Rad Sample Preparation
R	PGH-R-027	Neutron Dosimeter Wires by Gamma Spec
R	PGH-R-028	Neutron Dosimeter Capsules for Cs-137
R	PGH-R-030	Analysis of samples for I-129
R	PGH-R-031	Total Uranium by KPA
R	PGH-R-032	State of NJ 48Hr Gross Alpha Analysis
R	PGH-R-034	Analysis of C-14

Lab Area	PACE SOP No.	Document Name
R	PGH-R-035	Total Carbon Analysis by Combustion Method
R	PGH-R-037	Radon in Water
R	PGH-R-038	Dosimetry Foils for Niobium
R	PGH-R-040	Gamma Spectroscopy Analysis - Prep
R	PGH-R-041	Analysis of Polonium-210
R	PGH-R-042	Analysis of samples for Pb-210
R	PGH-R-043	Gravimetric Silicon Analysis
R	PGH-R-061	Iodine-131
R	F-PGH-R-063	Radioactive Calibrations
R	F-PGH-R-063	Low Energy Beta Analysis of Smears (Wipes)
	PGH-R-064	Alpha Scintillation Counter (NEEDS TO BE WRITTEN) Referenced in PGH-R-007 (Ra-226)
SV	PGH-O-001	Semivolatiles by GC/MS (8270C & 8270D)
SV	PGH-O-003	Semivolatiles by GC/MS (625)
SV	PGH-O-023	PAH's by SIM
SV	WI-PGH-O-036	Low Level PAH's by EPA 625
SY	PGH-C-019	Hood Face Velocity Monitoring
SY	PGH-S-001	Rescue Alert System Operation
SY	S-ALL-S-001	Hazard Assessment
VO	PGH-O-012	Encore soil preparation (EPA Method 5035)
VO	PGH-O-015	Volatile Organic Compounds by EPA Methods 8260B & 8260C
VO	PGH-O-016	Gasoline Range Organics (GRO) by EPA Method 8015B & 8015D
VO	PGH-O-033	Volatile Organic Compounds by EPA Method 624
	PGH-I-003	pH in Water, Soil & Waste
WC	PGH-I-004	Phenolics
WC	PGH-I-009	BOD/CBOD
WC	PGH-I-010	Sulfide
WC	PGH-I-011	Orthophosphate
WC	PGH-I-012	Hexavalent Chromium
WC	PGH-I-013	Filterable Residue (Total Suspended Solids, TSS)
WC	PGH-I-014	Fecal Coliform
WC	PGH-I-015	Alkalinity
WC	PGH-I-016	Acidity - Titrimetric
WC	PGH-I-017	Reactive Cyanide and Sulfide
WC	PGH-I-019	Paint Filter Liquids Test
WC	PGH-I-020	Nonfilterable Residue (TDS)
WC	PGH-I-021	Pensky-Martens Closed-Cup Method for Determining Ignitability
WC	PGH-I-024	Turbidity
WC	PGH-I-025	Fluoride
WC	PGH-I-027	Total Kjeldahl Nitrogen (TKN)
WC	PGH-I-028	Color
WC	PGH-I-030	Nitrate/Nitrite
WC	PGH-I-031	Chloride (by Lachat)
WC	PGH-I-033	Chemical Oxygen Demand
WC	PGH-I-035	Ammonia
WC	PGH-I-037	Sulfite
WC	PGH-I-038	Residual Chlorine
WC	PGH-I-039	Total Solids (TS) and Total Volatile Solids (TVS)
WC	PGH-I-042	Oil & Grease in water by SPE (EPA 1664)
WC	PGH-I-045	Dissolved Oxygen
WC	PGH-I-047	Settleable Material

Lab Area	PACE SOP No.	Document Name
WC	PGH-I-049	Total Coliform
WC	PGH-I-050	Methylene Blue Activated Substances (MBAS)
WC	PGH-I-052	O&G/TPH Soxhlet (hexane)
WC	PGH-I-053	Cyanide: Free, Total and Amenable - SmartChem
WC	PGH-I-054	Nitrite - Smartchem
WC	PGH-I-055	Thiocyanate
WC	PGH-I-056	Sulfate - Smartchem
WC	PGH-I-057	Phosphorus & Orthophosphate - SmartChem
WC	PGH-I-058	Ferrous Iron -SmartChem
WC	PGH-I-059	Anions by Ion Chromatograph
WC	PGH-I-060	Total Organic Carbon
WC	PGH-I-061	iPaq / Databridge Mobile 2
WC	PGH-I-062	Specific Conductance
IT	PGH-IT-001	System Security and Integrity
IT	PGH-IT-002	Server Backup
IT	S-ALL-Q-007	EPIC Pro: Acode Validation
IT	S-ALL-Q-008	EPIC Pro: Acode Addition/Modification
L	T-ALL-T-001	SLC: System Administrator Manual
L	T-ALL-T-002	SLC: Content Administrator Manual
L	T-ALL-T-003	SLC: Training Administrator Manual
L	T-ALL-T-004	SLC: Report Manager Manual

ATTACHMENT VI- LABORATORY CERTIFICATION LIST (CURRENT AS OF ISSUE DATE) SCOPE AND APPLICATION CERTIFICATES ARE MAINTAINED AND FILED IN THE LOCAL QUALITY DEPARTMENT

Laboratory: Pittsburgh

Accrediting Authority	Program Category	Accrediting Agency	Certification #
Connecticut	Waste Water & Hazardous Waste - Solid	DOPH	PH-0694
Maine	Waste Water	DOH&HS	PA0091
New Hampshire	Waste Water & Hazardous Waste - Solid	DES	2976
New Jersey	Waste Water & Hazardous Waste - Solid	DEP	PA-051
New York	Waste Water & Hazardous Waste - Solid	DOH - ELAP	10888
Pennsylvania	Drinking Water (RAD)	DEP	65-00282
Pennsylvania	Waste Water & Hazardous Waste - Solid	DEP	65-00282
PA Rad License	Materials License	NRC	PA-1057
USDA	Soil Permit	USDA	P330-11-0365
West Virginia	Waste Water & Hazardous Waste - Solid	DEP	143
Laboratory: Pittsburgh Radiological			
Alabama	Drinking Water	DEM	41590
Arizona	Drinking Water	DOHS	AZ0734
Arkansas	Drinking Water	DEQ	NA
California	Drinking Water & Hazardous Waste	DOH	04222CA
Colorado	Drinking Water	DPH&E	N/A
Connecticut	Drinking Water, Waste Water and Hazardous Waste	DPH	PH-0694
EPA Region 5	Drinking Water	US EPA	NA
Delaware	Drinking Water	H&SS	NA
DoD	Waste Water & Hazardous Waste	ACLASS	ADE-1544
Florida	Drinking Water & Waste Water	DOH	E87683
Guam	Drinking Water	EPA	NA
Hawaii	Drinking Water	DOH	NA
Idaho	Drinking Water	DOH&W	NA
Illinois	Drinking Water	DEP	NA
Indiana	Drinking Water	DEP	NA
Iowa	Drinking Water	DNR	391
Kansas	Drinking Water	DOH&EC	E-10358

Laboratory: Pittsburgh

Accrediting Authority	Program Category	Accrediting Agency	Certification #
Kentucky	Drinking Water	DEP	90133
Los Angeles Sanitation	Waste Water	Sanitation District	10257
Louisiana	Drinking Water	DOH	LA110004
Louisiana	Waste Water & Hazardous Waste - Solid	DEQ	04086
Maine	Drinking Water & Waste Water	DH & HS	PA0091
Maryland	Drinking Water	DOH&MH	308
Massachusetts	Drinking Water	DEP	M-PA1457
Michigan	Drinking Water	DEQ	NA
Missouri	Drinking Water	DONR	235
Montana	Drinking Water	DOPH&HS	Cert0082
Nevada	Drinking Water, Waste Water & Hazardous Waste	DOC&NR	PA01457
New Hampshire	Drinking Water, Waste Water	DES	2967
New Jersey	Drinking Water	DEP	PA051
New Mexico	Drinking Water, Waste Water and Hazardous Waste	DPNR	NA
New York	Drinking Water, Waste Water	DOH	10888
North Carolina	Drinking Water	DOH&HS	42706
North Dakota	Drinking Water, Waste Water & Hazardous Waste	ND DOH	R-190
Oregon	Drinking Water, Waste Water and Hazardous Waste	ORELAP	PA200002
Pennsylvania	Drinking Water, Waste Water and Hazardous Waste	DEP	65-00282
Puerto Rico	Drinking Water	DOH	PA01457
South Dakota	Drinking Water	DOE&NR	NA
Tennessee	Drinking Water	DEC	TN02867
Texas	Drinking Water	COEQ	T104704188-12-6
US Virgin Islands	Drinking Water	DPNR	NA
Utah	Drinking Water, Waste Water and Hazardous Waste	DOH	ANTE
Virginia	Drinking Water, Waste Water and Hazardous Waste	DGS	460198
Washington	Drinking Water	DOE	C868
West Virginia	Drinking Water	DOH	9964C
West Virginia	Waste Water & Hazardous Waste	DEP	143

Laboratory: Pittsburgh

Accrediting Authority	Program Category	Accrediting Agency	Certification #
Wisconsin	Drinking Water	DOH	NA
Wyoming	Drinking Water	DEP	8TMS-Q

ATTACHMENT VII- PACE CHAIN-OF-CUSTODY (CURRENT AS OF ISSUE DATE)

Pace Analytical
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:
Company:	Report To:	Attention:
Address:	Copy To:	Company Name:
		Address:
Email To:	Purchase Order No.:	Pace Quote Reference:
Phone: Fax:	Project Name:	Pace Project Manager:
Requested Due Date/TAT:	Project Number:	Pace Profile #:

Page: of

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER

☐ UST ☐ RCRA ☐ OTHER

Site Location

STATE:

Requested Analysis Filtered (Y/N)

Section D
Required Client Information:

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Matrix Codes
MATRIX / CODE

Matrix	Code
Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Tissue	TS
Other	OT

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED – COMPOSITE START – DATE	COLLECTED – COMPOSITE START – TIME	COLLECTED – COMPOSITE END/GRAB – DATE	COLLECTED – COMPOSITE END/GRAB – TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives – Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test ↓ Y/N									Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1																												
2																												
3																												
4																												
5																												
6																												
7																												
8																												
9																												
10																												
11																												
12																												

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS		

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: DATE Signed (MM/DD/YY):

Temp in °C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | [illegible] (Y/N)

ATTACHMENT VIII- METHOD HOLD TIME, CONTAINER AND PRESERVATION GUIDE (CURRENT AS OF ISSUE DATE)

THE HOLDING TIME INDICATED IN THE CHART BELOW IS THE MAXIMUM ALLOWABLE TIME FROM COLLECTION TO EXTRACTION AND/OR ANALYSIS PER THE ANALYTICAL METHOD. FOR METHODS THAT REQUIRE PROCESSING PRIOR TO ANALYSIS, THE HOLDING TIME IS DESIGNATED AS 'PREPARATION HOLDING TIME/ANALYSIS HOLDING TIME'.

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Acidity	SM2310B	Water	Plastic/Glass	$\leq 6^oC$	14 Days
Actinides	HASL-300	Water		pH<2 HNO_3	180 Days
Actinides	HASL-300	Solid		None	180 Days
Alkalinity	SM2320B/310.2	Water	Plastic/Glass	$\leq 6^oC$	14 Days
Alkylated PAHs		Water		$\leq 6^oC$; pH<2 1:1 HCl (optional)	14/40 Days preserved; 7/40 Days unpreserved
Alkylated PAHs		Solid		$\leq 10^oC$	1 Year/40 Days
Total Alpha Radium (see note 3)	9315/903.0	Water	Plastic/Glass	pH<2 HNO_3	180 days
Total Alpha Radium (see note 3)	9315	Solid		None	180 days
Anions (Br, Cl, F, NO_2, NO_3, o-Phos, SO_4, bromate, chlorite, chlorate)	300.0/300.1/SM4110B	Water	Plastic/Glass	$\leq 6^oC$; EDA if bromate or chlorite run	All analytes 28 days except: NO_2, NO_3, o-Phos (48 Hours); chlorite (immediately for 300.0; 14 Days for 300.1). NO_2/NO_3 combo 28 days.
Anions (Br, Cl, F, NO_2, NO_3, o-Phos, SO_4, bromate, chlorite, chlorate)	300.0	Solid	Plastic/Glass	$\leq 6^oC$	All analytes 28 days except: NO_2, NO_3, o-Phos (48 hours); chlorite (immediately). NO_2/NO_3 combo 28 days.
Anions (Br, Cl, F, NO_2, NO_3, o-Phos, SO_4	9056	Water/ Solid	Plastic/Glass	$\leq 6^oC$	28 days
Aromatic and Halogenated Volatiles (see note 1)	8021	Solid	5035 vial kit	See note 1	14 days
Aromatic and Halogenated Volatiles	602/8021	Water	40mL vials	pH<2 HCl; $\leq 6^oC$; $Na_2S_2O_3$ if Cl present	14 Days (7 Days for aromatics if unpreserved)
Acid Volatile Sulfide	Draft EPA 1629	Solid	8oz Glass	$\leq 6^oC$	14 Days
Bacteria, Total Plate Count	SM9221D	Water	Plastic/WK	$\leq 6^oC$; $Na_2S_2O_3$	24 Hours
Base/Neutrals and Acids	8270	Solid	8oz Glass	$\leq 6^oC$	14/40 Days
Base/Neutrals and Acids	625/8270	Water	1L Amber	$\leq 6^oC$;	7/40 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
			Glass	$Na_2S_2O_3$ if Cl present	
Base/Neutrals, Acids & Pesticides	525.2	Water	1L Amber Glass	pH<2 HCl; $\leq 6^oC$; Na sulfite if Cl present	14/30 Days
Biomarkers		Water	$\leq 6^oC$; pH<2 1:1 HCl (optional)	14/40 Days preserved; 7/40 Days unpreserved	$\leq 6^oC$; pH<2 1:1 HCl (optional)
Biomarkers		Solid	$\leq 10^oC$	1 Year/40 Days	$\leq 10^oC$
BOD/cBOD	SM5210B	Water	Plastic/Glass	$\leq 6^oC$	48 hours
BTEX/Total Hydrocarbons	TO-3	Air	Summa Canister	None	14 Days
BTEX/Total Hydrocarbons	TO-3	Air	Tedlar Bag or equivalent	None	48 Hours
Cation/Anion Balance	SM1030E	Water	Plastic/Glass	None	None
Cation Exchange	9081	Solid	8oz Glass	None	unknown
Chloride	SM4500Cl-C,E	Water	Plastic/Glass	None	28 Days
Chlorine, Residual	SM4500Cl-D,E,G/330.5/Hach 8167	Water	Plastic/Glass	None	15 minutes
Chlorophyll	SM10200H	Water	Opaque bottle or aluminum foil		
COD	SM5220C, D/410.4/Hach 8000	Water	Plastic/Glass	pH<2 H_2SO_4; $\leq 6^oC$	28 Days
Coliform, Fecal	SM9222D	Water	100mL Plastic	$\leq 6^oC$	6 Hours
Coliform, Fecal	SM9222D	Solid	100mL Plastic	$\leq 6^oC$	6 Hours
Coliform, Total and Escherichla (E. coli)	SM9223B	Water	100mL Plastic	$\leq 10^oC$	48 Hours after collection; results from samples analyzed 30-48 Hours after collection must be qualified as analyzed >30 hours
Color	SM2120B,E	Water	Covered Plastic/Acid Washed Amber Glass	$\leq 6^oC$	24 Hours
Condensable Particulate Emissions	EPA 202	Air	Solutions	None	180 Days
Cyanide, Reactive	SW846 chap.7	Water	Plastic/Glass	None	28 Days
Cyanide, Reactive	SW846 chap.7	Solid	Plastic/Glass	None	28 Days
Cyanide, Total and Amenable	SM4500CN-	Water	Plastic/Glass	pH$\geq$12	14 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
	A,B,C,D,E,G,I,N/9010/ 9012/335.4			NaOH; ≤ 6°C; ascorbic acid if Cl present	(24 Hours if sulfide present- applies to SM4500CN only)
Diesel Range Organics- Alaska DRO	AK102	Solid	8oz Glass	≤ 6°C	14/40 Days
Diesel Range Organics- Alaska DRO	AK102	Water	1L Glass	pH<2 HCl; ≤ 6°C	14/40 Days
Diesel Range Organics- TPH DRO	8015	Solid	8oz Glass Jar	≤ 6°C	14/40 Days
Diesel Range Organics- TPH DRO	8015	Water	1L Amber Glass	≤ 6°C; $Na_2S_2O_3$ if Cl present	7/40 Days
Diesel Range Organics- TPH DRO	8015	Tissue	1L Amber Glass	≤ - 10°C	1 Year if frozen/40 Days
Diesel Range Organics- NwTPH-Dx	Nw-TPH-Dx	Solid	8oz Glass Jar	≤ 6°C	14/40 Days
Diesel Range Organics- NwTPH-Dx	Nw-TPH-Dx	Water	1L Amber Glass	pH <2 HCl; ≤ 6°C	14/40 Days; 7 Days from collection to extraction if unpreserved
Diesel Range Organics- Wisconsin DRO	WI MOD DRO	Solid	Tared 4oz Glass Jar	≤ 6°C	10/47 Days
Diesel Range Organics- Wisconsin DRO	WI MOD DRO	Water	1L Amber Glass	≤ 6°C	14/40 Days
Dioxins and Furans	1613B	Solid	8oz Glass	≤ 6°C	1 year
Dioxins and Furans	1613B	Water	1L Amber Glass	≤ 6°C; $Na_2S_2O_3$ if Cl present	1 year
Dioxins and Furans	1613B	Fish/ Tissue	Aluminum foil	≤ 6°C	1 year
Dioxins and Furans	8290	Water	1L Amber Glass	≤ 6°C; $Na_2S_2O_3$ if Cl present	30/45 Days
Dioxins and Furans	8290	Solid	8oz Glass	≤ 6°C	30/45 Days
Dioxins and Furans	8290	Fish/ Tissue	Not specified	< -10°C	30/45 Days
Dioxins and Furans	TO-9	Air	PUF	None	30/45 Days
EDB/DBCP (8011) EDB/DBCP/1,2,3-TCP (504.1)	504.1/8011	Water	40mL vials	≤ 6°C; $Na_2S_2O_3$ if Cl present	14 Days
Explosives	8330/8332	Water	1L Amber Glass	≤ 6°C	7/40 Days
Explosives	8330/8332	Solid	8oz Glass Jar	≤ 6°C	14/40 Days
Extractable Petroleum Hydrocarbons (aliphatic and aromatic)	MA-EPH	Water	1L Amber Glass	pH<2 HCl; ≤ 6°C	14/40 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Extractable Petroleum Hydrocarbons (aliphatic and aromatic)	MA-EPH	Solid	4oz Glass Jar	$\leq 6^oC$	7/40 Days
Ferrous Iron	SN3500Fe-D	Water	Glass	None	Immediate
Flashpoint/Ignitability	1010	Liquid	Plastic/Glass	None	28 Days
Fluoride	SM4500Fl-C,D	Water	Plastic	None	28 Days
Gamma Emitting Radionuclides[3]	901.1	Water	Plastic/Glass	pH<2 HNO_3	180 days
Gasoline Range Organics	8015	Water	40mL vials	pH<2 HCl	14 Days
Gasoline Range Organics	8015	Solid	5035 vial kit	See note 1	14 days
Gasoline Range Organics-Alaska GRO	AK101	Solid	5035 vial kit	See 5035 note*	28 Days if GRO only (14 Days with BTEX)
Gasoline Range Organics-Alaska GRO	AK101	Water	40mL vials	pH<2 HCl; $\leq 6^oC$	14 Days
Gasoline Range Organics-NwTPH-Gx	Nw-TPH-Gx	Water	40mL vials	pH<2 HCl; $\leq 6^oC$	7 Days unpreserved; 14 Days preserved
Gasoline Range Organics-NwTPH-Gx	Nw-TPH-Gx	Solid	40mL vials	$\leq 6^oC$; packed jars with no headspace	14 Days
Gasoline Range Organics-Wisconsin GRO	WI MOD GRO	Water	40mL vials	pH<2 HCl; $\leq 6^oC$	14 Days
Gasoline Range Organics-Wisconsin GRO	WI MOD GRO	Solid	40mL MeOH vials	$\leq 6^oC$ in MeOH	21 Days
Gross Alpha (NJ 48Hr Method)	NJAC 7:18-6	Water	Plastic/Glass	pH<2 HNO_3	48 Hrs
Gross Alpha and Gross Beta[3]	9310/900.0	Water	Plastic/Glass	pH<2 HNO_3	180 Days
Gross Alpha and Gross Beta	9310	Solid	Glass	None	180 Days
Haloacetic Acids	552.1/552.2	Water	40mL Amber vials	NH_4Cl; $\leq 6^oC$	14/7 Days if extracts stored $\leq 6^oC$ or 14/14 Days if extracts stored at $\leq -10^oC$
Hardness, Total ($CaCO_3$)	SM2340B,C/130.1	Water	Plastic/Glass	pH<2 HNO_3	6 Months
Heterotrophic Plate Count (MPC)	SM9215B	Water	100mL Plastic	$\leq 6^oC$	24 Hours
Herbicides, Chlorinated	8151	Solid	8oz Glass Jar	$\leq 6^oC$	14/40 Days
Herbicides, Chlorinated	8151	Water	1L Amber Glass	$\leq 6^oC$; $Na_2S_2O_3$ if Cl present	7/40 Days
Herbicides, Chlorinated	515.1/515.3	Water	1L Amber Glass	$\leq 6^oC$; $Na_2S_2O_3$ if Cl present	14/28 Days
Hexavalent Chromium	7196/218.6/SM3500Cr-C,D	Water	Plastic/Glass	$\leq 6^oC$	24 Hours
Hexavalent Chromium	7196 (with 3060A)	Solid		$\leq 6^oC$	24 Hours after extraction
Hydrogen Halide and Halogen	EPA 26	Air	Solutions	None	6 Months

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Emissions					
Ignitability of Solids	1030	Non-liquid Waste	Plastic/Glass	None	28 Days
Lead Emissions	EPA 12	Air	Filter/Solutions	None	6 Months
Lipids	Pace Lipids	Tissue	Plastic/Glass	$\leq$ -10^{o}C	1 Year if frozen
Mercury, Low-Level	1631E	Solid			
Mercury, Low-Level	1631E	Water	Fluoropolymer bottles (Glass if Hg is only analyte being tested)	12N HCl or BrCl	48 Hours for preservation or analysis; 28 Days to preservation if sample oxidized in bottle; 90 Days for analysis if preserved
Mercury, Low-Level	1631E	Tissue	Plastic/Glass	$\leq$ - 10^{o}C	28 Days if frozen
Mercury	7471	Solid	8oz Glass Jar	$\leq$ 6^{o}C	28 days
Mercury	7470/245.1/245.2	Water	Plastic/Glass	pH<2 HNO_3	28 Days
Mercury	7471/245.6	Tissue	Plastic/Glass	$\leq$ - 10^{o}C	28 Days if frozen
Metals (GFAA)	7000/200.9	Water	Plastic/Glass	pH<2 HNO_3	180 Days
Metals (ICP)	NIOSH 7300A/7303	Air	Filters	None	180 Days
Metals (ICP/ICPMS)	6010/6020	Solid	8oz Glass Jar	None	180 Days
Metals (ICP/ICPMS)	6010/6020/200.7/200.8	Water	Plastic/Glass	pH<2 HNO_3	180 Days
Metals (ICP/ICPMS)	6020	Tissue	Plastic/Glass	$\leq$ -10^{o}C	180 Days if frozen
Methane, Ethane, Ethene	8015 modified	Water	40mL vials	HCl	14 Days
Methane, Ethane, Ethene	RSK-175	Water	40mL vials	HCl	14 Days
Methane, Ethane, Ethene	EPA 3C	Air	Summa Canister	None	14 Days
Methane, Ethane, Ethene	EPA 3C	Air	Tedlar Bag or equivalent	None	48 Hours
Methanol, Ethanol	8015 modified	Water	40mL vials	$\leq$ 6^{o}C	14 Days
Methanol, Ethanol	8015 modified	Solid	2oz Glass	$\leq$ 6^{o}C	14 Days
Nitrogen, Ammonia	SM4500NH3/350.1	Water	Plastic/Glass	pH<2 H_2SO_4; $\leq$ 6^{o}C	28 Days
Nitrogen, Kjeldahl (TKN)	351.2	Solid	Plastic/Glass	$\leq$ 6^{o}C	28 Days
Nitrogen, Kjeldahl (TKN)	SM4500-Norg/351.2	Water	Plastic/Glass	pH<2 H_2SO_4; $\leq$ 6^{o}C	28 Days
Nitrogen, Nitrate	SM4500-NO3/352.1	Water	Plastic/Glass	$\leq$ 6^{o}C	24 Hours preferred
Nitrogen, Nitrate & Nitrite combination	353.2	Solid	Plastic/Glass	$\leq$ 6^{o}C	28 Days
Nitrogen, Nitrate & Nitrite combination	SM4500-NO3/353.2	Water	Plastic/Glass	pH<2 H_2SO_4; $\leq$ 6^{o}C	28 Days
Nitrogen, Nitrite or Nitrate separately	SM4500-NO2/353.2	Water	Plastic/Glass	$\leq$ 6^{o}C	48 Hours
Nitrogen, Organic	SM4500-Norg/351.2	Water	Plastic/Glass	pH<2 H_2SO_4; $\leq$ 6^{o}C	28 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Non-Methane Organics	EPA 25C	Air	Summa Canister	None	14 Days
Non-Methane Organics	EPA 25C	Air	Tedlar Bag or equivalent	None	48 Hours
Odor	SM2150B	Water	Glass	$\leq$ 6°C	24 Hours
Oil and Grease/HEM	1664A/SM5520B/9070	Water	Glass	pH<2 H_2SO_4 or HCl; $\leq$ 6°C	28 Days
Oil and Grease/HEM	9071	Solid	Glass	$\leq$ 6°C	28 Days
PBDEs	1614	Water	1L Amber Glass	$\leq$ 6°C	1 Year/1 Year
PBDEs	1614	Solid	Wide Mouth Jar	$\leq$ 6°C	1 Year/1 Year
PBDEs	1614	Tissue	Aluminum Foil	$\leq$ -10°C	1 Year/1 Year
PCBs and Pesticides, Organochlorine (OC)	TO-4/TO-10	Air	PUF	None	7/40 Days
PCBs and Pesticides, Organochlorine (OC)	608	Water	1L Amber Glass		Pest: 7/40 Days; PCB: 1 Year/1 Year
Pesticides, Organochlorine (OC)	8081	Water	1L Amber Glass	$\leq$ 6°C; $Na_2S_2O_3$ if Cl present	7/40 Days
Pesticides, Organochlorine (OC)	8081	Solid	8oz Glass Jar	$\leq$ 6°C	14/40 Days
Pesticides, Organochlorine (OC)	8081	Tissue	8oz Glass Jar	$\leq$ -10°C	1 Year if frozen/40 Days
Pesticides, Organophosphorous (OP)	8141	Solid	8oz Glass Jar	$\leq$ 6°C	14/40 Days
Pesticides, Organophosphorous (OP)	8141	Water	1L Amber Glass	pH 5-8 with NaOH or H_2SO_4; $\leq$ 6°C; $Na_2S_2O_3$ if Cl present	7/40 Days
PCBs (Aroclors)	8082	Water	1L Amber Glass	$\leq$ 6°C; $Na_2S_2O_3$ if Cl present	1 Year/1 Year
PCBs (Aroclors)	8082	Solid	8oz Glass Jar	$\leq$ 6°C	1 Year/1 Year
PCBs (Aroclors)	8082	Tissue	Plastic/Glass	$\leq$ -10°C	1 Year if frozen/1 Year
PCB Congeners	1668A	Water	1L Amber Glass	$\leq$ 6°C but above freezing	1 Year/1 Year
PCB Congeners	1668A	Solid	4-8oz Glass Jar	$\leq$ 6°C but above freezing	1 Year/1 Year
PCB Congeners	1668A	Tissue	4-8oz Glass Jar	$\leq$ -10°C	1 Year/1 Year
Oil Range Organics- ORO					
Oxygen, Dissolved (Probe)	SM4500-O	Water	Glass	None	15 minutes
Paint Filter Liquid Test	9095	Water	Plastic/Glass	None	N/A

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Particulates	PM-10	Air	Filters	None	180 Days
Permanent Gases	EPA 3C	Air	Summa Canister	None	14 Days
Permanent Gases	EPA 3C	Air	Tedlar Bag or equivalent	None	48 Hours
pH	SM4500H+B/9040	Water	Plastic/Glass	None	15 minutes
pH	9045	Solid	Plastic/Glass	None	
Phenol, Total	420.1/420.4/9065/9066	Water	Glass	pH<2 H_2SO_4; $\leq$ 6°C	28 Days
Phosphorus, Orthophosphate	SM4500P/365.1/365.3	Water	Plastic	Filter; $\leq$ 6°C	Filter within 15 minutes, Analyze within 48 Hours
Phosphorus, Total	SM4500P/ 365.1/365.3/365.4	Water	Plastic/Glass	pH<2 H_2SO_4; $\leq$ 6°C	28 Days
Phosphorus, Total	365.4	Solid	Plastic/Glass	$\leq$ 6°C	28 Days
Polynuclear Aromatic Hydrocarbons (PAH)	TO-13	Air	PUF	None	7/40 Days
Polynuclear Aromatic Hydrocarbons (PAH)	8270 SIM	Solid	8oz Glass Jar	$\leq$ 6°C	14/40 Days
Polynuclear Aromatic Hydrocarbons (PAH)	8270 SIM	Water	1L Amber Glass	$\leq$ 6°C; $Na_2S_2O_3$ if Cl present	7/40 Days
Polynuclear Aromatic Hydrocarbons (PAH)	8270 SIM	Tissue	Plastic/Glass	$\leq$ -10°C	1 Year if frozen/40 Days
Radioactive Strontium[3]	905.0	Water	Plastic/Glass	pH<2 HNO_3	180 days
Radium-226[3]	903.0/903.1	Water	Plastic/Glass	pH<2 HNO_3	180 days
Radium-228 (see note 3)	9320/904.0	Water	Plastic/Glass	pH<2 HNO_3	180 days
Radium-228 (see note 3)	9320	Solid			
Residual Range Organics-Alaska RRO	AK103	Solid	8oz Glass	$\leq$ 6°C	14/40 Days
Saturated Hydrocarbons		Water	$\leq$ 6°C; pH<2 1:1 HCl (optional)	14/40 Days preserved; 7/40 Days unpreserved	$\leq$ 6°C; pH<2 1:1 HCl (optional)
Saturated Hydrocarbons		Solid	$\leq$ 10°C	1 Year/40 Days	$\leq$ 10°C
Silica, Dissolved	SM4500Si-D	Water	Plastic	$\leq$ 6°C	28 Days
Solids, Settleable	SM2540F	Water	Glass	$\leq$ 6°C	48 Hours
Solids, Total	SM2540B	Water	Plastic/Glass	$\leq$ 6°C	7 Days
Solids, Total	SM2540G	Solid	Plastic/Glass	$\leq$ 6°C	7 Days
Solids, Total (FOC, OM, Ash)	ASTM D2974	Solid	Plastic/Glass	$\leq$ 6°C	7 Days
Solids, Total Dissolved	SM2540C	Water	Plastic/Glass	$\leq$ 6°C	7 Days
Solids, Total Suspended	SM2540D/USGS I-3765-85	Water	Plastic/Glass	$\leq$ 6°C	7 Days
Solids, Total Volatile	160.4/SM2540E	Water	Plastic/Glass	$\leq$ 6°C	7 Days
Solids, Total Volatile	160.4	Solid	Plastic/Glass	$\leq$ 6°C	7 Days
Specific Conductance	SM2510B/9050/120.1	Water	Plastic/Glass	$\leq$ 6°C	28 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Stationary Source Dioxins and Furans	EPA 23	Air	XAD Trap	None	30/45 Days
Stationary Source Mercury	EPA 101	Air	Filters	None	180 Days, 28 Days for Hg
Stationary Source Metals	EPA 29	Air	Filters	None	180 Days, 28 Days for Hg
Stationary Source PM10	EPA 201A	Air	Filters	None	180 Days
Stationary Source Particulates	EPA 5	Air	Filter/Solutions	None	180 Days
Sulfate	SM4500SO4/9036/ 9038/375.2/ASTM D516	Water	Plastic/Glass	$\leq 6^{o}C$	28 Days
Sulfide, Reactive	SW-846 Chap.7	Water	Plastic/Glass	None	28 Days
Sulfide, Reactive	SW-846 Chap.7	Solid	Plastic/Glass	None	28 Days
Sulfide, Total	SM4500S/9030	Water	Plastic/Glass	pH>9 NaOH; ZnOAc; $\leq 6^{o}C$	7 Days
Sulfite	SM4500SO3	Water	Plastic/Glass	None	15 minutes
Surfactants (MBAS)	SM5540C	Water	Plastic/Glass	$\leq 6^{o}C$	48 Hours
Total Organic Carbon (TOC)	SM5310B,C,D/9060	Water	Glass	pH<2 H_2SO_4 or HCl; $\leq 6^{o}C$	28 Days
Total Organic Carbon (TOC)	9060/Walkley Black	Solid	Glass	$\leq 6^{o}C$	14 Days
Total Organic Halogen (TOX)	SM5320/9020/9021	Water	Glass; no headspace	$\leq 6^{o}C$	14 Days
Tritium	906.0	Water	Glass	None	180 days
Turbidity	SM2130B/180.1	Water	Plastic/Glass	$\leq 6^{o}C$	48 Hours
Total Uranium[3]	908.0/ASTM D5174-97	Water	Plastic/Glass	pH<2 HCl	180 days
Volatile Petroleum Hydrocarbons (aliphatic and aromatic)	MA-VPH	Water	40mL vials	pH<2 HCl; $\leq 6^{o}C$	14 Days preserved
Volatile Petroleum Hydrocarbons (aliphatic and aromatic)	MA-VPH	Solid	4-8oz Glass Jar	$\leq 6^{o}C$; packed jars with no headspace	7/28 Days
Volatiles	TO-14	Air	Summa Canister	None	30 Days
Volatiles	TO-14	Air	Tedlar Bag or equivalent	None	48 Hours
Volatiles	TO-15	Air	Summa Canister	None	30 Days
Volatiles	8260	Solid	5035 vial kit	See note 1	14 days
Volatiles	8260	Water	40mL vials	pH<2 HCl; $\leq 6^{o}C$; $Na_2S_2O_3$ if Cl present	14 Days
Volatiles	8260	Conc. Waste	5035 vial kit or 40mL vials	$\leq 6^{o}C$	14 Days
Volatiles	624	Water	40mL vials	pH<2 HCl; $\leq$	14 Days (7 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
				6°C; $Na_2S_2O_3$ if Cl present	for aromatics if unpreserved)
Volatiles (see note 2)	524.2	Water	40mL vials (in duplicate)	pH<2 HCl; ≤ 6°C; Ascorbic acid or $Na_2S_2O_3$ if Cl present[2]	14 Days

[1] **5035/5035A Note**: 5035 vial kit typically contains 2 vials water, preserved by freezing **or**, 2 vials aqueous sodium bisulfate preserved at 4°C, **and** one vial methanol preserved at ≤6°C **and** one container of unpreserved sample stored at ≤6°C.

[2] Method 524.2 lists ascorbic acid as the preservative when residual chlorine is suspected, unless gases or Table 7 compounds are NOT compounds of interest and then sodium thiosulfate is the preservative recommended.

[3] Methods 9315 and 9320 both state that if samples are unpreserved, the samples should be brought to the lab within 5 days of collection, preserved in the lab, and then allowed to sit for a minimum of 16 hours before sample preparation/analysis.

ERA

A Waters Company

Nilda B. Cox
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016

091313E Final Report

QuiK™ Response Proficiency Testing

A Waters Company

October 21, 2013

Nilda B. Cox
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016

Fax: 626-386-1139

Enclosed is your final report for ERA's QuiK™Response program. Your final report includes an evaluation of all results submitted by your laboratory to ERA. None of the assigned value(s) or acceptance limits were available to your laboratory at or before the time of reporting.

Please note the following changes to our final reports:

• At the request of the TNI Accreditation Council, we have included a Laboratory Exception Report that includes a list of all analytes reported with less than qualifiers when the assigned value was greater than "0." In addition, because we have received many requests from laboratories, this report also includes a list of all analytes with "Not Acceptable" evaluations.

• Some states have elected not to convert to the 2009 TNI Standards at this time. If you have released your results to a state that has retained the 2003 NELAC Evaluation Criteria, your final report will include a section that evaluates the results according to the 2003 Standard in addition to the 2009 TNI Standards.

As part of your accreditation(s), you may be required to identify the root cause of any "Not Acceptable" results, implement the necessary corrective actions, and then satisfy your PT requirements by participating in a supplemental (QuiK™Response) or future ERA PT study. ERA's technical staff is available to help your laboratory resolve any technical issues that may be impairing your PT performance and possibly affecting the quality of your routine data.

The data contained herein are confidential and intended for your use only.

If you are using this report for DMR-QA 33 Corrective Action, please note the following: permittees must submit a copy of this report to your DMRQA Coordinator, along with your corrective action documentation by October 7, 2013. Contract Laboratories should send a copy of this report to your permittees upon receipt.

Thank you for your participation in ERA's QuiK™Response program. If you have any questions, please contact our Proficiency Testing Department at 1-800-372-0122.

Sincerely,

Kristina Sanchez
Quality Officer

cc: Project File Number 091313E

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Report Recipient	Contact/Phone Number	Reporting Type	Evaluation Type
Arizona	Ali Mayfield / (602) 364-0728	All Analytes	2009 TNI
California ELAP	Fred Choske / 510-620-3175	All Analytes	2009 TNI
EPA Region 8	Marcie Tidd / (303) 312-7764	All Analytes	2009 TNI
Georgia	Lynne Grubb / 404-657-3189	All Analytes	2009 TNI
Guam	Rodolfo Paulino / 671-475-1655	All Analytes	2009 TNI
Mariana Island	Vinson Sablan / 670-664-8520	All Analytes	2009 TNI
Michigan (WS)	Greg Lundy / 517-335-9219	All Analytes	2009 TNI
Mississippi	Phyllis Givens / 601-576-7582	All Analytes	2009 TNI
Montana	Russell Leu / 406-444-5259	All Analytes	2009 TNI
Nevada	Sara Rairick / 775-687-9490	All Analytes	2003 NELAC
New Jersey	Rachel Ellis / 609-777-1749	All Analytes	2009 TNI
New York	Dan Dickinson / 518-485-5570	All Analytes	2003 NELAC

091313E Laboratory Exception Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601

2009 TNI Evaluation Checks

There are no values reported with < where the assigned value was greater than 0.

2009 TNI Not Acceptable Evaluations

There were no Not Acceptable evaluations for this study.

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Final Report Results For Laboratory
Eurofins Eaton Analytical, Inc - Monrovia

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2009 TNI Evaluation Report

Project Number: **091313E**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

Inorganic Results

091313E 2009 TNI Evaluation Final Complete Report

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Vanadium (cat# 660) Study Dates: 09/13/13 - 10/16/13												
1185	Vanadium	µg/L	13.4	12.9	10.9 - 14.7	Acceptable	EPA 200.8 5.4 1994	10/7/2013	1.20	12.7	0.562	
WS Inorganic Disinfection #1 (cat# 5272) Study Dates: 09/13/13 - 10/16/13												
1570	Chlorate	µg/L		176	123 - 229	Not Reported				127	0.00	
1595	Chlorite	µg/L	375	331	232 - 430	Acceptable	EPA 317.0 2	10/14/2013	0	307	0.00	
WS o-Phosphate Nutrients (cat# 667) Study Dates: 09/13/13 - 10/16/13												
1870	ortho-Phosphate as P	mg/L	0.998	1.03	0.876 - 1.18	Acceptable	EPA 365.1 2 1993	9/30/2013	-0.94	1.05	0.0546	
WS o-Phosphate Nutrients (cat# 667) Study Dates: 09/13/13 - 10/16/13												
1870	ortho-Phosphate as P	mg/L	0.998	1.03	0.876 - 1.18	Acceptable	SM4500P E 20th ED 1997	9/30/2013	-0.94	1.05	0.0546	
WS o-Phosphate Nutrients (cat# 667) Study Dates: 09/13/13 - 10/16/13												
1870	ortho-Phosphate as P	mg/L	0.998	1.03	0.876 - 1.18	Acceptable	SM4500P E 22nd ED 2011	9/30/2013	-0.94	1.05	0.0546	
WS o-Phosphate Nutrients (cat# 667) Study Dates: 09/13/13 - 10/16/13												
1870	ortho-Phosphate as P	mg/L	0.998	1.03	0.876 - 1.18	Acceptable	SM4500P F 22nd ED 2011	9/30/2013	-0.94	1.05	0.0546	
WS Turbidity (cat# 699) Study Dates: 09/13/13 - 10/16/13												
2055	Turbidity	NTU	3.71	4.08	3.45 - 4.63	Acceptable	EPA 180.1 2 1993	10/1/2013	-1.74	4.06	0.202	
WS Turbidity (cat# 699) Study Dates: 09/13/13 - 10/16/13												
2055	Turbidity	NTU	3.71	4.08	3.45 - 4.63	Acceptable	SM2130B 20th ED 1994	10/1/2013	-1.74	4.06	0.202	
WS Turbidity (cat# 699) Study Dates: 09/13/13 - 10/16/13												
2055	Turbidity	NTU	3.71	4.08	3.45 - 4.63	Acceptable	SM2130B 22nd ED 2011	10/1/2013	-1.74	4.06	0.202	

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2009 TNI Evaluation Report

Project Number: **091313E**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

Organic Results

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091313E 2009 TNI Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Chloral Hydrate (cat# 676) Study Dates: 09/13/13 - 10/21/13												
4460	Chloral Hydrate	µg/L	20.4	25.1	5.72 - 40.1	Acceptable	EPA 551.1 1 1992	10/17/2013	0	24.5	0.00	
WS Halomethanes (THMs) (cat# 702) Study Dates: 09/13/13 - 10/21/13												
4395	Bromodichloromethane	µg/L	28.1	26.5	21.2 - 31.8	Acceptable	EPA 524.2 4.1 1995	10/16/2013	0.906	26.2	2.04	
4400	Bromoform	µg/L	13.2	12.0	9.60 - 14.4	Acceptable	EPA 524.2 4.1 1995	10/16/2013	0.602	12.2	1.70	
4575	Chlorodibromomethane	µg/L	38.7	38.2	30.6 - 45.8	Acceptable	EPA 524.2 4.1 1995	10/16/2013	0.151	38.1	3.89	
4505	Chloroform	µg/L	22.2	20.2	16.2 - 24.2	Acceptable	EPA 524.2 4.1 1995	10/16/2013	1.65	20.2	1.23	
WS Toxaphene (cat# 700) Study Dates: 09/13/13 - 10/16/13												
8250	Toxaphene	µg/L	6.36	6.08	3.34 - 8.82	Acceptable	EPA 505 2.1 1995	9/18/2013	0.422	5.87	1.17	
WS EDB/DBCP/TCP (cat# 706) Study Dates: 09/13/13 - 10/16/13												
4570	Dibromochloropropane (DBCP)	µg/L	1.69	1.58	0.948 - 2.21	Acceptable	EPA 551.1 1 1992	9/26/2013	0.329	1.62	0.203	
4585	Ethylene Dibromide (EDB)	µg/L		1.72	1.03 - 2.41	Not Reported				1.69	0.173	
5180	1,2,3-Trichloropropane (TCP)	µg/L		1.14	0.684 - 1.60	Not Reported				1.28	0.302	

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Final Report Results For Laboratory
Eurofins Eaton Analytical, Inc - Monrovia

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2003 NELAC Evaluation Report

Project Number: **091313E**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

Inorganic Results

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091313E 2003 NELAC Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Vanadium (cat# 660) Study Dates: 09/13/13 - 10/16/13												
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WS Inorganic Disinfection #1 (cat# 5272) Study Dates: 09/13/13 - 10/16/13												
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1595	Chlorite	µg/L	375	331	232 - 430	Acceptable	EPA 317.0 2	10/14/2013	0	307	0.00	
WS o-Phosphate Nutrients (cat# 667) Study Dates: 09/13/13 - 10/16/13												
1870	ortho-Phosphate as P	mg/L	0.998	1.03	0.876 - 1.18	Acceptable	EPA 365.1 2 1993	9/30/2013	-0.94	1.05	0.0546	
WS o-Phosphate Nutrients (cat# 667) Study Dates: 09/13/13 - 10/16/13												
1870	ortho-Phosphate as P	mg/L	0.998	1.03	0.876 - 1.18	Acceptable	SM4500P E 20th ED 1997	9/30/2013	-0.94	1.05	0.0546	
WS o-Phosphate Nutrients (cat# 667) Study Dates: 09/13/13 - 10/16/13												
1870	ortho-Phosphate as P	mg/L	0.998	1.03	0.876 - 1.18	Acceptable	SM4500P E 22nd ED 2011	9/30/2013	-0.94	1.05	0.0546	
WS o-Phosphate Nutrients (cat# 667) Study Dates: 09/13/13 - 10/16/13												
1870	ortho-Phosphate as P	mg/L	0.998	1.03	0.876 - 1.18	Acceptable	SM4500P F 22nd ED 2011	9/30/2013	-0.94	1.05	0.0546	
WS Turbidity (cat# 699) Study Dates: 09/13/13 - 10/16/13												
2055	Turbidity	NTU	3.71	4.08	3.45 - 4.63	Acceptable	EPA 180.1 2 1993	10/1/2013	-1.74	4.06	0.202	
WS Turbidity (cat# 699) Study Dates: 09/13/13 - 10/16/13												
2055	Turbidity	NTU	3.71	4.08	3.45 - 4.63	Acceptable	SM2130B 20th ED 1994	10/1/2013	-1.74	4.06	0.202	
WS Turbidity (cat# 699) Study Dates: 09/13/13 - 10/16/13												
2055	Turbidity	NTU	3.71	4.08	3.45 - 4.63	Acceptable	SM2130B 22nd ED 2011	10/1/2013	-1.74	4.06	0.202	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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2003 NELAC Evaluation Report

Project Number: **091313E**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

Organic Results

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: **CA00006**
ERA Customer Number: **M327601**

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Chloral Hydrate (cat# 676) Study Dates: 09/13/13 - 10/21/13												
4460	Chloral Hydrate	µg/L	20.4	25.1	5.72 - 40.1	Acceptable	EPA 551.1 1 1992	10/17/2013	0	24.5	0.00	
WS Halomethanes (THMs) (cat# 702) Study Dates: 09/13/13 - 10/21/13												
4395	Bromodichloromethane	µg/L	28.1	26.5	21.2 - 31.8	Acceptable	EPA 524.2 4.1 1995	10/16/2013	0.906	26.2	2.04	
4400	Bromoform	µg/L	13.2	12.0	9.60 - 14.4	Acceptable	EPA 524.2 4.1 1995	10/16/2013	0.602	12.2	1.70	
4575	Chlorodibromomethane	µg/L	38.7	38.2	30.6 - 45.8	Acceptable	EPA 524.2 4.1 1995	10/16/2013	0.151	38.1	3.89	
4505	Chloroform	µg/L	22.2	20.2	16.2 - 24.2	Acceptable	EPA 524.2 4.1 1995	10/16/2013	1.65	20.2	1.23	
WS Toxaphene (cat# 700) Study Dates: 09/13/13 - 10/16/13												
8250	Toxaphene	µg/L	6.36	6.08	3.34 - 8.82	Acceptable	EPA 505 2.1 1995	9/18/2013	0.422	5.87	1.17	
WS EDB/DBCP/TCP (cat# 706) Study Dates: 09/13/13 - 10/16/13												
4570	Dibromochloropropane (DBCP)	µg/L	1.69	1.58	0.948 - 2.21	Acceptable	EPA 551.1 1 1992	9/26/2013	0.329	1.62	0.203	
4585	Ethylene Dibromide (EDB)	µg/L		1.72	1.03 - 2.41	Not Reported				1.69	0.173	
5180	1,2,3-Trichloropropane (TCP)	µg/L		1.14	0.684 - 1.60	Not Reported				1.28	0.302	

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A Waters Company

Nilda B. Cox
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016

WS-198 Final Report

WatR™ Supply Proficiency Testing

WatR™ Supply Study

Open Date: 01/07/13

Close Date: 02/21/13

Report Issued Date: 03/08/13

A Waters Company

March 8, 2013

Nilda B. Cox
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016

Enclosed is your final report for ERA's WS-198 WatR™Supply Proficiency Testing (PT) study. Your final report includes an evaluation of all results submitted by your laboratory to ERA.

Data Evaluation Protocols: All analytes in ERA's WS-198 WatR™Supply Proficiency Testing (PT) study have been evaluated using the following tiered approach. If the analyte is listed in the current TNI Fields of Proficiency Testing (FoPT) tables, the evaluation was completed by comparing the reported result to the acceptance limits generated using the criteria contained in the TNI FoPT tables. If the analyte is not included in the TNI FoPT tables, the reported result has been evaluated using the procedures outlined in ERA's Standard Operating Procedure for the Generation of Performance Acceptance Limits (SOP 0260).

Corrective Action Help: As part of your accreditation(s), you may be required to identify the root cause of any "Not Acceptable" results, implement the necessary corrective actions, and then satisfy your PT requirements by participating in a Supplemental (QuiK™Response) or future ERA PT study. ERA's technical staff is available to help your laboratory resolve any technical issues that may be impairing your PT performance and possibly affecting your routine data quality. Our laboratory and technical staff have many years of collective experience in performing the full range of environmental analyses. As part of our technical support, ERA offers QC samples that can be useful in helping you work through your technical issues.

Please note the following changes to our final reports:

• At the request of the TNI Accreditation Council, we have included a Laboratory Exception Report that includes a list of all analytes reported with less than qualifiers when the assigned value was greater than “0.” In addition, because we have received many requests from laboratories, this report also includes a list of all analytes with "Not Acceptable" evaluations.

• Some states have elected not to convert to the 2009 TNI Standards at this time. If you have released your results to a state that has retained the 2003 NELAC Evaluation Criteria, your final report will include a section that evaluates the results according to the 2003 Standard in addition to the 2009 TNI Standards.

Thank you for your participation in ERA's WS-198 WatR™Supply Proficiency Testing study. If you have any questions, please contact our Proficiency Testing Department at 1-800-372-0122.

Sincerely,

Kristina Sanchez
Quality Officer

attachments

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Report Recipient	Contact/Phone Number	Reporting Type	Evaluation Type
Alabama	Tom DeLoach / 334-271-7791	All Analytes	2009 TNI
Alaska	Lance Morris / 907-375-8210	All Analytes	2009 TNI
Alaska (Micro)	Sherri Trask / 907-375-8209	All Analytes	2009 TNI
Arizona	Ali Mayfield / (602) 364-0728	All Analytes	2009 TNI
California	Fred Choske / 510-620-3175	All Analytes	2009 TNI
Colorado	Ben Chouaf / 303-692-3045	All Analytes	2009 TNI
Connecticut (WS)	Philip Schlossberg / 860-509-7387	All Analytes	2009 TNI
Delaware	Brenda Haire / 302-741-8630	All Analytes	2009 TNI
EPA Region 8	Marcie Tidd / (303) 312-7764	All Analytes	2009 TNI
Georgia	Lynne Grubb / 404-657-3189	All Analytes	2009 TNI
Guam	Rodolfo Paulino / 671-475-1655	All Analytes	2009 TNI
Hawaii	Richard Kiyokane / 808-453-6679	All Analytes	2009 TNI
Hawaii (Micro)	Michael Kihara / 808-453-6609	All Analytes	2009 TNI
Idaho	Ernie Bader / 208-334-2235 x 290	All Analytes	2009 TNI
Idaho (Micro)	Sandra Radwin / 208-334-2235 X256	All Analytes	2009 TNI
Indiana	Phil Zillinger / 317-921-5571	All Analytes	2009 TNI
Kentucky	Patrick Garrity / 502-564-3410 ext 4968	All Analytes	2009 TNI
Maine	Jennifer Jamison / 207-287-1929	All Analytes	2009 TNI
Mariana Island	Vinson Sablan / 670-664-8520	All Analytes	2009 TNI
Maryland	Linda Ames / 410-537-3712	All Analytes	2009 TNI
Massachusetts	Ann Marie Allen / 978-682-5237 x 51333	All Analytes	2009 TNI
Michigan (WS)	Greg Lundy / 517-335-9219	All Analytes	2009 TNI
Mississippi	Phyllis Givens / 601-576-7582	All Analytes	2009 TNI
Montana	Russell Leu / 406-444-5259	All Analytes	2009 TNI
Nebraska	Laurie Wieting / 402-471-8407	All Analytes	2009 TNI
Nevada	Sara Rairick / 775-687-9490	All Analytes	2003 NELAC
New Jersey	Rachel Ellis / 609-777-1749	All Analytes	2009 TNI
New Mexico (WS)	Paul W. Gray / 505-383-9120	All Analytes	2009 TNI
New York	Dan Dickinson / 518-485-5570	All Analytes	2003 NELAC
North Carolina (WS)	Chris Goforth / 919-807-8871	All Analytes	2009 TNI
North Dakota	Errol Erickson / 701-328-6172	All Analytes	2009 TNI
South Carolina	Carol Smith / 803-896-0992	All Analytes	2003 NELAC
South Dakota	Mike Smith / 605-773-4757	All Analytes	2009 TNI

Tennessee	Craig LaFever / 615-532-0181	All Analytes	2009 TNI
Vermont (WS)	George Mills / 802-863-7335	All Analytes	2009 TNI
Virginia	Cathy Westerman / 804-648-4480 x391	All Analytes	2003 NELAC
Washington	Alan Rue / (360) 895-6178	All Analytes	2009 TNI
West Virginia (Micro)	Tom Ong / 304-558-3530	All Analytes	2003 NELAC
West Virginia (WS)	Greg Young / 304-965-2694 X2222	All Analytes	2003 NELAC
Wisconsin	Rick Mealy / 608-264-6006	All Analytes	2009 TNI
Wisconsin (Micro)	Laura Traas / 414-760-1364	All Analytes	2009 TNI

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WS-198 Definitions & Study Discussion

Study Dates: 01/07/13 - 02/21/13

Report Issued: 03/08/13

WS Study Definitions

The Reported Value is the value that the laboratory reported to ERA.

The ERA Assigned Values are compliant with the current TNI Fields of Proficiency Testing (FoPT) tables. A parameter not added to the standard is given an Assigned Value of "< PTRL" per the guidelines contained in the 2009 TNI Standards. The assigned values are directly traceable to the commercially prepared starting materials used to manufacture the PT standards.

The Acceptance Limits are established per the criteria contained in the most current TNI FoPT tables, or ERA's SOP for the Generation of Performance Acceptance Limits™ as applicable.

The Performance Evaluation:

Acceptable	= Reported Value falls within the Acceptance Limits.
Not Acceptable	= Reported Value falls outside the Acceptance Limits.
No Evaluation	= Reported Value cannot be evaluated.
Not Reported	= No Value reported.

The Method Description is the method the laboratory reported to ERA.

WS Study Discussion

ERA's WS-198 WatR™Supply Proficiency Testing study has been reviewed by ERA senior management and certified compliant with the requirements of the 2009 TNI PT Standards and the criteria contained in the most current TNI Fields of Proficiency Testing (FoPT) tables.

ERA's WS-198 WatR™Supply study standards were examined for any anomalies. A full review of all homogeneity, stability and accuracy verification data was completed. All analytical verification data for all analytes in the standards met the acceptance criteria contained in the 2009 TNI PT Standard and the criteria contained in the most current TNI FoPT tables.

The data submitted by participating laboratories was also examined for study anomalies. There were no anomalies observed during the statistical review of the data.

ERA's WS-198 WatR™Supply study reports shall not be reproduced except in their entirety and not without the permission of the participating laboratories. The report must not be used by the participating laboratories to claim product endorsement by any agency of the U. S. government.

The data contained herein are confidential and intended for your use only.

If you have any questions or concerns regarding your assessment in ERA's WatR™Supply Proficiency Testing program, please contact our Proficiency Testing Department at 1-800-372-0122.

WS-198 Laboratory Exception Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
ERA Customer Number:	M327601
Report Issued:	03/08/13
Study Dates:	01/07/13 - 02/21/13

2009 TNI Evaluation Checks

There are no values reported with < where the assigned value was greater than 0.

2009 TNI Not Acceptable Evaluations

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WS Inorganics (cat# 591)							
1730	Fluoride	mg/L	1.26	1.53	1.38 - 1.68	Not Acceptable	EPA 300.0 2.1 1993
WS Metals (cat# 590)							
1040	Chromium	µg/L	113	137	116 - 158	Not Acceptable	EPA 200.8 5.4 1994
1040	Chromium	µg/L	113	137	116 - 158	Not Acceptable	EPA 200.8 5.5 1998
1105	Nickel	µg/L	146	173	147 - 199	Not Acceptable	EPA 200.8 5.4 1994
1105	Nickel	µg/L	146	173	147 - 199	Not Acceptable	EPA 200.8 5.5 1998
WS Vanadium (cat# 856)							
1185	Vanadium	µg/L	10.6	12.5	10.9 - 14.0	Not Acceptable	EPA 200.8 5.4 1994
1185	Vanadium	µg/L	10.6	12.5	10.9 - 14.0	Not Acceptable	EPA 200.8 5.5 1998
WS Organic Carbon (cat# 557)							
1710	Dissolved Organic Carbon (DOC)	mg/L	4.02	7.98	7.09 - 8.78	Not Acceptable	SM5310C 20th ED 1996
1710	Dissolved Organic Carbon (DOC)	mg/L	4.02	7.98	7.09 - 8.78	Not Acceptable	SM5310C 21st ED 2000
2040	Total Organic Carbon (TOC)	mg/L	3.94	7.98	6.38 - 9.58	Not Acceptable	SM5310C 20th ED 1996
2040	Total Organic Carbon (TOC)	mg/L	3.94	7.98	6.38 - 9.58	Not Acceptable	SM5310C 21st ED 2000
WS UV 254 Absorbance (cat# 904)							
2060	UV 254 Absorbance	cm-1	0.0775	0.140	0.112 - 0.174	Not Acceptable	SM5910B 20th ED 1994

WS-198 Laboratory Exception Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
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Report Issued:	**03/08/13**
Study Dates:	**01/07/13 - 02/21/13**

2009 TNI Not Acceptable Evaluations

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WS UV 254 Absorbance (cat# 904)							
2060	UV 254 Absorbance	cm-1	0.0775	0.140	0.112 - 0.174	Not Acceptable	SM5910B 21st ED 2000
WS WS SourceWatR™ MicrobE™ (cat# 595)							
2500	Total Coliforms (MPN)	MPN/100mL	130	86.0	45.4 - 124	Not Acceptable	SM9221B+F ECMUG 20th ED 1998
2500	Total Coliforms (MPN)	MPN/100mL	130	86.0	45.4 - 124	Not Acceptable	SM9221B+F ECMUG online
2525	E.coli (MPN)	MPN/100mL	130	86.0	46.1 - 123	Not Acceptable	SM9221B+F ECMUG 20th ED 1998
2525	E.coli (MPN)	MPN/100mL	130	86.0	46.1 - 123	Not Acceptable	SM9221B+F ECMUG online
WS Halomethanes (THMs) (cat# 842)							
4400	Bromoform	µg/L	4.11	5.66	4.53 - 6.79	Not Acceptable	EPA 524.3 1 2009
4575	Chlorodibromomethane	µg/L	15.6	21.5	17.2 - 25.8	Not Acceptable	EPA 524.3 1 2009
WS Unregulated Volatiles (cat# 841)							
4665	2,2-Dichloropropane	µg/L	14.5	18.2	14.6 - 21.8	Not Acceptable	EPA 524.2 4.1 1995

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Final Report Results For Laboratory
Eurofins Eaton Analytical, Inc - Monrovia

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2009 TNI Evaluation Report

Study: **WS-198**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

Inorganic Results

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

WS-198 2009 TNI Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 03/08/13
Study Dates: 01/07/13 - 02/21/13

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Hardness (cat# 555)												
1035	Calcium	mg/L	79.2	79.9	67.9 - 91.9	Acceptable	EPA 200.7 4.4 1994	1/21/2013	0.0350	79.1	3.23	
1085	Magnesium	mg/L	15.6	15.0	12.8 - 17.2	Acceptable	EPA 200.7 4.4 1994	1/21/2013	0.421	15.3	0.756	
1155	Sodium	mg/L	41.5	40.4	34.3 - 46.5	Acceptable	EPA 200.7 4.4 1994	1/21/2013	0.606	40.4	1.82	
1550	Calcium Hardness as CaCO3	mg/L	198	199	169 - 229	Acceptable	EPA 200.7 4.4 1994	1/22/2013	0.161	197	7.00	
1755	Total Hardness as CaCO3	mg/L	262	261	222 - 300	Acceptable	EPA 200.7 4.4 1994	1/22/2013	0.246	260	8.85	
WS Hardness (cat# 555)												
1035	Calcium	mg/L	79.2	79.9	67.9 - 91.9	Acceptable	EPA 200.7 5 1998	1/21/2013	0.0350	79.1	3.23	
1085	Magnesium	mg/L	15.6	15.0	12.8 - 17.2	Acceptable	EPA 200.7 5 1998	1/21/2013	0.421	15.3	0.756	
1155	Sodium	mg/L	41.5	40.4	34.3 - 46.5	Acceptable	EPA 200.7 5 1998	1/21/2013	0.606	40.4	1.82	
1550	Calcium Hardness as CaCO3	mg/L	198	199	169 - 229	Acceptable	EPA 200.7 5 1998	1/22/2013	0.161	197	7.00	
1755	Total Hardness as CaCO3	mg/L	262	261	222 - 300	Acceptable	EPA 200.7 5 1998	1/22/2013	0.246	260	8.85	
WS Hardness (cat# 555)												
1035	Calcium	mg/L		79.9	67.9 - 91.9	Not Reported				79.1	3.23	
1085	Magnesium	mg/L		15.0	12.8 - 17.2	Not Reported				15.3	0.756	
1155	Sodium	mg/L		40.4	34.3 - 46.5	Not Reported				40.4	1.82	
1550	Calcium Hardness as CaCO3	mg/L	198	199	169 - 229	Acceptable	SM2340B 20th ED 1997	1/22/2013	0.161	197	7.00	
1755	Total Hardness as CaCO3	mg/L	262	261	222 - 300	Acceptable	SM2340B 20th ED 1997	1/22/2013	0.246	260	8.85	

WS-198 2009 TNI Evaluation Final Complete Report

ERA
A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 03/08/13
Study Dates: 01/07/13 - 02/21/13

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Hardness (cat# 555)												
1035	Calcium	mg/L		79.9	67.9 - 91.9	Not Reported				79.1	3.23	
1085	Magnesium	mg/L		15.0	12.8 - 17.2	Not Reported				15.3	0.756	
1155	Sodium	mg/L		40.4	34.3 - 46.5	Not Reported				40.4	1.82	
1550	Calcium Hardness as CaCO3	mg/L	198	199	169 - 229	Acceptable	SM2340B 21st ED 1997	1/22/2013	0.161	197	7.00	
1755	Total Hardness as CaCO3	mg/L	262	261	222 - 300	Acceptable	SM2340B 21st ED 1997	1/22/2013	0.246	260	8.85	
WS Inorganics (cat# 591)												
1505	Alkalinity as CaCO3	mg/L	45.9	47.7	42.9 - 52.5	Acceptable	SM2320B 20th ED 1997	1/15/2013	-0.786	47.5	2.06	
1575	Chloride	mg/L	55.2	55.0	46.8 - 63.2	Acceptable	EPA 300.0 2.1 1993	1/15/2013	0.378	54.4	2.19	
1610	Conductivity at 25°C	µmhos/cm	515	504	454 - 554	Acceptable	SM2510B 20th ED 1997	1/15/2013	0.296	511	12.6	
1730	Fluoride	mg/L	1.26	1.53	1.38 - 1.68	Not Acceptable	EPA 300.0 2.1 1993	1/16/2013	-2.58	1.49	0.0876	
1820	Nitrate + Nitrite as N	mg/L	6.90	7.10	6.04 - 8.16	Acceptable	EPA 300.0 2.1 1993	1/15/2013	-0.0432	6.91	0.310	
1810	Nitrate as N	mg/L	6.90	7.10	6.39 - 7.81	Acceptable	EPA 300.0 2.1 1993	1/15/2013	0.0153	6.90	0.304	
1125	Potassium	mg/L	23.0	23.0	19.6 - 26.4	Acceptable	EPA 200.7 4.4 1994	1/21/2013	0.513	22.4	1.07	
2000	Sulfate	mg/L	70.3	72.7	61.8 - 83.6	Acceptable	EPA 300.0 2.1 1993	1/15/2013	-0.272	71.1	2.85	
1955	Total Dissolved Solids at 180°C	mg/L	320	352	282 - 422	Acceptable	SM2540C 20th ED 1997	1/17/2013	-1.24	342	17.6	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WS-198 2009 TNI Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 03/08/13
Study Dates: 01/07/13 - 02/21/13

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Inorganics (cat# 591)												
1505	Alkalinity as CaCO3	mg/L	45.9	47.7	42.9 - 52.5	Acceptable	SM2320B 21st ED 1997	1/15/2013	-0.786	47.5	2.06	
1575	Chloride	mg/L		55.0	46.8 - 63.2	Not Reported				54.4	2.19	
1610	Conductivity at 25°C	µmhos/cm	515	504	454 - 554	Acceptable	SM2510B 21st ED 1997	1/15/2013	0.296	511	12.6	
1730	Fluoride	mg/L	1.40	1.53	1.38 - 1.68	Acceptable	SM4500F- C 20th ED 1997	1/18/2013	-0.984	1.49	0.0876	
1820	Nitrate + Nitrite as N	mg/L	6.82	7.10	6.04 - 8.16	Acceptable	EPA 353.2 2 1993	1/18/2013	-0.301	6.91	0.310	
1810	Nitrate as N	mg/L	6.81	7.10	6.39 - 7.81	Acceptable	EPA 353.2 2 1993	1/15/2013	-0.281	6.90	0.304	
1125	Potassium	mg/L	23.0	23.0	19.6 - 26.4	Acceptable	EPA 200.7 5 1998	1/21/2013	0.513	22.4	1.07	
2000	Sulfate	mg/L		72.7	61.8 - 83.6	Not Reported				71.1	2.85	
1955	Total Dissolved Solids at 180°C	mg/L	320	352	282 - 422	Acceptable	SM2540C 21st ED 1997	1/17/2013	-1.24	342	17.6	
WS pH (cat# 552)												
1900	pH	S.U.	6.98	6.95	6.75 - 7.15	Acceptable	EPA 150.1 1983	1/23/2013	0.842	6.93	0.0584	
WS pH (cat# 552)												
1900	pH	S.U.	6.98	6.95	6.75 - 7.15	Acceptable	SM4500H+ B 20th ED 1996	1/23/2013	0.842	6.93	0.0584	
WS pH (cat# 552)												
1900	pH	S.U.	6.98	6.95	6.75 - 7.15	Acceptable	SM4500H+ B 21st ED 2000	1/23/2013	0.842	6.93	0.0584	

WS-198 2009 TNI Evaluation Final Complete Report

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 03/08/13
Study Dates: 01/07/13 - 02/21/13

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Metals (cat# 590)												
1000	Aluminum	µg/L	225	221	177 - 265	Acceptable	EPA 200.8 5.4 1994	1/22/2013	-0.0932	226	15.1	
1005	Antimony	µg/L	37.4	42.5	29.8 - 55.2	Acceptable	EPA 200.8 5.4 1994	1/21/2013	-1.8	42.4	2.77	
1010	Arsenic	µg/L	22.5	24.0	16.8 - 31.2	Acceptable	EPA 200.8 5.4 1994	1/21/2013	-0.677	23.4	1.32	
1015	Barium	µg/L	1220	1160	986 - 1330	Acceptable	EPA 200.8 5.4 1994	1/22/2013	1.14	1160	50.6	
1020	Beryllium	µg/L	13.7	15.4	13.1 - 17.7	Acceptable	EPA 200.8 5.4 1994	1/21/2013	-2.86	15.7	0.716	
1025	Boron	µg/L		1090	926 - 1250	Not Reported				1070	53.9	
1030	Cadmium	µg/L	33.8	39.8	31.8 - 47.8	Acceptable	EPA 200.8 5.4 1994	1/21/2013	-3.85	39.8	1.56	
1040	Chromium	µg/L	113	137	116 - 158	Not Acceptable	EPA 200.8 5.4 1994	1/21/2013	-3.98	137	5.98	
1055	Copper	µg/L	1660	1620	1460 - 1780	Acceptable	EPA 200.8 5.4 1994	1/22/2013	0.809	1610	58.3	
1070	Iron	µg/L		564	479 - 649	Not Reported				564	26.1	
1075	Lead	µg/L	69.4	81.2	56.8 - 106	Acceptable	EPA 200.8 5.4 1994	1/21/2013	-2.72	81.5	4.45	
1090	Manganese	µg/L	239	235	200 - 270	Acceptable	EPA 200.8 5.4 1994	1/22/2013	-0.262	242	10.2	
1100	Molybdenum	µg/L	106	125	106 - 144	Acceptable	EPA 200.8 5.4 1994	1/21/2013	-2.92	123	5.88	
1105	Nickel	µg/L	146	173	147 - 199	Not Acceptable	EPA 200.8 5.4 1994	1/21/2013	-3.11	173	8.55	
1140	Selenium	µg/L	19.9	22.4	17.9 - 26.9	Acceptable	EPA 200.8 5.4 1994	1/21/2013	-1.32	22.4	1.89	
1150	Silver	µg/L	127	131	91.7 - 170	Acceptable	EPA 200.8 5.4 1994	2/1/2013	-0.758	131	5.37	
1165	Thallium	µg/L	4.26	4.89	3.42 - 6.36	Acceptable	EPA 200.8 5.4 1994	1/21/2013	-1.49	4.81	0.371	
1185	Vanadium	µg/L	508	520	442 - 598	Acceptable	EPA 200.8 5.4 1994	1/22/2013	-0.535	518	19.2	
1190	Zinc	µg/L	1280	1260	1070 - 1450	Acceptable	EPA 200.8 5.4 1994	1/22/2013	0.483	1250	53.0	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
Report Issued:	**03/08/13**
Study Dates:	**01/07/13 - 02/21/13**

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Metals (cat# 590)												
1000	Aluminum	µg/L	225	221	177 - 265	Acceptable	EPA 200.8 5.5 1998	1/22/2013	-0.0932	226	15.1	
1005	Antimony	µg/L	37.4	42.5	29.8 - 55.2	Acceptable	EPA 200.8 5.5 1998	1/21/2013	-1.8	42.4	2.77	
1010	Arsenic	µg/L	22.5	24.0	16.8 - 31.2	Acceptable	EPA 200.8 5.5 1998	1/21/2013	-0.677	23.4	1.32	
1015	Barium	µg/L	1220	1160	986 - 1330	Acceptable	EPA 200.8 5.5 1998	1/22/2013	1.14	1160	50.6	
1020	Beryllium	µg/L	13.7	15.4	13.1 - 17.7	Acceptable	EPA 200.8 5.5 1998	1/21/2013	-2.86	15.7	0.716	
1025	Boron	µg/L		1090	926 - 1250	Not Reported				1070	53.9	
1030	Cadmium	µg/L	33.8	39.8	31.8 - 47.8	Acceptable	EPA 200.8 5.5 1998	1/21/2013	-3.85	39.8	1.56	
1040	Chromium	µg/L	113	137	116 - 158	Not Acceptable	EPA 200.8 5.5 1998	1/21/2013	-3.98	137	5.98	
1055	Copper	µg/L	1660	1620	1460 - 1780	Acceptable	EPA 200.8 5.5 1998	1/22/2013	0.809	1610	58.3	
1070	Iron	µg/L		564	479 - 649	Not Reported				564	26.1	
1075	Lead	µg/L	69.4	81.2	56.8 - 106	Acceptable	EPA 200.8 5.5 1998	1/21/2013	-2.72	81.5	4.45	
1090	Manganese	µg/L	239	235	200 - 270	Acceptable	EPA 200.8 5.5 1998	1/22/2013	-0.262	242	10.2	
1100	Molybdenum	µg/L	106	125	106 - 144	Acceptable	EPA 200.8 5.5 1998	1/21/2013	-2.92	123	5.88	
1105	Nickel	µg/L	146	173	147 - 199	Not Acceptable	EPA 200.8 5.5 1998	1/21/2013	-3.11	173	8.55	
1140	Selenium	µg/L	19.9	22.4	17.9 - 26.9	Acceptable	EPA 200.8 5.5 1998	1/21/2013	-1.32	22.4	1.89	
1150	Silver	µg/L	127	131	91.7 - 170	Acceptable	EPA 200.8 5.5 1998	2/1/2013	-0.758	131	5.37	
1165	Thallium	µg/L	4.26	4.89	3.42 - 6.36	Acceptable	EPA 200.8 5.5 1998	1/21/2013	-1.49	4.81	0.371	
1185	Vanadium	µg/L	508	520	442 - 598	Acceptable	EPA 200.8 5.5 1998	1/22/2013	-0.535	518	19.2	
1190	Zinc	µg/L	1280	1260	1070 - 1450	Acceptable	EPA 200.8 5.5 1998	1/22/2013	0.483	1250	53.0	

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QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Metals (cat# 590)												
1000	Aluminum	µg/L	205	221	177 - 265	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-1.42	226	15.1	
1005	Antimony	µg/L		42.5	29.8 - 55.2	Not Reported				42.4	2.77	
1010	Arsenic	µg/L		24.0	16.8 - 31.2	Not Reported				23.4	1.32	
1015	Barium	µg/L	1160	1160	986 - 1330	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-0.043	1160	50.6	
1020	Beryllium	µg/L	15.3	15.4	13.1 - 17.7	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-0.621	15.7	0.716	
1025	Boron	µg/L	997	1090	926 - 1250	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-1.35	1070	53.9	
1030	Cadmium	µg/L	37.5	39.8	31.8 - 47.8	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-1.48	39.8	1.56	
1040	Chromium	µg/L	135	137	116 - 158	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-0.304	137	5.98	
1055	Copper	µg/L	1540	1620	1460 - 1780	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-1.25	1610	58.3	
1070	Iron	µg/L	563	564	479 - 649	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-0.0503	564	26.1	
1075	Lead	µg/L		81.2	56.8 - 106	Not Reported				81.5	4.45	
1090	Manganese	µg/L	249	235	200 - 270	Acceptable	EPA 200.7 4.4 1994	1/21/2013	0.723	242	10.2	
1100	Molybdenum	µg/L	114	125	106 - 144	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-1.56	123	5.88	
1105	Nickel	µg/L	178	173	147 - 199	Acceptable	EPA 200.7 4.4 1994	1/21/2013	0.630	173	8.55	
1140	Selenium	µg/L		22.4	17.9 - 26.9	Not Reported				22.4	1.89	
1150	Silver	µg/L	133	131	91.7 - 170	Acceptable	EPA 200.7 4.4 1994	1/21/2013	0.360	131	5.37	
1165	Thallium	µg/L		4.89	3.42 - 6.36	Not Reported				4.81	0.371	
1185	Vanadium	µg/L	490	520	442 - 598	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-1.47	518	19.2	
1190	Zinc	µg/L	1240	1260	1070 - 1450	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-0.273	1250	53.0	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Metals (cat# 590)												
1000	Aluminum	µg/L	205	221	177 - 265	Acceptable	EPA 200.7 5 1998	1/21/2013	-1.42	226	15.1	
1005	Antimony	µg/L		42.5	29.8 - 55.2	Not Reported				42.4	2.77	
1010	Arsenic	µg/L		24.0	16.8 - 31.2	Not Reported				23.4	1.32	
1015	Barium	µg/L	1160	1160	986 - 1330	Acceptable	EPA 200.7 5 1998	1/21/2013	-0.043	1160	50.6	
1020	Beryllium	µg/L	15.3	15.4	13.1 - 17.7	Acceptable	EPA 200.7 5 1998	1/21/2013	-0.621	15.7	0.716	
1025	Boron	µg/L	997	1090	926 - 1250	Acceptable	EPA 200.7 5 1998	1/21/2013	-1.35	1070	53.9	
1030	Cadmium	µg/L	37.5	39.8	31.8 - 47.8	Acceptable	EPA 200.7 5 1998	1/21/2013	-1.48	39.8	1.56	
1040	Chromium	µg/L	135	137	116 - 158	Acceptable	EPA 200.7 5 1998	1/21/2013	-0.304	137	5.98	
1055	Copper	µg/L	1540	1620	1460 - 1780	Acceptable	EPA 200.7 5 1998	1/21/2013	-1.25	1610	58.3	
1070	Iron	µg/L	563	564	479 - 649	Acceptable	EPA 200.7 5 1998	1/21/2013	-0.0503	564	26.1	
1075	Lead	µg/L		81.2	56.8 - 106	Not Reported				81.5	4.45	
1090	Manganese	µg/L	249	235	200 - 270	Acceptable	EPA 200.7 5 1998	1/21/2013	0.723	242	10.2	
1100	Molybdenum	µg/L	114	125	106 - 144	Acceptable	EPA 200.7 5 1998	1/21/2013	-1.56	123	5.88	
1105	Nickel	µg/L	178	173	147 - 199	Acceptable	EPA 200.7 5 1998	1/21/2013	0.630	173	8.55	
1140	Selenium	µg/L		22.4	17.9 - 26.9	Not Reported				22.4	1.89	
1150	Silver	µg/L	133	131	91.7 - 170	Acceptable	EPA 200.7 5 1998	1/21/2013	0.360	131	5.37	
1165	Thallium	µg/L		4.89	3.42 - 6.36	Not Reported				4.81	0.371	
1185	Vanadium	µg/L	490	520	442 - 598	Acceptable	EPA 200.7 5 1998	1/21/2013	-1.47	518	19.2	
1190	Zinc	µg/L	1240	1260	1070 - 1450	Acceptable	EPA 200.7 5 1998	1/21/2013	-0.273	1250	53.0	
WS Mercury (cat# 551)												
1095	Mercury	µg/L	2.57	2.39	1.67 - 3.11	Acceptable	EPA 245.1 3 1994	1/22/2013	0.800	2.40	0.208	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Hexavalent Chromium (cat# 854)												
1045	Hexavalent Chromium	µg/L	29.0	29.3	23.4 - 35.2	Acceptable	EPA 218.6 3.3 1994	1/25/2013	0.143	28.7	1.85	
WS Hexavalent Chromium (cat# 854)												
1045	Hexavalent Chromium	µg/L	28.0	29.3	23.4 - 35.2	Acceptable	SM3500Cr B 20th ED 1997	1/25/2013	-0.396	28.7	1.85	
WS Hexavalent Chromium (cat# 854)												
1045	Hexavalent Chromium	µg/L	28.0	29.3	23.4 - 35.2	Acceptable	SM3500Cr B 21st ED 2001	1/25/2013	-0.396	28.7	1.85	
WS Hexavalent Chromium (cat# 854)												
1045	Hexavalent Chromium	µg/L	28.0	29.3	23.4 - 35.2	Acceptable	SM3500Cr D 19th ED 1990	1/25/2013	-0.396	28.7	1.85	
WS Vanadium (cat# 856)												
1185	Vanadium	µg/L	10.6	12.5	10.9 - 14.0	Not Acceptable	EPA 200.8 5.4 1994	1/21/2013	-2.44	12.5	0.796	
WS Vanadium (cat# 856)												
1185	Vanadium	µg/L	10.6	12.5	10.9 - 14.0	Not Acceptable	EPA 200.8 5.5 1998	1/21/2013	-2.44	12.5	0.796	
WS Vanadium (cat# 856)												
1185	Vanadium	µg/L	12.3	12.5	10.9 - 14.0	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-0.302	12.5	0.796	
WS Vanadium (cat# 856)												
1185	Vanadium	µg/L	12.3	12.5	10.9 - 14.0	Acceptable	EPA 200.7 5 1998	1/21/2013	-0.302	12.5	0.796	
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L	180	179	125 - 233	Acceptable	EPA 300.1 1 2000	1/23/2013	0.797	170	12.2	
1595	Chlorite	µg/L	356	345	242 - 448	Acceptable	EPA 300.1 1 2000	1/23/2013	-0.0498	357	25.3	
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L	180	179	125 - 233	Acceptable	EPA 300.1 1997	1/23/2013	0.797	170	12.2	
1595	Chlorite	µg/L	356	345	242 - 448	Acceptable	EPA 300.1 1997	1/23/2013	-0.0498	357	25.3	

ERA

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L	175	179	125 - 233	Acceptable	EPA 300.0 2.1 1993	1/21/2013	0.387	170	12.2	
1595	Chlorite	µg/L	352	345	242 - 448	Acceptable	EPA 300.0 2.1 1993	1/21/2013	-0.208	357	25.3	
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L	175	179	125 - 233	Acceptable	EPA 9056 1996 1996	1/21/2013	0.387	170	12.2	
1595	Chlorite	µg/L		345	242 - 448	Not Reported				357	25.3	
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L		179	125 - 233	Not Reported				170	12.2	
1595	Chlorite	µg/L	396	345	242 - 448	Acceptable	EPA 317.0 2	1/23/2013	1.53	357	25.3	
WS Inorganic Disinfection #2 (cat# 5260)												
1535	Bromate	µg/L	39.3	42.6	29.8 - 55.4	Acceptable	EPA 300.1 1 2000	1/29/2013	-0.776	41.6	2.91	
1540	Bromide	µg/L	144	147	125 - 169	Acceptable	EPA 300.1 1 2000	1/23/2013	0.0138	144	8.38	
WS Inorganic Disinfection #2 (cat# 5260)												
1535	Bromate	µg/L	39.3	42.6	29.8 - 55.4	Acceptable	EPA 300.1 1997	1/29/2013	-0.776	41.6	2.91	
1540	Bromide	µg/L	144	147	125 - 169	Acceptable	EPA 300.1 1997	1/23/2013	0.0138	144	8.38	
WS Inorganic Disinfection #2 (cat# 5260)												
1535	Bromate	µg/L	44.6	42.6	29.8 - 55.4	Acceptable	EPA 317.0 2	1/23/2013	1.04	41.6	2.91	
1540	Bromide	µg/L		147	125 - 169	Not Reported				144	8.38	
WS Inorganic Disinfection #2 (cat# 5260)												
1535	Bromate	µg/L		42.6	29.8 - 55.4	Not Reported				41.6	2.91	
1540	Bromide	µg/L	143	147	125 - 169	Acceptable	EPA 300.0 2.1 1993	1/21/2013	-0.106	144	8.38	

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QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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WS Nitrite (cat# 594)												
1840	Nitrite as N	mg/L	1.87	1.84	1.56 - 2.12	Acceptable	EPA 300.1 1 2000	1/16/2013	0.351	1.84	0.0792	
WS Nitrite (cat# 594)												
1840	Nitrite as N	mg/L	1.87	1.84	1.56 - 2.12	Acceptable	EPA 300.1 1997	1/16/2013	0.351	1.84	0.0792	
WS Nitrite (cat# 594)												
1840	Nitrite as N	mg/L	1.92	1.84	1.56 - 2.12	Acceptable	EPA 300.0 2.1 1993	1/15/2013	0.983	1.84	0.0792	
WS Nitrite (cat# 594)												
1840	Nitrite as N	mg/L	1.85	1.84	1.56 - 2.12	Acceptable	EPA 353.2 2 1993	1/15/2013	0.0987	1.84	0.0792	
WS o-Phosphate Nutrients (cat# 558)												
1870	ortho-Phosphate as P	mg/L	2.63	2.55	2.17 - 2.93	Acceptable	EPA 365.1 2 1993	1/15/2013	0.633	2.56	0.116	
WS o-Phosphate Nutrients (cat# 558)												
1870	ortho-Phosphate as P	mg/L	2.63	2.55	2.17 - 2.93	Acceptable	SM4500P E 20th ED 1997	1/15/2013	0.633	2.56	0.116	
WS o-Phosphate Nutrients (cat# 558)												
1870	ortho-Phosphate as P	mg/L	2.63	2.55	2.17 - 2.93	Acceptable	SM4500P F 20th ED 1997	1/15/2013	0.633	2.56	0.116	
WS o-Phosphate Nutrients (cat# 558)												
1870	ortho-Phosphate as P	mg/L	2.63	2.55	2.17 - 2.93	Acceptable	SM4500P E 21st ED 1999	1/15/2013	0.633	2.56	0.116	
WS Residual Chlorine (cat# 593)												
1945	Free Residual Chlorine	mg/L	0.920	0.894	0.706 - 1.08	Acceptable	SM4500Cl G 20th ED 1993	1/25/2013	0.631	0.870	0.0795	
1940	Total Residual Chlorine	mg/L	0.950	0.894	0.747 - 1.03	Acceptable	SM4500Cl G 20th ED 1993	1/30/2013	0.728	0.906	0.0603	
WS Residual Chlorine (cat# 593)												
1945	Free Residual Chlorine	mg/L	0.920	0.894	0.706 - 1.08	Acceptable	SM4500Cl G 21st ED 2000	1/25/2013	0.631	0.870	0.0795	
1940	Total Residual Chlorine	mg/L	0.950	0.894	0.747 - 1.03	Acceptable	SM4500Cl G 21st ED 2000	1/30/2013	0.728	0.906	0.0603	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
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WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.400	0.415	0.311 - 0.519	Acceptable	EPA 335.4 1993	1/16/2013	-0.345	0.412	0.0338	
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.416	0.415	0.311 - 0.519	Acceptable	SM4500CN F 20th ED 1997	1/16/2013	0.128	0.412	0.0338	
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.416	0.415	0.311 - 0.519	Acceptable	SM4500CN F 21st ED 1999	1/16/2013	0.128	0.412	0.0338	
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.376	0.415	0.311 - 0.519	Acceptable	SM4500CN G 20th 1998	1/16/2013	-1.06	0.412	0.0338	
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.376	0.415	0.311 - 0.519	Acceptable	SM4500CN G 21st Ed 2005	1/16/2013	-1.06	0.412	0.0338	
WS Organic Carbon (cat# 557)												
1710	Dissolved Organic Carbon (DOC)	mg/L	4.02	7.98	7.09 - 8.78	Not Acceptable	SM5310C 20th ED 1996	1/15/2013	-11	8.02	0.362	
2040	Total Organic Carbon (TOC)	mg/L	3.94	7.98	6.38 - 9.58	Not Acceptable	SM5310C 20th ED 1996	1/15/2013	-10.7	8.10	0.389	
WS Organic Carbon (cat# 557)												
1710	Dissolved Organic Carbon (DOC)	mg/L	4.02	7.98	7.09 - 8.78	Not Acceptable	SM5310C 21st ED 2000	1/15/2013	-11	8.02	0.362	
2040	Total Organic Carbon (TOC)	mg/L	3.94	7.98	6.38 - 9.58	Not Acceptable	SM5310C 21st ED 2000	1/15/2013	-10.7	8.10	0.389	
WS Perchlorate (cat# 903)												
1895	Perchlorate	µg/L	11.0	10.7	8.56 - 12.8	Acceptable	EPA 314.0 1 1999	1/24/2013	0.409	10.6	0.946	
WS Perchlorate (cat# 903)												
1895	Perchlorate	µg/L	10.4	10.7	8.56 - 12.8	Acceptable	EPA 331.0 1.0 2005	1/29/2013	-0.225	10.6	0.946	
WS Silica (cat# 902)												
1990	Silica as SiO2	mg/L	34.4	31.3	26.6 - 36.0	Acceptable	EPA 200.7 4.4 1994	1/21/2013	1.54	31.1	2.12	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 03/08/13
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Silica (cat# 902)												
1990	Silica as SiO2	mg/L	34.4	31.3	26.6 - 36.0	Acceptable	EPA 200.7 5 1998	1/21/2013	1.54	31.1	2.12	
WS Silica (cat# 902)												
1990	Silica as SiO2	mg/L	30.0	31.3	26.6 - 36.0	Acceptable	SM4500SiO2 C 20th ED 1997	2/4/2013	-0.534	31.1	2.12	
WS Silica (cat# 902)												
1990	Silica as SiO2	mg/L	30.0	31.3	26.6 - 36.0	Acceptable	SM4500Si D 20th ED 1997	2/4/2013	-0.534	31.1	2.12	
WS Surfactants - MBAS (cat# 901)												
2025	Surfactants - MBAS	mg/L	0.317	0.312	0.200 - 0.423	Acceptable	SM5540C 20th ED 1993	1/15/2013	-0.075	0.320	0.0408	
WS Surfactants - MBAS (cat# 901)												
2025	Surfactants - MBAS	mg/L	0.317	0.312	0.200 - 0.423	Acceptable	SM5540C 21st ED 2000	1/15/2013	-0.075	0.320	0.0408	
WS Corrosivity (cat# 900)												
1620	Corrosivity	S.I.@ 20°C	1.63	1.52	1.12 - 1.92	Acceptable	SM2330B 18th ED 1989	2/1/2013	1.04	1.44	0.179	
WS Corrosivity (cat# 900)												
1620	Corrosivity	S.I.@ 20°C	1.63	1.52	1.12 - 1.92	Acceptable	EPA 9040C 2002	2/1/2013	1.04	1.44	0.179	
WS Turbidity (cat# 592)												
2055	Turbidity	NTU	0.995	0.940	0.738 - 1.21	Acceptable	EPA 180.1 2 1993	1/18/2013	0.00701	0.994	0.121	
WS Turbidity (cat# 592)												
2055	Turbidity	NTU	0.995	0.940	0.738 - 1.21	Acceptable	SM2130B 20th ED 1994	1/18/2013	0.00701	0.994	0.121	
WS Turbidity (cat# 592)												
2055	Turbidity	NTU	0.995	0.940	0.738 - 1.21	Acceptable	SM2130B 21st ED 2001	1/18/2013	0.00701	0.994	0.121	
WS UV 254 Absorbance (cat# 904)												
2060	UV 254 Absorbance	cm-1	0.0775	0.140	0.112 - 0.174	Not Acceptable	SM5910B 20th ED 1994	1/17/2013	-5.57	0.140	0.0113	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
ERA Customer Number:	M327601
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS UV 254 Absorbance (cat# 904)												
2060	UV 254 Absorbance	cm-1	0.0775	0.140	0.112 - 0.174	Not Acceptable	SM5910B 21st ED 2000	1/17/2013	-5.57	0.140	0.0113	

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Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

Microbiology Results

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080A)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/19/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/19/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 1, 6 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 2
Blank - No Organism, Samples 4 and 7

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
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WS MicrobE™ (Coliforms) (cat# 080A) (Continued)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2530	Fecal Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2530	Fecal Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/19/2013	0			
2530	Fecal Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2530	Fecal Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2530	Fecal Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2530	Fecal Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2530	Fecal Coliforms - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2530	Fecal Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2530	Fecal Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/19/2013	0			
2530	Fecal Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Acceptable**
E.coli Evaluation : **Not Reported**

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 1, 6 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 2
Blank - No Organism, Samples 4 and 7

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080A) (Continued)												
2525	E.coli - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 3	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 10	CFU/100mL		Presence	Presence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 1, 6 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 2
Blank - No Organism, Samples 4 and 7

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS MicrobE™ (Coliforms) (cat# 080A)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/19/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/19/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Acceptable**
E.coli Evaluation : **Not Reported**

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 1, 6 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 2
Blank - No Organism, Samples 4 and 7

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
ERA Customer Number:	M327601
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WS MicrobE™ (Coliforms) (cat# 080A) (Continued)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2530	Fecal Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2530	Fecal Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/19/2013	0			
2530	Fecal Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2530	Fecal Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2530	Fecal Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2530	Fecal Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2530	Fecal Coliforms - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2530	Fecal Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2530	Fecal Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/19/2013	0			
2530	Fecal Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 1, 6 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 2
Blank - No Organism, Samples 4 and 7

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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WS MicrobE™ (Coliforms) (cat# 080A) (Continued)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2525	E.coli - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 3	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 10	CFU/100mL		Presence	Presence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 1, 6 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 2
Blank - No Organism, Samples 4 and 7

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
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WS MicrobE™ (Coliforms) (cat# 080B)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 6
Total Coliform Organism - Enterobacter cloacae, Samples 5, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 3
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 2 and 10

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS MicrobE™ (Coliforms) (cat# 080B) (Continued)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2530	Fecal Coliforms - Sample 1	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 6
Total Coliform Organism - Enterobacter cloacae, Samples 5, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 3
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 2 and 10

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B) (Continued)												
2525	E.coli - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Not Reported**
E.coli Evaluation : **Acceptable**

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 6
Total Coliform Organism - Enterobacter cloacae, Samples 5, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 3
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 2 and 10

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
ERA Customer Number:	M327601
Report Issued:	03/08/13
Study Dates:	01/07/13 - 02/21/13

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 6
Total Coliform Organism - Enterobacter cloacae, Samples 5, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 3
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 2 and 10

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 6
Total Coliform Organism - Enterobacter cloacae, Samples 5, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 3
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 2 and 10

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B) (Continued)												
2525	E.coli - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 6
Total Coliform Organism - Enterobacter cloacae, Samples 5, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 3
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 2 and 10

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C)												
2500	Total Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Not Reported**
E.coli Evaluation : **Acceptable**

Fecal Coliform Organism - Escherichia coli, Samples 5, 7 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 4 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 1
Blank - No Organism, Samples 3 and 8

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 5, 7 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 4 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 1
Blank - No Organism, Samples 3 and 8

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C) (Continued)												
2525	E.coli - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 5, 7 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 4 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 1
Blank - No Organism, Samples 3 and 8

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C)												
2500	Total Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Not Reported**
E.coli Evaluation : **Acceptable**

Fecal Coliform Organism - Escherichia coli, Samples 5, 7 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 4 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 1
Blank - No Organism, Samples 3 and 8

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 5, 7 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 4 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 1
Blank - No Organism, Samples 3 and 8

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
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WS MicrobE™ (Coliforms) (cat# 080C) (Continued)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2525	E.coli - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 5, 7 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 4 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 1
Blank - No Organism, Samples 3 and 8

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Nilda B. Cox
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Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080D)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Not Reported**
E.coli Evaluation : **Acceptable**

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 5
Total Coliform Organism - Enterobacter cloacae, Samples 2, 8 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 6
Blank - No Organism, Samples 3 and 7

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
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WS MicrobE™ (Coliforms) (cat# 080D) (Continued)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2530	Fecal Coliforms - Sample 1	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Not Reported**
E.coli Evaluation : **Acceptable**

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 5
Total Coliform Organism - Enterobacter cloacae, Samples 2, 8 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 6
Blank - No Organism, Samples 3 and 7

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
ERA Customer Number:	M327601
Report Issued:	03/08/13
Study Dates:	01/07/13 - 02/21/13

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080D) (Continued)												
2525	E.coli - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 5
Total Coliform Organism - Enterobacter cloacae, Samples 2, 8 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 6
Blank - No Organism, Samples 3 and 7

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WS MicrobE™ (Coliforms) (cat# 080D)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 5
Total Coliform Organism - Enterobacter cloacae, Samples 2, 8 and 10
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Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 6
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750 Royal Oaks Dr.
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626-386-1170

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080D) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 5
Total Coliform Organism - Enterobacter cloacae, Samples 2, 8 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 6
Blank - No Organism, Samples 3 and 7

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Nilda B. Cox
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Eurofins Eaton Analytical, Inc - Monrovia
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Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080D) (Continued)												
2525	E.coli - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Not Reported**
E.coli Evaluation : **Acceptable**

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 5
Total Coliform Organism - Enterobacter cloacae, Samples 2, 8 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 6
Blank - No Organism, Samples 3 and 7

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QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS WS SourceWatR™ MicrobE™ (cat# 595)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	93.2	86.0	45.4 - 124	Acceptable	SM9223 COLertQT 20th ED 1998	1/16/2013	0.913	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL	93.2	86.0	36.8 - 174	Acceptable	SM9223 COLertQT 20th ED 1998	1/16/2013	0.387	80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	93.2	86.0	46.1 - 123	Acceptable	SM9223 COLertQT 20th ED 1998	1/16/2013	0.938	75.2	19.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

WS WS SourceWatR™ MicrobE™ (cat# 595)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	93.2	86.0	45.4 - 124	Acceptable	SM9223 COLertQT online	1/16/2013	0.913	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL	93.2	86.0	36.8 - 174	Acceptable	SM9223 COLertQT online	1/16/2013	0.387	80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	93.2	86.0	46.1 - 123	Acceptable	SM9223 COLertQT online	1/16/2013	0.938	75.2	19.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS WS SourceWatR™ MicrobE™ (cat# 595)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	77.6	86.0	45.4 - 124	Acceptable	SM9223 COLt18QT 20th ED 1998	1/16/2013	0.124	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL	77.6	86.0	36.8 - 174	Acceptable	SM9223 COLt18QT 20th ED 1998	1/16/2013	-0.0695	80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	77.6	86.0	46.1 - 123	Acceptable	SM9223 COLt18QT 20th ED 1998	1/16/2013	0.124	75.2	19.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	77.6	86.0	45.4 - 124	Acceptable	SM9223 COLt18QT online	1/16/2013	0.124	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL	77.6	86.0	36.8 - 174	Acceptable	SM9223 COLt18QT online	1/16/2013	-0.0695	80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	77.6	86.0	46.1 - 123	Acceptable	SM9223 COLt18QT online	1/16/2013	0.124	75.2	19.2	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS WS SourceWatR™ MicrobE™ (cat# 595)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	130	86.0	45.4 - 124	Not Acceptable	SM9221B+F ECMUG 20th ED 1998	1/15/2013	2.77	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL	130	86.0	36.8 - 174	Acceptable	SM9221B+F ECMUG 20th ED 1998	1/15/2013	1.46	80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	130	86.0	46.1 - 123	Not Acceptable	SM9221B+F ECMUG 20th ED 1998	1/15/2013	2.86	75.2	19.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
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2500	Total Coliforms (MPN)	MPN/100mL	130	86.0	45.4 - 124	Not Acceptable	SM9221B+F ECMUG online	1/15/2013	2.77	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL	130	86.0	36.8 - 174	Acceptable	SM9221B+F ECMUG online	1/15/2013	1.46	80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	130	86.0	46.1 - 123	Not Acceptable	SM9221B+F ECMUG online	1/15/2013	2.86	75.2	19.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
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626-386-1170

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WS WS SourceWatR™ MicrobE™ (cat# 595)

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2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	79.0	86.0	45.4 - 124	Acceptable	SM9223B MPN online	1/16/2013	0.195	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL		86.0	36.8 - 174	Not Reported				80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	79.0	86.0	46.1 - 123	Acceptable	SM9223B MPN online	1/16/2013	0.197	75.2	19.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
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2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	79.0	86.0	45.4 - 124	Acceptable	SM9223B MPN 20th ED 1997	1/16/2013	0.195	75.1	19.8	
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2525	E.coli (MPN)	MPN/100mL	79.0	86.0	46.1 - 123	Acceptable	SM9223B MPN 20th ED 1997	1/16/2013	0.197	75.2	19.2	

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	49.0	86.0	45.4 - 124	Acceptable	SM9223 COLert18 20th ED 1997	1/16/2013	-1.32	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL		86.0	36.8 - 174	Not Reported				80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	49.0	86.0	46.1 - 123	Acceptable	SM9223 COLert18 20th ED 1997	1/16/2013	-1.37	75.2	19.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	49.0	86.0	45.4 - 124	Acceptable	SM9223 COLert18 online	1/16/2013	-1.32	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL		86.0	36.8 - 174	Not Reported				80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	49.0	86.0	46.1 - 123	Acceptable	SM9223 COLert18 online	1/16/2013	-1.37	75.2	19.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Heterotrophic Plate Count (cat# 079)												
2555	Heterotrophic Plate Count (MF, PP)	CFU/mL	82.0	72.0	43.0 - 84.0	Acceptable	SM9215B PCA 20th ED 1998	1/17/2013	2.16	60.1	10.1	
2555	Heterotrophic Plate Count (MPN)	MPN/mL		79.0	32.5 - 111	Not Reported				59.9	19.5	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 03/08/13
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

WS Heterotrophic Plate Count (cat# 079)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2555	Heterotrophic Plate Count (MF, PP)	CFU/mL	82.0	72.0	43.0 - 84.0	Acceptable	SM9215B 18/19thED	1/17/2013	2.16	60.1	10.1	
2555	Heterotrophic Plate Count (MPN)	MPN/mL		79.0	32.5 - 111	Not Reported				59.9	19.5	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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2009 TNI Evaluation Report

Study: **WS-198**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

Organic Results

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Chloral Hydrate (cat# 853)												
4460	Chloral Hydrate	µg/L	22.5	14.1	2.76 - 22.6	Acceptable	EPA 551.1 1 1992	1/18/2013	1.10	16.9	5.11	
WS Haloacetic Acids (HAA) (cat# 852)												
9312	Bromoacetic acid	µg/L	14.2	14.3	8.58 - 20.0	Acceptable	SM 6251B 21st ED 21st ED	1/18/2013	-0.221	14.6	1.62	
9315	Bromochloroacetic acid	µg/L	24.8	23.7	14.2 - 33.2	Acceptable	SM 6251B 21st ED 21st ED	1/18/2013	-0.0796	25.0	2.24	
9336	Chloroacetic acid	µg/L	32.6	33.2	19.9 - 46.5	Acceptable	SM 6251B 21st ED 21st ED	1/18/2013	0.139	32.0	4.02	
9357	Dibromoacetic acid	µg/L	19.1	18.9	11.3 - 26.5	Acceptable	SM 6251B 21st ED 21st ED	1/18/2013	0.00828	19.1	1.61	
9360	Dichloroacetic acid	µg/L	19.2	17.0	10.2 - 23.8	Acceptable	SM 6251B 21st ED 21st ED	1/18/2013	0.608	18.1	1.84	
9642	Trichloroacetic acid	µg/L	19.1	19.8	11.9 - 27.7	Acceptable	SM 6251B 21st ED 21st ED	1/18/2013	-0.0952	19.3	2.27	
WS Haloacetic Acids (HAA) (cat# 852)												
9312	Bromoacetic acid	µg/L	14.2	14.3	8.58 - 20.0	Acceptable	SM 6251B 20th Ed 20th ED 2005	1/18/2013	-0.221	14.6	1.62	
9315	Bromochloroacetic acid	µg/L	24.8	23.7	14.2 - 33.2	Acceptable	SM 6251B 20th Ed 20th ED 2005	1/18/2013	-0.0796	25.0	2.24	
9336	Chloroacetic acid	µg/L	32.6	33.2	19.9 - 46.5	Acceptable	SM 6251B 20th Ed 20th ED 2005	1/18/2013	0.139	32.0	4.02	
9357	Dibromoacetic acid	µg/L	19.1	18.9	11.3 - 26.5	Acceptable	SM 6251B 20th Ed 20th ED 2005	1/18/2013	0.00828	19.1	1.61	
9360	Dichloroacetic acid	µg/L	19.2	17.0	10.2 - 23.8	Acceptable	SM 6251B 20th Ed 20th ED 2005	1/18/2013	0.608	18.1	1.84	
9642	Trichloroacetic acid	µg/L	19.1	19.8	11.9 - 27.7	Acceptable	SM 6251B 20th Ed 20th ED 2005	1/18/2013	-0.0952	19.3	2.27	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Haloacetic Acids (HAA) (cat# 852)												
9312	Bromoacetic acid	µg/L	14.3	14.3	8.58 - 20.0	Acceptable	EPA 552.3 1 2003	1/22/2013	-0.159	14.6	1.62	
9315	Bromochloroacetic acid	µg/L	25.0	23.7	14.2 - 33.2	Acceptable	EPA 552.3 1 2003	1/22/2013	0.00958	25.0	2.24	
9336	Chloroacetic acid	µg/L	32.8	33.2	19.9 - 46.5	Acceptable	EPA 552.3 1 2003	1/22/2013	0.188	32.0	4.02	
9357	Dibromoacetic acid	µg/L	18.9	18.9	11.3 - 26.5	Acceptable	EPA 552.3 1 2003	1/22/2013	-0.116	19.1	1.61	
9360	Dichloroacetic acid	µg/L	18.1	17.0	10.2 - 23.8	Acceptable	EPA 552.3 1 2003	1/22/2013	0.00955	18.1	1.84	
9642	Trichloroacetic acid	µg/L	18.5	19.8	11.9 - 27.7	Acceptable	EPA 552.3 1 2003	1/22/2013	-0.359	19.3	2.27	
WS Gasoline Additives (GAD) (cat# 905)												
4370	T-amylmethylether (TAME)	µg/L	7.53	7.46	5.58 - 9.49	Acceptable	EPA 524.2 4.1 1995	1/25/2013	0.0351	7.51	0.450	
4420	Tert-Butyl Alcohol	µg/L	41.7	31.8	19.0 - 44.3	Acceptable	EPA 524.2 4.1 1995	1/25/2013	1.39	29.2	8.93	
5000	tert-Butyl methyl ether (MTBE)	µg/L	20.3	17.8	14.2 - 21.4	Acceptable	EPA 524.2 4.1 1995	1/26/2013	1.30	18.5	1.37	
9375	Di-isopropylether (DIPE)	µg/L	17.9	17.6	14.3 - 22.0	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.447	18.7	1.75	
4770	Ethyl-t-butylether (ETBE)	µg/L	9.91	9.66	7.63 - 12.5	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.0204	9.92	0.686	
5175	Trichlorofluoromethane (Freon 11)	µg/L	29.8	31.2	18.7 - 43.7	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.664	32.9	4.61	
5185	Trichlorotrifluoroethane (Freon 113)	µg/L	37.0	33.4	22.3 - 44.5	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.171	38.0	5.99	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Gasoline Additives (GAD) (cat# 905)												
4370	T-amylmethylether (TAME)	µg/L	6.02	7.46	5.58 - 9.49	Acceptable	EPA 524.3 1 2009	2/7/2013	-3.32	7.51	0.450	
4420	Tert-Butyl Alcohol	µg/L		31.8	19.0 - 44.3	Not Reported				29.2	8.93	
5000	tert-Butyl methyl ether (MTBE)	µg/L	18.9	17.8	14.2 - 21.4	Acceptable	EPA 524.3 1 2009	2/7/2013	0.278	18.5	1.37	
9375	Di-isopropylether (DIPE)	µg/L	19.2	17.6	14.3 - 22.0	Acceptable	EPA 524.3 1 2009	2/7/2013	0.296	18.7	1.75	
4770	Ethyl-t-butylether (ETBE)	µg/L	8.33	9.66	7.63 - 12.5	Acceptable	EPA 524.3 1 2009	2/7/2013	-2.32	9.92	0.686	
5175	Trichlorofluoromethane (Freon 11)	µg/L	28.8	31.2	18.7 - 43.7	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.881	32.9	4.61	
5185	Trichlorotrifluoroethane (Freon 113)	µg/L		33.4	22.3 - 44.5	Not Reported				38.0	5.99	
WS Halomethanes (THMs) (cat# 842)												
4395	Bromodichloromethane	µg/L	9.82	9.63	7.70 - 11.6	Acceptable	EPA 524.2 4.1 1995	1/30/2013	0.114	9.70	1.01	
4400	Bromoform	µg/L	5.47	5.66	4.53 - 6.79	Acceptable	EPA 524.2 4.1 1995	1/30/2013	-0.0825	5.53	0.712	
4575	Chlorodibromomethane	µg/L	20.4	21.5	17.2 - 25.8	Acceptable	EPA 524.2 4.1 1995	1/30/2013	-0.333	21.1	2.09	
4505	Chloroform	µg/L	14.5	14.6	11.7 - 17.5	Acceptable	EPA 524.2 4.1 1995	1/30/2013	-0.307	14.9	1.46	
WS Halomethanes (THMs) (cat# 842)												
4395	Bromodichloromethane	µg/L	9.10	9.63	7.70 - 11.6	Acceptable	EPA 551.1 1 1992	2/3/2013	-0.598	9.70	1.01	
4400	Bromoform	µg/L	5.62	5.66	4.53 - 6.79	Acceptable	EPA 551.1 1 1992	2/3/2013	0.128	5.53	0.712	
4575	Chlorodibromomethane	µg/L	20.8	21.5	17.2 - 25.8	Acceptable	EPA 551.1 1 1992	2/3/2013	-0.141	21.1	2.09	
4505	Chloroform	µg/L	13.3	14.6	11.7 - 17.5	Acceptable	EPA 551.1 1 1992	2/3/2013	-1.13	14.9	1.46	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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WS Halomethanes (THMs) (cat# 842)												
4395	Bromodichloromethane	µg/L	8.30	9.63	7.70 - 11.6	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.39	9.70	1.01	
4400	Bromoform	µg/L	4.11	5.66	4.53 - 6.79	Not Acceptable	EPA 524.3 1 2009	2/6/2013	-1.99	5.53	0.712	
4575	Chlorodibromomethane	µg/L	15.6	21.5	17.2 - 25.8	Not Acceptable	EPA 524.3 1 2009	2/6/2013	-2.63	21.1	2.09	
4505	Chloroform	µg/L	13.9	14.6	11.7 - 17.5	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.718	14.9	1.46	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Regulated Volatiles (cat# 840)												
4375	Benzene	µg/L	7.01	7.23	4.34 - 10.1	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.591	7.34	0.566	
4455	Carbon tetrachloride	µg/L	12.7	13.7	11.0 - 16.4	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.697	13.8	1.59	
4475	Chlorobenzene	µg/L	9.66	9.71	5.83 - 13.6	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.209	9.80	0.698	
4610	1,2-Dichlorobenzene	µg/L	12.8	12.2	9.76 - 14.6	Acceptable	EPA 524.2 4.1 1995	1/25/2013	0.680	12.1	1.06	
4620	1,4-Dichlorobenzene	µg/L	17.6	17.7	14.2 - 21.2	Acceptable	EPA 524.2 4.1 1995	1/25/2013	0.00514	17.6	1.65	
4635	1,2-Dichloroethane	µg/L	2.20	2.45	1.47 - 3.43	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-1.23	2.54	0.276	
4640	1,1-Dichloroethylene	µg/L	18.8	18.1	14.5 - 21.7	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.0323	18.9	2.10	
4645	cis-1,2-Dichloroethylene	µg/L	13.5	14.4	11.5 - 17.3	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.524	14.1	1.11	
4700	trans-1,2-Dichloroethylene	µg/L	11.0	11.5	9.20 - 13.8	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.718	11.7	1.01	
4655	1,2-Dichloropropane	µg/L	8.22	8.37	5.02 - 11.7	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.271	8.39	0.640	
4765	Ethylbenzene	µg/L	6.82	6.92	4.15 - 9.69	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.292	7.00	0.625	
4975	Methylene chloride (Dichloromethane)	µg/L	6.10	6.35	3.81 - 8.89	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.536	6.43	0.615	
5100	Styrene	µg/L	2.63	3.15	1.89 - 4.41	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-1.41	3.28	0.466	
5115	Tetrachloroethylene	µg/L	8.78	8.56	5.14 - 12.0	Acceptable	EPA 524.2 4.1 1995	1/25/2013	0.581	8.28	0.853	
5140	Toluene	µg/L	4.61	4.84	2.90 - 6.78	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.406	4.76	0.378	
5155	1,2,4-Trichlorobenzene	µg/L	7.03	6.62	3.97 - 9.27	Acceptable	EPA 524.2 4.1 1995	1/25/2013	0.333	6.73	0.912	
5160	1,1,1-Trichloroethane	µg/L	11.4	11.7	9.36 - 14.0	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.219	11.6	1.18	
5165	1,1,2-Trichloroethane	µg/L	17.6	18.2	14.6 - 21.8	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.205	17.9	1.34	
5170	Trichloroethylene	µg/L	10.2	10.6	8.48 - 12.7	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.128	10.3	0.909	
5235	Vinyl chloride	µg/L	22.9	20.8	12.5 - 29.1	Acceptable	EPA 524.2 4.1 1995	1/25/2013	0.508	21.0	3.64	

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16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Regulated Volatiles (cat# 840) (Continued)												
5260	Xylenes, total	µg/L	36.5	39.8	31.8 - 47.8	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-1.11	40.0	3.13	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Regulated Volatiles (cat# 840)												
4375	Benzene	µg/L	6.98	7.23	4.34 - 10.1	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.644	7.34	0.566	
4455	Carbon tetrachloride	µg/L	11.1	13.7	11.0 - 16.4	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.7	13.8	1.59	
4475	Chlorobenzene	µg/L	9.33	9.71	5.83 - 13.6	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.682	9.80	0.698	
4610	1,2-Dichlorobenzene	µg/L	11.6	12.2	9.76 - 14.6	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.457	12.1	1.06	
4620	1,4-Dichlorobenzene	µg/L	17.1	17.7	14.2 - 21.2	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.298	17.6	1.65	
4635	1,2-Dichloroethane	µg/L	2.54	2.45	1.47 - 3.43	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.00234	2.54	0.276	
4640	1,1-Dichloroethylene	µg/L	18.4	18.1	14.5 - 21.7	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.223	18.9	2.10	
4645	cis-1,2-Dichloroethylene	µg/L	13.7	14.4	11.5 - 17.3	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.344	14.1	1.11	
4700	trans-1,2-Dichloroethylene	µg/L	11.1	11.5	9.20 - 13.8	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.619	11.7	1.01	
4655	1,2-Dichloropropane	µg/L	8.25	8.37	5.02 - 11.7	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.225	8.39	0.640	
4765	Ethylbenzene	µg/L	6.59	6.92	4.15 - 9.69	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.66	7.00	0.625	
4975	Methylene chloride (Dichloromethane)	µg/L	5.96	6.35	3.81 - 8.89	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.763	6.43	0.615	
5100	Styrene	µg/L	3.20	3.15	1.89 - 4.41	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.181	3.28	0.466	
5115	Tetrachloroethylene	µg/L	7.67	8.56	5.14 - 12.0	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.72	8.28	0.853	
5140	Toluene	µg/L	4.29	4.84	2.90 - 6.78	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.25	4.76	0.378	
5155	1,2,4-Trichlorobenzene	µg/L	6.27	6.62	3.97 - 9.27	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.5	6.73	0.912	
5160	1,1,1-Trichloroethane	µg/L	10.4	11.7	9.36 - 14.0	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.07	11.6	1.18	
5165	1,1,2-Trichloroethane	µg/L	17.3	18.2	14.6 - 21.8	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.429	17.9	1.34	
5170	Trichloroethylene	µg/L	9.93	10.6	8.48 - 12.7	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.425	10.3	0.909	
5235	Vinyl chloride	µg/L	21.4	20.8	12.5 - 29.1	Acceptable	EPA 524.3 1 2009	2/6/2013	0.0958	21.0	3.64	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 03/08/13
Study Dates: 01/07/13 - 02/21/13

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Regulated Volatiles (cat# 840) (Continued)												
5260	Xylenes, total	µg/L	38.3	39.8	31.8 - 47.8	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.533	40.0	3.13	

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WS Unregulated Volatiles (cat# 841)												
4385	Bromobenzene	µg/L	7.31	7.39	4.43 - 10.3	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.0362	7.33	0.651	
4390	Bromochloromethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
4950	Bromomethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
5000	tert-Butyl methyl ether (MTBE)	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
4435	n-Butylbenzene	µg/L	17.8	19.4	15.5 - 23.3	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.711	19.4	2.25	
4440	sec-Butylbenzene	µg/L	6.53	6.97	4.18 - 9.76	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.693	7.05	0.752	
4445	tert-Butylbenzene	µg/L	4.53	4.96	2.98 - 6.94	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.652	4.94	0.632	
4485	Chloroethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
4960	Chloromethane	µg/L	13.1	14.0	8.40 - 19.6	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.234	13.7	2.67	
4535	2-Chlorotoluene	µg/L	5.45	5.96	3.58 - 8.34	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.908	6.04	0.654	
4540	4-Chlorotoluene	µg/L	11.4	11.9	9.52 - 14.3	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.753	12.2	1.00	
4595	Dibromomethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
4615	1,3-Dichlorobenzene	µg/L	9.30	9.48	5.69 - 13.3	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.29	9.56	0.913	
4625	Dichlorodifluoromethane (Freon 12)	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
4630	1,1-Dichloroethane	µg/L	6.09	6.75	4.05 - 9.45	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.96	6.70	0.634	
4660	1,3-Dichloropropane	µg/L	8.67	8.85	5.31 - 12.4	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.0791	8.73	0.762	
4665	2,2-Dichloropropane	µg/L	14.5	18.2	14.6 - 21.8	Not Acceptable	EPA 524.2 4.1 1995	1/25/2013	-1.33	17.8	2.53	
4670	1,1-Dichloropropene	µg/L	11.2	13.4	10.7 - 16.1	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-1.23	13.1	1.58	
4680	cis-1,3-Dichloropropene	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
4685	trans-1,3-Dichloropropene	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	1/25/2013				

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Unregulated Volatiles (cat# 841) (Continued)												
5175	Fluorotrichloromethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
4835	Hexachlorobutadiene	µg/L	9.22	9.44	5.66 - 13.2	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.104	9.32	1.02	
4900	Isopropylbenzene	µg/L	12.1	14.0	11.2 - 16.8	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-1.19	14.0	1.63	
4910	4-Isopropyltoluene	µg/L	15.0	16.4	13.1 - 19.7	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.88	16.7	1.95	
5005	Naphthalene	µg/L	25.3	24.1	16.9 - 31.3	Acceptable	EPA 524.2 4.1 1995	1/25/2013	0.639	23.4	2.94	
5090	n-Propylbenzene	µg/L	6.37	6.92	4.15 - 9.69	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.894	7.07	0.780	
5105	1,1,1,2-Tetrachloroethane	µg/L	7.58	8.37	5.02 - 11.7	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.661	8.27	1.04	
5110	1,1,2,2-Tetrachloroethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
5150	1,2,3-Trichlorobenzene	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
5180	1,2,3-Trichloropropane (TCP)	µg/L	3.21	3.19	1.91 - 4.47	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.0104	3.21	0.416	
5210	1,2,4-Trimethylbenzene	µg/L	7.86	8.55	5.13 - 12.0	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.75	8.58	0.966	
5215	1,3,5-Trimethylbenzene	µg/L	4.26	4.77	2.86 - 6.68	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.942	4.79	0.561	

A Waters Company

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Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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WS Unregulated Volatiles (cat# 841)												
4385	Bromobenzene	µg/L	6.69	7.39	4.43 - 10.3	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.989	7.33	0.651	
4390	Bromochloromethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	2/6/2013				
4950	Bromomethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	2/6/2013				
5000	tert-Butyl methyl ether (MTBE)	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	2/7/2013				
4435	n-Butylbenzene	µg/L	18.4	19.4	15.5 - 23.3	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.445	19.4	2.25	
4440	sec-Butylbenzene	µg/L	6.33	6.97	4.18 - 9.76	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.959	7.05	0.752	
4445	tert-Butylbenzene	µg/L	4.44	4.96	2.98 - 6.94	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.794	4.94	0.632	
4485	Chloroethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	2/6/2013				
4960	Chloromethane	µg/L	13.9	14.0	8.40 - 19.6	Acceptable	EPA 524.3 1 2009	2/6/2013	0.0658	13.7	2.67	
4535	2-Chlorotoluene	µg/L	5.34	5.96	3.58 - 8.34	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.08	6.04	0.654	
4540	4-Chlorotoluene	µg/L	11.1	11.9	9.52 - 14.3	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.05	12.2	1.00	
4595	Dibromomethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	2/6/2013				
4615	1,3-Dichlorobenzene	µg/L	8.50	9.48	5.69 - 13.3	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.17	9.56	0.913	
4625	Dichlorodifluoromethane (Freon 12)	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	2/6/2013				
4630	1,1-Dichloroethane	µg/L	6.26	6.75	4.05 - 9.45	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.692	6.70	0.634	
4660	1,3-Dichloropropane	µg/L	8.22	8.85	5.31 - 12.4	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.67	8.73	0.762	
4665	2,2-Dichloropropane	µg/L		18.2	14.6 - 21.8	Not Reported				17.8	2.53	
4670	1,1-Dichloropropene	µg/L	11.8	13.4	10.7 - 16.1	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.847	13.1	1.58	
4680	cis-1,3-Dichloropropene	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	2/6/2013				
4685	trans-1,3-Dichloropropene	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	2/6/2013				

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
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WS Unregulated Volatiles (cat# 841) (Continued)												
5175	Fluorotrichloromethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	2/6/2013				
4835	Hexachlorobutadiene	µg/L	8.99	9.44	5.66 - 13.2	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.33	9.32	1.02	
4900	Isopropylbenzene	µg/L	12.9	14.0	11.2 - 16.8	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.702	14.0	1.63	
4910	4-Isopropyltoluene	µg/L	15.1	16.4	13.1 - 19.7	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.829	16.7	1.95	
5005	Naphthalene	µg/L	24.6	24.1	16.9 - 31.3	Acceptable	EPA 524.3 1 2009	2/6/2013	0.401	23.4	2.94	
5090	n-Propylbenzene	µg/L	6.03	6.92	4.15 - 9.69	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.33	7.07	0.780	
5105	1,1,1,2-Tetrachloroethane	µg/L	6.51	8.37	5.02 - 11.7	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.69	8.27	1.04	
5110	1,1,2,2-Tetrachloroethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	2/6/2013				
5150	1,2,3-Trichlorobenzene	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	2/6/2013				
5180	1,2,3-Trichloropropane (TCP)	µg/L	3.15	3.19	1.91 - 4.47	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.155	3.21	0.416	
5210	1,2,4-Trimethylbenzene	µg/L	7.58	8.55	5.13 - 12.0	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.04	8.58	0.966	
5215	1,3,5-Trimethylbenzene	µg/L	4.20	4.77	2.86 - 6.68	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.05	4.79	0.561	

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WS Pesticides (cat# 850)												
7005	Alachlor	µg/L	4.49	4.34	2.39 - 6.29	Acceptable	EPA 525.2 2 1995	1/29/2013	0.242	4.32	0.713	
7025	Aldrin	µg/L	1.55	1.61	0.723 - 2.05	Acceptable	EPA 525.2 2 1995	1/29/2013	0.507	1.36	0.379	
7065	Atrazine	µg/L	7.71	8.26	4.54 - 12.0	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.67	8.51	1.20	
7120	gamma-BHC (Lindane)	µg/L	0.638	0.710	0.390 - 1.03	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.618	0.704	0.107	
7130	Bromacil	µg/L	< 0.20	< 2.00	0.00 - 2.00	Acceptable	EPA 525.2 2 1995	1/29/2013				
7160	Butachlor	µg/L	9.66	8.23	4.53 - 11.9	Acceptable	EPA 525.2 2 1995	1/29/2013	0.700	8.40	1.80	
7410	Diazinon	µg/L	< 0.10	< 2.00	0.00 - 2.00	Acceptable	EPA 525.2 2 1995	1/29/2013				
7470	Dieldrin	µg/L	1.79	1.59	0.874 - 2.30	Acceptable	EPA 525.2 2 1995	1/29/2013	0.890	1.58	0.235	
7540	Endrin	µg/L	1.27	1.14	0.798 - 1.48	Acceptable	EPA 525.2 2 1995	1/29/2013	0.471	1.17	0.219	
7685	Heptachlor	µg/L	2.05	2.16	1.19 - 3.13	Acceptable	EPA 525.2 2 1995	1/29/2013	0.0765	2.02	0.380	
7690	Heptachlor epoxide (beta)	µg/L	1.64	1.84	1.01 - 2.67	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.644	1.81	0.266	
6275	Hexachlorobenzene	µg/L	3.64	4.02	2.03 - 5.00	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.0241	3.66	0.675	
6285	Hexachlorocyclopentadiene	µg/L	9.25	9.33	2.74 - 13.3	Acceptable	EPA 525.2 2 1995	1/29/2013	0.495	7.81	2.91	
7810	Methoxychlor	µg/L	4.58	4.47	2.46 - 6.48	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.0522	4.62	0.801	
7835	Metolachlor	µg/L	< 0.05	< 1.10	0.00 - 1.10	Acceptable	EPA 525.2 2 1995	1/29/2013				
7845	Metribuzin	µg/L	5.70	6.73	3.36 - 10.1	Acceptable	EPA 525.2 2 1995	1/29/2013	0.131	5.44	1.94	
7875	Molinate (Ordram)	µg/L	< 0.10	< 2.00	0.00 - 2.00	Acceptable	EPA 525.2 2 1995	1/29/2013				
8035	Prometon	µg/L		< 2.00	0.00 - 2.00	Not Reported						
8045	Propachlor	µg/L	6.93	7.07	3.89 - 10.2	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.11	7.08	1.38	
8125	Simazine	µg/L	6.61	7.19	3.95 - 10.4	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.533	7.59	1.84	

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WS Pesticides (cat# 850) (Continued)												
8220	Thiobencarb	µg/L	< 0.20	< 2.00	0.00 - 2.00	Acceptable	EPA 525.2 2 1995	1/29/2013				
8295	Trifluralin	µg/L	2.99	3.69	2.03 - 5.35	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.528	3.34	0.666	

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WS Pesticides (cat# 850)												
7005	Alachlor	µg/L	4.30	4.34	2.39 - 6.29	Acceptable	EPA 505 2.1 1995	1/19/2013	-0.025	4.32	0.713	
7025	Aldrin	µg/L	1.55	1.61	0.723 - 2.05	Acceptable	EPA 505 2.1 1995	1/19/2013	0.507	1.36	0.379	
7065	Atrazine	µg/L		8.26	4.54 - 12.0	Not Reported				8.51	1.20	
7120	gamma-BHC (Lindane)	µg/L	0.712	0.710	0.390 - 1.03	Acceptable	EPA 505 2.1 1995	1/19/2013	0.0722	0.704	0.107	
7130	Bromacil	µg/L		< 2.00	0.00 - 2.00	Not Reported						
7160	Butachlor	µg/L		8.23	4.53 - 11.9	Not Reported				8.40	1.80	
7410	Diazinon	µg/L		< 2.00	0.00 - 2.00	Not Reported						
7470	Dieldrin	µg/L	1.41	1.59	0.874 - 2.30	Acceptable	EPA 505 2.1 1995	1/19/2013	-0.725	1.58	0.235	
7540	Endrin	µg/L	1.17	1.14	0.798 - 1.48	Acceptable	EPA 505 2.1 1995	1/19/2013	0.0135	1.17	0.219	
7685	Heptachlor	µg/L	1.89	2.16	1.19 - 3.13	Acceptable	EPA 505 2.1 1995	1/19/2013	-0.344	2.02	0.380	
7690	Heptachlor epoxide (beta)	µg/L	1.85	1.84	1.01 - 2.67	Acceptable	EPA 505 2.1 1995	1/19/2013	0.144	1.81	0.266	
6275	Hexachlorobenzene	µg/L		4.02	2.03 - 5.00	Not Reported				3.66	0.675	
6285	Hexachlorocyclopentadiene	µg/L		9.33	2.74 - 13.3	Not Reported				7.81	2.91	
7810	Methoxychlor	µg/L	3.62	4.47	2.46 - 6.48	Acceptable	EPA 505 2.1 1995	1/19/2013	-1.25	4.62	0.801	
7835	Metolachlor	µg/L		< 1.10	0.00 - 1.10	Not Reported						
7845	Metribuzin	µg/L		6.73	3.36 - 10.1	Not Reported				5.44	1.94	
7875	Molinate (Ordram)	µg/L		< 2.00	0.00 - 2.00	Not Reported						
8035	Prometon	µg/L		< 2.00	0.00 - 2.00	Not Reported						
8045	Propachlor	µg/L		7.07	3.89 - 10.2	Not Reported				7.08	1.38	
8125	Simazine	µg/L		7.19	3.95 - 10.4	Not Reported				7.59	1.84	

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 03/08/13
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Pesticides (cat# 850) (Continued)												
8220	Thiobencarb	µg/L		< 2.00	0.00 - 2.00	Not Reported						
8295	Trifluralin	µg/L		3.69	2.03 - 5.35	Not Reported				3.34	0.666	
WS Carbamate/Carbamoxyloxime Pesticides (cat# 846)												
7010	Aldicarb	µg/L	55.5	61.3	46.0 - 76.6	Acceptable	EPA 531.2 1 2001	1/16/2013	-0.822	61.3	7.11	
7015	Aldicarb sulfone	µg/L	34.4	39.4	29.6 - 49.2	Acceptable	EPA 531.2 1 2001	1/16/2013	-1.14	39.2	4.18	
7020	Aldicarb sulfoxide	µg/L	27.0	30.9	23.2 - 38.6	Acceptable	EPA 531.2 1 2001	1/16/2013	-0.191	27.4	2.19	
8080	Baygon	µg/L	34.8	37.3	30.3 - 44.2	Acceptable	EPA 531.2 1 2001	1/16/2013	-0.645	36.8	3.18	
7195	Carbaryl	µg/L	33.3	34.8	26.1 - 43.5	Acceptable	EPA 531.2 1 2001	1/16/2013	0.0997	33.0	2.67	
7205	Carbofuran	µg/L	107	106	58.3 - 154	Acceptable	EPA 531.2 1 2001	1/16/2013	0.265	104	10.4	
7710	3-Hydroxycarbofuran	µg/L	20.2	21.4	17.1 - 25.7	Acceptable	EPA 531.2 1 2001	1/16/2013	-0.686	21.6	2.06	
7800	Methiocarb	µg/L	32.0	33.2	25.9 - 39.6	Acceptable	EPA 531.2 1 2001	1/16/2013	0.144	31.7	2.05	
7805	Methomyl	µg/L	23.7	25.5	20.4 - 30.6	Acceptable	EPA 531.2 1 2001	1/16/2013	-1.03	26.0	2.20	
7940	Oxamyl (vydate)	µg/L	52.5	52.6	39.4 - 65.8	Acceptable	EPA 531.2 1 2001	1/16/2013	0.0881	52.1	4.24	
WS Chlordane (cat# 845)												
7250	Chlordane, technical	µg/L	11.3	11.8	6.49 - 17.1	Acceptable	EPA 505 2.1 1995	1/19/2013	0.230	10.9	1.80	
WS Chlordane (cat# 845)												
7250	Chlordane, technical	µg/L	12.2	11.8	6.49 - 17.1	Acceptable	EPA 525.2 2 1995	2/6/2013	0.729	10.9	1.80	
WS Toxaphene (cat# 844)												
8250	Toxaphene	µg/L	19.3	14.6	8.03 - 21.2	Acceptable	EPA 505 2.1 1995	1/19/2013	1.82	14.5	2.64	

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ERA
A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS EDB/DBCP/TCP (cat# 847)												
4570	Dibromochloropropane (DBCP)	µg/L	0.261	0.258	0.155 - 0.361	Acceptable	EPA 504.1 1.1 1995	1/16/2013	-0.0802	0.264	0.0427	
4585	Ethylene Dibromide (EDB)	µg/L	1.25	1.31	0.786 - 1.83	Acceptable	EPA 504.1 1.1 1995	1/17/2013	0.101	1.23	0.168	
5180	1,2,3-Trichloropropane (TCP)	µg/L	0.892	0.949	0.569 - 1.33	Acceptable	EPA 504.1 1.1 1995	1/16/2013	-0.39	0.938	0.119	
WS EDB/DBCP/TCP (cat# 847)												
4570	Dibromochloropropane (DBCP)	µg/L	0.261	0.258	0.155 - 0.361	Acceptable	EPA 551.1 1 1992	1/22/2013	-0.0802	0.264	0.0427	
4585	Ethylene Dibromide (EDB)	µg/L	1.36	1.31	0.786 - 1.83	Acceptable	EPA 551.1 1 1992	1/23/2013	0.756	1.23	0.168	
5180	1,2,3-Trichloropropane (TCP)	µg/L		0.949	0.569 - 1.33	Not Reported				0.938	0.119	
WS EDB/DBCP/TCP (cat# 847)												
4570	Dibromochloropropane (DBCP)	µg/L	0.303	0.258	0.155 - 0.361	Acceptable	EPA 8011 1994	1/17/2013	0.903	0.264	0.0427	
4585	Ethylene Dibromide (EDB)	µg/L	1.46	1.31	0.786 - 1.83	Acceptable	EPA 8011 1994	1/17/2013	1.35	1.23	0.168	
5180	1,2,3-Trichloropropane (TCP)	µg/L		0.949	0.569 - 1.33	Not Reported				0.938	0.119	
WS EDB/DBCP/TCP (cat# 847)												
4570	Dibromochloropropane (DBCP)	µg/L		0.258	0.155 - 0.361	Not Reported				0.264	0.0427	
4585	Ethylene Dibromide (EDB)	µg/L		1.31	0.786 - 1.83	Not Reported				1.23	0.168	
5180	1,2,3-Trichloropropane (TCP)	µg/L	1.01	0.949	0.569 - 1.33	Acceptable	EPA 524.2 4.1 1995	1/28/2013	0.601	0.938	0.119	
WS Dioxin (cat# 857)												
9618	2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/L	57.6	58.7	33.6 - 70.8	Acceptable	EPA 1613 1994	1/16/2013	-0.617	60.4	4.59	
WS Dioxin (cat# 857)												
9618	2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/L	57.6	58.7	33.6 - 70.8	Acceptable	EPA 1613B Appendix A 1997	1/16/2013	-0.617	60.4	4.59	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS PCBs as Decachlorobiphenyl (cat# 839)												
8880	Aroclor 1016	µg/L	< 0.08	< 0.260	0.00 - 0.260	Acceptable	EPA 505 2.1 1995	1/19/2013				
8885	Aroclor 1221	µg/L	< 0.10	< 0.190	0.00 - 0.190	Acceptable	EPA 505 2.1 1995	1/19/2013				
8890	Aroclor 1232	µg/L	< 0.10	< 0.230	0.00 - 0.230	Acceptable	EPA 505 2.1 1995	1/19/2013				
8895	Aroclor 1242	µg/L	< 0.10	< 0.260	0.00 - 0.260	Acceptable	EPA 505 2.1 1995	1/19/2013				
8900	Aroclor 1248	µg/L	3.55	2.95	1.69 - 3.62	Acceptable	EPA 505 2.1 1995	1/19/2013	1.30	2.80	0.578	
8905	Aroclor 1254	µg/L	< 0.10	< 0.330	0.00 - 0.330	Acceptable	EPA 505 2.1 1995	1/19/2013				
8910	Aroclor 1260	µg/L	< 0.10	< 0.360	0.00 - 0.360	Acceptable	EPA 505 2.1 1995	1/19/2013				
8872	PCB Aroclor Identity	Identity	1248	1248		Acceptable	EPA 505 2.1 1995	1/19/2013	0			
9105	PCB as Decachlorobiphenyl	µg/L		4.92	0.492 - 9.84	Not Reported				3.68	1.67	

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Regulated Semivolatiles Ampule #1 (cat# 848)												
5500	Acenaphthene	µg/L	5.02	4.91	2.44 - 6.16	Acceptable	EPA 525.2 2 1995	1/29/2013	1.51	4.78	0.157	
5505	Acenaphthylene	µg/L	6.97	7.19	3.39 - 9.66	Acceptable	EPA 525.2 2 1995	1/29/2013	0.258	6.78	0.752	
5555	Anthracene	µg/L	1.19	1.20	0.521 - 1.56	Acceptable	EPA 525.2 2 1995	1/29/2013	0.153	1.15	0.247	
5575	Benzo(a)anthracene	µg/L	4.96	4.88	2.69 - 6.18	Acceptable	EPA 525.2 2 1995	1/29/2013	0.521	4.36	1.14	
5585	Benzo(b)fluoranthene	µg/L	1.29	1.53	0.815 - 2.11	Acceptable	EPA 525.2 2 1995	1/29/2013	-1.63	1.50	0.127	
5600	Benzo(k)fluoranthene	µg/L	1.48	1.51	0.818 - 2.04	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.244	1.51	0.129	
5590	Benzo(g,h,i)perylene	µg/L	1.45	1.56	0.705 - 2.23	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.222	1.48	0.112	
5580	Benzo(a)pyrene	µg/L	1.05	1.32	0.515 - 1.71	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.219	1.11	0.290	
5670	Butylbenzylphthalate	µg/L	36.9	29.8	16.2 - 43.3	Acceptable	EPA 525.2 2 1995	1/29/2013	0.780	31.2	7.27	
5855	Chrysene	µg/L	2.30	2.42	1.38 - 3.11	Acceptable	EPA 525.2 2 1995	1/29/2013	0.104	2.29	0.128	
5895	Dibenz(a,h)anthracene	µg/L	6.16	5.59	2.59 - 8.03	Acceptable	EPA 525.2 2 1995	1/29/2013	0.946	5.57	0.622	
6070	Diethylphthalate	µg/L	32.0	33.6	18.1 - 47.5	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.136	32.6	4.19	
6135	Dimethylphthalate	µg/L	17.3	18.9	9.05 - 26.0	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.207	17.8	2.67	
5925	Di-n-butylphthalate	µg/L	47.8	41.0	22.4 - 59.0	Acceptable	EPA 525.2 2 1995	1/29/2013	0.771	41.0	8.85	
6200	Di-n-octylphthalate	µg/L	20.6	23.1	11.4 - 32.2	Acceptable	EPA 525.2 2 1995	1/29/2013	0.0379	20.3	6.77	
6062	bis(2-Ethylhexyl)adipate	µg/L	9.12	8.88	3.14 - 13.4	Acceptable	EPA 525.2 2 1995	1/29/2013	0.102	8.94	1.72	
6065	bis(2-Ethylhexyl)phthalate	µg/L	36.8	34.0	17.2 - 48.0	Acceptable	EPA 525.2 2 1995	1/29/2013	0.429	32.5	10.1	
6265	Fluoranthene	µg/L	8.18	8.10	3.90 - 10.9	Acceptable	EPA 525.2 2 1995	1/29/2013	0.525	7.76	0.794	
6270	Fluorene	µg/L	2.77	2.71	1.58 - 3.47	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.287	2.86	0.314	
6315	Indeno(1,2,3-cd)pyrene	µg/L	5.82	5.16	2.24 - 7.38	Acceptable	EPA 525.2 2 1995	1/29/2013	1.23	5.17	0.530	

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QA Officer
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750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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WS Regulated Semivolatiles Ampule #1 (cat# 848) (Continued)												
5005	Naphthalene	µg/L	2.72	2.37	0.960 - 3.03	Acceptable	EPA 525.2 2 1995	1/29/2013	1.95	2.47	0.128	
6615	Phenanthrene	µg/L	9.05	8.97	5.70 - 11.3	Acceptable	EPA 525.2 2 1995	1/29/2013	0.603	8.47	0.963	
6665	Pyrene	µg/L	1.89	1.89	1.13 - 2.44	Acceptable	EPA 525.2 2 1995	1/29/2013	0.246	1.83	0.246	
WS Chlorinated Acid Herbicides (cat# 851)												
8505	Acifluorfen	µg/L	46.0	45.9	23.0 - 68.8	Acceptable	EPA 515.4 1 2000	1/15/2013	-0.69	50.0	5.74	
8530	Bentazon	µg/L	36.6	39.4	20.4 - 53.6	Acceptable	EPA 515.4 1 2000	1/15/2013	-0.303	39.1	8.33	
8540	Chloramben	µg/L		33.9	9.08 - 46.0	Not Reported				31.6	4.90	
8545	2,4-D	µg/L	17.4	16.6	8.30 - 24.9	Acceptable	EPA 515.4 1 2000	1/15/2013	0.208	16.7	3.42	
8550	Dacthal diacid (DCPA)	µg/L	30.9	28.3	10.5 - 45.9	Acceptable	EPA 515.4 1 2000	1/15/2013	0.900	25.3	6.25	
8555	Dalapon	µg/L	49.7	45.0	22.5 - 67.5	Acceptable	EPA 515.4 1 2000	1/15/2013	1.04	42.4	6.96	
8560	2,4-DB	µg/L	24.7	29.9	15.0 - 44.8	Acceptable	EPA 515.4 1 2000	1/15/2013	-1.4	30.2	3.94	
8595	Dicamba	µg/L	49.4	40.9	20.4 - 61.4	Acceptable	EPA 515.4 1 2000	1/15/2013	1.18	40.3	7.73	
8600	3,5-Dichlorobenzoic acid	µg/L	26.3	25.9	12.3 - 34.3	Acceptable	EPA 515.4 1 2000	1/15/2013	0.572	24.2	3.64	
8605	Dichlorprop	µg/L	25.1	24.5	11.2 - 33.8	Acceptable	EPA 515.4 1 2000	1/15/2013	0.301	23.8	4.22	
8620	Dinoseb	µg/L	32.4	33.0	11.5 - 46.2	Acceptable	EPA 515.4 1 2000	1/15/2013	-0.0211	32.5	4.93	
6500	4-Nitrophenol	µg/L		11.8	1.18 - 15.9	Not Reported				8.76	1.94	
6605	Pentachlorophenol	µg/L	11.5	12.2	6.10 - 18.3	Acceptable	EPA 515.4 1 2000	1/15/2013	-0.491	12.2	1.40	
8645	Picloram	µg/L	18.5	16.8	8.40 - 25.2	Acceptable	EPA 515.4 1 2000	1/15/2013	0.580	16.7	3.12	
8655	2,4,5-T	µg/L	43.7	44.4	22.2 - 66.6	Acceptable	EPA 515.4 1 2000	1/15/2013	0.310	42.2	4.99	
8650	2,4,5-TP (Silvex)	µg/L	16.8	18.6	9.30 - 27.9	Acceptable	EPA 515.4 1 2000	1/15/2013	-0.489	18.5	3.42	

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WS Chlorinated Acid Herbicides (cat# 851)												
8505	Acifluorfen	µg/L		45.9	23.0 - 68.8	Not Reported				50.0	5.74	
8530	Bentazon	µg/L		39.4	20.4 - 53.6	Not Reported				39.1	8.33	
8540	Chloramben	µg/L		33.9	9.08 - 46.0	Not Reported				31.6	4.90	
8545	2,4-D	µg/L		16.6	8.30 - 24.9	Not Reported				16.7	3.42	
8550	Dacthal diacid (DCPA)	µg/L		28.3	10.5 - 45.9	Not Reported				25.3	6.25	
8555	Dalapon	µg/L	48.9	45.0	22.5 - 67.5	Acceptable	EPA 552.3 1 2003	1/22/2013	0.926	42.4	6.96	
8560	2,4-DB	µg/L		29.9	15.0 - 44.8	Not Reported				30.2	3.94	
8595	Dicamba	µg/L		40.9	20.4 - 61.4	Not Reported				40.3	7.73	
8600	3,5-Dichlorobenzoic acid	µg/L		25.9	12.3 - 34.3	Not Reported				24.2	3.64	
8605	Dichlorprop	µg/L		24.5	11.2 - 33.8	Not Reported				23.8	4.22	
8620	Dinoseb	µg/L		33.0	11.5 - 46.2	Not Reported				32.5	4.93	
6500	4-Nitrophenol	µg/L		11.8	1.18 - 15.9	Not Reported				8.76	1.94	
6605	Pentachlorophenol	µg/L		12.2	6.10 - 18.3	Not Reported				12.2	1.40	
8645	Picloram	µg/L		16.8	8.40 - 25.2	Not Reported				16.7	3.12	
8655	2,4,5-T	µg/L		44.4	22.2 - 66.6	Not Reported				42.2	4.99	
8650	2,4,5-TP (Silvex)	µg/L		18.6	9.30 - 27.9	Not Reported				18.5	3.42	

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WS Chlorinated Acid Herbicides (cat# 851)												
8505	Acifluorfen	µg/L		45.9	23.0 - 68.8	Not Reported				50.0	5.74	
8530	Bentazon	µg/L		39.4	20.4 - 53.6	Not Reported				39.1	8.33	
8540	Chloramben	µg/L		33.9	9.08 - 46.0	Not Reported				31.6	4.90	
8545	2,4-D	µg/L		16.6	8.30 - 24.9	Not Reported				16.7	3.42	
8550	Dacthal diacid (DCPA)	µg/L		28.3	10.5 - 45.9	Not Reported				25.3	6.25	
8555	Dalapon	µg/L		45.0	22.5 - 67.5	Not Reported				42.4	6.96	
8560	2,4-DB	µg/L		29.9	15.0 - 44.8	Not Reported				30.2	3.94	
8595	Dicamba	µg/L		40.9	20.4 - 61.4	Not Reported				40.3	7.73	
8600	3,5-Dichlorobenzoic acid	µg/L		25.9	12.3 - 34.3	Not Reported				24.2	3.64	
8605	Dichlorprop	µg/L		24.5	11.2 - 33.8	Not Reported				23.8	4.22	
8620	Dinoseb	µg/L		33.0	11.5 - 46.2	Not Reported				32.5	4.93	
6500	4-Nitrophenol	µg/L		11.8	1.18 - 15.9	Not Reported				8.76	1.94	
6605	Pentachlorophenol	µg/L	13.6	12.2	6.10 - 18.3	Acceptable	EPA 525.2 2 1995	1/29/2013	1.01	12.2	1.40	
8645	Picloram	µg/L		16.8	8.40 - 25.2	Not Reported				16.7	3.12	
8655	2,4,5-T	µg/L		44.4	22.2 - 66.6	Not Reported				42.2	4.99	
8650	2,4,5-TP (Silvex)	µg/L		18.6	9.30 - 27.9	Not Reported				18.5	3.42	
WS Regulated Semivolatiles #2 Herbicides (cat# 849)												
9390	Diquat	µg/L	9.62	16.5	8.25 - 24.8	Acceptable	EPA 549.2 1 1997	1/16/2013	-1.57	13.1	2.22	
7525	Endothall	µg/L	212	332	166 - 498	Acceptable	EPA 548.1 1 1992	1/17/2013	-1.37	302	65.8	
9411	Glyphosate	µg/L	423	382	306 - 458	Acceptable	EPA 547 1990	1/18/2013	0.390	406	43.0	
9528	Paraquat	µg/L	16.2	33.8	14.8 - 42.4	Acceptable	EPA 549.2 1 1997	1/16/2013	-0.632	19.9	5.90	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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Final Report Results For Laboratory
Eurofins Eaton Analytical, Inc - Monrovia

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

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2003 NELAC Evaluation Report

Study: **WS-198**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

Inorganic Results

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WS-198 2003 NELAC Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 03/08/13
Study Dates: 01/07/13 - 02/21/13

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Hardness (cat# 555)												
1035	Calcium	mg/L	79.2	79.9	67.9 - 91.9	Acceptable	EPA 200.7 4.4 1994	1/21/2013	0.0350	79.1	3.23	
1085	Magnesium	mg/L	15.6	15.0	12.8 - 17.2	Acceptable	EPA 200.7 4.4 1994	1/21/2013	0.421	15.3	0.756	
1155	Sodium	mg/L	41.5	40.4	34.3 - 46.5	Acceptable	EPA 200.7 4.4 1994	1/21/2013	0.606	40.4	1.82	
1550	Calcium Hardness as CaCO3	mg/L	198	199	169 - 229	Acceptable	EPA 200.7 4.4 1994	1/22/2013	0.161	197	7.00	
1755	Total Hardness as CaCO3	mg/L	262	261	222 - 300	Acceptable	EPA 200.7 4.4 1994	1/22/2013	0.246	260	8.85	
WS Hardness (cat# 555)												
1035	Calcium	mg/L	79.2	79.9	67.9 - 91.9	Acceptable	EPA 200.7 5 1998	1/21/2013	0.0350	79.1	3.23	
1085	Magnesium	mg/L	15.6	15.0	12.8 - 17.2	Acceptable	EPA 200.7 5 1998	1/21/2013	0.421	15.3	0.756	
1155	Sodium	mg/L	41.5	40.4	34.3 - 46.5	Acceptable	EPA 200.7 5 1998	1/21/2013	0.606	40.4	1.82	
1550	Calcium Hardness as CaCO3	mg/L	198	199	169 - 229	Acceptable	EPA 200.7 5 1998	1/22/2013	0.161	197	7.00	
1755	Total Hardness as CaCO3	mg/L	262	261	222 - 300	Acceptable	EPA 200.7 5 1998	1/22/2013	0.246	260	8.85	
WS Hardness (cat# 555)												
1035	Calcium	mg/L		79.9	67.9 - 91.9	Not Reported				79.1	3.23	
1085	Magnesium	mg/L		15.0	12.8 - 17.2	Not Reported				15.3	0.756	
1155	Sodium	mg/L		40.4	34.3 - 46.5	Not Reported				40.4	1.82	
1550	Calcium Hardness as CaCO3	mg/L	198	199	169 - 229	Acceptable	SM2340B 20th ED 1997	1/22/2013	0.161	197	7.00	
1755	Total Hardness as CaCO3	mg/L	262	261	222 - 300	Acceptable	SM2340B 20th ED 1997	1/22/2013	0.246	260	8.85	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Hardness (cat# 555)												
1035	Calcium	mg/L		79.9	67.9 - 91.9	Not Reported				79.1	3.23	
1085	Magnesium	mg/L		15.0	12.8 - 17.2	Not Reported				15.3	0.756	
1155	Sodium	mg/L		40.4	34.3 - 46.5	Not Reported				40.4	1.82	
1550	Calcium Hardness as CaCO3	mg/L	198	199	169 - 229	Acceptable	SM2340B 21st ED 1997	1/22/2013	0.161	197	7.00	
1755	Total Hardness as CaCO3	mg/L	262	261	222 - 300	Acceptable	SM2340B 21st ED 1997	1/22/2013	0.246	260	8.85	
WS Inorganics (cat# 591)												
1505	Alkalinity as CaCO3	mg/L	45.9	47.7	42.9 - 52.5	Acceptable	SM2320B 20th ED 1997	1/15/2013	-0.786	47.5	2.06	
1575	Chloride	mg/L	55.2	55.0	46.8 - 63.2	Acceptable	EPA 300.0 2.1 1993	1/15/2013	0.378	54.4	2.19	
1610	Conductivity at 25°C	µmhos/cm	515	504	454 - 554	Acceptable	SM2510B 20th ED 1997	1/15/2013	0.296	511	12.6	
1730	Fluoride	mg/L	1.26	1.53	1.38 - 1.68	Not Acceptable	EPA 300.0 2.1 1993	1/16/2013	-2.58	1.49	0.0876	
1820	Nitrate + Nitrite as N	mg/L	6.90	7.10	6.04 - 8.16	Acceptable	EPA 300.0 2.1 1993	1/15/2013	-0.0432	6.91	0.310	
1810	Nitrate as N	mg/L	6.90	7.10	6.39 - 7.81	Acceptable	EPA 300.0 2.1 1993	1/15/2013	0.0153	6.90	0.304	
1125	Potassium	mg/L	23.0	23.0	19.6 - 26.4	Acceptable	EPA 200.7 4.4 1994	1/21/2013	0.513	22.4	1.07	
2000	Sulfate	mg/L	70.3	72.7	61.8 - 83.6	Acceptable	EPA 300.0 2.1 1993	1/15/2013	-0.272	71.1	2.85	
1955	Total Dissolved Solids at 180°C	mg/L	320	352	282 - 422	Acceptable	SM2540C 20th ED 1997	1/17/2013	-1.24	342	17.6	

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ERA
A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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ERA Customer Number: M327601
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Inorganics (cat# 591)												
1505	Alkalinity as CaCO3	mg/L	45.9	47.7	42.9 - 52.5	Acceptable	SM2320B 21st ED 1997	1/15/2013	-0.786	47.5	2.06	
1575	Chloride	mg/L		55.0	46.8 - 63.2	Not Reported				54.4	2.19	
1610	Conductivity at 25°C	µmhos/cm	515	504	454 - 554	Acceptable	SM2510B 21st ED 1997	1/15/2013	0.296	511	12.6	
1730	Fluoride	mg/L	1.40	1.53	1.38 - 1.68	Acceptable	SM4500F- C 20th ED 1997	1/18/2013	-0.984	1.49	0.0876	
1820	Nitrate + Nitrite as N	mg/L	6.82	7.10	6.04 - 8.16	Acceptable	EPA 353.2 2 1993	1/18/2013	-0.301	6.91	0.310	
1810	Nitrate as N	mg/L	6.81	7.10	6.39 - 7.81	Acceptable	EPA 353.2 2 1993	1/15/2013	-0.281	6.90	0.304	
1125	Potassium	mg/L	23.0	23.0	19.6 - 26.4	Acceptable	EPA 200.7 5 1998	1/21/2013	0.513	22.4	1.07	
2000	Sulfate	mg/L		72.7	61.8 - 83.6	Not Reported				71.1	2.85	
1955	Total Dissolved Solids at 180°C	mg/L	320	352	282 - 422	Acceptable	SM2540C 21st ED 1997	1/17/2013	-1.24	342	17.6	
WS pH (cat# 552)												
1900	pH	S.U.	6.98	6.95	6.75 - 7.15	Acceptable	EPA 150.1 1983	1/23/2013	0.842	6.93	0.0584	
WS pH (cat# 552)												
1900	pH	S.U.	6.98	6.95	6.75 - 7.15	Acceptable	SM4500H+ B 20th ED 1996	1/23/2013	0.842	6.93	0.0584	
WS pH (cat# 552)												
1900	pH	S.U.	6.98	6.95	6.75 - 7.15	Acceptable	SM4500H+ B 21st ED 2000	1/23/2013	0.842	6.93	0.0584	

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ERA
A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Metals (cat# 590)												
1000	Aluminum	µg/L	225	221	177 - 265	Acceptable	EPA 200.8 5.4 1994	1/22/2013	-0.0932	226	15.1	
1005	Antimony	µg/L	37.4	42.5	29.8 - 55.2	Acceptable	EPA 200.8 5.4 1994	1/21/2013	-1.8	42.4	2.77	
1010	Arsenic	µg/L	22.5	24.0	16.8 - 31.2	Acceptable	EPA 200.8 5.4 1994	1/21/2013	-0.677	23.4	1.32	
1015	Barium	µg/L	1220	1160	986 - 1330	Acceptable	EPA 200.8 5.4 1994	1/22/2013	1.14	1160	50.6	
1020	Beryllium	µg/L	13.7	15.4	13.1 - 17.7	Acceptable	EPA 200.8 5.4 1994	1/21/2013	-2.86	15.7	0.716	
1025	Boron	µg/L		1090	926 - 1250	Not Reported				1070	53.9	
1030	Cadmium	µg/L	33.8	39.8	31.8 - 47.8	Acceptable	EPA 200.8 5.4 1994	1/21/2013	-3.85	39.8	1.56	
1040	Chromium	µg/L	113	137	116 - 158	Not Acceptable	EPA 200.8 5.4 1994	1/21/2013	-3.98	137	5.98	
1055	Copper	µg/L	1660	1620	1460 - 1780	Acceptable	EPA 200.8 5.4 1994	1/22/2013	0.809	1610	58.3	
1070	Iron	µg/L		564	479 - 649	Not Reported				564	26.1	
1075	Lead	µg/L	69.4	81.2	56.8 - 106	Acceptable	EPA 200.8 5.4 1994	1/21/2013	-2.72	81.5	4.45	
1090	Manganese	µg/L	239	235	200 - 270	Acceptable	EPA 200.8 5.4 1994	1/22/2013	-0.262	242	10.2	
1100	Molybdenum	µg/L	106	125	106 - 144	Acceptable	EPA 200.8 5.4 1994	1/21/2013	-2.92	123	5.88	
1105	Nickel	µg/L	146	173	147 - 199	Not Acceptable	EPA 200.8 5.4 1994	1/21/2013	-3.11	173	8.55	
1140	Selenium	µg/L	19.9	22.4	17.9 - 26.9	Acceptable	EPA 200.8 5.4 1994	1/21/2013	-1.32	22.4	1.89	
1150	Silver	µg/L	127	131	91.7 - 170	Acceptable	EPA 200.8 5.4 1994	2/1/2013	-0.758	131	5.37	
1165	Thallium	µg/L	4.26	4.89	3.42 - 6.36	Acceptable	EPA 200.8 5.4 1994	1/21/2013	-1.49	4.81	0.371	
1185	Vanadium	µg/L	508	520	442 - 598	Acceptable	EPA 200.8 5.4 1994	1/22/2013	-0.535	518	19.2	
1190	Zinc	µg/L	1280	1260	1070 - 1450	Acceptable	EPA 200.8 5.4 1994	1/22/2013	0.483	1250	53.0	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
Report Issued:	**03/08/13**
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Metals (cat# 590)												
1000	Aluminum	µg/L	225	221	177 - 265	Acceptable	EPA 200.8 5.5 1998	1/22/2013	-0.0932	226	15.1	
1005	Antimony	µg/L	37.4	42.5	29.8 - 55.2	Acceptable	EPA 200.8 5.5 1998	1/21/2013	-1.8	42.4	2.77	
1010	Arsenic	µg/L	22.5	24.0	16.8 - 31.2	Acceptable	EPA 200.8 5.5 1998	1/21/2013	-0.677	23.4	1.32	
1015	Barium	µg/L	1220	1160	986 - 1330	Acceptable	EPA 200.8 5.5 1998	1/22/2013	1.14	1160	50.6	
1020	Beryllium	µg/L	13.7	15.4	13.1 - 17.7	Acceptable	EPA 200.8 5.5 1998	1/21/2013	-2.86	15.7	0.716	
1025	Boron	µg/L		1090	926 - 1250	Not Reported				1070	53.9	
1030	Cadmium	µg/L	33.8	39.8	31.8 - 47.8	Acceptable	EPA 200.8 5.5 1998	1/21/2013	-3.85	39.8	1.56	
1040	Chromium	µg/L	113	137	116 - 158	Not Acceptable	EPA 200.8 5.5 1998	1/21/2013	-3.98	137	5.98	
1055	Copper	µg/L	1660	1620	1460 - 1780	Acceptable	EPA 200.8 5.5 1998	1/22/2013	0.809	1610	58.3	
1070	Iron	µg/L		564	479 - 649	Not Reported				564	26.1	
1075	Lead	µg/L	69.4	81.2	56.8 - 106	Acceptable	EPA 200.8 5.5 1998	1/21/2013	-2.72	81.5	4.45	
1090	Manganese	µg/L	239	235	200 - 270	Acceptable	EPA 200.8 5.5 1998	1/22/2013	-0.262	242	10.2	
1100	Molybdenum	µg/L	106	125	106 - 144	Acceptable	EPA 200.8 5.5 1998	1/21/2013	-2.92	123	5.88	
1105	Nickel	µg/L	146	173	147 - 199	Not Acceptable	EPA 200.8 5.5 1998	1/21/2013	-3.11	173	8.55	
1140	Selenium	µg/L	19.9	22.4	17.9 - 26.9	Acceptable	EPA 200.8 5.5 1998	1/21/2013	-1.32	22.4	1.89	
1150	Silver	µg/L	127	131	91.7 - 170	Acceptable	EPA 200.8 5.5 1998	2/1/2013	-0.758	131	5.37	
1165	Thallium	µg/L	4.26	4.89	3.42 - 6.36	Acceptable	EPA 200.8 5.5 1998	1/21/2013	-1.49	4.81	0.371	
1185	Vanadium	µg/L	508	520	442 - 598	Acceptable	EPA 200.8 5.5 1998	1/22/2013	-0.535	518	19.2	
1190	Zinc	µg/L	1280	1260	1070 - 1450	Acceptable	EPA 200.8 5.5 1998	1/22/2013	0.483	1250	53.0	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Metals (cat# 590)												
1000	Aluminum	µg/L	205	221	177 - 265	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-1.42	226	15.1	
1005	Antimony	µg/L		42.5	29.8 - 55.2	Not Reported				42.4	2.77	
1010	Arsenic	µg/L		24.0	16.8 - 31.2	Not Reported				23.4	1.32	
1015	Barium	µg/L	1160	1160	986 - 1330	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-0.043	1160	50.6	
1020	Beryllium	µg/L	15.3	15.4	13.1 - 17.7	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-0.621	15.7	0.716	
1025	Boron	µg/L	997	1090	926 - 1250	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-1.35	1070	53.9	
1030	Cadmium	µg/L	37.5	39.8	31.8 - 47.8	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-1.48	39.8	1.56	
1040	Chromium	µg/L	135	137	116 - 158	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-0.304	137	5.98	
1055	Copper	µg/L	1540	1620	1460 - 1780	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-1.25	1610	58.3	
1070	Iron	µg/L	563	564	479 - 649	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-0.0503	564	26.1	
1075	Lead	µg/L		81.2	56.8 - 106	Not Reported				81.5	4.45	
1090	Manganese	µg/L	249	235	200 - 270	Acceptable	EPA 200.7 4.4 1994	1/21/2013	0.723	242	10.2	
1100	Molybdenum	µg/L	114	125	106 - 144	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-1.56	123	5.88	
1105	Nickel	µg/L	178	173	147 - 199	Acceptable	EPA 200.7 4.4 1994	1/21/2013	0.630	173	8.55	
1140	Selenium	µg/L		22.4	17.9 - 26.9	Not Reported				22.4	1.89	
1150	Silver	µg/L	133	131	91.7 - 170	Acceptable	EPA 200.7 4.4 1994	1/21/2013	0.360	131	5.37	
1165	Thallium	µg/L		4.89	3.42 - 6.36	Not Reported				4.81	0.371	
1185	Vanadium	µg/L	490	520	442 - 598	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-1.47	518	19.2	
1190	Zinc	µg/L	1240	1260	1070 - 1450	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-0.273	1250	53.0	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Metals (cat# 590)												
1000	Aluminum	µg/L	205	221	177 - 265	Acceptable	EPA 200.7 5 1998	1/21/2013	-1.42	226	15.1	
1005	Antimony	µg/L		42.5	29.8 - 55.2	Not Reported				42.4	2.77	
1010	Arsenic	µg/L		24.0	16.8 - 31.2	Not Reported				23.4	1.32	
1015	Barium	µg/L	1160	1160	986 - 1330	Acceptable	EPA 200.7 5 1998	1/21/2013	-0.043	1160	50.6	
1020	Beryllium	µg/L	15.3	15.4	13.1 - 17.7	Acceptable	EPA 200.7 5 1998	1/21/2013	-0.621	15.7	0.716	
1025	Boron	µg/L	997	1090	926 - 1250	Acceptable	EPA 200.7 5 1998	1/21/2013	-1.35	1070	53.9	
1030	Cadmium	µg/L	37.5	39.8	31.8 - 47.8	Acceptable	EPA 200.7 5 1998	1/21/2013	-1.48	39.8	1.56	
1040	Chromium	µg/L	135	137	116 - 158	Acceptable	EPA 200.7 5 1998	1/21/2013	-0.304	137	5.98	
1055	Copper	µg/L	1540	1620	1460 - 1780	Acceptable	EPA 200.7 5 1998	1/21/2013	-1.25	1610	58.3	
1070	Iron	µg/L	563	564	479 - 649	Acceptable	EPA 200.7 5 1998	1/21/2013	-0.0503	564	26.1	
1075	Lead	µg/L		81.2	56.8 - 106	Not Reported				81.5	4.45	
1090	Manganese	µg/L	249	235	200 - 270	Acceptable	EPA 200.7 5 1998	1/21/2013	0.723	242	10.2	
1100	Molybdenum	µg/L	114	125	106 - 144	Acceptable	EPA 200.7 5 1998	1/21/2013	-1.56	123	5.88	
1105	Nickel	µg/L	178	173	147 - 199	Acceptable	EPA 200.7 5 1998	1/21/2013	0.630	173	8.55	
1140	Selenium	µg/L		22.4	17.9 - 26.9	Not Reported				22.4	1.89	
1150	Silver	µg/L	133	131	91.7 - 170	Acceptable	EPA 200.7 5 1998	1/21/2013	0.360	131	5.37	
1165	Thallium	µg/L		4.89	3.42 - 6.36	Not Reported				4.81	0.371	
1185	Vanadium	µg/L	490	520	442 - 598	Acceptable	EPA 200.7 5 1998	1/21/2013	-1.47	518	19.2	
1190	Zinc	µg/L	1240	1260	1070 - 1450	Acceptable	EPA 200.7 5 1998	1/21/2013	-0.273	1250	53.0	
WS Mercury (cat# 551)												
1095	Mercury	µg/L	2.57	2.39	1.67 - 3.11	Acceptable	EPA 245.1 3 1994	1/22/2013	0.800	2.40	0.208	

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A Waters Company

Nilda B. Cox
QA Officer
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750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Hexavalent Chromium (cat# 854)												
1045	Hexavalent Chromium	µg/L	29.0	29.3	23.4 - 35.2	Acceptable	EPA 218.6 3.3 1994	1/25/2013	0.143	28.7	1.85	
WS Hexavalent Chromium (cat# 854)												
1045	Hexavalent Chromium	µg/L	28.0	29.3	23.4 - 35.2	Acceptable	SM3500Cr B 20th ED 1997	1/25/2013	-0.396	28.7	1.85	
WS Hexavalent Chromium (cat# 854)												
1045	Hexavalent Chromium	µg/L	28.0	29.3	23.4 - 35.2	Acceptable	SM3500Cr B 21st ED 2001	1/25/2013	-0.396	28.7	1.85	
WS Hexavalent Chromium (cat# 854)												
1045	Hexavalent Chromium	µg/L	28.0	29.3	23.4 - 35.2	Acceptable	SM3500Cr D 19th ED 1990	1/25/2013	-0.396	28.7	1.85	
WS Vanadium (cat# 856)												
1185	Vanadium	µg/L	10.6	12.5	10.9 - 14.0	Not Acceptable	EPA 200.8 5.4 1994	1/21/2013	-2.44	12.5	0.796	
WS Vanadium (cat# 856)												
1185	Vanadium	µg/L	10.6	12.5	10.9 - 14.0	Not Acceptable	EPA 200.8 5.5 1998	1/21/2013	-2.44	12.5	0.796	
WS Vanadium (cat# 856)												
1185	Vanadium	µg/L	12.3	12.5	10.9 - 14.0	Acceptable	EPA 200.7 4.4 1994	1/21/2013	-0.302	12.5	0.796	
WS Vanadium (cat# 856)												
1185	Vanadium	µg/L	12.3	12.5	10.9 - 14.0	Acceptable	EPA 200.7 5 1998	1/21/2013	-0.302	12.5	0.796	
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L	180	179	125 - 233	Acceptable	EPA 300.1 1 2000	1/23/2013	0.797	170	12.2	
1595	Chlorite	µg/L	356	345	242 - 448	Acceptable	EPA 300.1 1 2000	1/23/2013	-0.0498	357	25.3	
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L	180	179	125 - 233	Acceptable	EPA 300.1 1997	1/23/2013	0.797	170	12.2	
1595	Chlorite	µg/L	356	345	242 - 448	Acceptable	EPA 300.1 1997	1/23/2013	-0.0498	357	25.3	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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ERA
A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 03/08/13
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L	175	179	125 - 233	Acceptable	EPA 300.0 2.1 1993	1/21/2013	0.387	170	12.2	
1595	Chlorite	µg/L	352	345	242 - 448	Acceptable	EPA 300.0 2.1 1993	1/21/2013	-0.208	357	25.3	
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L	175	179	125 - 233	Acceptable	EPA 9056 1996 1996	1/21/2013	0.387	170	12.2	
1595	Chlorite	µg/L		345	242 - 448	Not Reported				357	25.3	
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L		179	125 - 233	Not Reported				170	12.2	
1595	Chlorite	µg/L	396	345	242 - 448	Acceptable	EPA 317.0 2	1/23/2013	1.53	357	25.3	
WS Inorganic Disinfection #2 (cat# 5260)												
1535	Bromate	µg/L	39.3	42.6	29.8 - 55.4	Acceptable	EPA 300.1 1 2000	1/29/2013	-0.776	41.6	2.91	
1540	Bromide	µg/L	144	147	125 - 169	Acceptable	EPA 300.1 1 2000	1/23/2013	0.0138	144	8.38	
WS Inorganic Disinfection #2 (cat# 5260)												
1535	Bromate	µg/L	39.3	42.6	29.8 - 55.4	Acceptable	EPA 300.1 1997	1/29/2013	-0.776	41.6	2.91	
1540	Bromide	µg/L	144	147	125 - 169	Acceptable	EPA 300.1 1997	1/23/2013	0.0138	144	8.38	
WS Inorganic Disinfection #2 (cat# 5260)												
1535	Bromate	µg/L	44.6	42.6	29.8 - 55.4	Acceptable	EPA 317.0 2	1/23/2013	1.04	41.6	2.91	
1540	Bromide	µg/L		147	125 - 169	Not Reported				144	8.38	
WS Inorganic Disinfection #2 (cat# 5260)												
1535	Bromate	µg/L		42.6	29.8 - 55.4	Not Reported				41.6	2.91	
1540	Bromide	µg/L	143	147	125 - 169	Acceptable	EPA 300.0 2.1 1993	1/21/2013	-0.106	144	8.38	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Nitrite (cat# 594)												
1840	Nitrite as N	mg/L	1.87	1.84	1.56 - 2.12	Acceptable	EPA 300.1 1 2000	1/16/2013	0.351	1.84	0.0792	
WS Nitrite (cat# 594)												
1840	Nitrite as N	mg/L	1.87	1.84	1.56 - 2.12	Acceptable	EPA 300.1 1997	1/16/2013	0.351	1.84	0.0792	
WS Nitrite (cat# 594)												
1840	Nitrite as N	mg/L	1.92	1.84	1.56 - 2.12	Acceptable	EPA 300.0 2.1 1993	1/15/2013	0.983	1.84	0.0792	
WS Nitrite (cat# 594)												
1840	Nitrite as N	mg/L	1.85	1.84	1.56 - 2.12	Acceptable	EPA 353.2 2 1993	1/15/2013	0.0987	1.84	0.0792	
WS o-Phosphate Nutrients (cat# 558)												
1870	ortho-Phosphate as P	mg/L	2.63	2.55	2.17 - 2.93	Acceptable	EPA 365.1 2 1993	1/15/2013	0.633	2.56	0.116	
WS o-Phosphate Nutrients (cat# 558)												
1870	ortho-Phosphate as P	mg/L	2.63	2.55	2.17 - 2.93	Acceptable	SM4500P E 20th ED 1997	1/15/2013	0.633	2.56	0.116	
WS o-Phosphate Nutrients (cat# 558)												
1870	ortho-Phosphate as P	mg/L	2.63	2.55	2.17 - 2.93	Acceptable	SM4500P F 20th ED 1997	1/15/2013	0.633	2.56	0.116	
WS o-Phosphate Nutrients (cat# 558)												
1870	ortho-Phosphate as P	mg/L	2.63	2.55	2.17 - 2.93	Acceptable	SM4500P E 21st ED 1999	1/15/2013	0.633	2.56	0.116	
WS Residual Chlorine (cat# 593)												
1945	Free Residual Chlorine	mg/L	0.920	0.894	0.706 - 1.08	Acceptable	SM4500Cl G 20th ED 1993	1/25/2013	0.631	0.870	0.0795	
1940	Total Residual Chlorine	mg/L	0.950	0.894	0.747 - 1.03	Acceptable	SM4500Cl G 20th ED 1993	1/30/2013	0.728	0.906	0.0603	
WS Residual Chlorine (cat# 593)												
1945	Free Residual Chlorine	mg/L	0.920	0.894	0.706 - 1.08	Acceptable	SM4500Cl G 21st ED 2000	1/25/2013	0.631	0.870	0.0795	
1940	Total Residual Chlorine	mg/L	0.950	0.894	0.747 - 1.03	Acceptable	SM4500Cl G 21st ED 2000	1/30/2013	0.728	0.906	0.0603	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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ERA Customer Number: M327601
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.400	0.415	0.311 - 0.519	Acceptable	EPA 335.4 1993	1/16/2013	-0.345	0.412	0.0338	
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.416	0.415	0.311 - 0.519	Acceptable	SM4500CN F 20th ED 1997	1/16/2013	0.128	0.412	0.0338	
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.416	0.415	0.311 - 0.519	Acceptable	SM4500CN F 21st ED 1999	1/16/2013	0.128	0.412	0.0338	
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.376	0.415	0.311 - 0.519	Acceptable	SM4500CN G 20th 1998	1/16/2013	-1.06	0.412	0.0338	
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.376	0.415	0.311 - 0.519	Acceptable	SM4500CN G 21st Ed 2005	1/16/2013	-1.06	0.412	0.0338	
WS Organic Carbon (cat# 557)												
1710	Dissolved Organic Carbon (DOC)	mg/L	4.02	7.98	7.09 - 8.78	Not Acceptable	SM5310C 20th ED 1996	1/15/2013	-11	8.02	0.362	
2040	Total Organic Carbon (TOC)	mg/L	3.94	7.98	6.38 - 9.58	Not Acceptable	SM5310C 20th ED 1996	1/15/2013	-10.7	8.10	0.389	
WS Organic Carbon (cat# 557)												
1710	Dissolved Organic Carbon (DOC)	mg/L	4.02	7.98	7.09 - 8.78	Not Acceptable	SM5310C 21st ED 2000	1/15/2013	-11	8.02	0.362	
2040	Total Organic Carbon (TOC)	mg/L	3.94	7.98	6.38 - 9.58	Not Acceptable	SM5310C 21st ED 2000	1/15/2013	-10.7	8.10	0.389	
WS Perchlorate (cat# 903)												
1895	Perchlorate	µg/L	11.0	10.7	8.56 - 12.8	Acceptable	EPA 314.0 1 1999	1/24/2013	0.409	10.6	0.946	
WS Perchlorate (cat# 903)												
1895	Perchlorate	µg/L	10.4	10.7	8.56 - 12.8	Acceptable	EPA 331.0 1.0 2005	1/29/2013	-0.225	10.6	0.946	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Silica (cat# 902)												
1990	Silica as SiO2	mg/L	34.4	31.3	26.6 - 36.0	Acceptable	EPA 200.7 4.4 1994	1/21/2013	1.54	31.1	2.12	
WS Silica (cat# 902)												
1990	Silica as SiO2	mg/L	34.4	31.3	26.6 - 36.0	Acceptable	EPA 200.7 5 1998	1/21/2013	1.54	31.1	2.12	
WS Silica (cat# 902)												
1990	Silica as SiO2	mg/L	30.0	31.3	26.6 - 36.0	Acceptable	SM4500SiO2 C 20th ED 1997	2/4/2013	-0.534	31.1	2.12	
WS Silica (cat# 902)												
1990	Silica as SiO2	mg/L	30.0	31.3	26.6 - 36.0	Acceptable	SM4500Si D 20th ED 1997	2/4/2013	-0.534	31.1	2.12	
WS Surfactants - MBAS (cat# 901)												
2025	Surfactants - MBAS	mg/L	0.317	0.312	0.200 - 0.423	Acceptable	SM5540C 20th ED 1993	1/15/2013	-0.075	0.320	0.0408	
WS Surfactants - MBAS (cat# 901)												
2025	Surfactants - MBAS	mg/L	0.317	0.312	0.200 - 0.423	Acceptable	SM5540C 21st ED 2000	1/15/2013	-0.075	0.320	0.0408	
WS Corrosivity (cat# 900)												
1620	Corrosivity	S.I.@ 20°C	1.63	1.52	1.12 - 1.92	Acceptable	SM2330B 18th ED 1989	2/1/2013	1.04	1.44	0.179	
WS Corrosivity (cat# 900)												
1620	Corrosivity	S.I.@ 20°C	1.63	1.52	1.12 - 1.92	Acceptable	EPA 9040C 2002	2/1/2013	1.04	1.44	0.179	
WS Turbidity (cat# 592)												
2055	Turbidity	NTU	0.995	0.940	0.738 - 1.21	Acceptable	EPA 180.1 2 1993	1/18/2013	0.00701	0.994	0.121	
WS Turbidity (cat# 592)												
2055	Turbidity	NTU	0.995	0.940	0.738 - 1.21	Acceptable	SM2130B 20th ED 1994	1/18/2013	0.00701	0.994	0.121	
WS Turbidity (cat# 592)												
2055	Turbidity	NTU	0.995	0.940	0.738 - 1.21	Acceptable	SM2130B 21st ED 2001	1/18/2013	0.00701	0.994	0.121	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS UV 254 Absorbance (cat# 904)												
2060	UV 254 Absorbance	cm-1	0.0775	0.140	0.112 - 0.174	Not Acceptable	SM5910B 20th ED 1994	1/17/2013	-5.57	0.140	0.0113	
WS UV 254 Absorbance (cat# 904)												
2060	UV 254 Absorbance	cm-1	0.0775	0.140	0.112 - 0.174	Not Acceptable	SM5910B 21st ED 2000	1/17/2013	-5.57	0.140	0.0113	

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2003 NELAC Evaluation Report

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Microbiology Results

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080A)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/19/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/19/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 1, 6 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 2
Blank - No Organism, Samples 4 and 7

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080A) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2530	Fecal Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/19/2013	0			
2530	Fecal Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2530	Fecal Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2530	Fecal Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2530	Fecal Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2530	Fecal Coliforms - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2530	Fecal Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			
2530	Fecal Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	1/19/2013	0			
2530	Fecal Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	1/17/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 1, 6 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 2
Blank - No Organism, Samples 4 and 7

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
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WS MicrobE™ (Coliforms) (cat# 080A) (Continued)												
2525	E.coli - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 3	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 10	CFU/100mL		Presence	Presence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 1, 6 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
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Blank - No Organism, Samples 4 and 7

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080A)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/19/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/19/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 1, 6 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 2
Blank - No Organism, Samples 4 and 7

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 03/08/13
Study Dates: 01/07/13 - 02/21/13

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080A) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2530	Fecal Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/19/2013	0			
2530	Fecal Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2530	Fecal Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2530	Fecal Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2530	Fecal Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2530	Fecal Coliforms - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2530	Fecal Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/17/2013	0			
2530	Fecal Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	1/19/2013	0			
2530	Fecal Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	1/17/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 1, 6 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 2
Blank - No Organism, Samples 4 and 7

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Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080A) (Continued)												
2525	E.coli - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 3	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 10	CFU/100mL		Presence	Presence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 1, 6 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 2
Blank - No Organism, Samples 4 and 7

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
ERA Customer Number:	M327601
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 6
Total Coliform Organism - Enterobacter cloacae, Samples 5, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 3
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 2 and 10

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 6
Total Coliform Organism - Enterobacter cloacae, Samples 5, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 3
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 2 and 10

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B) (Continued)												
2525	E.coli - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	1/16/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 6
Total Coliform Organism - Enterobacter cloacae, Samples 5, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 3
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 2 and 10

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 6
Total Coliform Organism - Enterobacter cloacae, Samples 5, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 3
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 2 and 10

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 03/08/13
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WS MicrobE™ (Coliforms) (cat# 080B) (Continued)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2530	Fecal Coliforms - Sample 1	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 6
Total Coliform Organism - Enterobacter cloacae, Samples 5, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 3
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 2 and 10

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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WS MicrobE™ (Coliforms) (cat# 080B) (Continued)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2525	E.coli - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	1/16/2013	0			

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Not Reported**
E.coli Evaluation : **Acceptable**

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 6
Total Coliform Organism - Enterobacter cloacae, Samples 5, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 3
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 2 and 10

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C)												
2500	Total Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 5, 7 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 4 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 1
Blank - No Organism, Samples 3 and 8

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 5, 7 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 4 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 1
Blank - No Organism, Samples 3 and 8

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS MicrobE™ (Coliforms) (cat# 080C) (Continued)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2525	E.coli - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	1/16/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 5, 7 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 4 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 1
Blank - No Organism, Samples 3 and 8

WS-198 2003 NELAC Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 03/08/13
Study Dates: 01/07/13 - 02/21/13

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C)												
2500	Total Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Not Reported**
E.coli Evaluation : **Acceptable**

Fecal Coliform Organism - Escherichia coli, Samples 5, 7 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 4 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 1
Blank - No Organism, Samples 3 and 8

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Eurofins Eaton Analytical, Inc - Monrovia
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 5, 7 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 4 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 1
Blank - No Organism, Samples 3 and 8

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Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C) (Continued)												
2525	E.coli - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	1/16/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	1/16/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 5, 7 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 4 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 1
Blank - No Organism, Samples 3 and 8

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Nilda B. Cox
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Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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Study Dates: 01/07/13 - 02/21/13

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080D)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 5
Total Coliform Organism - Enterobacter cloacae, Samples 2, 8 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 6
Blank - No Organism, Samples 3 and 7

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
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WS MicrobE™ (Coliforms) (cat# 080D) (Continued)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2530	Fecal Coliforms - Sample 1	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 5
Total Coliform Organism - Enterobacter cloacae, Samples 2, 8 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 6
Blank - No Organism, Samples 3 and 7

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080D) (Continued)												
2525	E.coli - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	1/16/2013	0			

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Not Reported**
E.coli Evaluation : **Acceptable**

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 5
Total Coliform Organism - Enterobacter cloacae, Samples 2, 8 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 6
Blank - No Organism, Samples 3 and 7

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080D)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Not Reported**
E.coli Evaluation : **Acceptable**

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 5
Total Coliform Organism - Enterobacter cloacae, Samples 2, 8 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 6
Blank - No Organism, Samples 3 and 7

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080D) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 5
Total Coliform Organism - Enterobacter cloacae, Samples 2, 8 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 6
Blank - No Organism, Samples 3 and 7

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS MicrobE™ (Coliforms) (cat# 080D) (Continued)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2525	E.coli - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	1/16/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 1, 4 and 5
Total Coliform Organism - Enterobacter cloacae, Samples 2, 8 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 9
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 6
Blank - No Organism, Samples 3 and 7

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ERA
A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	93.2	86.0	45.4 - 124	Acceptable	SM9223 COLertQT 20th ED 1998	1/16/2013	0.913	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL	93.2	86.0	36.8 - 174	Acceptable	SM9223 COLertQT 20th ED 1998	1/16/2013	0.387	80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	93.2	86.0	46.1 - 123	Acceptable	SM9223 COLertQT 20th ED 1998	1/16/2013	0.938	75.2	19.2	
WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	93.2	86.0	45.4 - 124	Acceptable	SM9223 COLertQT online	1/16/2013	0.913	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL	93.2	86.0	36.8 - 174	Acceptable	SM9223 COLertQT online	1/16/2013	0.387	80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	93.2	86.0	46.1 - 123	Acceptable	SM9223 COLertQT online	1/16/2013	0.938	75.2	19.2	
WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	77.6	86.0	45.4 - 124	Acceptable	SM9223 COLt18QT 20th ED 1998	1/16/2013	0.124	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL	77.6	86.0	36.8 - 174	Acceptable	SM9223 COLt18QT 20th ED 1998	1/16/2013	-0.0695	80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	77.6	86.0	46.1 - 123	Acceptable	SM9223 COLt18QT 20th ED 1998	1/16/2013	0.124	75.2	19.2	

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ERA
A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 03/08/13
Study Dates: 01/07/13 - 02/21/13

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	77.6	86.0	45.4 - 124	Acceptable	SM9223 COLt18QT online	1/16/2013	0.124	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL	77.6	86.0	36.8 - 174	Acceptable	SM9223 COLt18QT online	1/16/2013	-0.0695	80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	77.6	86.0	46.1 - 123	Acceptable	SM9223 COLt18QT online	1/16/2013	0.124	75.2	19.2	
WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	130	86.0	45.4 - 124	Not Acceptable	SM9221B+F ECMUG 20th ED 1998	1/15/2013	2.77	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL	130	86.0	36.8 - 174	Acceptable	SM9221B+F ECMUG 20th ED 1998	1/15/2013	1.46	80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	130	86.0	46.1 - 123	Not Acceptable	SM9221B+F ECMUG 20th ED 1998	1/15/2013	2.86	75.2	19.2	
WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	130	86.0	45.4 - 124	Not Acceptable	SM9221B+F ECMUG online	1/15/2013	2.77	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL	130	86.0	36.8 - 174	Acceptable	SM9221B+F ECMUG online	1/15/2013	1.46	80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	130	86.0	46.1 - 123	Not Acceptable	SM9221B+F ECMUG online	1/15/2013	2.86	75.2	19.2	

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QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	79.0	86.0	45.4 - 124	Acceptable	SM9223B MPN online	1/16/2013	0.195	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL		86.0	36.8 - 174	Not Reported				80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	79.0	86.0	46.1 - 123	Acceptable	SM9223B MPN online	1/16/2013	0.197	75.2	19.2	
WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	79.0	86.0	45.4 - 124	Acceptable	SM9223B MPN 20th ED 1997	1/16/2013	0.195	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL		86.0	36.8 - 174	Not Reported				80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	79.0	86.0	46.1 - 123	Acceptable	SM9223B MPN 20th ED 1997	1/16/2013	0.197	75.2	19.2	
WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	49.0	86.0	45.4 - 124	Acceptable	SM9223 COLert18 20th ED 1997	1/16/2013	-1.32	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL		86.0	36.8 - 174	Not Reported				80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	49.0	86.0	46.1 - 123	Acceptable	SM9223 COLert18 20th ED 1997	1/16/2013	-1.37	75.2	19.2	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		80.0	35.0 - 89.0	Not Reported				55.8	13.4	
2530	Fecal Coliforms (MF)	CFU/100mL		80.0	11.0 - 78.0	Not Reported				28.6	16.7	
2525	E.coli (MF)	CFU/100mL		80.0	16.0 - 103	Not Reported				41.1	21.6	
2500	Total Coliforms (MPN)	MPN/100mL	49.0	86.0	45.4 - 124	Acceptable	SM9223 COLert18 online	1/16/2013	-1.32	75.1	19.8	
2530	Fecal Coliforms (MPN)	MPN/100mL		86.0	36.8 - 174	Not Reported				80.0	34.2	
2525	E.coli (MPN)	MPN/100mL	49.0	86.0	46.1 - 123	Acceptable	SM9223 COLert18 online	1/16/2013	-1.37	75.2	19.2	
WS Heterotrophic Plate Count (cat# 079)												
2555	Heterotrophic Plate Count (MF, PP)	CFU/mL	82.0	72.0	43.0 - 84.0	Acceptable	SM9215B PCA 20th ED 1998	1/17/2013	2.16	60.1	10.1	
2555	Heterotrophic Plate Count (MPN)	MPN/mL		79.0	32.5 - 111	Not Reported				59.9	19.5	
WS Heterotrophic Plate Count (cat# 079)												
2555	Heterotrophic Plate Count (MF, PP)	CFU/mL	82.0	72.0	43.0 - 84.0	Acceptable	SM9215B 18/19thED	1/17/2013	2.16	60.1	10.1	
2555	Heterotrophic Plate Count (MPN)	MPN/mL		79.0	32.5 - 111	Not Reported				59.9	19.5	

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ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

Organic Results

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Chloral Hydrate (cat# 853)												
4460	Chloral Hydrate	µg/L	22.5	14.1	2.76 - 22.6	Acceptable	EPA 551.1 1 1992	1/18/2013	1.10	16.9	5.11	
WS Haloacetic Acids (HAA) (cat# 852)												
9312	Bromoacetic acid	µg/L	14.2	14.3	8.58 - 20.0	Acceptable	SM 6251B 21st ED 21st ED	1/18/2013	-0.221	14.6	1.62	
9315	Bromochloroacetic acid	µg/L	24.8	23.7	14.2 - 33.2	Acceptable	SM 6251B 21st ED 21st ED	1/18/2013	-0.0796	25.0	2.24	
9336	Chloroacetic acid	µg/L	32.6	33.2	19.9 - 46.5	Acceptable	SM 6251B 21st ED 21st ED	1/18/2013	0.139	32.0	4.02	
9357	Dibromoacetic acid	µg/L	19.1	18.9	11.3 - 26.5	Acceptable	SM 6251B 21st ED 21st ED	1/18/2013	0.00828	19.1	1.61	
9360	Dichloroacetic acid	µg/L	19.2	17.0	10.2 - 23.8	Acceptable	SM 6251B 21st ED 21st ED	1/18/2013	0.608	18.1	1.84	
9642	Trichloroacetic acid	µg/L	19.1	19.8	11.9 - 27.7	Acceptable	SM 6251B 21st ED 21st ED	1/18/2013	-0.0952	19.3	2.27	
WS Haloacetic Acids (HAA) (cat# 852)												
9312	Bromoacetic acid	µg/L	14.2	14.3	8.58 - 20.0	Acceptable	SM 6251B 20th Ed 20th ED 2005	1/18/2013	-0.221	14.6	1.62	
9315	Bromochloroacetic acid	µg/L	24.8	23.7	14.2 - 33.2	Acceptable	SM 6251B 20th Ed 20th ED 2005	1/18/2013	-0.0796	25.0	2.24	
9336	Chloroacetic acid	µg/L	32.6	33.2	19.9 - 46.5	Acceptable	SM 6251B 20th Ed 20th ED 2005	1/18/2013	0.139	32.0	4.02	
9357	Dibromoacetic acid	µg/L	19.1	18.9	11.3 - 26.5	Acceptable	SM 6251B 20th Ed 20th ED 2005	1/18/2013	0.00828	19.1	1.61	
9360	Dichloroacetic acid	µg/L	19.2	17.0	10.2 - 23.8	Acceptable	SM 6251B 20th Ed 20th ED 2005	1/18/2013	0.608	18.1	1.84	
9642	Trichloroacetic acid	µg/L	19.1	19.8	11.9 - 27.7	Acceptable	SM 6251B 20th Ed 20th ED 2005	1/18/2013	-0.0952	19.3	2.27	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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ERA Customer Number: M327601
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WS Haloacetic Acids (HAA) (cat# 852)												
9312	Bromoacetic acid	µg/L	14.3	14.3	8.58 - 20.0	Acceptable	EPA 552.3 1 2003	1/22/2013	-0.159	14.6	1.62	
9315	Bromochloroacetic acid	µg/L	25.0	23.7	14.2 - 33.2	Acceptable	EPA 552.3 1 2003	1/22/2013	0.00958	25.0	2.24	
9336	Chloroacetic acid	µg/L	32.8	33.2	19.9 - 46.5	Acceptable	EPA 552.3 1 2003	1/22/2013	0.188	32.0	4.02	
9357	Dibromoacetic acid	µg/L	18.9	18.9	11.3 - 26.5	Acceptable	EPA 552.3 1 2003	1/22/2013	-0.116	19.1	1.61	
9360	Dichloroacetic acid	µg/L	18.1	17.0	10.2 - 23.8	Acceptable	EPA 552.3 1 2003	1/22/2013	0.00955	18.1	1.84	
9642	Trichloroacetic acid	µg/L	18.5	19.8	11.9 - 27.7	Acceptable	EPA 552.3 1 2003	1/22/2013	-0.359	19.3	2.27	
WS Gasoline Additives (GAD) (cat# 905)												
4370	T-amylmethylether (TAME)	µg/L	7.53	7.46	5.58 - 9.49	Acceptable	EPA 524.2 4.1 1995	1/25/2013	0.0351	7.51	0.450	
4420	Tert-Butyl Alcohol	µg/L	41.7	31.8	19.0 - 44.3	Acceptable	EPA 524.2 4.1 1995	1/25/2013	1.39	29.2	8.93	
5000	tert-Butyl methyl ether (MTBE)	µg/L	20.3	17.8	14.2 - 21.4	Acceptable	EPA 524.2 4.1 1995	1/26/2013	1.30	18.5	1.37	
9375	Di-isopropylether (DIPE)	µg/L	17.9	17.6	14.3 - 22.0	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.447	18.7	1.75	
4770	Ethyl-t-butylether (ETBE)	µg/L	9.91	9.66	7.63 - 12.5	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.0204	9.92	0.686	
5175	Trichlorofluoromethane (Freon 11)	µg/L	29.8	31.2	18.7 - 43.7	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.664	32.9	4.61	
5185	Trichlorotrifluoroethane (Freon 113)	µg/L	37.0	33.4	22.3 - 44.5	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.171	38.0	5.99	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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ERA Customer Number: M327601
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WS Gasoline Additives (GAD) (cat# 905)												
4370	T-amylmethylether (TAME)	µg/L	6.02	7.46	5.58 - 9.49	Acceptable	EPA 524.3 1 2009	2/7/2013	-3.32	7.51	0.450	
4420	Tert-Butyl Alcohol	µg/L		31.8	19.0 - 44.3	Not Reported				29.2	8.93	
5000	tert-Butyl methyl ether (MTBE)	µg/L	18.9	17.8	14.2 - 21.4	Acceptable	EPA 524.3 1 2009	2/7/2013	0.278	18.5	1.37	
9375	Di-isopropylether (DIPE)	µg/L	19.2	17.6	14.3 - 22.0	Acceptable	EPA 524.3 1 2009	2/7/2013	0.296	18.7	1.75	
4770	Ethyl-t-butylether (ETBE)	µg/L	8.33	9.66	7.63 - 12.5	Acceptable	EPA 524.3 1 2009	2/7/2013	-2.32	9.92	0.686	
5175	Trichlorofluoromethane (Freon 11)	µg/L	28.8	31.2	18.7 - 43.7	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.881	32.9	4.61	
5185	Trichlorotrifluoroethane (Freon 113)	µg/L		33.4	22.3 - 44.5	Not Reported				38.0	5.99	
WS Halomethanes (THMs) (cat# 842)												
4395	Bromodichloromethane	µg/L	9.82	9.63	7.70 - 11.6	Acceptable	EPA 524.2 4.1 1995	1/30/2013	0.114	9.70	1.01	
4400	Bromoform	µg/L	5.47	5.66	4.53 - 6.79	Acceptable	EPA 524.2 4.1 1995	1/30/2013	-0.0825	5.53	0.712	
4575	Chlorodibromomethane	µg/L	20.4	21.5	17.2 - 25.8	Acceptable	EPA 524.2 4.1 1995	1/30/2013	-0.333	21.1	2.09	
4505	Chloroform	µg/L	14.5	14.6	11.7 - 17.5	Acceptable	EPA 524.2 4.1 1995	1/30/2013	-0.307	14.9	1.46	
WS Halomethanes (THMs) (cat# 842)												
4395	Bromodichloromethane	µg/L	9.10	9.63	7.70 - 11.6	Acceptable	EPA 551.1 1 1992	2/3/2013	-0.598	9.70	1.01	
4400	Bromoform	µg/L	5.62	5.66	4.53 - 6.79	Acceptable	EPA 551.1 1 1992	2/3/2013	0.128	5.53	0.712	
4575	Chlorodibromomethane	µg/L	20.8	21.5	17.2 - 25.8	Acceptable	EPA 551.1 1 1992	2/3/2013	-0.141	21.1	2.09	
4505	Chloroform	µg/L	13.3	14.6	11.7 - 17.5	Acceptable	EPA 551.1 1 1992	2/3/2013	-1.13	14.9	1.46	

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Nilda B. Cox
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750 Royal Oaks Dr.
Suite 100
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WS Halomethanes (THMs) (cat# 842)												
4395	Bromodichloromethane	µg/L	8.30	9.63	7.70 - 11.6	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.39	9.70	1.01	
4400	Bromoform	µg/L	4.11	5.66	4.53 - 6.79	Not Acceptable	EPA 524.3 1 2009	2/6/2013	-1.99	5.53	0.712	
4575	Chlorodibromomethane	µg/L	15.6	21.5	17.2 - 25.8	Not Acceptable	EPA 524.3 1 2009	2/6/2013	-2.63	21.1	2.09	
4505	Chloroform	µg/L	13.9	14.6	11.7 - 17.5	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.718	14.9	1.46	

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QA Officer
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750 Royal Oaks Dr.
Suite 100
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626-386-1170

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WS Regulated Volatiles (cat# 840)												
4375	Benzene	µg/L	7.01	7.23	4.34 - 10.1	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.591	7.34	0.566	
4455	Carbon tetrachloride	µg/L	12.7	13.7	11.0 - 16.4	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.697	13.8	1.59	
4475	Chlorobenzene	µg/L	9.66	9.71	5.83 - 13.6	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.209	9.80	0.698	
4610	1,2-Dichlorobenzene	µg/L	12.8	12.2	9.76 - 14.6	Acceptable	EPA 524.2 4.1 1995	1/25/2013	0.680	12.1	1.06	
4620	1,4-Dichlorobenzene	µg/L	17.6	17.7	14.2 - 21.2	Acceptable	EPA 524.2 4.1 1995	1/25/2013	0.00514	17.6	1.65	
4635	1,2-Dichloroethane	µg/L	2.20	2.45	1.47 - 3.43	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-1.23	2.54	0.276	
4640	1,1-Dichloroethylene	µg/L	18.8	18.1	14.5 - 21.7	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.0323	18.9	2.10	
4645	cis-1,2-Dichloroethylene	µg/L	13.5	14.4	11.5 - 17.3	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.524	14.1	1.11	
4700	trans-1,2-Dichloroethylene	µg/L	11.0	11.5	9.20 - 13.8	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.718	11.7	1.01	
4655	1,2-Dichloropropane	µg/L	8.22	8.37	5.02 - 11.7	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.271	8.39	0.640	
4765	Ethylbenzene	µg/L	6.82	6.92	4.15 - 9.69	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.292	7.00	0.625	
4975	Methylene chloride (Dichloromethane)	µg/L	6.10	6.35	3.81 - 8.89	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.536	6.43	0.615	
5100	Styrene	µg/L	2.63	3.15	1.89 - 4.41	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-1.41	3.28	0.466	
5115	Tetrachloroethylene	µg/L	8.78	8.56	5.14 - 12.0	Acceptable	EPA 524.2 4.1 1995	1/25/2013	0.581	8.28	0.853	
5140	Toluene	µg/L	4.61	4.84	2.90 - 6.78	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.406	4.76	0.378	
5155	1,2,4-Trichlorobenzene	µg/L	7.03	6.62	3.97 - 9.27	Acceptable	EPA 524.2 4.1 1995	1/25/2013	0.333	6.73	0.912	
5160	1,1,1-Trichloroethane	µg/L	11.4	11.7	9.36 - 14.0	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.219	11.6	1.18	
5165	1,1,2-Trichloroethane	µg/L	17.6	18.2	14.6 - 21.8	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.205	17.9	1.34	
5170	Trichloroethylene	µg/L	10.2	10.6	8.48 - 12.7	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.128	10.3	0.909	
5235	Vinyl chloride	µg/L	22.9	20.8	12.5 - 29.1	Acceptable	EPA 524.2 4.1 1995	1/25/2013	0.508	21.0	3.64	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 03/08/13
Study Dates: 01/07/13 - 02/21/13

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Regulated Volatiles (cat# 840) (Continued)												
5260	Xylenes, total	µg/L	36.5	39.8	31.8 - 47.8	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-1.11	40.0	3.13	

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WS Regulated Volatiles (cat# 840)												
4375	Benzene	µg/L	6.98	7.23	4.34 - 10.1	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.644	7.34	0.566	
4455	Carbon tetrachloride	µg/L	11.1	13.7	11.0 - 16.4	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.7	13.8	1.59	
4475	Chlorobenzene	µg/L	9.33	9.71	5.83 - 13.6	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.682	9.80	0.698	
4610	1,2-Dichlorobenzene	µg/L	11.6	12.2	9.76 - 14.6	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.457	12.1	1.06	
4620	1,4-Dichlorobenzene	µg/L	17.1	17.7	14.2 - 21.2	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.298	17.6	1.65	
4635	1,2-Dichloroethane	µg/L	2.54	2.45	1.47 - 3.43	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.00234	2.54	0.276	
4640	1,1-Dichloroethylene	µg/L	18.4	18.1	14.5 - 21.7	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.223	18.9	2.10	
4645	cis-1,2-Dichloroethylene	µg/L	13.7	14.4	11.5 - 17.3	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.344	14.1	1.11	
4700	trans-1,2-Dichloroethylene	µg/L	11.1	11.5	9.20 - 13.8	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.619	11.7	1.01	
4655	1,2-Dichloropropane	µg/L	8.25	8.37	5.02 - 11.7	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.225	8.39	0.640	
4765	Ethylbenzene	µg/L	6.59	6.92	4.15 - 9.69	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.66	7.00	0.625	
4975	Methylene chloride (Dichloromethane)	µg/L	5.96	6.35	3.81 - 8.89	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.763	6.43	0.615	
5100	Styrene	µg/L	3.20	3.15	1.89 - 4.41	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.181	3.28	0.466	
5115	Tetrachloroethylene	µg/L	7.67	8.56	5.14 - 12.0	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.72	8.28	0.853	
5140	Toluene	µg/L	4.29	4.84	2.90 - 6.78	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.25	4.76	0.378	
5155	1,2,4-Trichlorobenzene	µg/L	6.27	6.62	3.97 - 9.27	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.5	6.73	0.912	
5160	1,1,1-Trichloroethane	µg/L	10.4	11.7	9.36 - 14.0	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.07	11.6	1.18	
5165	1,1,2-Trichloroethane	µg/L	17.3	18.2	14.6 - 21.8	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.429	17.9	1.34	
5170	Trichloroethylene	µg/L	9.93	10.6	8.48 - 12.7	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.425	10.3	0.909	
5235	Vinyl chloride	µg/L	21.4	20.8	12.5 - 29.1	Acceptable	EPA 524.3 1 2009	2/6/2013	0.0958	21.0	3.64	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
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Study Dates:	**01/07/13 - 02/21/13**

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Regulated Volatiles (cat# 840) (Continued)												
5260	Xylenes, total	µg/L	38.3	39.8	31.8 - 47.8	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.533	40.0	3.13	

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ERA
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Suite 100
Monrovia, CA 91016
626-386-1170

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WS Unregulated Volatiles (cat# 841)												
4385	Bromobenzene	µg/L	7.31	7.39	4.43 - 10.3	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.0362	7.33	0.651	
4390	Bromochloromethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
4950	Bromomethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
5000	tert-Butyl methyl ether (MTBE)	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
4435	n-Butylbenzene	µg/L	17.8	19.4	15.5 - 23.3	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.711	19.4	2.25	
4440	sec-Butylbenzene	µg/L	6.53	6.97	4.18 - 9.76	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.693	7.05	0.752	
4445	tert-Butylbenzene	µg/L	4.53	4.96	2.98 - 6.94	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.652	4.94	0.632	
4485	Chloroethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
4960	Chloromethane	µg/L	13.1	14.0	8.40 - 19.6	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.234	13.7	2.67	
4535	2-Chlorotoluene	µg/L	5.45	5.96	3.58 - 8.34	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.908	6.04	0.654	
4540	4-Chlorotoluene	µg/L	11.4	11.9	9.52 - 14.3	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.753	12.2	1.00	
4595	Dibromomethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
4615	1,3-Dichlorobenzene	µg/L	9.30	9.48	5.69 - 13.3	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.29	9.56	0.913	
4625	Dichlorodifluoromethane (Freon 12)	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
4630	1,1-Dichloroethane	µg/L	6.09	6.75	4.05 - 9.45	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.96	6.70	0.634	
4660	1,3-Dichloropropane	µg/L	8.67	8.85	5.31 - 12.4	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.0791	8.73	0.762	
4665	2,2-Dichloropropane	µg/L	14.5	18.2	14.6 - 21.8	Not Acceptable	EPA 524.2 4.1 1995	1/25/2013	-1.33	17.8	2.53	
4670	1,1-Dichloropropene	µg/L	11.2	13.4	10.7 - 16.1	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-1.23	13.1	1.58	
4680	cis-1,3-Dichloropropene	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
4685	trans-1,3-Dichloropropene	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	1/25/2013				

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750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Unregulated Volatiles (cat# 841) (Continued)												
5175	Fluorotrichloromethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
4835	Hexachlorobutadiene	µg/L	9.22	9.44	5.66 - 13.2	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.104	9.32	1.02	
4900	Isopropylbenzene	µg/L	12.1	14.0	11.2 - 16.8	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-1.19	14.0	1.63	
4910	4-Isopropyltoluene	µg/L	15.0	16.4	13.1 - 19.7	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.88	16.7	1.95	
5005	Naphthalene	µg/L	25.3	24.1	16.9 - 31.3	Acceptable	EPA 524.2 4.1 1995	1/25/2013	0.639	23.4	2.94	
5090	n-Propylbenzene	µg/L	6.37	6.92	4.15 - 9.69	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.894	7.07	0.780	
5105	1,1,1,2-Tetrachloroethane	µg/L	7.58	8.37	5.02 - 11.7	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.661	8.27	1.04	
5110	1,1,2,2-Tetrachloroethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
5150	1,2,3-Trichlorobenzene	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	1/25/2013				
5180	1,2,3-Trichloropropane (TCP)	µg/L	3.21	3.19	1.91 - 4.47	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.0104	3.21	0.416	
5210	1,2,4-Trimethylbenzene	µg/L	7.86	8.55	5.13 - 12.0	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.75	8.58	0.966	
5215	1,3,5-Trimethylbenzene	µg/L	4.26	4.77	2.86 - 6.68	Acceptable	EPA 524.2 4.1 1995	1/25/2013	-0.942	4.79	0.561	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Unregulated Volatiles (cat# 841)												
4385	Bromobenzene	µg/L	6.69	7.39	4.43 - 10.3	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.989	7.33	0.651	
4390	Bromochloromethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	2/6/2013				
4950	Bromomethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	2/6/2013				
5000	tert-Butyl methyl ether (MTBE)	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	2/7/2013				
4435	n-Butylbenzene	µg/L	18.4	19.4	15.5 - 23.3	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.445	19.4	2.25	
4440	sec-Butylbenzene	µg/L	6.33	6.97	4.18 - 9.76	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.959	7.05	0.752	
4445	tert-Butylbenzene	µg/L	4.44	4.96	2.98 - 6.94	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.794	4.94	0.632	
4485	Chloroethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	2/6/2013				
4960	Chloromethane	µg/L	13.9	14.0	8.40 - 19.6	Acceptable	EPA 524.3 1 2009	2/6/2013	0.0658	13.7	2.67	
4535	2-Chlorotoluene	µg/L	5.34	5.96	3.58 - 8.34	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.08	6.04	0.654	
4540	4-Chlorotoluene	µg/L	11.1	11.9	9.52 - 14.3	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.05	12.2	1.00	
4595	Dibromomethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	2/6/2013				
4615	1,3-Dichlorobenzene	µg/L	8.50	9.48	5.69 - 13.3	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.17	9.56	0.913	
4625	Dichlorodifluoromethane (Freon 12)	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	2/6/2013				
4630	1,1-Dichloroethane	µg/L	6.26	6.75	4.05 - 9.45	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.692	6.70	0.634	
4660	1,3-Dichloropropane	µg/L	8.22	8.85	5.31 - 12.4	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.67	8.73	0.762	
4665	2,2-Dichloropropane	µg/L		18.2	14.6 - 21.8	Not Reported				17.8	2.53	
4670	1,1-Dichloropropene	µg/L	11.8	13.4	10.7 - 16.1	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.847	13.1	1.58	
4680	cis-1,3-Dichloropropene	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	2/6/2013				
4685	trans-1,3-Dichloropropene	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	2/6/2013				

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WS Unregulated Volatiles (cat# 841) (Continued)												
5175	Fluorotrichloromethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	2/6/2013				
4835	Hexachlorobutadiene	µg/L	8.99	9.44	5.66 - 13.2	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.33	9.32	1.02	
4900	Isopropylbenzene	µg/L	12.9	14.0	11.2 - 16.8	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.702	14.0	1.63	
4910	4-Isopropyltoluene	µg/L	15.1	16.4	13.1 - 19.7	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.829	16.7	1.95	
5005	Naphthalene	µg/L	24.6	24.1	16.9 - 31.3	Acceptable	EPA 524.3 1 2009	2/6/2013	0.401	23.4	2.94	
5090	n-Propylbenzene	µg/L	6.03	6.92	4.15 - 9.69	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.33	7.07	0.780	
5105	1,1,1,2-Tetrachloroethane	µg/L	6.51	8.37	5.02 - 11.7	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.69	8.27	1.04	
5110	1,1,2,2-Tetrachloroethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	2/6/2013				
5150	1,2,3-Trichlorobenzene	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	2/6/2013				
5180	1,2,3-Trichloropropane (TCP)	µg/L	3.15	3.19	1.91 - 4.47	Acceptable	EPA 524.3 1 2009	2/6/2013	-0.155	3.21	0.416	
5210	1,2,4-Trimethylbenzene	µg/L	7.58	8.55	5.13 - 12.0	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.04	8.58	0.966	
5215	1,3,5-Trimethylbenzene	µg/L	4.20	4.77	2.86 - 6.68	Acceptable	EPA 524.3 1 2009	2/6/2013	-1.05	4.79	0.561	

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WS Pesticides (cat# 850)												
7005	Alachlor	µg/L	4.49	4.34	2.39 - 6.29	Acceptable	EPA 525.2 2 1995	1/29/2013	0.242	4.32	0.713	
7025	Aldrin	µg/L	1.55	1.61	0.723 - 2.05	Acceptable	EPA 525.2 2 1995	1/29/2013	0.507	1.36	0.379	
7065	Atrazine	µg/L	7.71	8.26	4.54 - 12.0	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.67	8.51	1.20	
7120	gamma-BHC (Lindane)	µg/L	0.638	0.710	0.390 - 1.03	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.618	0.704	0.107	
7130	Bromacil	µg/L	< 0.20	< 2.00	0.00 - 2.00	Acceptable	EPA 525.2 2 1995	1/29/2013				
7160	Butachlor	µg/L	9.66	8.23	4.53 - 11.9	Acceptable	EPA 525.2 2 1995	1/29/2013	0.700	8.40	1.80	
7410	Diazinon	µg/L	< 0.10	< 2.00	0.00 - 2.00	Acceptable	EPA 525.2 2 1995	1/29/2013				
7470	Dieldrin	µg/L	1.79	1.59	0.874 - 2.30	Acceptable	EPA 525.2 2 1995	1/29/2013	0.890	1.58	0.235	
7540	Endrin	µg/L	1.27	1.14	0.798 - 1.48	Acceptable	EPA 525.2 2 1995	1/29/2013	0.471	1.17	0.219	
7685	Heptachlor	µg/L	2.05	2.16	1.19 - 3.13	Acceptable	EPA 525.2 2 1995	1/29/2013	0.0765	2.02	0.380	
7690	Heptachlor epoxide (beta)	µg/L	1.64	1.84	1.01 - 2.67	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.644	1.81	0.266	
6275	Hexachlorobenzene	µg/L	3.64	4.02	2.03 - 5.00	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.0241	3.66	0.675	
6285	Hexachlorocyclopentadiene	µg/L	9.25	9.33	2.74 - 13.3	Acceptable	EPA 525.2 2 1995	1/29/2013	0.495	7.81	2.91	
7810	Methoxychlor	µg/L	4.58	4.47	2.46 - 6.48	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.0522	4.62	0.801	
7835	Metolachlor	µg/L	< 0.05	< 1.10	0.00 - 1.10	Acceptable	EPA 525.2 2 1995	1/29/2013				
7845	Metribuzin	µg/L	5.70	6.73	3.36 - 10.1	Acceptable	EPA 525.2 2 1995	1/29/2013	0.131	5.44	1.94	
7875	Molinate (Ordram)	µg/L	< 0.10	< 2.00	0.00 - 2.00	Acceptable	EPA 525.2 2 1995	1/29/2013				
8035	Prometon	µg/L		< 2.00	0.00 - 2.00	Not Reported						
8045	Propachlor	µg/L	6.93	7.07	3.89 - 10.2	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.11	7.08	1.38	
8125	Simazine	µg/L	6.61	7.19	3.95 - 10.4	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.533	7.59	1.84	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Pesticides (cat# 850) (Continued)												
8220	Thiobencarb	µg/L	< 0.20	< 2.00	0.00 - 2.00	Acceptable	EPA 525.2 2 1995	1/29/2013				
8295	Trifluralin	µg/L	2.99	3.69	2.03 - 5.35	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.528	3.34	0.666	

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WS Pesticides (cat# 850)												
7005	Alachlor	µg/L	4.30	4.34	2.39 - 6.29	Acceptable	EPA 505 2.1 1995	1/19/2013	-0.025	4.32	0.713	
7025	Aldrin	µg/L	1.55	1.61	0.723 - 2.05	Acceptable	EPA 505 2.1 1995	1/19/2013	0.507	1.36	0.379	
7065	Atrazine	µg/L		8.26	4.54 - 12.0	Not Reported				8.51	1.20	
7120	gamma-BHC (Lindane)	µg/L	0.712	0.710	0.390 - 1.03	Acceptable	EPA 505 2.1 1995	1/19/2013	0.0722	0.704	0.107	
7130	Bromacil	µg/L		< 2.00	0.00 - 2.00	Not Reported						
7160	Butachlor	µg/L		8.23	4.53 - 11.9	Not Reported				8.40	1.80	
7410	Diazinon	µg/L		< 2.00	0.00 - 2.00	Not Reported						
7470	Dieldrin	µg/L	1.41	1.59	0.874 - 2.30	Acceptable	EPA 505 2.1 1995	1/19/2013	-0.725	1.58	0.235	
7540	Endrin	µg/L	1.17	1.14	0.798 - 1.48	Acceptable	EPA 505 2.1 1995	1/19/2013	0.0135	1.17	0.219	
7685	Heptachlor	µg/L	1.89	2.16	1.19 - 3.13	Acceptable	EPA 505 2.1 1995	1/19/2013	-0.344	2.02	0.380	
7690	Heptachlor epoxide (beta)	µg/L	1.85	1.84	1.01 - 2.67	Acceptable	EPA 505 2.1 1995	1/19/2013	0.144	1.81	0.266	
6275	Hexachlorobenzene	µg/L		4.02	2.03 - 5.00	Not Reported				3.66	0.675	
6285	Hexachlorocyclopentadiene	µg/L		9.33	2.74 - 13.3	Not Reported				7.81	2.91	
7810	Methoxychlor	µg/L	3.62	4.47	2.46 - 6.48	Acceptable	EPA 505 2.1 1995	1/19/2013	-1.25	4.62	0.801	
7835	Metolachlor	µg/L		< 1.10	0.00 - 1.10	Not Reported						
7845	Metribuzin	µg/L		6.73	3.36 - 10.1	Not Reported				5.44	1.94	
7875	Molinate (Ordram)	µg/L		< 2.00	0.00 - 2.00	Not Reported						
8035	Prometon	µg/L		< 2.00	0.00 - 2.00	Not Reported						
8045	Propachlor	µg/L		7.07	3.89 - 10.2	Not Reported				7.08	1.38	
8125	Simazine	µg/L		7.19	3.95 - 10.4	Not Reported				7.59	1.84	

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QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Pesticides (cat# 850) (Continued)												
8220	Thiobencarb	µg/L		< 2.00	0.00 - 2.00	Not Reported						
8295	Trifluralin	µg/L		3.69	2.03 - 5.35	Not Reported				3.34	0.666	
WS Carbamate/Carbamoxyloxime Pesticides (cat# 846)												
7010	Aldicarb	µg/L	55.5	61.3	46.0 - 76.6	Acceptable	EPA 531.2 1 2001	1/16/2013	-0.822	61.3	7.11	
7015	Aldicarb sulfone	µg/L	34.4	39.4	29.6 - 49.2	Acceptable	EPA 531.2 1 2001	1/16/2013	-1.14	39.2	4.18	
7020	Aldicarb sulfoxide	µg/L	27.0	30.9	23.2 - 38.6	Acceptable	EPA 531.2 1 2001	1/16/2013	-0.191	27.4	2.19	
8080	Baygon	µg/L	34.8	37.3	30.3 - 44.2	Acceptable	EPA 531.2 1 2001	1/16/2013	-0.645	36.8	3.18	
7195	Carbaryl	µg/L	33.3	34.8	26.1 - 43.5	Acceptable	EPA 531.2 1 2001	1/16/2013	0.0997	33.0	2.67	
7205	Carbofuran	µg/L	107	106	58.3 - 154	Acceptable	EPA 531.2 1 2001	1/16/2013	0.265	104	10.4	
7710	3-Hydroxycarbofuran	µg/L	20.2	21.4	17.1 - 25.7	Acceptable	EPA 531.2 1 2001	1/16/2013	-0.686	21.6	2.06	
7800	Methiocarb	µg/L	32.0	33.2	25.9 - 39.6	Acceptable	EPA 531.2 1 2001	1/16/2013	0.144	31.7	2.05	
7805	Methomyl	µg/L	23.7	25.5	20.4 - 30.6	Acceptable	EPA 531.2 1 2001	1/16/2013	-1.03	26.0	2.20	
7940	Oxamyl (vydate)	µg/L	52.5	52.6	39.4 - 65.8	Acceptable	EPA 531.2 1 2001	1/16/2013	0.0881	52.1	4.24	
WS Chlordane (cat# 845)												
7250	Chlordane, technical	µg/L	11.3	11.8	6.49 - 17.1	Acceptable	EPA 505 2.1 1995	1/19/2013	0.230	10.9	1.80	
WS Chlordane (cat# 845)												
7250	Chlordane, technical	µg/L	12.2	11.8	6.49 - 17.1	Acceptable	EPA 525.2 2 1995	2/6/2013	0.729	10.9	1.80	
WS Toxaphene (cat# 844)												
8250	Toxaphene	µg/L	19.3	14.6	8.03 - 21.2	Acceptable	EPA 505 2.1 1995	1/19/2013	1.82	14.5	2.64	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS EDB/DBCP/TCP (cat# 847)												
4570	Dibromochloropropane (DBCP)	µg/L	0.261	0.258	0.155 - 0.361	Acceptable	EPA 504.1 1.1 1995	1/16/2013	-0.0802	0.264	0.0427	
4585	Ethylene Dibromide (EDB)	µg/L	1.25	1.31	0.786 - 1.83	Acceptable	EPA 504.1 1.1 1995	1/17/2013	0.101	1.23	0.168	
5180	1,2,3-Trichloropropane (TCP)	µg/L	0.892	0.949	0.569 - 1.33	Acceptable	EPA 504.1 1.1 1995	1/16/2013	-0.39	0.938	0.119	
WS EDB/DBCP/TCP (cat# 847)												
4570	Dibromochloropropane (DBCP)	µg/L	0.261	0.258	0.155 - 0.361	Acceptable	EPA 551.1 1 1992	1/22/2013	-0.0802	0.264	0.0427	
4585	Ethylene Dibromide (EDB)	µg/L	1.36	1.31	0.786 - 1.83	Acceptable	EPA 551.1 1 1992	1/23/2013	0.756	1.23	0.168	
5180	1,2,3-Trichloropropane (TCP)	µg/L		0.949	0.569 - 1.33	Not Reported				0.938	0.119	
WS EDB/DBCP/TCP (cat# 847)												
4570	Dibromochloropropane (DBCP)	µg/L	0.303	0.258	0.155 - 0.361	Acceptable	EPA 8011 1994	1/17/2013	0.903	0.264	0.0427	
4585	Ethylene Dibromide (EDB)	µg/L	1.46	1.31	0.786 - 1.83	Acceptable	EPA 8011 1994	1/17/2013	1.35	1.23	0.168	
5180	1,2,3-Trichloropropane (TCP)	µg/L		0.949	0.569 - 1.33	Not Reported				0.938	0.119	
WS EDB/DBCP/TCP (cat# 847)												
4570	Dibromochloropropane (DBCP)	µg/L		0.258	0.155 - 0.361	Not Reported				0.264	0.0427	
4585	Ethylene Dibromide (EDB)	µg/L		1.31	0.786 - 1.83	Not Reported				1.23	0.168	
5180	1,2,3-Trichloropropane (TCP)	µg/L	1.01	0.949	0.569 - 1.33	Acceptable	EPA 524.2 4.1 1995	1/28/2013	0.601	0.938	0.119	
WS Dioxin (cat# 857)												
9618	2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/L	57.6	58.7	33.6 - 70.8	Acceptable	EPA 1613 1994	1/16/2013	-0.617	60.4	4.59	
WS Dioxin (cat# 857)												
9618	2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/L	57.6	58.7	33.6 - 70.8	Acceptable	EPA 1613B Appendix A 1997	1/16/2013	-0.617	60.4	4.59	

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Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS PCBs as Decachlorobiphenyl (cat# 839)												
8880	Aroclor 1016	µg/L	< 0.08	< 0.260	0.00 - 0.260	Acceptable	EPA 505 2.1 1995	1/19/2013				
8885	Aroclor 1221	µg/L	< 0.10	< 0.190	0.00 - 0.190	Acceptable	EPA 505 2.1 1995	1/19/2013				
8890	Aroclor 1232	µg/L	< 0.10	< 0.230	0.00 - 0.230	Acceptable	EPA 505 2.1 1995	1/19/2013				
8895	Aroclor 1242	µg/L	< 0.10	< 0.260	0.00 - 0.260	Acceptable	EPA 505 2.1 1995	1/19/2013				
8900	Aroclor 1248	µg/L	3.55	2.95	1.69 - 3.62	Acceptable	EPA 505 2.1 1995	1/19/2013	1.30	2.80	0.578	
8905	Aroclor 1254	µg/L	< 0.10	< 0.330	0.00 - 0.330	Acceptable	EPA 505 2.1 1995	1/19/2013				
8910	Aroclor 1260	µg/L	< 0.10	< 0.360	0.00 - 0.360	Acceptable	EPA 505 2.1 1995	1/19/2013				
8872	PCB Aroclor Identity	Identity	1248	1248		Acceptable	EPA 505 2.1 1995	1/19/2013	0			
9105	PCB as Decachlorobiphenyl	µg/L		4.92	0.492 - 9.84	Not Reported				3.68	1.67	

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750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Regulated Semivolatiles Ampule #1 (cat# 848)												
5500	Acenaphthene	µg/L	5.02	4.91	2.44 - 6.16	Acceptable	EPA 525.2 2 1995	1/29/2013	1.51	4.78	0.157	
5505	Acenaphthylene	µg/L	6.97	7.19	3.39 - 9.66	Acceptable	EPA 525.2 2 1995	1/29/2013	0.258	6.78	0.752	
5555	Anthracene	µg/L	1.19	1.20	0.521 - 1.56	Acceptable	EPA 525.2 2 1995	1/29/2013	0.153	1.15	0.247	
5575	Benzo(a)anthracene	µg/L	4.96	4.88	2.69 - 6.18	Acceptable	EPA 525.2 2 1995	1/29/2013	0.521	4.36	1.14	
5585	Benzo(b)fluoranthene	µg/L	1.29	1.53	0.815 - 2.11	Acceptable	EPA 525.2 2 1995	1/29/2013	-1.63	1.50	0.127	
5600	Benzo(k)fluoranthene	µg/L	1.48	1.51	0.818 - 2.04	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.244	1.51	0.129	
5590	Benzo(g,h,i)perylene	µg/L	1.45	1.56	0.705 - 2.23	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.222	1.48	0.112	
5580	Benzo(a)pyrene	µg/L	1.05	1.32	0.515 - 1.71	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.219	1.11	0.290	
5670	Butylbenzylphthalate	µg/L	36.9	29.8	16.2 - 43.3	Acceptable	EPA 525.2 2 1995	1/29/2013	0.780	31.2	7.27	
5855	Chrysene	µg/L	2.30	2.42	1.38 - 3.11	Acceptable	EPA 525.2 2 1995	1/29/2013	0.104	2.29	0.128	
5895	Dibenz(a,h)anthracene	µg/L	6.16	5.59	2.59 - 8.03	Acceptable	EPA 525.2 2 1995	1/29/2013	0.946	5.57	0.622	
6070	Diethylphthalate	µg/L	32.0	33.6	18.1 - 47.5	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.136	32.6	4.19	
6135	Dimethylphthalate	µg/L	17.3	18.9	9.05 - 26.0	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.207	17.8	2.67	
5925	Di-n-butylphthalate	µg/L	47.8	41.0	22.4 - 59.0	Acceptable	EPA 525.2 2 1995	1/29/2013	0.771	41.0	8.85	
6200	Di-n-octylphthalate	µg/L	20.6	23.1	11.4 - 32.2	Acceptable	EPA 525.2 2 1995	1/29/2013	0.0379	20.3	6.77	
6062	bis(2-Ethylhexyl)adipate	µg/L	9.12	8.88	3.14 - 13.4	Acceptable	EPA 525.2 2 1995	1/29/2013	0.102	8.94	1.72	
6065	bis(2-Ethylhexyl)phthalate	µg/L	36.8	34.0	17.2 - 48.0	Acceptable	EPA 525.2 2 1995	1/29/2013	0.429	32.5	10.1	
6265	Fluoranthene	µg/L	8.18	8.10	3.90 - 10.9	Acceptable	EPA 525.2 2 1995	1/29/2013	0.525	7.76	0.794	
6270	Fluorene	µg/L	2.77	2.71	1.58 - 3.47	Acceptable	EPA 525.2 2 1995	1/29/2013	-0.287	2.86	0.314	
6315	Indeno(1,2,3-cd)pyrene	µg/L	5.82	5.16	2.24 - 7.38	Acceptable	EPA 525.2 2 1995	1/29/2013	1.23	5.17	0.530	

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WS Regulated Semivolatiles Ampule #1 (cat# 848) (Continued)												
5005	Naphthalene	µg/L	2.72	2.37	0.960 - 3.03	Acceptable	EPA 525.2 2 1995	1/29/2013	1.95	2.47	0.128	
6615	Phenanthrene	µg/L	9.05	8.97	5.70 - 11.3	Acceptable	EPA 525.2 2 1995	1/29/2013	0.603	8.47	0.963	
6665	Pyrene	µg/L	1.89	1.89	1.13 - 2.44	Acceptable	EPA 525.2 2 1995	1/29/2013	0.246	1.83	0.246	
WS Chlorinated Acid Herbicides (cat# 851)												
8505	Acifluorfen	µg/L	46.0	45.9	23.0 - 68.8	Acceptable	EPA 515.4 1 2000	1/15/2013	-0.69	50.0	5.74	
8530	Bentazon	µg/L	36.6	39.4	20.4 - 53.6	Acceptable	EPA 515.4 1 2000	1/15/2013	-0.303	39.1	8.33	
8540	Chloramben	µg/L		33.9	9.08 - 46.0	Not Reported				31.6	4.90	
8545	2,4-D	µg/L	17.4	16.6	8.30 - 24.9	Acceptable	EPA 515.4 1 2000	1/15/2013	0.208	16.7	3.42	
8550	Dacthal diacid (DCPA)	µg/L	30.9	28.3	10.5 - 45.9	Acceptable	EPA 515.4 1 2000	1/15/2013	0.900	25.3	6.25	
8555	Dalapon	µg/L	49.7	45.0	22.5 - 67.5	Acceptable	EPA 515.4 1 2000	1/15/2013	1.04	42.4	6.96	
8560	2,4-DB	µg/L	24.7	29.9	15.0 - 44.8	Acceptable	EPA 515.4 1 2000	1/15/2013	-1.4	30.2	3.94	
8595	Dicamba	µg/L	49.4	40.9	20.4 - 61.4	Acceptable	EPA 515.4 1 2000	1/15/2013	1.18	40.3	7.73	
8600	3,5-Dichlorobenzoic acid	µg/L	26.3	25.9	12.3 - 34.3	Acceptable	EPA 515.4 1 2000	1/15/2013	0.572	24.2	3.64	
8605	Dichlorprop	µg/L	25.1	24.5	11.2 - 33.8	Acceptable	EPA 515.4 1 2000	1/15/2013	0.301	23.8	4.22	
8620	Dinoseb	µg/L	32.4	33.0	11.5 - 46.2	Acceptable	EPA 515.4 1 2000	1/15/2013	-0.0211	32.5	4.93	
6500	4-Nitrophenol	µg/L		11.8	1.18 - 15.9	Not Reported				8.76	1.94	
6605	Pentachlorophenol	µg/L	11.5	12.2	6.10 - 18.3	Acceptable	EPA 515.4 1 2000	1/15/2013	-0.491	12.2	1.40	
8645	Picloram	µg/L	18.5	16.8	8.40 - 25.2	Acceptable	EPA 515.4 1 2000	1/15/2013	0.580	16.7	3.12	
8655	2,4,5-T	µg/L	43.7	44.4	22.2 - 66.6	Acceptable	EPA 515.4 1 2000	1/15/2013	0.310	42.2	4.99	
8650	2,4,5-TP (Silvex)	µg/L	16.8	18.6	9.30 - 27.9	Acceptable	EPA 515.4 1 2000	1/15/2013	-0.489	18.5	3.42	

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WS Chlorinated Acid Herbicides (cat# 851)												
8505	Acifluorfen	µg/L		45.9	23.0 - 68.8	Not Reported				50.0	5.74	
8530	Bentazon	µg/L		39.4	20.4 - 53.6	Not Reported				39.1	8.33	
8540	Chloramben	µg/L		33.9	9.08 - 46.0	Not Reported				31.6	4.90	
8545	2,4-D	µg/L		16.6	8.30 - 24.9	Not Reported				16.7	3.42	
8550	Dacthal diacid (DCPA)	µg/L		28.3	10.5 - 45.9	Not Reported				25.3	6.25	
8555	Dalapon	µg/L	48.9	45.0	22.5 - 67.5	Acceptable	EPA 552.3 1 2003	1/22/2013	0.926	42.4	6.96	
8560	2,4-DB	µg/L		29.9	15.0 - 44.8	Not Reported				30.2	3.94	
8595	Dicamba	µg/L		40.9	20.4 - 61.4	Not Reported				40.3	7.73	
8600	3,5-Dichlorobenzoic acid	µg/L		25.9	12.3 - 34.3	Not Reported				24.2	3.64	
8605	Dichlorprop	µg/L		24.5	11.2 - 33.8	Not Reported				23.8	4.22	
8620	Dinoseb	µg/L		33.0	11.5 - 46.2	Not Reported				32.5	4.93	
6500	4-Nitrophenol	µg/L		11.8	1.18 - 15.9	Not Reported				8.76	1.94	
6605	Pentachlorophenol	µg/L		12.2	6.10 - 18.3	Not Reported				12.2	1.40	
8645	Picloram	µg/L		16.8	8.40 - 25.2	Not Reported				16.7	3.12	
8655	2,4,5-T	µg/L		44.4	22.2 - 66.6	Not Reported				42.2	4.99	
8650	2,4,5-TP (Silvex)	µg/L		18.6	9.30 - 27.9	Not Reported				18.5	3.42	

WS-198 2003 NELAC Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
Report Issued:	**03/08/13**
Study Dates:	**01/07/13 - 02/21/13**

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Chlorinated Acid Herbicides (cat# 851)												
8505	Acifluorfen	µg/L		45.9	23.0 - 68.8	Not Reported				50.0	5.74	
8530	Bentazon	µg/L		39.4	20.4 - 53.6	Not Reported				39.1	8.33	
8540	Chloramben	µg/L		33.9	9.08 - 46.0	Not Reported				31.6	4.90	
8545	2,4-D	µg/L		16.6	8.30 - 24.9	Not Reported				16.7	3.42	
8550	Dacthal diacid (DCPA)	µg/L		28.3	10.5 - 45.9	Not Reported				25.3	6.25	
8555	Dalapon	µg/L		45.0	22.5 - 67.5	Not Reported				42.4	6.96	
8560	2,4-DB	µg/L		29.9	15.0 - 44.8	Not Reported				30.2	3.94	
8595	Dicamba	µg/L		40.9	20.4 - 61.4	Not Reported				40.3	7.73	
8600	3,5-Dichlorobenzoic acid	µg/L		25.9	12.3 - 34.3	Not Reported				24.2	3.64	
8605	Dichlorprop	µg/L		24.5	11.2 - 33.8	Not Reported				23.8	4.22	
8620	Dinoseb	µg/L		33.0	11.5 - 46.2	Not Reported				32.5	4.93	
6500	4-Nitrophenol	µg/L		11.8	1.18 - 15.9	Not Reported				8.76	1.94	
6605	Pentachlorophenol	µg/L	13.6	12.2	6.10 - 18.3	Acceptable	EPA 525.2 2 1995	1/29/2013	1.01	12.2	1.40	
8645	Picloram	µg/L		16.8	8.40 - 25.2	Not Reported				16.7	3.12	
8655	2,4,5-T	µg/L		44.4	22.2 - 66.6	Not Reported				42.2	4.99	
8650	2,4,5-TP (Silvex)	µg/L		18.6	9.30 - 27.9	Not Reported				18.5	3.42	
WS Regulated Semivolatiles #2 Herbicides (cat# 849)												
9390	Diquat	µg/L	9.62	16.5	8.25 - 24.8	Acceptable	EPA 549.2 1 1997	1/16/2013	-1.57	13.1	2.22	
7525	Endothall	µg/L	212	332	166 - 498	Acceptable	EPA 548.1 1 1992	1/17/2013	-1.37	302	65.8	
9411	Glyphosate	µg/L	423	382	306 - 458	Acceptable	EPA 547 1990	1/18/2013	0.390	406	43.0	
9528	Paraquat	µg/L	16.2	33.8	14.8 - 42.4	Acceptable	EPA 549.2 1 1997	1/16/2013	-0.632	19.9	5.90	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

ERA

A Waters Company

Nilda B. Cox
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016

WS-204 Final Report

WatR™ Supply Proficiency Testing

WatR™ Supply Study

Open Date: 07/08/13

Close Date: 08/22/13

Report Issued Date: 08/26/13

A Waters Company

August 26, 2013

Nilda B. Cox
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016

Enclosed is your final report for ERA's WS-204 WatR™Supply Proficiency Testing (PT) study. Your final report includes an evaluation of all results submitted by your laboratory to ERA.

Data Evaluation Protocols: All analytes in ERA's WS-204 WatR™Supply Proficiency Testing (PT) study have been evaluated using the following tiered approach. If the analyte is listed in the current TNI Fields of Proficiency Testing (FoPT) tables, the evaluation was completed by comparing the reported result to the acceptance limits generated using the criteria contained in the TNI FoPT tables. If the analyte is not included in the TNI FoPT tables, the reported result has been evaluated using the procedures outlined in ERA's Standard Operating Procedure for the Generation of Performance Acceptance Limits (SOP 0260).

Corrective Action Help: As part of your accreditation(s), you may be required to identify the root cause of any "Not Acceptable" results, implement the necessary corrective actions, and then satisfy your PT requirements by participating in a Supplemental (QuiK™Response) or future ERA PT study. ERA's technical staff is available to help your laboratory resolve any technical issues that may be impairing your PT performance and possibly affecting your routine data quality. Our laboratory and technical staff have many years of collective experience in performing the full range of environmental analyses. As part of our technical support, ERA offers QC samples that can be useful in helping you work through your technical issues.

Please note the following changes to our final reports:

• At the request of the TNI Accreditation Council, we have included a Laboratory Exception Report that includes a list of all analytes reported with less than qualifiers when the assigned value was greater than "0." In addition, because we have received many requests from laboratories, this report also includes a list of all analytes with "Not Acceptable" evaluations.

• Some states have elected not to convert to the 2009 TNI Standards at this time. If you have released your results to a state that has retained the 2003 NELAC Evaluation Criteria, your final report will include a section that evaluates the results according to the 2003 Standard in addition to the 2009 TNI Standards.

Thank you for your participation in ERA's WS-204 WatR™Supply Proficiency Testing study. If you have any questions, please contact our Proficiency Testing Department at 1-800-372-0122.

Sincerely,

Kristina Sanchez
Quality Officer

attachments

A Waters Company

Report Recipient	Contact/Phone Number	Reporting Type	Evaluation Type
Arizona	Ali Mayfield / (602) 364-0728	Custom Reporting	2009 TNI
California ELAP	Fred Choske / 510-620-3175	Custom Reporting	2009 TNI
EPA Region 8	Marcie Tidd / (303) 312-7764	Custom Reporting	2009 TNI
Georgia	Lynne Grubb / 404-657-3189	Custom Reporting	2009 TNI
Guam	Rodolfo Paulino / 671-475-1655	Custom Reporting	2009 TNI
Mariana Island	Vinson Sablan / 670-664-8520	Custom Reporting	2009 TNI
Michigan (WS)	Greg Lundy / 517-335-9219	Custom Reporting	2009 TNI
Mississippi	Phyllis Givens / 601-576-7582	Custom Reporting	2009 TNI
Montana	Russell Leu / 406-444-5259	Custom Reporting	2009 TNI
Nevada	Sara Rairick / 775-687-9490	Custom Reporting	2003 NELAC
New Jersey	Rachel Ellis / 609-777-1749	Custom Reporting	2009 TNI
New York	Dan Dickinson / 518-485-5570	Custom Reporting	2003 NELAC
North Carolina (WS)	Chris Goforth / 919-807-8871	Custom Reporting	2009 TNI

WS-204 Definitions & Study Discussion

Study Dates: 07/08/13 - 08/22/13

Report Issued: 08/26/13

WS Study Definitions

The Reported Value is the value that the laboratory reported to ERA.

The ERA Assigned Values are compliant with the current TNI Fields of Proficiency Testing (FoPT) tables. A parameter not added to the standard is given an Assigned Value of "< PTRL" per the guidelines contained in the 2009 TNI Standards. The assigned values are directly traceable to the commercially prepared starting materials used to manufacture the PT standards.

The Acceptance Limits are established per the criteria contained in the most current TNI FoPT tables, or ERA's SOP for the Generation of Performance Acceptance Limits™ as applicable.

The Performance Evaluation:

Acceptable	= Reported Value falls within the Acceptance Limits.
Not Acceptable	= Reported Value falls outside the Acceptance Limits.
No Evaluation	= Reported Value cannot be evaluated.
Not Reported	= No Value reported.

The Method Description is the method the laboratory reported to ERA.

WS Study Discussion

ERA's WS-204 WatR™Supply Proficiency Testing study has been reviewed by ERA senior management and certified compliant with the requirements of the 2009 TNI PT Standards and the criteria contained in the most current TNI Fields of Proficiency Testing (FoPT) tables.

ERA's WS-204 WatR™Supply study standards were examined for any anomalies. A full review of all homogeneity, stability and accuracy verification data was completed. All analytical verification data for all analytes in the standards met the acceptance criteria contained in the 2009 TNI PT Standard and the criteria contained in the most current TNI FoPT tables.

The data submitted by participating laboratories was also examined for study anomalies. There were no anomalies observed during the statistical review of the data.

If you have any questions or concerns regarding your assessment in ERA's WatR™Supply Proficiency Testing program, please contact our Proficiency Testing Department at 1-800-372-0122.

WS-204 Laboratory Exception Report

ERA
A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
ERA Customer Number:	M327601
Report Issued:	08/26/13
Study Dates:	07/08/13 - 08/22/13

2009 TNI Evaluation Checks

There are no values reported with < where the assigned value was greater than 0.

2009 TNI Not Acceptable Evaluations

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WS Vanadium (cat# 856)							
1185	Vanadium	µg/L	10.9	12.7	11.1 - 14.2	Not Acceptable	EPA 200.8 5.4 1994
WS Inorganic Disinfection #1 (cat# 5270)							
1595	Chlorite	µg/L	302	231	162 - 300	Not Acceptable	EPA 317.0 2
WS o-Phosphate Nutrients (cat# 558)							
1870	ortho-Phosphate as P	mg/L	1.37	1.16	0.986 - 1.33	Not Acceptable	EPA 365.1 2 1993
1870	ortho-Phosphate as P	mg/L	1.37	1.16	0.986 - 1.33	Not Acceptable	SM4500P E 20th ED 1997
1870	ortho-Phosphate as P	mg/L	1.37	1.16	0.986 - 1.33	Not Acceptable	SM4500P E 22nd ED 2011
1870	ortho-Phosphate as P	mg/L	1.37	1.16	0.986 - 1.33	Not Acceptable	SM4500P F 22nd ED 2011
WS Turbidity (cat# 592)							
2055	Turbidity	NTU	6.88	6.00	5.10 - 6.72	Not Acceptable	EPA 180.1 2 1993
2055	Turbidity	NTU	6.88	6.00	5.10 - 6.72	Not Acceptable	SM2130B 20th ED 1994
2055	Turbidity	NTU	6.88	6.00	5.10 - 6.72	Not Acceptable	SM2130B 22nd ED 2011
WS Chloral Hydrate (cat# 853)							
4460	Chloral Hydrate	µg/L	36.9	19.5	4.22 - 31.2	Not Acceptable	EPA 551.1 1 1992
WS Halomethanes (THMs) (cat# 842)							
4395	Bromodichloromethane	µg/L	51.4	42.4	33.9 - 50.9	Not Acceptable	EPA 524.2 4.1 1995

WS-204 Laboratory Exception Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
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2009 TNI Not Acceptable Evaluations

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WS Halomethanes (THMs) (cat# 842)							
4400	Bromoform	µg/L	11.1	8.98	7.18 - 10.8	Not Acceptable	EPA 524.2 4.1 1995
4505	Chloroform	µg/L	30.1	24.7	19.8 - 29.6	Not Acceptable	EPA 524.2 4.1 1995
WS Toxaphene (cat# 844)							
8250	Toxaphene	µg/L	14.1	8.66	4.76 - 12.6	Not Acceptable	EPA 505 2.1 1995
WS EDB/DBCP/TCP (cat# 847)							
4570	Dibromochloropropane (DBCP)	µg/L	1.19	0.812	0.487 - 1.14	Not Acceptable	EPA 551.1 1 1992

Final Report Results For Laboratory
Eurofins Eaton Analytical, Inc - Monrovia

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

A Waters Company

2009 TNI Evaluation Report

Study: **WS-204**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

Inorganic Results

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

WS-204 2009 TNI Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 08/26/13
Study Dates: 07/08/13 - 08/22/13

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Hardness (cat# 555)												
1035	Calcium	mg/L	36.4	35.8	30.4 - 41.2	Acceptable	EPA 200.7 4.4 1994	8/7/2013	0.404	35.7	1.75	
1085	Magnesium	mg/L	9.72	9.33	7.93 - 10.7	Acceptable	EPA 200.7 4.4 1994	8/7/2013	0.728	9.29	0.584	
1155	Sodium	mg/L	34.5	33.0	28.0 - 38.0	Acceptable	EPA 200.7 4.4 1994	8/7/2013	0.709	33.2	1.90	
1550	Calcium Hardness as CaCO3	mg/L	90.9	89.5	76.1 - 103	Acceptable	EPA 200.7 4.4 1994	8/8/2013	0.232	89.9	4.37	
1755	Total Hardness as CaCO3	mg/L	131	128	109 - 147	Acceptable	EPA 200.7 4.4 1994	8/8/2013	0.663	128	4.66	
WS Hardness (cat# 555)												
1035	Calcium	mg/L		35.8	30.4 - 41.2	Not Reported				35.7	1.75	
1085	Magnesium	mg/L		9.33	7.93 - 10.7	Not Reported				9.29	0.584	
1155	Sodium	mg/L		33.0	28.0 - 38.0	Not Reported				33.2	1.90	
1550	Calcium Hardness as CaCO3	mg/L	90.9	89.5	76.1 - 103	Acceptable	SM2340B 20th ED 1997	8/8/2013	0.232	89.9	4.37	
1755	Total Hardness as CaCO3	mg/L	131	128	109 - 147	Acceptable	SM2340B 20th ED 1997	8/8/2013	0.663	128	4.66	
WS Hardness (cat# 555)												
1035	Calcium	mg/L		35.8	30.4 - 41.2	Not Reported				35.7	1.75	
1085	Magnesium	mg/L		9.33	7.93 - 10.7	Not Reported				9.29	0.584	
1155	Sodium	mg/L		33.0	28.0 - 38.0	Not Reported				33.2	1.90	
1550	Calcium Hardness as CaCO3	mg/L	90.9	89.5	76.1 - 103	Acceptable	SM2340B 22nd ED 2011	8/8/2013	0.232	89.9	4.37	
1755	Total Hardness as CaCO3	mg/L	131	128	109 - 147	Acceptable	SM2340B 22nd ED 2011	8/8/2013	0.663	128	4.66	

WS-204 2009 TNI Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
ERA Customer Number:	M327601
Report Issued:	08/26/13
Study Dates:	07/08/13 - 08/22/13

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Inorganics (cat# 591)												
1505	Alkalinity as CaCO3	mg/L	54.0	57.7	51.9 - 63.5	Acceptable	SM2320B 20th ED 1997	7/23/2013	-1.14	57.4	2.95	
1575	Chloride	mg/L	102	107	91.0 - 123	Acceptable	EPA 300.0 2.1 1993	7/24/2013	-0.672	105	3.96	
1610	Conductivity at 25°C	µmhos/cm	928	909	818 - 1000	Acceptable	SM2510B 20th ED 1997	7/23/2013	0.0883	926	19.0	
1730	Fluoride	mg/L	6.11	6.48	5.83 - 7.13	Acceptable	SM4500F- C 20th ED 1997	7/30/2013	-0.823	6.30	0.236	
1820	Nitrate + Nitrite as N	mg/L	8.30	8.74	7.43 - 10.0	Acceptable	EPA 300.0 2.1 1993	7/24/2013	-0.617	8.50	0.316	
1810	Nitrate as N	mg/L	8.30	8.74	7.87 - 9.61	Acceptable	EPA 300.0 2.1 1993	7/24/2013	-0.672	8.52	0.329	
1125	Potassium	mg/L	35.2	37.7	32.0 - 43.4	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-0.954	37.1	2.04	
2000	Sulfate	mg/L	152	158	134 - 182	Acceptable	EPA 300.0 2.1 1993	7/24/2013	-0.416	154	5.76	
1955	Total Dissolved Solids at 180°C	mg/L	608	614	491 - 737	Acceptable	SM2540C 20th ED 1997	7/25/2013	0.611	594	23.0	
WS Inorganics (cat# 591)												
1505	Alkalinity as CaCO3	mg/L	54.0	57.7	51.9 - 63.5	Acceptable	SM2320B 22nd ED 2011	7/23/2013	-1.14	57.4	2.95	
1575	Chloride	mg/L		107	91.0 - 123	Not Reported				105	3.96	
1610	Conductivity at 25°C	µmhos/cm	928	909	818 - 1000	Acceptable	SM2510B 22nd ED 2011	7/23/2013	0.0883	926	19.0	
1730	Fluoride	mg/L	6.11	6.48	5.83 - 7.13	Acceptable	SM4500F- C 22nd ED 2011	7/30/2013	-0.823	6.30	0.236	
1820	Nitrate + Nitrite as N	mg/L	8.16	8.74	7.43 - 10.0	Acceptable	EPA 353.2 2 1993	7/26/2013	-1.06	8.50	0.316	
1810	Nitrate as N	mg/L	8.16	8.74	7.87 - 9.61	Acceptable	EPA 353.2 2 1993	7/26/2013	-1.1	8.52	0.329	
1125	Potassium	mg/L		37.7	32.0 - 43.4	Not Reported				37.1	2.04	
2000	Sulfate	mg/L		158	134 - 182	Not Reported				154	5.76	
1955	Total Dissolved Solids at 180°C	mg/L	608	614	491 - 737	Acceptable	SM2540C 22nd ED 2011	7/25/2013	0.611	594	23.0	

WS-204 2009 TNI Evaluation Final Complete Report

ERA
A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
ERA Customer Number:	M327601
Report Issued:	08/26/13
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Inorganics (cat# 591)												
1505	Alkalinity as CaCO3	mg/L	54.0	57.7	51.9 - 63.5	Acceptable	SM2320B SM2320B-1997	7/23/2013	-1.14	57.4	2.95	
1575	Chloride	mg/L		107	91.0 - 123	Not Reported				105	3.96	
1610	Conductivity at 25°C	µmhos/cm	928	909	818 - 1000	Acceptable	SM2510B SM2510B-2011	7/23/2013	0.0883	926	19.0	
1730	Fluoride	mg/L	6.20	6.48	5.83 - 7.13	Acceptable	EPA 300.0 2.1 1993	8/6/2013	-0.441	6.30	0.236	
1820	Nitrate + Nitrite as N	mg/L		8.74	7.43 - 10.0	Not Reported				8.50	0.316	
1810	Nitrate as N	mg/L		8.74	7.87 - 9.61	Not Reported				8.52	0.329	
1125	Potassium	mg/L		37.7	32.0 - 43.4	Not Reported				37.1	2.04	
2000	Sulfate	mg/L		158	134 - 182	Not Reported				154	5.76	
1955	Total Dissolved Solids at 180°C	mg/L	608	614	491 - 737	Acceptable	SM2540C online	7/25/2013	0.611	594	23.0	
WS pH (cat# 552)												
1900	pH	S.U.	6.19	6.19	5.99 - 6.39	Acceptable	EPA 150.1 1983	7/23/2013	-0.38	6.20	0.0394	
WS pH (cat# 552)												
1900	pH	S.U.	6.19	6.19	5.99 - 6.39	Acceptable	SM4500H+ B 20th ED 1996	7/23/2013	-0.38	6.20	0.0394	
WS pH (cat# 552)												
1900	pH	S.U.	6.19	6.19	5.99 - 6.39	Acceptable	SM4500H+ B 22nd ED 2011	7/23/2013	-0.38	6.20	0.0394	

WS-204 2009 TNI Evaluation Final Complete Report

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
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Report Issued:	**08/26/13**
Study Dates:	**07/08/13 - 08/22/13**

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Metals (cat# 590)												
1000	Aluminum	µg/L	312	316	253 - 379	Acceptable	EPA 200.8 5.4 1994	8/14/2013	-0.474	320	17.8	
1005	Antimony	µg/L	34.5	36.6	25.6 - 47.6	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-0.741	36.2	2.31	
1010	Arsenic	µg/L	11.3	11.8	8.26 - 15.3	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-0.436	11.7	0.910	
1015	Barium	µg/L	838	855	727 - 983	Acceptable	EPA 200.8 5.4 1994	8/14/2013	-0.215	846	35.1	
1020	Beryllium	µg/L	9.93	10.2	8.67 - 11.7	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-0.323	10.1	0.472	
1025	Boron	µg/L		1320	1120 - 1520	Not Reported				1300	60.2	
1030	Cadmium	µg/L	32.5	33.9	27.1 - 40.7	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-0.519	33.2	1.46	
1040	Chromium	µg/L	160	163	138 - 187	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-0.343	162	6.95	
1055	Copper	µg/L	1270	1350	1220 - 1480	Acceptable	EPA 200.8 5.4 1994	8/14/2013	-1.06	1340	68.2	
1070	Iron	µg/L		1290	1100 - 1480	Not Reported				1290	58.9	
1075	Lead	µg/L	13.0	14.0	9.80 - 18.2	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-1.01	14.0	1.02	
1090	Manganese	µg/L	440	445	378 - 512	Acceptable	EPA 200.8 5.4 1994	8/14/2013	-0.722	454	19.1	
1100	Molybdenum	µg/L	94.6	102	86.7 - 117	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-1.09	99.1	4.13	
1105	Nickel	µg/L	246	253	215 - 291	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-0.398	251	12.1	
1140	Selenium	µg/L	21.0	21.2	17.0 - 25.4	Acceptable	EPA 200.8 5.4 1994	8/13/2013	0.114	20.8	1.54	
1150	Silver	µg/L	45.6	47.3	33.1 - 61.5	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-0.387	46.5	2.41	
1165	Thallium	µg/L	7.95	8.27	5.79 - 10.8	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-0.143	8.03	0.569	
1185	Vanadium	µg/L	452	466	396 - 536	Acceptable	EPA 200.8 5.4 1994	8/14/2013	-0.31	457	16.8	
1190	Zinc	µg/L	289	306	260 - 352	Acceptable	EPA 200.8 5.4 1994	8/14/2013	-1.1	307	16.2	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Metals (cat# 590)												
1000	Aluminum	µg/L	267	316	253 - 379	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-3.0	320	17.8	
1005	Antimony	µg/L		36.6	25.6 - 47.6	Not Reported				36.2	2.31	
1010	Arsenic	µg/L		11.8	8.26 - 15.3	Not Reported				11.7	0.910	
1015	Barium	µg/L	851	855	727 - 983	Acceptable	EPA 200.7 4.4 1994	8/7/2013	0.155	846	35.1	
1020	Beryllium	µg/L	9.91	10.2	8.67 - 11.7	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-0.366	10.1	0.472	
1025	Boron	µg/L	1150	1320	1120 - 1520	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-2.51	1300	60.2	
1030	Cadmium	µg/L	29.8	33.9	27.1 - 40.7	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-2.37	33.2	1.46	
1040	Chromium	µg/L	161	163	138 - 187	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-0.199	162	6.95	
1055	Copper	µg/L	1270	1350	1220 - 1480	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-1.06	1340	68.2	
1070	Iron	µg/L	1220	1290	1100 - 1480	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-1.23	1290	58.9	
1075	Lead	µg/L		14.0	9.80 - 18.2	Not Reported				14.0	1.02	
1090	Manganese	µg/L	464	445	378 - 512	Acceptable	EPA 200.7 4.4 1994	8/7/2013	0.534	454	19.1	
1100	Molybdenum	µg/L	91.5	102	86.7 - 117	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-1.84	99.1	4.13	
1105	Nickel	µg/L	256	253	215 - 291	Acceptable	EPA 200.7 4.4 1994	8/7/2013	0.429	251	12.1	
1140	Selenium	µg/L		21.2	17.0 - 25.4	Not Reported				20.8	1.54	
1150	Silver	µg/L	46.5	47.3	33.1 - 61.5	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-0.0141	46.5	2.41	
1165	Thallium	µg/L		8.27	5.79 - 10.8	Not Reported				8.03	0.569	
1185	Vanadium	µg/L	429	466	396 - 536	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-1.68	457	16.8	
1190	Zinc	µg/L	298	306	260 - 352	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-0.541	307	16.2	
WS Mercury (cat# 551)												
1095	Mercury	µg/L	3.81	3.75	2.62 - 4.88	Acceptable	EPA 245.1 3 1994	7/25/2013	0.371	3.69	0.317	

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QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Hexavalent Chromium (cat# 854)												
1045	Hexavalent Chromium	µg/L	14.5	15.1	12.1 - 18.1	Acceptable	EPA 218.6 3.3 1994	7/31/2013	-0.217	14.7	1.14	
WS Hexavalent Chromium (cat# 854)												
1045	Hexavalent Chromium	µg/L	15.0	15.1	12.1 - 18.1	Acceptable	SM3500Cr B 20th ED 1997	7/30/2013	0.224	14.7	1.14	
WS Hexavalent Chromium (cat# 854)												
1045	Hexavalent Chromium	µg/L	15.0	15.1	12.1 - 18.1	Acceptable	SM3500Cr B 22nd ED 2011	7/30/2013	0.224	14.7	1.14	
WS Vanadium (cat# 856)												
1185	Vanadium	µg/L	10.9	12.7	11.1 - 14.2	Not Acceptable	EPA 200.8 5.4 1994	8/13/2013	-2.29	12.4	0.672	
WS Vanadium (cat# 856)												
1185	Vanadium	µg/L	12.2	12.7	11.1 - 14.2	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-0.353	12.4	0.672	
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L	145	146	102 - 190	Acceptable	EPA 300.1 1 2000	7/25/2013	0.929	138	8.04	
1595	Chlorite	µg/L	236	231	162 - 300	Acceptable	EPA 300.1 1 2000	7/25/2013	-0.0446	237	18.7	
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L	141	146	102 - 190	Acceptable	EPA 300.0 2.1 1993	7/25/2013	0.431	138	8.04	
1595	Chlorite	µg/L	253	231	162 - 300	Acceptable	EPA 300.0 2.1 1993	7/25/2013	0.862	237	18.7	
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L		146	102 - 190	Not Reported				138	8.04	
1595	Chlorite	µg/L	302	231	162 - 300	Not Acceptable	EPA 317.0 2	7/25/2013	3.48	237	18.7	
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L	141	146	102 - 190	Acceptable	EPA 9056 1996	7/25/2013	0.431	138	8.04	
1595	Chlorite	µg/L		231	162 - 300	Not Reported				237	18.7	

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ERA
A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L	145	146	102 - 190	Acceptable	EPA 300.1 1997	7/25/2013	0.929	138	8.04	
1595	Chlorite	µg/L	236	231	162 - 300	Acceptable	EPA 300.1 1997	7/25/2013	-0.0446	237	18.7	
WS Inorganic Disinfection #2 (cat# 5260)												
1535	Bromate	µg/L	32.2	37.4	26.2 - 48.6	Acceptable	EPA 300.1 1 2000	7/25/2013	-1.89	36.4	2.22	
1540	Bromide	µg/L	100	106	90.1 - 122	Acceptable	EPA 300.1 1 2000	7/25/2013	-0.381	103	7.03	
WS Inorganic Disinfection #2 (cat# 5260)												
1535	Bromate	µg/L	36.9	37.4	26.2 - 48.6	Acceptable	EPA 317.0 2	7/25/2013	0.222	36.4	2.22	
1540	Bromide	µg/L		106	90.1 - 122	Not Reported				103	7.03	
WS Inorganic Disinfection #2 (cat# 5260)												
1535	Bromate	µg/L		37.4	26.2 - 48.6	Not Reported				36.4	2.22	
1540	Bromide	µg/L	107	106	90.1 - 122	Acceptable	EPA 300.0 2.1 1993	7/25/2013	0.615	103	7.03	
WS Inorganic Disinfection #2 (cat# 5260)												
1535	Bromate	µg/L	32.2	37.4	26.2 - 48.6	Acceptable	EPA 300.1 1997	7/25/2013	-1.89	36.4	2.22	
1540	Bromide	µg/L	100	106	90.1 - 122	Acceptable	EPA 300.1 1997	7/25/2013	-0.381	103	7.03	
WS Nitrite (cat# 594)												
1840	Nitrite as N	mg/L	1.73	1.74	1.48 - 2.00	Acceptable	EPA 300.1 1 2000	7/19/2013	-0.371	1.76	0.0834	
WS Nitrite (cat# 594)												
1840	Nitrite as N	mg/L	1.77	1.74	1.48 - 2.00	Acceptable	EPA 300.0 2.1 1993	7/18/2013	0.108	1.76	0.0834	
WS Nitrite (cat# 594)												
1840	Nitrite as N	mg/L	1.63	1.74	1.48 - 2.00	Acceptable	EPA 353.2 2 1993	7/17/2013	-1.57	1.76	0.0834	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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WS Nitrite (cat# 594)												
1840	Nitrite as N	mg/L	1.73	1.74	1.48 - 2.00	Acceptable	EPA 300.1 1997	7/19/2013	-0.371	1.76	0.0834	
WS o-Phosphate Nutrients (cat# 558)												
1870	ortho-Phosphate as P	mg/L	1.37	1.16	0.986 - 1.33	Not Acceptable	EPA 365.1 2 1993	7/18/2013	2.89	1.16	0.0738	
WS o-Phosphate Nutrients (cat# 558)												
1870	ortho-Phosphate as P	mg/L	1.37	1.16	0.986 - 1.33	Not Acceptable	SM4500P E 20th ED 1997	7/18/2013	2.89	1.16	0.0738	
WS o-Phosphate Nutrients (cat# 558)												
1870	ortho-Phosphate as P	mg/L	1.37	1.16	0.986 - 1.33	Not Acceptable	SM4500P E 22nd ED 2011	7/18/2013	2.89	1.16	0.0738	
WS o-Phosphate Nutrients (cat# 558)												
1870	ortho-Phosphate as P	mg/L	1.37	1.16	0.986 - 1.33	Not Acceptable	SM4500P F 22nd ED 2011	7/18/2013	2.89	1.16	0.0738	
WS Residual Chlorine (cat# 593)												
1945	Free Residual Chlorine	mg/L	0.690	0.694	0.537 - 0.851	Acceptable	SM4500Cl G 20th ED 1993	7/18/2013	0.432	0.661	0.0668	
1940	Total Residual Chlorine	mg/L	0.690	0.694	0.576 - 0.802	Acceptable	SM4500Cl G 20th ED 1993	7/18/2013	0.162	0.684	0.0388	
WS Residual Chlorine (cat# 593)												
1945	Free Residual Chlorine	mg/L	0.690	0.694	0.537 - 0.851	Acceptable	SM4500Cl G 22nd ED 2011	7/18/2013	0.432	0.661	0.0668	
1940	Total Residual Chlorine	mg/L	0.690	0.694	0.576 - 0.802	Acceptable	SM4500Cl G 22nd ED 2011	7/18/2013	0.162	0.684	0.0388	
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.344	0.356	0.267 - 0.445	Acceptable	EPA 335.4 1993	7/19/2013	0.169	0.339	0.0275	
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.341	0.356	0.267 - 0.445	Acceptable	SM4500CN F 20th ED 1997	8/6/2013	0.0598	0.339	0.0275	
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.341	0.356	0.267 - 0.445	Acceptable	SM4500CN F 22nd ED 2011	8/6/2013	0.0598	0.339	0.0275	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.334	0.356	0.267 - 0.445	Acceptable	SM4500CN G 22nd ED 2011	7/25/2013	-0.194	0.339	0.0275	
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.334	0.356	0.267 - 0.445	Acceptable	SM4500CN G 20th ED 1997	7/25/2013	-0.194	0.339	0.0275	
WS Organic Carbon (cat# 557)												
1710	Dissolved Organic Carbon (DOC)	mg/L	11.9	11.6	10.3 - 12.8	Acceptable	SM5310C 20th ED 1996	7/19/2013	0.202	11.8	0.409	
2040	Total Organic Carbon (TOC)	mg/L	12.0	11.6	9.28 - 13.9	Acceptable	SM5310C 20th ED 1996	7/19/2013	0.428	11.8	0.492	
WS Organic Carbon (cat# 557)												
1710	Dissolved Organic Carbon (DOC)	mg/L	11.9	11.6	10.3 - 12.8	Acceptable	SM5310C 22nd ED 2011	7/19/2013	0.202	11.8	0.409	
2040	Total Organic Carbon (TOC)	mg/L	12.0	11.6	9.28 - 13.9	Acceptable	SM5310C 22nd ED 2011	7/19/2013	0.428	11.8	0.492	
WS Perchlorate (cat# 903)												
1895	Perchlorate	µg/L	8.42	8.37	6.70 - 10.0	Acceptable	EPA 314.0 1 1999	7/18/2013	0.330	8.17	0.760	
WS Perchlorate (cat# 903)												
1895	Perchlorate	µg/L	7.91	8.37	6.70 - 10.0	Acceptable	EPA 331.0 1.0 2005	7/19/2013	-0.342	8.17	0.760	
WS Silica (cat# 902)												
1990	Silica as SiO2	mg/L	27.4	26.0	22.1 - 29.9	Acceptable	EPA 200.7 4.4 1994	8/8/2013	0.364	26.8	1.67	
WS Silica (cat# 902)												
1990	Silica as SiO2	mg/L	25.5	26.0	22.1 - 29.9	Acceptable	SM4500SiO2 C 20th ED 1997	8/8/2013	-0.771	26.8	1.67	
WS Silica (cat# 902)												
1990	Silica as SiO2	mg/L	25.5	26.0	22.1 - 29.9	Acceptable	SM4500SiO2 C 22nd ED 2011	8/8/2013	-0.771	26.8	1.67	
WS Silica (cat# 902)												
1990	Silica as SiO2	mg/L	25.5	26.0	22.1 - 29.9	Acceptable	SM4500Si D 19th ED 1993	8/8/2013	-0.771	26.8	1.67	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Surfactants - MBAS (cat# 901)												
2025	Surfactants - MBAS	mg/L	0.339	0.355	0.236 - 0.471	Acceptable	SM5540C 20th ED 1993	7/16/2013	-0.399	0.364	0.0620	
WS Surfactants - MBAS (cat# 901)												
2025	Surfactants - MBAS	mg/L	0.339	0.355	0.236 - 0.471	Acceptable	SM5540C 22nd ED 2011	7/16/2013	-0.399	0.364	0.0620	
WS Corrosivity (cat# 900)												
1620	Corrosivity	S.I.@ 20°C	1.95	1.82	1.42 - 2.22	Acceptable	SM2330B 20th ED 1993	8/8/2013	0.973	1.81	0.139	
WS Corrosivity (cat# 900)												
1620	Corrosivity	S.I.@ 20°C	1.95	1.82	1.42 - 2.22	Acceptable	SM2330B 21st ED 2000	8/8/2013	0.973	1.81	0.139	
WS Corrosivity (cat# 900)												
1620	Corrosivity	S.I.@ 20°C	1.95	1.82	1.42 - 2.22	Acceptable	EPA 9040C 2002	8/8/2013	0.973	1.81	0.139	
WS Turbidity (cat# 592)												
2055	Turbidity	NTU	6.88	6.00	5.10 - 6.72	Not Acceptable	EPA 180.1 2 1993	7/23/2013	2.69	5.89	0.367	
WS Turbidity (cat# 592)												
2055	Turbidity	NTU	6.88	6.00	5.10 - 6.72	Not Acceptable	SM2130B 20th ED 1994	7/23/2013	2.69	5.89	0.367	
WS Turbidity (cat# 592)												
2055	Turbidity	NTU	6.88	6.00	5.10 - 6.72	Not Acceptable	SM2130B 22nd ED 2011	7/23/2013	2.69	5.89	0.367	
WS UV 254 Absorbance (cat# 904)												
2060	UV 254 Absorbance	cm-1	0.235	0.208	0.168 - 0.254	Acceptable	SM5910B 20th ED 1994	7/17/2013	1.16	0.210	0.0213	
WS UV 254 Absorbance (cat# 904)												
2060	UV 254 Absorbance	cm-1	0.235	0.208	0.168 - 0.254	Acceptable	SM5910B 22nd ED 2011	7/17/2013	1.16	0.210	0.0213	

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Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

Microbiology Results

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS MicrobE™ (Coliforms) (cat# 080A)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/27/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/26/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 2, 5 and 7
Total Coliform Organism - Enterobacter cloacae, Samples 1, 3 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 8 and 9

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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WS MicrobE™ (Coliforms) (cat# 080A) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2530	Fecal Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2530	Fecal Coliforms - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2530	Fecal Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/27/2013	0			
2530	Fecal Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2530	Fecal Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2530	Fecal Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2530	Fecal Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2530	Fecal Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2530	Fecal Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/26/2013	0			

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Acceptable**
E.coli Evaluation : **Not Reported**

Fecal Coliform Organism - Escherichia coli, Samples 2, 5 and 7
Total Coliform Organism - Enterobacter cloacae, Samples 1, 3 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 8 and 9

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 08/26/13
Study Dates: 07/08/13 - 08/22/13

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080A) (Continued)												
2525	E.coli - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 2	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 7	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 2, 5 and 7
Total Coliform Organism - Enterobacter cloacae, Samples 1, 3 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 8 and 9

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Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080A)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/27/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/26/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 2, 5 and 7
Total Coliform Organism - Enterobacter cloacae, Samples 1, 3 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 8 and 9

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Monrovia, CA 91016
626-386-1170

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WS MicrobE™ (Coliforms) (cat# 080A) (Continued)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2530	Fecal Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2530	Fecal Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2530	Fecal Coliforms - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2530	Fecal Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/27/2013	0			
2530	Fecal Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2530	Fecal Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2530	Fecal Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2530	Fecal Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2530	Fecal Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2530	Fecal Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/26/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 2, 5 and 7
Total Coliform Organism - Enterobacter cloacae, Samples 1, 3 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 8 and 9

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Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080A) (Continued)												
2525	E.coli - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 2	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 7	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 2, 5 and 7
Total Coliform Organism - Enterobacter cloacae, Samples 1, 3 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 8 and 9

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Not Reported**
E.coli Evaluation : **Acceptable**

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 8
Total Coliform Organism - Enterobacter cloacae, Samples 1, 4 and 7
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 6 and 10

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 8
Total Coliform Organism - Enterobacter cloacae, Samples 1, 4 and 7
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 6 and 10

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B) (Continued)												
2525	E.coli - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 8
Total Coliform Organism - Enterobacter cloacae, Samples 1, 4 and 7
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 6 and 10

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Eurofins Eaton Analytical, Inc - Monrovia
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 8
Total Coliform Organism - Enterobacter cloacae, Samples 1, 4 and 7
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 6 and 10

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QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 8
Total Coliform Organism - Enterobacter cloacae, Samples 1, 4 and 7
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 6 and 10

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Eurofins Eaton Analytical, Inc - Monrovia
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Suite 100
Monrovia, CA 91016
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B) (Continued)												
2525	E.coli - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 8
Total Coliform Organism - Enterobacter cloacae, Samples 1, 4 and 7
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C)												
2500	Total Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Not Reported**
E.coli Evaluation : **Acceptable**

Fecal Coliform Organism - Escherichia coli, Samples 6, 9 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 3, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 1 and 5

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 08/26/13
Study Dates: 07/08/13 - 08/22/13

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Presence	Presence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 6, 9 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 3, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 1 and 5

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS MicrobE™ (Coliforms) (cat# 080C) (Continued)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2525	E.coli - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 6, 9 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 3, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 1 and 5

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750 Royal Oaks Dr.
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C)												
2500	Total Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Not Reported**
E.coli Evaluation : **Acceptable**

Fecal Coliform Organism - Escherichia coli, Samples 6, 9 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 3, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 1 and 5

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QA Officer
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750 Royal Oaks Dr.
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Monrovia, CA 91016
626-386-1170

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Presence	Presence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 6, 9 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 3, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 1 and 5

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C) (Continued)												
2525	E.coli - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 6, 9 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 3, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 1 and 5

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080D)												
2500	Total Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 4, 5 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 3 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 6
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 7
Blank - No Organism, Samples 1 and 8

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080D) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Not Reported**
E.coli Evaluation : **Acceptable**

Fecal Coliform Organism - Escherichia coli, Samples 4, 5 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 3 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 6
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 7
Blank - No Organism, Samples 1 and 8

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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ERA Customer Number: M327601
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WS MicrobE™ (Coliforms) (cat# 080D) (Continued)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2525	E.coli - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 4, 5 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 3 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 6
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 7
Blank - No Organism, Samples 1 and 8

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080D)												
2500	Total Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 4, 5 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 3 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 6
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 7
Blank - No Organism, Samples 1 and 8

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WS MicrobE™ (Coliforms) (cat# 080D) (Continued)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2530	Fecal Coliforms - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 4, 5 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 3 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 6
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 7
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Suite 100
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080D) (Continued)												
2525	E.coli - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 4, 5 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 3 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 6
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 7
Blank - No Organism, Samples 1 and 8

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ERA
A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
ERA Customer Number:	M327601
Report Issued:	08/26/13
Study Dates:	07/08/13 - 08/22/13

WS WS SourceWatR™ MicrobE™ (cat# 595)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms (MF)	CFU/100mL		108	56.7 - 116	Not Reported				80.9	14.7	
2530	Fecal Coliforms (MF)	CFU/100mL		108	30.8 - 126	Not Reported				62.2	23.7	
2525	E.coli (MF)	CFU/100mL		108	37.1 - 135	Not Reported				70.8	24.5	
2500	Total Coliforms (MPN)	MPN/100mL	79.0	101	61.1 - 166	Acceptable	SM9223B MPN 20th ED 1997	7/30/2013	-0.829	101	26.2	
2530	Fecal Coliforms (MPN)	MPN/100mL		101	63.2 - 177	Not Reported				106	28.4	
2525	E.coli (MPN)	MPN/100mL	79.0	101	61.0 - 162	Acceptable	SM9223B MPN 20th ED 1997	7/30/2013	-0.81	99.5	25.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

WS WS SourceWatR™ MicrobE™ (cat# 595)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms (MF)	CFU/100mL		108	56.7 - 116	Not Reported				80.9	14.7	
2530	Fecal Coliforms (MF)	CFU/100mL		108	30.8 - 126	Not Reported				62.2	23.7	
2525	E.coli (MF)	CFU/100mL		108	37.1 - 135	Not Reported				70.8	24.5	
2500	Total Coliforms (MPN)	MPN/100mL	79.0	101	61.1 - 166	Acceptable	SM9223B MPN online	7/30/2013	-0.829	101	26.2	
2530	Fecal Coliforms (MPN)	MPN/100mL		101	63.2 - 177	Not Reported				106	28.4	
2525	E.coli (MPN)	MPN/100mL	79.0	101	61.0 - 162	Acceptable	SM9223B MPN online	7/30/2013	-0.81	99.5	25.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		108	56.7 - 116	Not Reported				80.9	14.7	
2530	Fecal Coliforms (MF)	CFU/100mL		108	30.8 - 126	Not Reported				62.2	23.7	
2525	E.coli (MF)	CFU/100mL		108	37.1 - 135	Not Reported				70.8	24.5	
2500	Total Coliforms (MPN)	MPN/100mL	79.0	101	61.1 - 166	Acceptable	SM9223 COLert18 20th ED 1997	7/30/2013	-0.829	101	26.2	
2530	Fecal Coliforms (MPN)	MPN/100mL		101	63.2 - 177	Not Reported				106	28.4	
2525	E.coli (MPN)	MPN/100mL	79.0	101	61.0 - 162	Acceptable	SM9223 COLert18 20th ED 1997	7/30/2013	-0.81	99.5	25.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
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2500	Total Coliforms (MF)	CFU/100mL		108	56.7 - 116	Not Reported				80.9	14.7	
2530	Fecal Coliforms (MF)	CFU/100mL		108	30.8 - 126	Not Reported				62.2	23.7	
2525	E.coli (MF)	CFU/100mL		108	37.1 - 135	Not Reported				70.8	24.5	
2500	Total Coliforms (MPN)	MPN/100mL	79.0	101	61.1 - 166	Acceptable	SM9223 COLert18 online	7/30/2013	-0.829	101	26.2	
2530	Fecal Coliforms (MPN)	MPN/100mL		101	63.2 - 177	Not Reported				106	28.4	
2525	E.coli (MPN)	MPN/100mL	79.0	101	61.0 - 162	Acceptable	SM9223 COLert18 online	7/30/2013	-0.81	99.5	25.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
ERA Customer Number:	M327601
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WS WS SourceWatR™ MicrobE™ (cat# 595)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms (MF)	CFU/100mL		108	56.7 - 116	Not Reported				80.9	14.7	
2530	Fecal Coliforms (MF)	CFU/100mL		108	30.8 - 126	Not Reported				62.2	23.7	
2525	E.coli (MF)	CFU/100mL		108	37.1 - 135	Not Reported				70.8	24.5	
2500	Total Coliforms (MPN)	MPN/100mL	105	101	61.1 - 166	Acceptable	SM9223 COLt18QT 20th ED 1998	8/9/2013	0.163	101	26.2	
2530	Fecal Coliforms (MPN)	MPN/100mL	105	101	63.2 - 177	Acceptable	SM9223 COLt18QT 20th ED 1998	8/9/2013	-0.0254	106	28.4	
2525	E.coli (MPN)	MPN/100mL	105	101	61.0 - 162	Acceptable	SM9223 COLt18QT 20th ED 1998	8/9/2013	0.219	99.5	25.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

WS WS SourceWatR™ MicrobE™ (cat# 595)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms (MF)	CFU/100mL		108	56.7 - 116	Not Reported				80.9	14.7	
2530	Fecal Coliforms (MF)	CFU/100mL		108	30.8 - 126	Not Reported				62.2	23.7	
2525	E.coli (MF)	CFU/100mL		108	37.1 - 135	Not Reported				70.8	24.5	
2500	Total Coliforms (MPN)	MPN/100mL	105	101	61.1 - 166	Acceptable	SM9223 COLt18QT online	8/9/2013	0.163	101	26.2	
2530	Fecal Coliforms (MPN)	MPN/100mL	105	101	63.2 - 177	Acceptable	SM9223 COLt18QT online	8/9/2013	-0.0254	106	28.4	
2525	E.coli (MPN)	MPN/100mL	105	101	61.0 - 162	Acceptable	SM9223 COLt18QT online	8/9/2013	0.219	99.5	25.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		108	56.7 - 116	Not Reported				80.9	14.7	
2530	Fecal Coliforms (MF)	CFU/100mL		108	30.8 - 126	Not Reported				62.2	23.7	
2525	E.coli (MF)	CFU/100mL		108	37.1 - 135	Not Reported				70.8	24.5	
2500	Total Coliforms (MPN)	MPN/100mL	138	101	61.1 - 166	Acceptable	SM9223 COLertQT 20th ED 1998	8/9/2013	1.42	101	26.2	
2530	Fecal Coliforms (MPN)	MPN/100mL	138	101	63.2 - 177	Acceptable	SM9223 COLertQT 20th ED 1998	8/9/2013	1.14	106	28.4	
2525	E.coli (MPN)	MPN/100mL	138	101	61.0 - 162	Acceptable	SM9223 COLertQT 20th ED 1998	8/9/2013	1.52	99.5	25.2	

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WS WS SourceWatR™ MicrobE™ (cat# 595)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms (MF)	CFU/100mL		108	56.7 - 116	Not Reported				80.9	14.7	
2530	Fecal Coliforms (MF)	CFU/100mL		108	30.8 - 126	Not Reported				62.2	23.7	
2525	E.coli (MF)	CFU/100mL		108	37.1 - 135	Not Reported				70.8	24.5	
2500	Total Coliforms (MPN)	MPN/100mL	138	101	61.1 - 166	Acceptable	SM9223 COLertQT online	8/9/2013	1.42	101	26.2	
2530	Fecal Coliforms (MPN)	MPN/100mL	138	101	63.2 - 177	Acceptable	SM9223 COLertQT online	8/9/2013	1.14	106	28.4	
2525	E.coli (MPN)	MPN/100mL	138	101	61.0 - 162	Acceptable	SM9223 COLertQT online	8/9/2013	1.52	99.5	25.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

WS Heterotrophic Plate Count (cat# 079)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2555	Heterotrophic Plate Count (MF, PP)	CFU/mL	55.0	59.0	33.5 - 74.3	Acceptable	SM9215B PCA 20th ED 1998	7/31/2013	0.500	49.9	10.2	
2555	Heterotrophic Plate Count (MPN)	MPN/mL		54.0	27.3 - 99.7	Not Reported				54.2	18.9	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
Report Issued:	**08/26/13**
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Heterotrophic Plate Count (cat# 079)												
2555	Heterotrophic Plate Count (MF, PP)	CFU/mL	55.0	59.0	33.5 - 74.3	Acceptable	SM9215B PCA 21st ED 2000	7/31/2013	0.500	49.9	10.2	
2555	Heterotrophic Plate Count (MPN)	MPN/mL		54.0	27.3 - 99.7	Not Reported				54.2	18.9	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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2009 TNI Evaluation Report

Study: **WS-204**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

Organic Results

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Chloral Hydrate (cat# 853)												
4460	Chloral Hydrate	µg/L	36.9	19.5	4.22 - 31.2	Not Acceptable	EPA 551.1 1 1992	8/21/2013	8.16	19.3	2.16	
WS Haloacetic Acids (HAA) (cat# 852)												
9312	Bromoacetic acid	µg/L	25.6	25.2	15.1 - 35.3	Acceptable	SM 6251 B 21st ED 1994	7/24/2013	0.339	24.8	2.50	
9315	Bromochloroacetic acid	µg/L	16.5	16.8	10.1 - 23.5	Acceptable	SM 6251 B 21st ED 1994	7/24/2013	-0.445	17.3	1.81	
9336	Chloroacetic acid	µg/L	37.8	42.9	25.7 - 60.1	Acceptable	SM 6251 B 21st ED 1994	7/24/2013	-0.553	40.4	4.63	
9357	Dibromoacetic acid	µg/L	18.6	19.9	11.9 - 27.9	Acceptable	SM 6251 B 21st ED 1994	7/24/2013	0.0366	18.5	2.64	
9360	Dichloroacetic acid	µg/L	47.1	47.0	28.2 - 65.8	Acceptable	SM 6251 B 21st ED 1994	7/24/2013	0.544	44.3	5.21	
9642	Trichloroacetic acid	µg/L	33.3	34.9	20.9 - 48.9	Acceptable	SM 6251 B 21st ED 1994	7/24/2013	-0.073	33.5	2.91	
WS Haloacetic Acids (HAA) (cat# 852)												
9312	Bromoacetic acid	µg/L	25.6	25.2	15.1 - 35.3	Acceptable	SM 6251 B 22nd ED 2007	7/24/2013	0.339	24.8	2.50	
9315	Bromochloroacetic acid	µg/L	16.5	16.8	10.1 - 23.5	Acceptable	SM 6251 B 22nd ED 2007	7/24/2013	-0.445	17.3	1.81	
9336	Chloroacetic acid	µg/L	37.8	42.9	25.7 - 60.1	Acceptable	SM 6251 B 22nd ED 2007	7/24/2013	-0.553	40.4	4.63	
9357	Dibromoacetic acid	µg/L	18.6	19.9	11.9 - 27.9	Acceptable	SM 6251 B 22nd ED 2007	7/24/2013	0.0366	18.5	2.64	
9360	Dichloroacetic acid	µg/L	47.1	47.0	28.2 - 65.8	Acceptable	SM 6251 B 22nd ED 2007	7/24/2013	0.544	44.3	5.21	
9642	Trichloroacetic acid	µg/L	33.3	34.9	20.9 - 48.9	Acceptable	SM 6251 B 22nd ED 2007	7/24/2013	-0.073	33.5	2.91	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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ERA A Waters Company

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QA Officer
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750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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WS Haloacetic Acids (HAA) (cat# 852)												
9312	Bromoacetic acid	µg/L	25.4	25.2	15.1 - 35.3	Acceptable	EPA 552.3 1 2003	8/6/2013	0.259	24.8	2.50	
9315	Bromochloroacetic acid	µg/L	17.2	16.8	10.1 - 23.5	Acceptable	EPA 552.3 1 2003	8/6/2013	-0.0594	17.3	1.81	
9336	Chloroacetic acid	µg/L	40.9	42.9	25.7 - 60.1	Acceptable	EPA 552.3 1 2003	8/6/2013	0.117	40.4	4.63	
9357	Dibromoacetic acid	µg/L	18.2	19.9	11.9 - 27.9	Acceptable	EPA 552.3 1 2003	8/6/2013	-0.115	18.5	2.64	
9360	Dichloroacetic acid	µg/L	44.9	47.0	28.2 - 65.8	Acceptable	EPA 552.3 1 2003	8/6/2013	0.121	44.3	5.21	
9642	Trichloroacetic acid	µg/L	32.5	34.9	20.9 - 48.9	Acceptable	EPA 552.3 1 2003	8/6/2013	-0.348	33.5	2.91	
WS Gasoline Additives (GAD) (cat# 905)												
4370	T-amylmethylether (TAME)	µg/L	28.2	28.9	21.6 - 36.8	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.764	30.0	2.35	
4420	Tert-Butyl Alcohol	µg/L	66.3	48.5	28.9 - 67.5	Acceptable	EPA 524.2 4.1 1995	7/22/2013	2.30	45.7	8.95	
5000	tert-Butyl methyl ether (MTBE)	µg/L	42.5	39.3	31.4 - 47.2	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.172	41.8	4.19	
9375	Di-isopropylether (DIPE)	µg/L	42.9	36.6	29.7 - 45.7	Acceptable	EPA 524.2 4.1 1995	7/25/2013	1.10	39.1	3.48	
4770	Ethyl-t-butylether (ETBE)	µg/L	45.3	39.5	31.2 - 51.0	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.813	42.9	2.95	
5175	Trichlorofluoromethane (Freon 11)	µg/L	24.9	23.1	13.9 - 32.3	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.11	25.3	3.36	
5185	Trichlorotrifluoroethane (Freon 113)	µg/L	41.6	39.6	26.4 - 52.7	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.459	44.9	7.13	

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WS Gasoline Additives (GAD) (cat# 905)												
4370	T-amylmethylether (TAME)	µg/L	30.2	28.9	21.6 - 36.8	Acceptable	EPA 524.3 1 2009	8/22/2013	0.0868	30.0	2.35	
4420	Tert-Butyl Alcohol	µg/L		48.5	28.9 - 67.5	Not Reported				45.7	8.95	
5000	tert-Butyl methyl ether (MTBE)	µg/L	42.6	39.3	31.4 - 47.2	Acceptable	EPA 524.3 1 2009	8/22/2013	0.196	41.8	4.19	
9375	Di-isopropylether (DIPE)	µg/L	38.1	36.6	29.7 - 45.7	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.282	39.1	3.48	
4770	Ethyl-t-butylether (ETBE)	µg/L	42.2	39.5	31.2 - 51.0	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.238	42.9	2.95	
5175	Trichlorofluoromethane (Freon 11)	µg/L	24.4	23.1	13.9 - 32.3	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.259	25.3	3.36	
5185	Trichlorotrifluoroethane (Freon 113)	µg/L	42.1	39.6	26.4 - 52.7	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.389	44.9	7.13	
WS Halomethanes (THMs) (cat# 842)												
4395	Bromodichloromethane	µg/L	45.4	42.4	33.9 - 50.9	Acceptable	EPA 551.1 1 1992	8/2/2013	0.174	44.6	4.30	
4400	Bromoform	µg/L	9.70	8.98	7.18 - 10.8	Acceptable	EPA 551.1 1 1992	8/2/2013	0.606	9.04	1.09	
4575	Chlorodibromomethane	µg/L	20.5	19.4	15.5 - 23.3	Acceptable	EPA 551.1 1 1992	8/2/2013	0.251	20.0	2.05	
4505	Chloroform	µg/L	25.6	24.7	19.8 - 29.6	Acceptable	EPA 551.1 1 1992	8/2/2013	-0.162	26.0	2.49	
WS Halomethanes (THMs) (cat# 842)												
4395	Bromodichloromethane	µg/L	51.4	42.4	33.9 - 50.9	Not Acceptable	EPA 524.2 4.1 1995	8/15/2013	1.57	44.6	4.30	
4400	Bromoform	µg/L	11.1	8.98	7.18 - 10.8	Not Acceptable	EPA 524.2 4.1 1995	8/15/2013	1.89	9.04	1.09	
4575	Chlorodibromomethane	µg/L	23.2	19.4	15.5 - 23.3	Acceptable	EPA 524.2 4.1 1995	8/15/2013	1.57	20.0	2.05	
4505	Chloroform	µg/L	30.1	24.7	19.8 - 29.6	Not Acceptable	EPA 524.2 4.1 1995	8/15/2013	1.64	26.0	2.49	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Halomethanes (THMs) (cat# 842)												
4395	Bromodichloromethane	µg/L	44.8	42.4	33.9 - 50.9	Acceptable	EPA 524.3 1 2009	8/22/2013	0.0344	44.6	4.30	
4400	Bromoform	µg/L	8.45	8.98	7.18 - 10.8	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.545	9.04	1.09	
4575	Chlorodibromomethane	µg/L	18.8	19.4	15.5 - 23.3	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.579	20.0	2.05	
4505	Chloroform	µg/L	26.2	24.7	19.8 - 29.6	Acceptable	EPA 524.3 1 2009	8/22/2013	0.0790	26.0	2.49	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Regulated Volatiles (cat# 840)												
4375	Benzene	µg/L	14.0	13.7	11.0 - 16.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.324	13.7	0.903	
4455	Carbon tetrachloride	µg/L	4.51	5.10	3.06 - 7.14	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.878	5.05	0.611	
4475	Chlorobenzene	µg/L	6.06	6.13	3.68 - 8.58	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.402	6.26	0.491	
4610	1,2-Dichlorobenzene	µg/L	8.21	8.58	5.15 - 12.0	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.529	8.64	0.812	
4620	1,4-Dichlorobenzene	µg/L	12.4	12.8	10.2 - 15.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.397	12.9	1.24	
4635	1,2-Dichloroethane	µg/L	20.8	19.1	15.3 - 22.9	Acceptable	EPA 524.2 4.1 1995	7/25/2013	1.20	19.3	1.22	
4640	1,1-Dichloroethylene	µg/L	3.93	3.14	1.88 - 4.40	Acceptable	EPA 524.2 4.1 1995	7/25/2013	1.16	3.45	0.411	
4645	cis-1,2-Dichloroethylene	µg/L	13.2	12.3	9.84 - 14.8	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.802	12.4	0.998	
4700	trans-1,2-Dichloroethylene	µg/L	18.0	15.7	12.6 - 18.8	Acceptable	EPA 524.2 4.1 1995	7/25/2013	1.14	16.3	1.52	
4655	1,2-Dichloropropane	µg/L	8.71	9.28	5.57 - 13.0	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-1.18	9.33	0.524	
4765	Ethylbenzene	µg/L	7.36	6.98	4.19 - 9.77	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.653	7.04	0.489	
4975	Methylene chloride (Dichloromethane)	µg/L	9.26	8.16	4.90 - 11.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	1.04	8.35	0.871	
5100	Styrene	µg/L	13.6	11.7	9.36 - 14.0	Acceptable	EPA 524.2 4.1 1995	7/25/2013	1.75	11.7	1.05	
5115	Tetrachloroethylene	µg/L	10.2	11.2	8.96 - 13.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.383	10.6	1.15	
5140	Toluene	µg/L	13.7	13.9	11.1 - 16.7	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.285	14.0	0.920	
5155	1,2,4-Trichlorobenzene	µg/L	9.40	10.8	8.64 - 13.0	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.698	10.4	1.40	
5160	1,1,1-Trichloroethane	µg/L	10.6	11.2	8.96 - 13.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.54	11.1	0.871	
5165	1,1,2-Trichloroethane	µg/L	13.3	14.1	11.3 - 16.9	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.972	14.1	0.806	
5170	Trichloroethylene	µg/L	15.7	16.0	12.8 - 19.2	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.193	15.4	1.30	
5235	Vinyl chloride	µg/L	12.8	9.80	5.88 - 13.7	Acceptable	EPA 524.2 4.1 1995	7/25/2013	1.39	10.7	1.53	

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Nilda B. Cox
QA Officer
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750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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WS Regulated Volatiles (cat# 840) (Continued)												
5260	Xylenes, total	µg/L	18.0	17.7	14.2 - 21.2	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.117	18.2	1.40	

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WS Regulated Volatiles (cat# 840)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
4375	Benzene	µg/L	14.3	13.7	11.0 - 16.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.656	13.7	0.903	
4455	Carbon tetrachloride	µg/L	5.14	5.10	3.06 - 7.14	Acceptable	EPA 524.3 1 2009	8/22/2013	0.154	5.05	0.611	
4475	Chlorobenzene	µg/L	6.44	6.13	3.68 - 8.58	Acceptable	EPA 524.3 1 2009	8/22/2013	0.372	6.26	0.491	
4610	1,2-Dichlorobenzene	µg/L	9.24	8.58	5.15 - 12.0	Acceptable	EPA 524.3 1 2009	8/22/2013	0.739	8.64	0.812	
4620	1,4-Dichlorobenzene	µg/L	13.3	12.8	10.2 - 15.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.330	12.9	1.24	
4635	1,2-Dichloroethane	µg/L	20.8	19.1	15.3 - 22.9	Acceptable	EPA 524.3 1 2009	8/22/2013	1.20	19.3	1.22	
4640	1,1-Dichloroethylene	µg/L	3.52	3.14	1.88 - 4.40	Acceptable	EPA 524.3 1 2009	8/22/2013	0.162	3.45	0.411	
4645	cis-1,2-Dichloroethylene	µg/L	12.5	12.3	9.84 - 14.8	Acceptable	EPA 524.3 1 2009	8/22/2013	0.101	12.4	0.998	
4700	trans-1,2-Dichloroethylene	µg/L	17.3	15.7	12.6 - 18.8	Acceptable	EPA 524.3 1 2009	8/22/2013	0.675	16.3	1.52	
4655	1,2-Dichloropropane	µg/L	9.69	9.28	5.57 - 13.0	Acceptable	EPA 524.3 1 2009	8/22/2013	0.689	9.33	0.524	
4765	Ethylbenzene	µg/L	7.43	6.98	4.19 - 9.77	Acceptable	EPA 524.3 1 2009	8/22/2013	0.796	7.04	0.489	
4975	Methylene chloride (Dichloromethane)	µg/L	8.70	8.16	4.90 - 11.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.401	8.35	0.871	
5100	Styrene	µg/L	11.9	11.7	9.36 - 14.0	Acceptable	EPA 524.3 1 2009	8/22/2013	0.143	11.7	1.05	
5115	Tetrachloroethylene	µg/L	11.5	11.2	8.96 - 13.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.746	10.6	1.15	
5140	Toluene	µg/L	14.5	13.9	11.1 - 16.7	Acceptable	EPA 524.3 1 2009	8/22/2013	0.584	14.0	0.920	
5155	1,2,4-Trichlorobenzene	µg/L	11.3	10.8	8.64 - 13.0	Acceptable	EPA 524.3 1 2009	8/22/2013	0.656	10.4	1.40	
5160	1,1,1-Trichloroethane	µg/L	11.5	11.2	8.96 - 13.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.493	11.1	0.871	
5165	1,1,2-Trichloroethane	µg/L	14.6	14.1	11.3 - 16.9	Acceptable	EPA 524.3 1 2009	8/22/2013	0.640	14.1	0.806	
5170	Trichloroethylene	µg/L	16.2	16.0	12.8 - 19.2	Acceptable	EPA 524.3 1 2009	8/22/2013	0.576	15.4	1.30	
5235	Vinyl chloride	µg/L	11.4	9.80	5.88 - 13.7	Acceptable	EPA 524.3 1 2009	8/22/2013	0.481	10.7	1.53	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Regulated Volatiles (cat# 840) (Continued)												
5260	Xylenes, total	µg/L	18.4	17.7	14.2 - 21.2	Acceptable	EPA 524.3 1 2009	8/22/2013	0.168	18.2	1.40	

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WS Unregulated Volatiles (cat# 841)												
4385	Bromobenzene	µg/L	9.94	10.3	8.24 - 12.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.61	10.5	0.926	
4390	Bromochloromethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	7/25/2013				
4950	Bromomethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	7/25/2013				
5000	tert-Butyl methyl ether (MTBE)	µg/L	17.2	16.2	13.0 - 19.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.0159	17.2	1.68	
4435	n-Butylbenzene	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	7/25/2013				
4440	sec-Butylbenzene	µg/L	6.56	6.68	4.01 - 9.35	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.439	6.91	0.789	
4445	tert-Butylbenzene	µg/L	16.0	16.2	13.0 - 19.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.215	16.4	2.04	
4485	Chloroethane	µg/L	14.2	12.2	7.32 - 17.1	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.491	13.3	1.82	
4960	Chloromethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	7/25/2013				
4535	2-Chlorotoluene	µg/L	4.41	4.81	2.89 - 6.73	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.949	4.97	0.588	
4540	4-Chlorotoluene	µg/L	5.54	5.70	3.42 - 7.98	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.639	5.98	0.693	
4595	Dibromomethane	µg/L	17.7	18.4	14.7 - 22.1	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.963	19.1	1.44	
4615	1,3-Dichlorobenzene	µg/L	10.2	10.7	8.56 - 12.8	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.684	11.0	1.18	
4625	Dichlorodifluoromethane (Freon 12)	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	7/25/2013				
4630	1,1-Dichloroethane	µg/L	9.06	8.18	4.91 - 11.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.618	8.52	0.864	
4660	1,3-Dichloropropane	µg/L	8.68	9.41	5.65 - 13.2	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-1.03	9.46	0.762	
4665	2,2-Dichloropropane	µg/L	15.4	15.0	12.0 - 18.0	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.0305	15.3	1.97	
4670	1,1-Dichloropropene	µg/L	12.9	14.3	11.4 - 17.2	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.674	14.0	1.62	
4680	cis-1,3-Dichloropropene	µg/L	15.1	16.6	13.3 - 19.9	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.48	15.8	1.56	
4685	trans-1,3-Dichloropropene	µg/L	5.43	6.17	3.70 - 8.64	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.692	5.89	0.666	

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WS Unregulated Volatiles (cat# 841) (Continued)												
5175	Fluorotrichloromethane	µg/L	45.1	38.2	22.9 - 53.5	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.305	42.9	7.17	
4835	Hexachlorobutadiene	µg/L	5.69	7.96	4.78 - 11.1	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-1.53	7.17	0.964	
4900	Isopropylbenzene	µg/L	4.34	4.66	2.80 - 6.52	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.468	4.64	0.644	
4910	4-Isopropyltoluene	µg/L	8.45	8.66	5.20 - 12.1	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.236	8.66	0.911	
5005	Naphthalene	µg/L	34.5	35.9	25.1 - 46.7	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.393	36.4	4.76	
5090	n-Propylbenzene	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	7/25/2013				
5105	1,1,1,2-Tetrachloroethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	7/25/2013				
5110	1,1,2,2-Tetrachloroethane	µg/L	4.22	4.07	2.44 - 5.70	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.171	4.13	0.500	
5150	1,2,3-Trichlorobenzene	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	7/25/2013				
5180	1,2,3-Trichloropropane (TCP)	µg/L	15.7	15.3	12.2 - 18.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.043	15.8	1.76	
5210	1,2,4-Trimethylbenzene	µg/L	2.45	2.28	1.37 - 3.19	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.164	2.40	0.313	
5215	1,3,5-Trimethylbenzene	µg/L	7.38	6.88	4.13 - 9.63	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.560	6.93	0.806	

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WS Unregulated Volatiles (cat# 841)												
4385	Bromobenzene	µg/L	10.3	10.3	8.24 - 12.4	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.222	10.5	0.926	
4390	Bromochloromethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	8/22/2013				
4950	Bromomethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	8/22/2013				
5000	tert-Butyl methyl ether (MTBE)	µg/L	18.6	16.2	13.0 - 19.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.819	17.2	1.68	
4435	n-Butylbenzene	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	8/22/2013				
4440	sec-Butylbenzene	µg/L	7.04	6.68	4.01 - 9.35	Acceptable	EPA 524.3 1 2009	8/22/2013	0.169	6.91	0.789	
4445	tert-Butylbenzene	µg/L	17.0	16.2	13.0 - 19.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.276	16.4	2.04	
4485	Chloroethane	µg/L	13.9	12.2	7.32 - 17.1	Acceptable	EPA 524.3 1 2009	8/22/2013	0.326	13.3	1.82	
4960	Chloromethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	8/22/2013				
4535	2-Chlorotoluene	µg/L	4.68	4.81	2.89 - 6.73	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.489	4.97	0.588	
4540	4-Chlorotoluene	µg/L	5.83	5.70	3.42 - 7.98	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.221	5.98	0.693	
4595	Dibromomethane	µg/L	19.6	18.4	14.7 - 22.1	Acceptable	EPA 524.3 1 2009	8/22/2013	0.358	19.1	1.44	
4615	1,3-Dichlorobenzene	µg/L	10.7	10.7	8.56 - 12.8	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.26	11.0	1.18	
4625	Dichlorodifluoromethane (Freon 12)	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	8/22/2013				
4630	1,1-Dichloroethane	µg/L	9.05	8.18	4.91 - 11.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.606	8.52	0.864	
4660	1,3-Dichloropropane	µg/L	9.54	9.41	5.65 - 13.2	Acceptable	EPA 524.3 1 2009	8/22/2013	0.103	9.46	0.762	
4665	2,2-Dichloropropane	µg/L	15.4	15.0	12.0 - 18.0	Acceptable	EPA 524.3 1 2009	8/22/2013	0.0305	15.3	1.97	
4670	1,1-Dichloropropene	µg/L	14.2	14.3	11.4 - 17.2	Acceptable	EPA 524.3 1 2009	8/22/2013	0.130	14.0	1.62	
4680	cis-1,3-Dichloropropene	µg/L	16.0	16.6	13.3 - 19.9	Acceptable	EPA 524.3 1 2009	8/22/2013	0.0982	15.8	1.56	
4685	trans-1,3-Dichloropropene	µg/L	5.71	6.17	3.70 - 8.64	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.272	5.89	0.666	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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WS Unregulated Volatiles (cat# 841) (Continued)												
5175	Fluorotrichloromethane	µg/L	45.2	38.2	22.9 - 53.5	Acceptable	EPA 524.3 1 2009	8/22/2013	0.319	42.9	7.17	
4835	Hexachlorobutadiene	µg/L	7.73	7.96	4.78 - 11.1	Acceptable	EPA 524.3 1 2009	8/22/2013	0.583	7.17	0.964	
4900	Isopropylbenzene	µg/L	4.56	4.66	2.80 - 6.52	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.127	4.64	0.644	
4910	4-Isopropyltoluene	µg/L	8.62	8.66	5.20 - 12.1	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.0489	8.66	0.911	
5005	Naphthalene	µg/L	37.8	35.9	25.1 - 46.7	Acceptable	EPA 524.3 1 2009	8/22/2013	0.300	36.4	4.76	
5090	n-Propylbenzene	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	8/22/2013				
5105	1,1,1,2-Tetrachloroethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	8/22/2013				
5110	1,1,2,2-Tetrachloroethane	µg/L	4.46	4.07	2.44 - 5.70	Acceptable	EPA 524.3 1 2009	8/22/2013	0.652	4.13	0.500	
5150	1,2,3-Trichlorobenzene	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	8/22/2013				
5180	1,2,3-Trichloropropane (TCP)	µg/L	17.1	15.3	12.2 - 18.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.754	15.8	1.76	
5210	1,2,4-Trimethylbenzene	µg/L	2.37	2.28	1.37 - 3.19	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.0908	2.40	0.313	
5215	1,3,5-Trimethylbenzene	µg/L	7.04	6.88	4.13 - 9.63	Acceptable	EPA 524.3 1 2009	8/22/2013	0.138	6.93	0.806	

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Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Pesticides (cat# 850)												
7005	Alachlor	µg/L	14.0	14.5	7.98 - 21.0	Acceptable	EPA 525.2 2 1995	7/23/2013	0.0286	13.9	2.36	
7025	Aldrin	µg/L	1.60	2.08	0.938 - 2.64	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.147	1.66	0.427	
7065	Atrazine	µg/L	2.75	2.69	1.48 - 3.90	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.5	3.09	0.682	
7120	gamma-BHC (Lindane)	µg/L	0.986	0.994	0.547 - 1.44	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.169	1.02	0.206	
7130	Bromacil	µg/L	< 0.20	< 2.00	0.00 - 2.00	Acceptable	EPA 525.2 2 1995	7/23/2013				
7160	Butachlor	µg/L	11.7	10.5	5.78 - 15.2	Acceptable	EPA 525.2 2 1995	7/23/2013	0.152	11.4	1.68	
7410	Diazinon	µg/L	< 0.10	< 2.00	0.00 - 2.00	Acceptable	EPA 525.2 2 1995	7/23/2013				
7470	Dieldrin	µg/L	1.87	1.90	1.04 - 2.76	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.097	1.89	0.211	
7540	Endrin	µg/L	1.21	1.27	0.889 - 1.65	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.548	1.34	0.228	
7685	Heptachlor	µg/L	0.908	0.950	0.522 - 1.38	Acceptable	EPA 525.2 2 1995	7/23/2013	0.0772	0.896	0.153	
7690	Heptachlor epoxide (beta)	µg/L	1.36	1.58	0.869 - 2.29	Acceptable	EPA 525.2 2 1995	7/23/2013	-1.01	1.59	0.227	
6275	Hexachlorobenzene	µg/L	0.840	0.924	0.440 - 1.18	Acceptable	EPA 525.2 2 1995	7/23/2013	0.129	0.817	0.179	
6285	Hexachlorocyclopentadiene	µg/L	7.80	6.94	2.01 - 9.98	Acceptable	EPA 525.2 2 1995	7/23/2013	0.732	6.18	2.21	
7810	Methoxychlor	µg/L	11.7	11.7	6.44 - 17.0	Acceptable	EPA 525.2 2 1995	7/23/2013	0.109	11.5	1.41	
7835	Metolachlor	µg/L	14.2	12.8	7.04 - 18.6	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.0793	14.5	3.53	
7845	Metribuzin	µg/L	6.85	7.41	3.70 - 11.1	Acceptable	EPA 525.2 2 1995	7/23/2013	0.308	6.44	1.34	
7875	Molinate (Ordram)	µg/L	6.18	6.54	3.77 - 9.00	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.127	6.29	0.854	
8035	Prometon	µg/L		2.86	0.872 - 3.98	Not Reported				2.59	0.908	
8045	Propachlor	µg/L	2.79	2.84	1.56 - 4.12	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.855	3.13	0.403	
8125	Simazine	µg/L	8.84	8.10	4.46 - 11.7	Acceptable	EPA 525.2 2 1995	7/23/2013	0.325	8.04	2.46	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 08/26/13
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Pesticides (cat# 850) (Continued)												
8220	Thiobencarb	µg/L	< 0.20	< 2.00	0.00 - 2.00	Acceptable	EPA 525.2 2 1995	7/23/2013				
8295	Trifluralin	µg/L	1.62	1.82	1.00 - 2.64	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.495	1.89	0.549	

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Eurofins Eaton Analytical, Inc - Monrovia
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WS Pesticides (cat# 850)												
7005	Alachlor	µg/L	15.6	14.5	7.98 - 21.0	Acceptable	EPA 505 2.1 1995	7/30/2013	0.708	13.9	2.36	
7025	Aldrin	µg/L	1.93	2.08	0.938 - 2.64	Acceptable	EPA 505 2.1 1995	7/30/2013	0.625	1.66	0.427	
7065	Atrazine	µg/L		2.69	1.48 - 3.90	Not Reported				3.09	0.682	
7120	gamma-BHC (Lindane)	µg/L	1.07	0.994	0.547 - 1.44	Acceptable	EPA 505 2.1 1995	7/30/2013	0.238	1.02	0.206	
7130	Bromacil	µg/L		< 2.00	0.00 - 2.00	Not Reported						
7160	Butachlor	µg/L		10.5	5.78 - 15.2	Not Reported				11.4	1.68	
7410	Diazinon	µg/L		< 2.00	0.00 - 2.00	Not Reported						
7470	Dieldrin	µg/L	1.89	1.90	1.04 - 2.76	Acceptable	EPA 505 2.1 1995	7/30/2013	-0.00219	1.89	0.211	
7540	Endrin	µg/L	1.32	1.27	0.889 - 1.65	Acceptable	EPA 505 2.1 1995	7/30/2013	-0.0661	1.34	0.228	
7685	Heptachlor	µg/L	0.817	0.950	0.522 - 1.38	Acceptable	EPA 505 2.1 1995	7/30/2013	-0.516	0.896	0.153	
7690	Heptachlor epoxide (beta)	µg/L	1.68	1.58	0.869 - 2.29	Acceptable	EPA 505 2.1 1995	7/30/2013	0.399	1.59	0.227	
6275	Hexachlorobenzene	µg/L		0.924	0.440 - 1.18	Not Reported				0.817	0.179	
6285	Hexachlorocyclopentadiene	µg/L		6.94	2.01 - 9.98	Not Reported				6.18	2.21	
7810	Methoxychlor	µg/L	11.9	11.7	6.44 - 17.0	Acceptable	EPA 505 2.1 1995	7/30/2013	0.251	11.5	1.41	
7835	Metolachlor	µg/L		12.8	7.04 - 18.6	Not Reported				14.5	3.53	
7845	Metribuzin	µg/L		7.41	3.70 - 11.1	Not Reported				6.44	1.34	
7875	Molinate (Ordram)	µg/L		6.54	3.77 - 9.00	Not Reported				6.29	0.854	
8035	Prometon	µg/L		2.86	0.872 - 3.98	Not Reported				2.59	0.908	
8045	Propachlor	µg/L		2.84	1.56 - 4.12	Not Reported				3.13	0.403	
8125	Simazine	µg/L		8.10	4.46 - 11.7	Not Reported				8.04	2.46	

A Waters Company

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QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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WS Pesticides (cat# 850) (Continued)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
8220	Thiobencarb	µg/L		< 2.00	0.00 - 2.00	Not Reported						
8295	Trifluralin	µg/L		1.82	1.00 - 2.64	Not Reported				1.89	0.549	

WS Carbamate/Carbamoxyloxime Pesticides (cat# 846)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
7010	Aldicarb	µg/L	26.0	28.0	21.0 - 35.0	Acceptable	EPA 531.2 1 2001	7/26/2013	-0.639	27.6	2.54	
7015	Aldicarb sulfone	µg/L	16.4	16.2	12.2 - 20.2	Acceptable	EPA 531.2 1 2001	7/26/2013	-0.278	16.7	1.10	
7020	Aldicarb sulfoxide	µg/L	27.1	29.6	22.2 - 37.0	Acceptable	EPA 531.2 1 2001	7/26/2013	-0.00734	27.1	2.63	
8080	Baygon	µg/L	69.0	70.1	57.0 - 83.2	Acceptable	EPA 531.2 1 2001	7/26/2013	-0.213	69.9	4.16	
7195	Carbaryl	µg/L	24.6	26.4	19.8 - 33.0	Acceptable	EPA 531.2 1 2001	7/26/2013	0.282	24.2	1.50	
7205	Carbofuran	µg/L	84.1	85.8	47.2 - 124	Acceptable	EPA 531.2 1 2001	7/26/2013	0.0660	83.6	8.05	
7710	3-Hydroxycarbofuran	µg/L	35.1	35.4	28.3 - 42.5	Acceptable	EPA 531.2 1 2001	7/26/2013	0.0220	35.0	2.68	
7800	Methiocarb	µg/L	47.8	47.5	37.1 - 56.7	Acceptable	EPA 531.2 1 2001	7/26/2013	0.886	44.8	3.33	
7805	Methomyl	µg/L	37.0	38.4	30.7 - 46.1	Acceptable	EPA 531.2 1 2001	7/26/2013	-0.132	37.4	3.04	
7940	Oxamyl (vydate)	µg/L	58.0	61.0	45.8 - 76.2	Acceptable	EPA 531.2 1 2001	7/26/2013	0.530	56.4	3.05	

WS Chlordane (cat# 845)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
7250	Chlordane, technical	µg/L	3.19	3.00	1.65 - 4.35	Acceptable	EPA 505 2.1 1995	7/24/2013	0.553	2.90	0.526	

WS Chlordane (cat# 845)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
7250	Chlordane, technical	µg/L	3.09	3.00	1.65 - 4.35	Acceptable	EPA 525.2 2 1995	7/23/2013	0.363	2.90	0.526	

WS Toxaphene (cat# 844)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
8250	Toxaphene	µg/L	14.1	8.66	4.76 - 12.6	Not Acceptable	EPA 505 2.1 1995	7/24/2013	1.65	9.78	2.62	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
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WS EDB/DBCP/TCP (cat# 847)												
4570	Dibromochloropropane (DBCP)	µg/L	0.811	0.812	0.487 - 1.14	Acceptable	EPA 504.1 1.1 1995	7/30/2013	-0.0924	0.824	0.142	
4585	Ethylene Dibromide (EDB)	µg/L	1.69	1.72	1.03 - 2.41	Acceptable	EPA 504.1 1.1 1995	7/30/2013	0.286	1.61	0.263	
5180	1,2,3-Trichloropropane (TCP)	µg/L	0.940	0.854	0.512 - 1.20	Acceptable	EPA 504.1 1.1 1995	7/29/2013	0.667	0.873	0.100	
WS EDB/DBCP/TCP (cat# 847)												
4570	Dibromochloropropane (DBCP)	µg/L	0.811	0.812	0.487 - 1.14	Acceptable	EPA 8011 1994	7/30/2013	-0.0924	0.824	0.142	
4585	Ethylene Dibromide (EDB)	µg/L	1.69	1.72	1.03 - 2.41	Acceptable	EPA 8011 1994	7/30/2013	0.286	1.61	0.263	
5180	1,2,3-Trichloropropane (TCP)	µg/L		0.854	0.512 - 1.20	Not Reported				0.873	0.100	
WS EDB/DBCP/TCP (cat# 847)												
4570	Dibromochloropropane (DBCP)	µg/L	1.19	0.812	0.487 - 1.14	Not Acceptable	EPA 551.1 1 1992	7/18/2013	2.57	0.824	0.142	
4585	Ethylene Dibromide (EDB)	µg/L	1.85	1.72	1.03 - 2.41	Acceptable	EPA 551.1 1 1992	7/18/2013	0.894	1.61	0.263	
5180	1,2,3-Trichloropropane (TCP)	µg/L		0.854	0.512 - 1.20	Not Reported				0.873	0.100	
WS EDB/DBCP/TCP (cat# 847)												
4570	Dibromochloropropane (DBCP)	µg/L		0.812	0.487 - 1.14	Not Reported				0.824	0.142	
4585	Ethylene Dibromide (EDB)	µg/L		1.72	1.03 - 2.41	Not Reported				1.61	0.263	
5180	1,2,3-Trichloropropane (TCP)	µg/L	0.985	0.854	0.512 - 1.20	Acceptable	EPA 524.2 4.1 1995	7/23/2013	1.12	0.873	0.100	
WS Dioxin (cat# 857)												
9618	2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/L	72.0	71.5	41.1 - 85.5	Acceptable	EPA 1613 1994	7/18/2013	-0.452	75.8	8.34	
WS Dioxin (cat# 857)												
9618	2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/L	72.0	71.5	41.1 - 85.5	Acceptable	EPA 1613B Appendix A 1997	7/18/2013	-0.452	75.8	8.34	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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WS PCBs as Decachlorobiphenyl (cat# 839)												
8880	Aroclor 1016	µg/L	< 0.08	< 0.260	0.00 - 0.260	Acceptable	EPA 505 2.1 1995	7/24/2013				
8885	Aroclor 1221	µg/L	< 0.10	< 0.190	0.00 - 0.190	Acceptable	EPA 505 2.1 1995	7/24/2013				
8890	Aroclor 1232	µg/L	< 0.10	< 0.230	0.00 - 0.230	Acceptable	EPA 505 2.1 1995	7/24/2013				
8895	Aroclor 1242	µg/L	< 0.10	< 0.260	0.00 - 0.260	Acceptable	EPA 505 2.1 1995	7/24/2013				
8900	Aroclor 1248	µg/L	2.71	2.38	1.36 - 2.90	Acceptable	EPA 505 2.1 1995	7/24/2013	0.882	2.46	0.289	
8905	Aroclor 1254	µg/L	< 0.10	< 0.330	0.00 - 0.330	Acceptable	EPA 505 2.1 1995	7/24/2013				
8910	Aroclor 1260	µg/L	< 0.10	< 0.360	0.00 - 0.360	Acceptable	EPA 505 2.1 1995	7/24/2013				
8872	PCB Aroclor Identity	Identity	1248	1248		Acceptable	EPA 505 2.1 1995	7/24/2013	0			
9105	PCB as Decachlorobiphenyl	µg/L		3.98	0.398 - 7.96	Not Reported				3.52	1.07	

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Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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WS Regulated Semivolatiles Ampule #1 (cat# 848)												
5500	Acenaphthene	µg/L	3.29	3.60	1.79 - 4.51	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.109	3.31	0.200	
5505	Acenaphthylene	µg/L	8.60	9.17	4.32 - 12.3	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.374	8.93	0.885	
5555	Anthracene	µg/L	6.24	6.75	2.93 - 8.76	Acceptable	EPA 525.2 2 1995	7/23/2013	0.00373	6.24	0.298	
5575	Benzo(a)anthracene	µg/L	6.45	6.71	3.70 - 8.50	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.145	6.58	0.910	
5585	Benzo(b)fluoranthene	µg/L	4.74	4.88	2.60 - 6.72	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.326	4.94	0.632	
5600	Benzo(k)fluoranthene	µg/L	1.69	1.88	1.02 - 2.54	Acceptable	EPA 525.2 2 1995	7/23/2013	-1.06	2.04	0.329	
5590	Benzo(g,h,i)perylene	µg/L	4.24	4.01	1.81 - 5.73	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.368	4.40	0.451	
5580	Benzo(a)pyrene	µg/L	1.51	1.80	0.744 - 2.30	Acceptable	EPA 525.2 2 1995	7/23/2013	0.0155	1.50	0.321	
5670	Butylbenzylphthalate	µg/L	58.1	47.1	25.6 - 68.4	Acceptable	EPA 525.2 2 1995	7/23/2013	0.932	49.0	9.77	
5855	Chrysene	µg/L	2.46	2.53	1.45 - 3.25	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.0644	2.48	0.311	
5895	Dibenz(a,h)anthracene	µg/L	1.30	1.19	0.552 - 1.71	Acceptable	EPA 525.2 2 1995	7/23/2013	0.242	1.27	0.131	
6070	Diethylphthalate	µg/L	51.7	47.2	25.4 - 66.7	Acceptable	EPA 525.2 2 1995	8/2/2013	0.699	47.0	6.66	
6135	Dimethylphthalate	µg/L	32.8	27.5	13.2 - 37.8	Acceptable	EPA 525.2 2 1995	7/23/2013	1.55	27.5	3.42	
5925	Di-n-butylphthalate	µg/L	35.6	32.2	17.6 - 46.3	Acceptable	EPA 525.2 2 1995	7/23/2013	0.0201	35.4	8.04	
6200	Di-n-octylphthalate	µg/L	34.7	36.9	18.3 - 51.5	Acceptable	EPA 525.2 2 1995	7/23/2013	0.214	32.6	10.1	
6062	bis(2-Ethylhexyl)adipate	µg/L	28.3	29.0	17.9 - 38.2	Acceptable	EPA 525.2 2 1995	7/23/2013	0.102	27.7	5.49	
6065	bis(2-Ethylhexyl)phthalate	µg/L	29.9	28.4	14.4 - 40.6	Acceptable	EPA 525.2 2 1995	7/23/2013	0.0898	29.2	7.21	
6265	Fluoranthene	µg/L	4.84	5.22	2.52 - 7.05	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.388	4.99	0.384	
6270	Fluorene	µg/L	2.91	2.88	1.68 - 3.68	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.412	3.03	0.287	
6315	Indeno(1,2,3-cd)pyrene	µg/L	4.11	4.69	2.04 - 6.71	Acceptable	EPA 525.2 2 1995	7/23/2013	-1.28	4.84	0.574	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
ERA Customer Number:	M327601
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WS Regulated Semivolatiles Ampule #1 (cat# 848) (Continued)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
5005	Naphthalene	µg/L	3.52	3.48	1.41 - 4.44	Acceptable	EPA 525.2 2 1995	7/23/2013	1.08	3.25	0.248	
6615	Phenanthrene	µg/L	1.72	2.00	1.27 - 2.52	Acceptable	EPA 525.2 2 1995	7/23/2013	-1.12	1.90	0.164	
6665	Pyrene	µg/L	3.13	3.19	1.90 - 4.12	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.153	3.18	0.295	

WS Chlorinated Acid Herbicides (cat# 851)

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
8505	Acifluorfen	µg/L	69.4	58.9	29.4 - 88.4	Acceptable	EPA 515.4 1 2000	7/26/2013	0.912	63.5	6.42	
8530	Bentazon	µg/L	15.0	17.4	9.01 - 23.7	Acceptable	EPA 515.4 1 2000	7/25/2013	-1.67	17.6	1.56	
8540	Chloramben	µg/L		37.3	9.99 - 50.6	Not Reported				30.4	5.86	
8545	2,4-D	µg/L	16.9	13.8	6.90 - 20.7	Acceptable	EPA 515.4 1 2000	7/26/2013	1.49	13.8	2.08	
8550	Dacthal diacid (DCPA)	µg/L	48.6	40.5	15.1 - 65.7	Acceptable	EPA 515.4 1 2000	7/26/2013	1.24	39.5	7.34	
8555	Dalapon	µg/L	27.8	28.7	14.4 - 43.0	Acceptable	EPA 515.4 1 2000	7/25/2013	-0.274	29.2	5.15	
8560	2,4-DB	µg/L	38.9	47.5	23.8 - 71.2	Acceptable	EPA 515.4 1 2000	7/25/2013	-0.702	43.3	6.27	
8595	Dicamba	µg/L	29.2	27.9	14.0 - 41.8	Acceptable	EPA 515.4 1 2000	7/26/2013	1.46	26.0	2.16	
8600	3,5-Dichlorobenzoic acid	µg/L	15.4	17.4	8.29 - 23.0	Acceptable	EPA 515.4 1 2000	7/25/2013	-0.418	16.7	3.01	
8605	Dichlorprop	µg/L	24.8	20.4	9.34 - 28.1	Acceptable	EPA 515.4 1 2000	7/26/2013	0.382	22.8	5.31	
8620	Dinoseb	µg/L	16.6	16.3	6.09 - 23.2	Acceptable	EPA 515.4 1 2000	7/26/2013	0.410	15.8	1.97	
6500	4-Nitrophenol	µg/L		21.6	2.16 - 29.2	Not Reported				14.6	3.18	
6605	Pentachlorophenol	µg/L	14.5	14.1	7.05 - 21.2	Acceptable	EPA 515.4 1 2000	7/26/2013	-0.182	14.9	2.20	
8645	Picloram	µg/L	25.5	23.6	11.8 - 35.4	Acceptable	EPA 515.4 1 2000	7/26/2013	1.14	21.8	3.22	
8655	2,4,5-T	µg/L	30.3	34.5	17.2 - 51.8	Acceptable	EPA 515.4 1 2000	7/26/2013	-0.411	31.3	2.47	
8650	2,4,5-TP (Silvex)	µg/L	23.9	24.6	12.3 - 36.9	Acceptable	EPA 515.4 1 2000	7/26/2013	0.0848	23.6	3.58	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 08/26/13
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Chlorinated Acid Herbicides (cat# 851)												
8505	Acifluorfen	µg/L		58.9	29.4 - 88.4	Not Reported				63.5	6.42	
8530	Bentazon	µg/L		17.4	9.01 - 23.7	Not Reported				17.6	1.56	
8540	Chloramben	µg/L		37.3	9.99 - 50.6	Not Reported				30.4	5.86	
8545	2,4-D	µg/L		13.8	6.90 - 20.7	Not Reported				13.8	2.08	
8550	Dacthal diacid (DCPA)	µg/L		40.5	15.1 - 65.7	Not Reported				39.5	7.34	
8555	Dalapon	µg/L		28.7	14.4 - 43.0	Not Reported				29.2	5.15	
8560	2,4-DB	µg/L		47.5	23.8 - 71.2	Not Reported				43.3	6.27	
8595	Dicamba	µg/L		27.9	14.0 - 41.8	Not Reported				26.0	2.16	
8600	3,5-Dichlorobenzoic acid	µg/L		17.4	8.29 - 23.0	Not Reported				16.7	3.01	
8605	Dichlorprop	µg/L		20.4	9.34 - 28.1	Not Reported				22.8	5.31	
8620	Dinoseb	µg/L		16.3	6.09 - 23.2	Not Reported				15.8	1.97	
6500	4-Nitrophenol	µg/L		21.6	2.16 - 29.2	Not Reported				14.6	3.18	
6605	Pentachlorophenol	µg/L	15.9	14.1	7.05 - 21.2	Acceptable	EPA 525.2 2 1995	7/23/2013	0.453	14.9	2.20	
8645	Picloram	µg/L		23.6	11.8 - 35.4	Not Reported				21.8	3.22	
8655	2,4,5-T	µg/L		34.5	17.2 - 51.8	Not Reported				31.3	2.47	
8650	2,4,5-TP (Silvex)	µg/L		24.6	12.3 - 36.9	Not Reported				23.6	3.58	

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QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
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Monrovia, CA 91016
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Chlorinated Acid Herbicides (cat# 851)												
8505	Acifluorfen	µg/L		58.9	29.4 - 88.4	Not Reported				63.5	6.42	
8530	Bentazon	µg/L		17.4	9.01 - 23.7	Not Reported				17.6	1.56	
8540	Chloramben	µg/L		37.3	9.99 - 50.6	Not Reported				30.4	5.86	
8545	2,4-D	µg/L		13.8	6.90 - 20.7	Not Reported				13.8	2.08	
8550	Dacthal diacid (DCPA)	µg/L		40.5	15.1 - 65.7	Not Reported				39.5	7.34	
8555	Dalapon	µg/L	28.7	28.7	14.4 - 43.0	Acceptable	EPA 552.3 1 2003	7/26/2013	-0.0993	29.2	5.15	
8560	2,4-DB	µg/L		47.5	23.8 - 71.2	Not Reported				43.3	6.27	
8595	Dicamba	µg/L		27.9	14.0 - 41.8	Not Reported				26.0	2.16	
8600	3,5-Dichlorobenzoic acid	µg/L		17.4	8.29 - 23.0	Not Reported				16.7	3.01	
8605	Dichlorprop	µg/L		20.4	9.34 - 28.1	Not Reported				22.8	5.31	
8620	Dinoseb	µg/L		16.3	6.09 - 23.2	Not Reported				15.8	1.97	
6500	4-Nitrophenol	µg/L		21.6	2.16 - 29.2	Not Reported				14.6	3.18	
6605	Pentachlorophenol	µg/L		14.1	7.05 - 21.2	Not Reported				14.9	2.20	
8645	Picloram	µg/L		23.6	11.8 - 35.4	Not Reported				21.8	3.22	
8655	2,4,5-T	µg/L		34.5	17.2 - 51.8	Not Reported				31.3	2.47	
8650	2,4,5-TP (Silvex)	µg/L		24.6	12.3 - 36.9	Not Reported				23.6	3.58	
WS Regulated Semivolatiles #2 Herbicides (cat# 849)												
9390	Diquat	µg/L	7.11	13.2	6.60 - 19.8	Acceptable	EPA 549.2 1 1997	8/9/2013	-1.86	10.7	1.91	
7525	Endothall	µg/L	136	168	84.0 - 252	Acceptable	EPA 548.1 1 1992	8/8/2013	-0.417	150	33.8	
9411	Glyphosate	µg/L	413	387	310 - 464	Acceptable	EPA 547 1990	7/30/2013	1.02	386	26.4	
9528	Paraquat	µg/L	14.6	30.6	13.4 - 38.4	Acceptable	EPA 549.2 1 1997	8/9/2013	-1.68	21.3	4.00	

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Final Report Results For Laboratory
Eurofins Eaton Analytical, Inc - Monrovia

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

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2003 NELAC Evaluation Report

Study: **WS-204**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

Inorganic Results

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Hardness (cat# 555)												
1035	Calcium	mg/L	36.4	35.8	30.4 - 41.2	Acceptable	EPA 200.7 4.4 1994	8/7/2013	0.404	35.7	1.75	
1085	Magnesium	mg/L	9.72	9.33	7.93 - 10.7	Acceptable	EPA 200.7 4.4 1994	8/7/2013	0.728	9.29	0.584	
1155	Sodium	mg/L	34.5	33.0	28.0 - 38.0	Acceptable	EPA 200.7 4.4 1994	8/7/2013	0.709	33.2	1.90	
1550	Calcium Hardness as CaCO3	mg/L	90.9	89.5	76.1 - 103	Acceptable	EPA 200.7 4.4 1994	8/8/2013	0.232	89.9	4.37	
1755	Total Hardness as CaCO3	mg/L	131	128	109 - 147	Acceptable	EPA 200.7 4.4 1994	8/8/2013	0.663	128	4.66	
WS Hardness (cat# 555)												
1035	Calcium	mg/L		35.8	30.4 - 41.2	Not Reported				35.7	1.75	
1085	Magnesium	mg/L		9.33	7.93 - 10.7	Not Reported				9.29	0.584	
1155	Sodium	mg/L		33.0	28.0 - 38.0	Not Reported				33.2	1.90	
1550	Calcium Hardness as CaCO3	mg/L	90.9	89.5	76.1 - 103	Acceptable	SM2340B 20th ED 1997	8/8/2013	0.232	89.9	4.37	
1755	Total Hardness as CaCO3	mg/L	131	128	109 - 147	Acceptable	SM2340B 20th ED 1997	8/8/2013	0.663	128	4.66	
WS Hardness (cat# 555)												
1035	Calcium	mg/L		35.8	30.4 - 41.2	Not Reported				35.7	1.75	
1085	Magnesium	mg/L		9.33	7.93 - 10.7	Not Reported				9.29	0.584	
1155	Sodium	mg/L		33.0	28.0 - 38.0	Not Reported				33.2	1.90	
1550	Calcium Hardness as CaCO3	mg/L	90.9	89.5	76.1 - 103	Acceptable	SM2340B 22nd ED 2011	8/8/2013	0.232	89.9	4.37	
1755	Total Hardness as CaCO3	mg/L	131	128	109 - 147	Acceptable	SM2340B 22nd ED 2011	8/8/2013	0.663	128	4.66	

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ERA
A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Inorganics (cat# 591)												
1505	Alkalinity as CaCO3	mg/L	54.0	57.7	51.9 - 63.5	Acceptable	SM2320B 20th ED 1997	7/23/2013	-1.14	57.4	2.95	
1575	Chloride	mg/L	102	107	91.0 - 123	Acceptable	EPA 300.0 2.1 1993	7/24/2013	-0.672	105	3.96	
1610	Conductivity at 25°C	µmhos/cm	928	909	818 - 1000	Acceptable	SM2510B 20th ED 1997	7/23/2013	0.0883	926	19.0	
1730	Fluoride	mg/L	6.11	6.48	5.83 - 7.13	Acceptable	SM4500F- C 20th ED 1997	7/30/2013	-0.823	6.30	0.236	
1820	Nitrate + Nitrite as N	mg/L	8.30	8.74	7.43 - 10.0	Acceptable	EPA 300.0 2.1 1993	7/24/2013	-0.617	8.50	0.316	
1810	Nitrate as N	mg/L	8.30	8.74	7.87 - 9.61	Acceptable	EPA 300.0 2.1 1993	7/24/2013	-0.672	8.52	0.329	
1125	Potassium	mg/L	35.2	37.7	32.0 - 43.4	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-0.954	37.1	2.04	
2000	Sulfate	mg/L	152	158	134 - 182	Acceptable	EPA 300.0 2.1 1993	7/24/2013	-0.416	154	5.76	
1955	Total Dissolved Solids at 180°C	mg/L	608	614	491 - 737	Acceptable	SM2540C 20th ED 1997	7/25/2013	0.611	594	23.0	
WS Inorganics (cat# 591)												
1505	Alkalinity as CaCO3	mg/L	54.0	57.7	51.9 - 63.5	Acceptable	SM2320B 22nd ED 2011	7/23/2013	-1.14	57.4	2.95	
1575	Chloride	mg/L		107	91.0 - 123	Not Reported				105	3.96	
1610	Conductivity at 25°C	µmhos/cm	928	909	818 - 1000	Acceptable	SM2510B 22nd ED 2011	7/23/2013	0.0883	926	19.0	
1730	Fluoride	mg/L	6.11	6.48	5.83 - 7.13	Acceptable	SM4500F- C 22nd ED 2011	7/30/2013	-0.823	6.30	0.236	
1820	Nitrate + Nitrite as N	mg/L	8.16	8.74	7.43 - 10.0	Acceptable	EPA 353.2 2 1993	7/26/2013	-1.06	8.50	0.316	
1810	Nitrate as N	mg/L	8.16	8.74	7.87 - 9.61	Acceptable	EPA 353.2 2 1993	7/26/2013	-1.1	8.52	0.329	
1125	Potassium	mg/L		37.7	32.0 - 43.4	Not Reported				37.1	2.04	
2000	Sulfate	mg/L		158	134 - 182	Not Reported				154	5.76	
1955	Total Dissolved Solids at 180°C	mg/L	608	614	491 - 737	Acceptable	SM2540C 22nd ED 2011	7/25/2013	0.611	594	23.0	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Inorganics (cat# 591)												
1505	Alkalinity as CaCO3	mg/L	54.0	57.7	51.9 - 63.5	Acceptable	SM2320B SM2320B-1997	7/23/2013	-1.14	57.4	2.95	
1575	Chloride	mg/L		107	91.0 - 123	Not Reported				105	3.96	
1610	Conductivity at 25°C	µmhos/cm	928	909	818 - 1000	Acceptable	SM2510B SM2510B-2011	7/23/2013	0.0883	926	19.0	
1730	Fluoride	mg/L	6.20	6.48	5.83 - 7.13	Acceptable	EPA 300.0 2.1 1993	8/6/2013	-0.441	6.30	0.236	
1820	Nitrate + Nitrite as N	mg/L		8.74	7.43 - 10.0	Not Reported				8.50	0.316	
1810	Nitrate as N	mg/L		8.74	7.87 - 9.61	Not Reported				8.52	0.329	
1125	Potassium	mg/L		37.7	32.0 - 43.4	Not Reported				37.1	2.04	
2000	Sulfate	mg/L		158	134 - 182	Not Reported				154	5.76	
1955	Total Dissolved Solids at 180°C	mg/L	608	614	491 - 737	Acceptable	SM2540C online	7/25/2013	0.611	594	23.0	
WS pH (cat# 552)												
1900	pH	S.U.	6.19	6.19	5.99 - 6.39	Acceptable	EPA 150.1 1983	7/23/2013	-0.38	6.20	0.0394	
WS pH (cat# 552)												
1900	pH	S.U.	6.19	6.19	5.99 - 6.39	Acceptable	SM4500H+ B 20th ED 1996	7/23/2013	-0.38	6.20	0.0394	
WS pH (cat# 552)												
1900	pH	S.U.	6.19	6.19	5.99 - 6.39	Acceptable	SM4500H+ B 22nd ED 2011	7/23/2013	-0.38	6.20	0.0394	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Metals (cat# 590)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
1000	Aluminum	µg/L	312	316	253 - 379	Acceptable	EPA 200.8 5.4 1994	8/14/2013	-0.474	320	17.8	
1005	Antimony	µg/L	34.5	36.6	25.6 - 47.6	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-0.741	36.2	2.31	
1010	Arsenic	µg/L	11.3	11.8	8.26 - 15.3	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-0.436	11.7	0.910	
1015	Barium	µg/L	838	855	727 - 983	Acceptable	EPA 200.8 5.4 1994	8/14/2013	-0.215	846	35.1	
1020	Beryllium	µg/L	9.93	10.2	8.67 - 11.7	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-0.323	10.1	0.472	
1025	Boron	µg/L		1320	1120 - 1520	Not Reported				1300	60.2	
1030	Cadmium	µg/L	32.5	33.9	27.1 - 40.7	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-0.519	33.2	1.46	
1040	Chromium	µg/L	160	163	138 - 187	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-0.343	162	6.95	
1055	Copper	µg/L	1270	1350	1220 - 1480	Acceptable	EPA 200.8 5.4 1994	8/14/2013	-1.06	1340	68.2	
1070	Iron	µg/L		1290	1100 - 1480	Not Reported				1290	58.9	
1075	Lead	µg/L	13.0	14.0	9.80 - 18.2	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-1.01	14.0	1.02	
1090	Manganese	µg/L	440	445	378 - 512	Acceptable	EPA 200.8 5.4 1994	8/14/2013	-0.722	454	19.1	
1100	Molybdenum	µg/L	94.6	102	86.7 - 117	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-1.09	99.1	4.13	
1105	Nickel	µg/L	246	253	215 - 291	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-0.398	251	12.1	
1140	Selenium	µg/L	21.0	21.2	17.0 - 25.4	Acceptable	EPA 200.8 5.4 1994	8/13/2013	0.114	20.8	1.54	
1150	Silver	µg/L	45.6	47.3	33.1 - 61.5	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-0.387	46.5	2.41	
1165	Thallium	µg/L	7.95	8.27	5.79 - 10.8	Acceptable	EPA 200.8 5.4 1994	8/13/2013	-0.143	8.03	0.569	
1185	Vanadium	µg/L	452	466	396 - 536	Acceptable	EPA 200.8 5.4 1994	8/14/2013	-0.31	457	16.8	
1190	Zinc	µg/L	289	306	260 - 352	Acceptable	EPA 200.8 5.4 1994	8/14/2013	-1.1	307	16.2	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Metals (cat# 590)												
1000	Aluminum	µg/L	267	316	253 - 379	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-3.0	320	17.8	
1005	Antimony	µg/L		36.6	25.6 - 47.6	Not Reported				36.2	2.31	
1010	Arsenic	µg/L		11.8	8.26 - 15.3	Not Reported				11.7	0.910	
1015	Barium	µg/L	851	855	727 - 983	Acceptable	EPA 200.7 4.4 1994	8/7/2013	0.155	846	35.1	
1020	Beryllium	µg/L	9.91	10.2	8.67 - 11.7	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-0.366	10.1	0.472	
1025	Boron	µg/L	1150	1320	1120 - 1520	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-2.51	1300	60.2	
1030	Cadmium	µg/L	29.8	33.9	27.1 - 40.7	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-2.37	33.2	1.46	
1040	Chromium	µg/L	161	163	138 - 187	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-0.199	162	6.95	
1055	Copper	µg/L	1270	1350	1220 - 1480	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-1.06	1340	68.2	
1070	Iron	µg/L	1220	1290	1100 - 1480	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-1.23	1290	58.9	
1075	Lead	µg/L		14.0	9.80 - 18.2	Not Reported				14.0	1.02	
1090	Manganese	µg/L	464	445	378 - 512	Acceptable	EPA 200.7 4.4 1994	8/7/2013	0.534	454	19.1	
1100	Molybdenum	µg/L	91.5	102	86.7 - 117	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-1.84	99.1	4.13	
1105	Nickel	µg/L	256	253	215 - 291	Acceptable	EPA 200.7 4.4 1994	8/7/2013	0.429	251	12.1	
1140	Selenium	µg/L		21.2	17.0 - 25.4	Not Reported				20.8	1.54	
1150	Silver	µg/L	46.5	47.3	33.1 - 61.5	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-0.0141	46.5	2.41	
1165	Thallium	µg/L		8.27	5.79 - 10.8	Not Reported				8.03	0.569	
1185	Vanadium	µg/L	429	466	396 - 536	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-1.68	457	16.8	
1190	Zinc	µg/L	298	306	260 - 352	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-0.541	307	16.2	
WS Mercury (cat# 551)												
1095	Mercury	µg/L	3.81	3.75	2.62 - 4.88	Acceptable	EPA 245.1 3 1994	7/25/2013	0.371	3.69	0.317	

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626-386-1170

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WS Hexavalent Chromium (cat# 854)												
1045	Hexavalent Chromium	µg/L	14.5	15.1	12.1 - 18.1	Acceptable	EPA 218.6 3.3 1994	7/31/2013	-0.217	14.7	1.14	
WS Hexavalent Chromium (cat# 854)												
1045	Hexavalent Chromium	µg/L	15.0	15.1	12.1 - 18.1	Acceptable	SM3500Cr B 20th ED 1997	7/30/2013	0.224	14.7	1.14	
WS Hexavalent Chromium (cat# 854)												
1045	Hexavalent Chromium	µg/L	15.0	15.1	12.1 - 18.1	Acceptable	SM3500Cr B 22nd ED 2011	7/30/2013	0.224	14.7	1.14	
WS Vanadium (cat# 856)												
1185	Vanadium	µg/L	10.9	12.7	11.1 - 14.2	Not Acceptable	EPA 200.8 5.4 1994	8/13/2013	-2.29	12.4	0.672	
WS Vanadium (cat# 856)												
1185	Vanadium	µg/L	12.2	12.7	11.1 - 14.2	Acceptable	EPA 200.7 4.4 1994	8/7/2013	-0.353	12.4	0.672	
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L	145	146	102 - 190	Acceptable	EPA 300.1 1 2000	7/25/2013	0.929	138	8.04	
1595	Chlorite	µg/L	236	231	162 - 300	Acceptable	EPA 300.1 1 2000	7/25/2013	-0.0446	237	18.7	
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L	141	146	102 - 190	Acceptable	EPA 300.0 2.1 1993	7/25/2013	0.431	138	8.04	
1595	Chlorite	µg/L	253	231	162 - 300	Acceptable	EPA 300.0 2.1 1993	7/25/2013	0.862	237	18.7	
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L		146	102 - 190	Not Reported				138	8.04	
1595	Chlorite	µg/L	302	231	162 - 300	Not Acceptable	EPA 317.0 2	7/25/2013	3.48	237	18.7	
WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L	141	146	102 - 190	Acceptable	EPA 9056 1996	7/25/2013	0.431	138	8.04	
1595	Chlorite	µg/L		231	162 - 300	Not Reported				237	18.7	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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ERA
A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Inorganic Disinfection #1 (cat# 5270)												
1570	Chlorate	µg/L	145	146	102 - 190	Acceptable	EPA 300.1 1997	7/25/2013	0.929	138	8.04	
1595	Chlorite	µg/L	236	231	162 - 300	Acceptable	EPA 300.1 1997	7/25/2013	-0.0446	237	18.7	
WS Inorganic Disinfection #2 (cat# 5260)												
1535	Bromate	µg/L	32.2	37.4	26.2 - 48.6	Acceptable	EPA 300.1 1 2000	7/25/2013	-1.89	36.4	2.22	
1540	Bromide	µg/L	100	106	90.1 - 122	Acceptable	EPA 300.1 1 2000	7/25/2013	-0.381	103	7.03	
WS Inorganic Disinfection #2 (cat# 5260)												
1535	Bromate	µg/L	36.9	37.4	26.2 - 48.6	Acceptable	EPA 317.0 2	7/25/2013	0.222	36.4	2.22	
1540	Bromide	µg/L		106	90.1 - 122	Not Reported				103	7.03	
WS Inorganic Disinfection #2 (cat# 5260)												
1535	Bromate	µg/L		37.4	26.2 - 48.6	Not Reported				36.4	2.22	
1540	Bromide	µg/L	107	106	90.1 - 122	Acceptable	EPA 300.0 2.1 1993	7/25/2013	0.615	103	7.03	
WS Inorganic Disinfection #2 (cat# 5260)												
1535	Bromate	µg/L	32.2	37.4	26.2 - 48.6	Acceptable	EPA 300.1 1997	7/25/2013	-1.89	36.4	2.22	
1540	Bromide	µg/L	100	106	90.1 - 122	Acceptable	EPA 300.1 1997	7/25/2013	-0.381	103	7.03	
WS Nitrite (cat# 594)												
1840	Nitrite as N	mg/L	1.73	1.74	1.48 - 2.00	Acceptable	EPA 300.1 1 2000	7/19/2013	-0.371	1.76	0.0834	
WS Nitrite (cat# 594)												
1840	Nitrite as N	mg/L	1.77	1.74	1.48 - 2.00	Acceptable	EPA 300.0 2.1 1993	7/18/2013	0.108	1.76	0.0834	
WS Nitrite (cat# 594)												
1840	Nitrite as N	mg/L	1.63	1.74	1.48 - 2.00	Acceptable	EPA 353.2 2 1993	7/17/2013	-1.57	1.76	0.0834	

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QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Nitrite (cat# 594)												
1840	Nitrite as N	mg/L	1.73	1.74	1.48 - 2.00	Acceptable	EPA 300.1 1997	7/19/2013	-0.371	1.76	0.0834	
WS o-Phosphate Nutrients (cat# 558)												
1870	ortho-Phosphate as P	mg/L	1.37	1.16	0.986 - 1.33	Not Acceptable	EPA 365.1 2 1993	7/18/2013	2.89	1.16	0.0738	
WS o-Phosphate Nutrients (cat# 558)												
1870	ortho-Phosphate as P	mg/L	1.37	1.16	0.986 - 1.33	Not Acceptable	SM4500P E 20th ED 1997	7/18/2013	2.89	1.16	0.0738	
WS o-Phosphate Nutrients (cat# 558)												
1870	ortho-Phosphate as P	mg/L	1.37	1.16	0.986 - 1.33	Not Acceptable	SM4500P E 22nd ED 2011	7/18/2013	2.89	1.16	0.0738	
WS o-Phosphate Nutrients (cat# 558)												
1870	ortho-Phosphate as P	mg/L	1.37	1.16	0.986 - 1.33	Not Acceptable	SM4500P F 22nd ED 2011	7/18/2013	2.89	1.16	0.0738	
WS Residual Chlorine (cat# 593)												
1945	Free Residual Chlorine	mg/L	0.690	0.694	0.537 - 0.851	Acceptable	SM4500Cl G 20th ED 1993	7/18/2013	0.432	0.661	0.0668	
1940	Total Residual Chlorine	mg/L	0.690	0.694	0.576 - 0.802	Acceptable	SM4500Cl G 20th ED 1993	7/18/2013	0.162	0.684	0.0388	
WS Residual Chlorine (cat# 593)												
1945	Free Residual Chlorine	mg/L	0.690	0.694	0.537 - 0.851	Acceptable	SM4500Cl G 22nd ED 2011	7/18/2013	0.432	0.661	0.0668	
1940	Total Residual Chlorine	mg/L	0.690	0.694	0.576 - 0.802	Acceptable	SM4500Cl G 22nd ED 2011	7/18/2013	0.162	0.684	0.0388	
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.344	0.356	0.267 - 0.445	Acceptable	EPA 335.4 1993	7/19/2013	0.169	0.339	0.0275	
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.341	0.356	0.267 - 0.445	Acceptable	SM4500CN F 20th ED 1997	8/6/2013	0.0598	0.339	0.0275	
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.341	0.356	0.267 - 0.445	Acceptable	SM4500CN F 22nd ED 2011	8/6/2013	0.0598	0.339	0.0275	

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750 Royal Oaks Dr.
Suite 100
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626-386-1170

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WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.334	0.356	0.267 - 0.445	Acceptable	SM4500CN G 22nd ED 2011	7/25/2013	-0.194	0.339	0.0275	
WS Cyanide (cat# 556)												
1645	Cyanide, total	mg/L	0.334	0.356	0.267 - 0.445	Acceptable	SM4500CN G 20th ED 1997	7/25/2013	-0.194	0.339	0.0275	
WS Organic Carbon (cat# 557)												
1710	Dissolved Organic Carbon (DOC)	mg/L	11.9	11.6	10.3 - 12.8	Acceptable	SM5310C 20th ED 1996	7/19/2013	0.202	11.8	0.409	
2040	Total Organic Carbon (TOC)	mg/L	12.0	11.6	9.28 - 13.9	Acceptable	SM5310C 20th ED 1996	7/19/2013	0.428	11.8	0.492	
WS Organic Carbon (cat# 557)												
1710	Dissolved Organic Carbon (DOC)	mg/L	11.9	11.6	10.3 - 12.8	Acceptable	SM5310C 22nd ED 2011	7/19/2013	0.202	11.8	0.409	
2040	Total Organic Carbon (TOC)	mg/L	12.0	11.6	9.28 - 13.9	Acceptable	SM5310C 22nd ED 2011	7/19/2013	0.428	11.8	0.492	
WS Perchlorate (cat# 903)												
1895	Perchlorate	µg/L	8.42	8.37	6.70 - 10.0	Acceptable	EPA 314.0 1 1999	7/18/2013	0.330	8.17	0.760	
WS Perchlorate (cat# 903)												
1895	Perchlorate	µg/L	7.91	8.37	6.70 - 10.0	Acceptable	EPA 331.0 1.0 2005	7/19/2013	-0.342	8.17	0.760	
WS Silica (cat# 902)												
1990	Silica as SiO2	mg/L	27.4	26.0	22.1 - 29.9	Acceptable	EPA 200.7 4.4 1994	8/8/2013	0.364	26.8	1.67	
WS Silica (cat# 902)												
1990	Silica as SiO2	mg/L	25.5	26.0	22.1 - 29.9	Acceptable	SM4500SiO2 C 20th ED 1997	8/8/2013	-0.771	26.8	1.67	
WS Silica (cat# 902)												
1990	Silica as SiO2	mg/L	25.5	26.0	22.1 - 29.9	Acceptable	SM4500SiO2 C 22nd ED 2011	8/8/2013	-0.771	26.8	1.67	

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750 Royal Oaks Dr.
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WS Silica (cat# 902)												
1990	Silica as SiO2	mg/L	25.5	26.0	22.1 - 29.9	Acceptable	SM4500Si D 19th ED 1993	8/8/2013	-0.771	26.8	1.67	
WS Surfactants - MBAS (cat# 901)												
2025	Surfactants - MBAS	mg/L	0.339	0.355	0.236 - 0.471	Acceptable	SM5540C 20th ED 1993	7/16/2013	-0.399	0.364	0.0620	
WS Surfactants - MBAS (cat# 901)												
2025	Surfactants - MBAS	mg/L	0.339	0.355	0.236 - 0.471	Acceptable	SM5540C 22nd ED 2011	7/16/2013	-0.399	0.364	0.0620	
WS Corrosivity (cat# 900)												
1620	Corrosivity	S.I.@ 20°C	1.95	1.82	1.42 - 2.22	Acceptable	SM2330B 20th ED 1993	8/8/2013	0.973	1.81	0.139	
WS Corrosivity (cat# 900)												
1620	Corrosivity	S.I.@ 20°C	1.95	1.82	1.42 - 2.22	Acceptable	SM2330B 21st ED 2000	8/8/2013	0.973	1.81	0.139	
WS Corrosivity (cat# 900)												
1620	Corrosivity	S.I.@ 20°C	1.95	1.82	1.42 - 2.22	Acceptable	EPA 9040C 2002	8/8/2013	0.973	1.81	0.139	
WS Turbidity (cat# 592)												
2055	Turbidity	NTU	6.88	6.00	5.10 - 6.72	Not Acceptable	EPA 180.1 2 1993	7/23/2013	2.69	5.89	0.367	
WS Turbidity (cat# 592)												
2055	Turbidity	NTU	6.88	6.00	5.10 - 6.72	Not Acceptable	SM2130B 20th ED 1994	7/23/2013	2.69	5.89	0.367	
WS Turbidity (cat# 592)												
2055	Turbidity	NTU	6.88	6.00	5.10 - 6.72	Not Acceptable	SM2130B 22nd ED 2011	7/23/2013	2.69	5.89	0.367	
WS UV 254 Absorbance (cat# 904)												
2060	UV 254 Absorbance	cm-1	0.235	0.208	0.168 - 0.254	Acceptable	SM5910B 20th ED 1994	7/17/2013	1.16	0.210	0.0213	
WS UV 254 Absorbance (cat# 904)												
2060	UV 254 Absorbance	cm-1	0.235	0.208	0.168 - 0.254	Acceptable	SM5910B 22nd ED 2011	7/17/2013	1.16	0.210	0.0213	

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2003 NELAC Evaluation Report

Study: **WS-204**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

Microbiology Results

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

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WS MicrobE™ (Coliforms) (cat# 080A)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/27/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/26/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 2, 5 and 7
Total Coliform Organism - Enterobacter cloacae, Samples 1, 3 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 8 and 9

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WS MicrobE™ (Coliforms) (cat# 080A) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2530	Fecal Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2530	Fecal Coliforms - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2530	Fecal Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/27/2013	0			
2530	Fecal Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2530	Fecal Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2530	Fecal Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2530	Fecal Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2530	Fecal Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/25/2013	0			
2530	Fecal Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC 20th ED 1994	7/26/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 2, 5 and 7
Total Coliform Organism - Enterobacter cloacae, Samples 1, 3 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 8 and 9

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 08/26/13
Study Dates: 07/08/13 - 08/22/13

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080A) (Continued)												
2525	E.coli - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 2	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 7	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 2, 5 and 7
Total Coliform Organism - Enterobacter cloacae, Samples 1, 3 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 8 and 9

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS MicrobE™ (Coliforms) (cat# 080A)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/27/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/26/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 2, 5 and 7
Total Coliform Organism - Enterobacter cloacae, Samples 1, 3 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 8 and 9

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080A) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2530	Fecal Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2530	Fecal Coliforms - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2530	Fecal Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/27/2013	0			
2530	Fecal Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2530	Fecal Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2530	Fecal Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2530	Fecal Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2530	Fecal Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/25/2013	0			
2530	Fecal Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9221B + E EC online	7/26/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 2, 5 and 7
Total Coliform Organism - Enterobacter cloacae, Samples 1, 3 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 8 and 9

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080A) (Continued)												
2525	E.coli - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 2	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 7	CFU/100mL		Presence	Presence	Not Reported						
2525	E.coli - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2525	E.coli - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Acceptable
E.coli Evaluation : Not Reported

Fecal Coliform Organism - Escherichia coli, Samples 2, 5 and 7
Total Coliform Organism - Enterobacter cloacae, Samples 1, 3 and 6
Negative (1) Coliform Organism - Proteus mirabilis, Sample 10
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 8 and 9

WS-204 2003 NELAC Evaluation Final Complete Report

ERA
A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 8
Total Coliform Organism - Enterobacter cloacae, Samples 1, 4 and 7
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 6 and 10

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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ERA Customer Number: M327601
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 8
Total Coliform Organism - Enterobacter cloacae, Samples 1, 4 and 7
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 6 and 10

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B) (Continued)												
2525	E.coli - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT 20th ED 1997	7/30/2013	0			

Total Coliforms Evaluation : **Acceptable**
Fecal Coliforms Evaluation : **Not Reported**
E.coli Evaluation : **Acceptable**

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 8
Total Coliform Organism - Enterobacter cloacae, Samples 1, 4 and 7
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 6 and 10

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B)												
2500	Total Coliforms - Sample 1	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 8
Total Coliform Organism - Enterobacter cloacae, Samples 1, 4 and 7
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 6 and 10

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080B) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 8
Total Coliform Organism - Enterobacter cloacae, Samples 1, 4 and 7
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
Blank - No Organism, Samples 6 and 10

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A Waters Company

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QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS MicrobE™ (Coliforms) (cat# 080B) (Continued)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2525	E.coli - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLILERT online	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 3, 5 and 8
Total Coliform Organism - Enterobacter cloacae, Samples 1, 4 and 7
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 9
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C)												
2500	Total Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 6, 9 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 3, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 1 and 5

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 08/26/13
Study Dates: 07/08/13 - 08/22/13

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Presence	Presence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 6, 9 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 3, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
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QA Officer
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750 Royal Oaks Dr.
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C) (Continued)												
2525	E.coli - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 20th ED 1998	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 6, 9 and 10
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C)												
2500	Total Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 6, 9 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 3, 7 and 8
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Suite 100
Monrovia, CA 91016
626-386-1170

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Presence	Presence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 6, 9 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 3, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 1 and 5

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080C) (Continued)												
2525	E.coli - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLert18 online	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 6, 9 and 10
Total Coliform Organism - Enterobacter cloacae, Samples 3, 7 and 8
Negative (1) Coliform Organism - Proteus mirabilis, Sample 2
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 4
Blank - No Organism, Samples 1 and 5

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
Report Issued:	**08/26/13**
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WS MicrobE™ (Coliforms) (cat# 080D)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 4, 5 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 3 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 6
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 7
Blank - No Organism, Samples 1 and 8

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
ERA Customer Number:	M327601
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobE™ (Coliforms) (cat# 080D) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 4, 5 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 3 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 6
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 7
Blank - No Organism, Samples 1 and 8

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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WS MicrobE™ (Coliforms) (cat# 080D) (Continued)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2525	E.coli - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE 20th ED 1997	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 4, 5 and 9
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QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
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2500	Total Coliforms - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 2	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 3	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2500	Total Coliforms - Sample 10	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 4, 5 and 9
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS MicrobeE™ (Coliforms) (cat# 080D) (Continued)												
2530	Fecal Coliforms - Sample 1	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 2	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 3	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 4	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 5	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 6	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 7	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 8	CFU/100mL		Absence	Absence	Not Reported						
2530	Fecal Coliforms - Sample 9	CFU/100mL		Presence	Presence	Not Reported						
2530	Fecal Coliforms - Sample 10	CFU/100mL		Absence	Absence	Not Reported						

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 4, 5 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 3 and 10
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WS MicrobE™ (Coliforms) (cat# 080D) (Continued)												
2525	E.coli - Sample 1	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 2	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 3	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 4	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 5	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 6	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 7	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 8	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 9	CFU/100mL	Presence	Presence	Presence	Acceptable	SM9223 COLISURE online	7/30/2013	0			
2525	E.coli - Sample 10	CFU/100mL	Absence	Absence	Absence	Acceptable	SM9223 COLISURE online	7/30/2013	0			

Total Coliforms Evaluation : Acceptable
Fecal Coliforms Evaluation : Not Reported
E.coli Evaluation : Acceptable

Fecal Coliform Organism - Escherichia coli, Samples 4, 5 and 9
Total Coliform Organism - Enterobacter cloacae, Samples 2, 3 and 10
Negative (1) Coliform Organism - Proteus mirabilis, Sample 6
Negative (2) Coliform Organism - Pseudomonas aeruginosa, Sample 7
Blank - No Organism, Samples 1 and 8

WS-204 2003 NELAC Evaluation Final Complete Report

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 08/26/13
Study Dates: 07/08/13 - 08/22/13

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		108	56.7 - 116	Not Reported				80.9	14.7	
2530	Fecal Coliforms (MF)	CFU/100mL		108	30.8 - 126	Not Reported				62.2	23.7	
2525	E.coli (MF)	CFU/100mL		108	37.1 - 135	Not Reported				70.8	24.5	
2500	Total Coliforms (MPN)	MPN/100mL	79.0	101	61.1 - 166	Acceptable	SM9223B MPN 20th ED 1997	7/30/2013	-0.829	101	26.2	
2530	Fecal Coliforms (MPN)	MPN/100mL		101	63.2 - 177	Not Reported				106	28.4	
2525	E.coli (MPN)	MPN/100mL	79.0	101	61.0 - 162	Acceptable	SM9223B MPN 20th ED 1997	7/30/2013	-0.81	99.5	25.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

WS WS SourceWatR™ MicrobE™ (cat# 595)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms (MF)	CFU/100mL		108	56.7 - 116	Not Reported				80.9	14.7	
2530	Fecal Coliforms (MF)	CFU/100mL		108	30.8 - 126	Not Reported				62.2	23.7	
2525	E.coli (MF)	CFU/100mL		108	37.1 - 135	Not Reported				70.8	24.5	
2500	Total Coliforms (MPN)	MPN/100mL	79.0	101	61.1 - 166	Acceptable	SM9223B MPN online	7/30/2013	-0.829	101	26.2	
2530	Fecal Coliforms (MPN)	MPN/100mL		101	63.2 - 177	Not Reported				106	28.4	
2525	E.coli (MPN)	MPN/100mL	79.0	101	61.0 - 162	Acceptable	SM9223B MPN online	7/30/2013	-0.81	99.5	25.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS WS SourceWatR™ MicrobE™ (cat# 595)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms (MF)	CFU/100mL		108	56.7 - 116	Not Reported				80.9	14.7	
2530	Fecal Coliforms (MF)	CFU/100mL		108	30.8 - 126	Not Reported				62.2	23.7	
2525	E.coli (MF)	CFU/100mL		108	37.1 - 135	Not Reported				70.8	24.5	
2500	Total Coliforms (MPN)	MPN/100mL	79.0	101	61.1 - 166	Acceptable	SM9223 COLert18 20th ED 1997	7/30/2013	-0.829	101	26.2	
2530	Fecal Coliforms (MPN)	MPN/100mL		101	63.2 - 177	Not Reported				106	28.4	
2525	E.coli (MPN)	MPN/100mL	79.0	101	61.0 - 162	Acceptable	SM9223 COLert18 20th ED 1997	7/30/2013	-0.81	99.5	25.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms (MF)	CFU/100mL		108	56.7 - 116	Not Reported				80.9	14.7	
2530	Fecal Coliforms (MF)	CFU/100mL		108	30.8 - 126	Not Reported				62.2	23.7	
2525	E.coli (MF)	CFU/100mL		108	37.1 - 135	Not Reported				70.8	24.5	
2500	Total Coliforms (MPN)	MPN/100mL	79.0	101	61.1 - 166	Acceptable	SM9223 COLert18 online	7/30/2013	-0.829	101	26.2	
2530	Fecal Coliforms (MPN)	MPN/100mL		101	63.2 - 177	Not Reported				106	28.4	
2525	E.coli (MPN)	MPN/100mL	79.0	101	61.0 - 162	Acceptable	SM9223 COLert18 online	7/30/2013	-0.81	99.5	25.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS WS SourceWatR™ MicrobE™ (cat# 595)

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2500	Total Coliforms (MF)	CFU/100mL		108	56.7 - 116	Not Reported				80.9	14.7	
2530	Fecal Coliforms (MF)	CFU/100mL		108	30.8 - 126	Not Reported				62.2	23.7	
2525	E.coli (MF)	CFU/100mL		108	37.1 - 135	Not Reported				70.8	24.5	
2500	Total Coliforms (MPN)	MPN/100mL	105	101	61.1 - 166	Acceptable	SM9223 COLt18QT 20th ED 1998	8/9/2013	0.163	101	26.2	
2530	Fecal Coliforms (MPN)	MPN/100mL	105	101	63.2 - 177	Acceptable	SM9223 COLt18QT 20th ED 1998	8/9/2013	-0.0254	106	28.4	
2525	E.coli (MPN)	MPN/100mL	105	101	61.0 - 162	Acceptable	SM9223 COLt18QT 20th ED 1998	8/9/2013	0.219	99.5	25.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

WS WS SourceWatR™ MicrobE™ (cat# 595)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
2500	Total Coliforms (MF)	CFU/100mL		108	56.7 - 116	Not Reported				80.9	14.7	
2530	Fecal Coliforms (MF)	CFU/100mL		108	30.8 - 126	Not Reported				62.2	23.7	
2525	E.coli (MF)	CFU/100mL		108	37.1 - 135	Not Reported				70.8	24.5	
2500	Total Coliforms (MPN)	MPN/100mL	105	101	61.1 - 166	Acceptable	SM9223 COLt18QT online	8/9/2013	0.163	101	26.2	
2530	Fecal Coliforms (MPN)	MPN/100mL	105	101	63.2 - 177	Acceptable	SM9223 COLt18QT online	8/9/2013	-0.0254	106	28.4	
2525	E.coli (MPN)	MPN/100mL	105	101	61.0 - 162	Acceptable	SM9223 COLt18QT online	8/9/2013	0.219	99.5	25.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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ERA
A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		108	56.7 - 116	Not Reported				80.9	14.7	
2530	Fecal Coliforms (MF)	CFU/100mL		108	30.8 - 126	Not Reported				62.2	23.7	
2525	E.coli (MF)	CFU/100mL		108	37.1 - 135	Not Reported				70.8	24.5	
2500	Total Coliforms (MPN)	MPN/100mL	138	101	61.1 - 166	Acceptable	SM9223 COLertQT 20th ED 1998	8/9/2013	1.42	101	26.2	
2530	Fecal Coliforms (MPN)	MPN/100mL	138	101	63.2 - 177	Acceptable	SM9223 COLertQT 20th ED 1998	8/9/2013	1.14	106	28.4	
2525	E.coli (MPN)	MPN/100mL	138	101	61.0 - 162	Acceptable	SM9223 COLertQT 20th ED 1998	8/9/2013	1.52	99.5	25.2	

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WS WS SourceWatR™ MicrobE™ (cat# 595)

2500	Total Coliforms (MF)	CFU/100mL		108	56.7 - 116	Not Reported				80.9	14.7	
2530	Fecal Coliforms (MF)	CFU/100mL		108	30.8 - 126	Not Reported				62.2	23.7	
2525	E.coli (MF)	CFU/100mL		108	37.1 - 135	Not Reported				70.8	24.5	
2500	Total Coliforms (MPN)	MPN/100mL	138	101	61.1 - 166	Acceptable	SM9223 COLertQT online	8/9/2013	1.42	101	26.2	
2530	Fecal Coliforms (MPN)	MPN/100mL	138	101	63.2 - 177	Acceptable	SM9223 COLertQT online	8/9/2013	1.14	106	28.4	
2525	E.coli (MPN)	MPN/100mL	138	101	61.0 - 162	Acceptable	SM9223 COLertQT online	8/9/2013	1.52	99.5	25.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

WS Heterotrophic Plate Count (cat# 079)

2555	Heterotrophic Plate Count (MF, PP)	CFU/mL	55.0	59.0	33.5 - 74.3	Acceptable	SM9215B PCA 20th ED 1998	7/31/2013	0.500	49.9	10.2	
2555	Heterotrophic Plate Count (MPN)	MPN/mL		54.0	27.3 - 99.7	Not Reported				54.2	18.9	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Heterotrophic Plate Count (cat# 079)												
2555	Heterotrophic Plate Count (MF, PP)	CFU/mL	55.0	59.0	33.5 - 74.3	Acceptable	SM9215B PCA 21st ED 2000	7/31/2013	0.500	49.9	10.2	
2555	Heterotrophic Plate Count (MPN)	MPN/mL		54.0	27.3 - 99.7	Not Reported				54.2	18.9	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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2003 NELAC Evaluation Report

Study: **WS-204**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

Organic Results

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

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QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Chloral Hydrate (cat# 853)												
4460	Chloral Hydrate	µg/L	36.9	19.5	4.22 - 31.2	Not Acceptable	EPA 551.1 1 1992	8/21/2013	8.16	19.3	2.16	
WS Haloacetic Acids (HAA) (cat# 852)												
9312	Bromoacetic acid	µg/L	25.6	25.2	15.1 - 35.3	Acceptable	SM 6251 B 21st ED 1994	7/24/2013	0.339	24.8	2.50	
9315	Bromochloroacetic acid	µg/L	16.5	16.8	10.1 - 23.5	Acceptable	SM 6251 B 21st ED 1994	7/24/2013	-0.445	17.3	1.81	
9336	Chloroacetic acid	µg/L	37.8	42.9	25.7 - 60.1	Acceptable	SM 6251 B 21st ED 1994	7/24/2013	-0.553	40.4	4.63	
9357	Dibromoacetic acid	µg/L	18.6	19.9	11.9 - 27.9	Acceptable	SM 6251 B 21st ED 1994	7/24/2013	0.0366	18.5	2.64	
9360	Dichloroacetic acid	µg/L	47.1	47.0	28.2 - 65.8	Acceptable	SM 6251 B 21st ED 1994	7/24/2013	0.544	44.3	5.21	
9642	Trichloroacetic acid	µg/L	33.3	34.9	20.9 - 48.9	Acceptable	SM 6251 B 21st ED 1994	7/24/2013	-0.073	33.5	2.91	
WS Haloacetic Acids (HAA) (cat# 852)												
9312	Bromoacetic acid	µg/L	25.6	25.2	15.1 - 35.3	Acceptable	SM 6251 B 22nd ED 2007	7/24/2013	0.339	24.8	2.50	
9315	Bromochloroacetic acid	µg/L	16.5	16.8	10.1 - 23.5	Acceptable	SM 6251 B 22nd ED 2007	7/24/2013	-0.445	17.3	1.81	
9336	Chloroacetic acid	µg/L	37.8	42.9	25.7 - 60.1	Acceptable	SM 6251 B 22nd ED 2007	7/24/2013	-0.553	40.4	4.63	
9357	Dibromoacetic acid	µg/L	18.6	19.9	11.9 - 27.9	Acceptable	SM 6251 B 22nd ED 2007	7/24/2013	0.0366	18.5	2.64	
9360	Dichloroacetic acid	µg/L	47.1	47.0	28.2 - 65.8	Acceptable	SM 6251 B 22nd ED 2007	7/24/2013	0.544	44.3	5.21	
9642	Trichloroacetic acid	µg/L	33.3	34.9	20.9 - 48.9	Acceptable	SM 6251 B 22nd ED 2007	7/24/2013	-0.073	33.5	2.91	

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WS Haloacetic Acids (HAA) (cat# 852)												
9312	Bromoacetic acid	µg/L	25.4	25.2	15.1 - 35.3	Acceptable	EPA 552.3 1 2003	8/6/2013	0.259	24.8	2.50	
9315	Bromochloroacetic acid	µg/L	17.2	16.8	10.1 - 23.5	Acceptable	EPA 552.3 1 2003	8/6/2013	-0.0594	17.3	1.81	
9336	Chloroacetic acid	µg/L	40.9	42.9	25.7 - 60.1	Acceptable	EPA 552.3 1 2003	8/6/2013	0.117	40.4	4.63	
9357	Dibromoacetic acid	µg/L	18.2	19.9	11.9 - 27.9	Acceptable	EPA 552.3 1 2003	8/6/2013	-0.115	18.5	2.64	
9360	Dichloroacetic acid	µg/L	44.9	47.0	28.2 - 65.8	Acceptable	EPA 552.3 1 2003	8/6/2013	0.121	44.3	5.21	
9642	Trichloroacetic acid	µg/L	32.5	34.9	20.9 - 48.9	Acceptable	EPA 552.3 1 2003	8/6/2013	-0.348	33.5	2.91	
WS Gasoline Additives (GAD) (cat# 905)												
4370	T-amylmethylether (TAME)	µg/L	28.2	28.9	21.6 - 36.8	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.764	30.0	2.35	
4420	Tert-Butyl Alcohol	µg/L	66.3	48.5	28.9 - 67.5	Acceptable	EPA 524.2 4.1 1995	7/22/2013	2.30	45.7	8.95	
5000	tert-Butyl methyl ether (MTBE)	µg/L	42.5	39.3	31.4 - 47.2	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.172	41.8	4.19	
9375	Di-isopropylether (DIPE)	µg/L	42.9	36.6	29.7 - 45.7	Acceptable	EPA 524.2 4.1 1995	7/25/2013	1.10	39.1	3.48	
4770	Ethyl-t-butylether (ETBE)	µg/L	45.3	39.5	31.2 - 51.0	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.813	42.9	2.95	
5175	Trichlorofluoromethane (Freon 11)	µg/L	24.9	23.1	13.9 - 32.3	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.11	25.3	3.36	
5185	Trichlorotrifluoroethane (Freon 113)	µg/L	41.6	39.6	26.4 - 52.7	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.459	44.9	7.13	

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WS Gasoline Additives (GAD) (cat# 905)												
4370	T-amylmethylether (TAME)	µg/L	30.2	28.9	21.6 - 36.8	Acceptable	EPA 524.3 1 2009	8/22/2013	0.0868	30.0	2.35	
4420	Tert-Butyl Alcohol	µg/L		48.5	28.9 - 67.5	Not Reported				45.7	8.95	
5000	tert-Butyl methyl ether (MTBE)	µg/L	42.6	39.3	31.4 - 47.2	Acceptable	EPA 524.3 1 2009	8/22/2013	0.196	41.8	4.19	
9375	Di-isopropylether (DIPE)	µg/L	38.1	36.6	29.7 - 45.7	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.282	39.1	3.48	
4770	Ethyl-t-butylether (ETBE)	µg/L	42.2	39.5	31.2 - 51.0	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.238	42.9	2.95	
5175	Trichlorofluoromethane (Freon 11)	µg/L	24.4	23.1	13.9 - 32.3	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.259	25.3	3.36	
5185	Trichlorotrifluoroethane (Freon 113)	µg/L	42.1	39.6	26.4 - 52.7	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.389	44.9	7.13	
WS Halomethanes (THMs) (cat# 842)												
4395	Bromodichloromethane	µg/L	45.4	42.4	33.9 - 50.9	Acceptable	EPA 551.1 1 1992	8/2/2013	0.174	44.6	4.30	
4400	Bromoform	µg/L	9.70	8.98	7.18 - 10.8	Acceptable	EPA 551.1 1 1992	8/2/2013	0.606	9.04	1.09	
4575	Chlorodibromomethane	µg/L	20.5	19.4	15.5 - 23.3	Acceptable	EPA 551.1 1 1992	8/2/2013	0.251	20.0	2.05	
4505	Chloroform	µg/L	25.6	24.7	19.8 - 29.6	Acceptable	EPA 551.1 1 1992	8/2/2013	-0.162	26.0	2.49	
WS Halomethanes (THMs) (cat# 842)												
4395	Bromodichloromethane	µg/L	51.4	42.4	33.9 - 50.9	Not Acceptable	EPA 524.2 4.1 1995	8/15/2013	1.57	44.6	4.30	
4400	Bromoform	µg/L	11.1	8.98	7.18 - 10.8	Not Acceptable	EPA 524.2 4.1 1995	8/15/2013	1.89	9.04	1.09	
4575	Chlorodibromomethane	µg/L	23.2	19.4	15.5 - 23.3	Acceptable	EPA 524.2 4.1 1995	8/15/2013	1.57	20.0	2.05	
4505	Chloroform	µg/L	30.1	24.7	19.8 - 29.6	Not Acceptable	EPA 524.2 4.1 1995	8/15/2013	1.64	26.0	2.49	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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WS Halomethanes (THMs) (cat# 842)												
4395	Bromodichloromethane	µg/L	44.8	42.4	33.9 - 50.9	Acceptable	EPA 524.3 1 2009	8/22/2013	0.0344	44.6	4.30	
4400	Bromoform	µg/L	8.45	8.98	7.18 - 10.8	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.545	9.04	1.09	
4575	Chlorodibromomethane	µg/L	18.8	19.4	15.5 - 23.3	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.579	20.0	2.05	
4505	Chloroform	µg/L	26.2	24.7	19.8 - 29.6	Acceptable	EPA 524.3 1 2009	8/22/2013	0.0790	26.0	2.49	

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WS Regulated Volatiles (cat# 840)												
4375	Benzene	µg/L	14.0	13.7	11.0 - 16.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.324	13.7	0.903	
4455	Carbon tetrachloride	µg/L	4.51	5.10	3.06 - 7.14	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.878	5.05	0.611	
4475	Chlorobenzene	µg/L	6.06	6.13	3.68 - 8.58	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.402	6.26	0.491	
4610	1,2-Dichlorobenzene	µg/L	8.21	8.58	5.15 - 12.0	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.529	8.64	0.812	
4620	1,4-Dichlorobenzene	µg/L	12.4	12.8	10.2 - 15.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.397	12.9	1.24	
4635	1,2-Dichloroethane	µg/L	20.8	19.1	15.3 - 22.9	Acceptable	EPA 524.2 4.1 1995	7/25/2013	1.20	19.3	1.22	
4640	1,1-Dichloroethylene	µg/L	3.93	3.14	1.88 - 4.40	Acceptable	EPA 524.2 4.1 1995	7/25/2013	1.16	3.45	0.411	
4645	cis-1,2-Dichloroethylene	µg/L	13.2	12.3	9.84 - 14.8	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.802	12.4	0.998	
4700	trans-1,2-Dichloroethylene	µg/L	18.0	15.7	12.6 - 18.8	Acceptable	EPA 524.2 4.1 1995	7/25/2013	1.14	16.3	1.52	
4655	1,2-Dichloropropane	µg/L	8.71	9.28	5.57 - 13.0	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-1.18	9.33	0.524	
4765	Ethylbenzene	µg/L	7.36	6.98	4.19 - 9.77	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.653	7.04	0.489	
4975	Methylene chloride (Dichloromethane)	µg/L	9.26	8.16	4.90 - 11.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	1.04	8.35	0.871	
5100	Styrene	µg/L	13.6	11.7	9.36 - 14.0	Acceptable	EPA 524.2 4.1 1995	7/25/2013	1.75	11.7	1.05	
5115	Tetrachloroethylene	µg/L	10.2	11.2	8.96 - 13.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.383	10.6	1.15	
5140	Toluene	µg/L	13.7	13.9	11.1 - 16.7	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.285	14.0	0.920	
5155	1,2,4-Trichlorobenzene	µg/L	9.40	10.8	8.64 - 13.0	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.698	10.4	1.40	
5160	1,1,1-Trichloroethane	µg/L	10.6	11.2	8.96 - 13.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.54	11.1	0.871	
5165	1,1,2-Trichloroethane	µg/L	13.3	14.1	11.3 - 16.9	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.972	14.1	0.806	
5170	Trichloroethylene	µg/L	15.7	16.0	12.8 - 19.2	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.193	15.4	1.30	
5235	Vinyl chloride	µg/L	12.8	9.80	5.88 - 13.7	Acceptable	EPA 524.2 4.1 1995	7/25/2013	1.39	10.7	1.53	

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Nilda B. Cox
QA Officer
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750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Regulated Volatiles (cat# 840) (Continued)												
5260	Xylenes, total	µg/L	18.0	17.7	14.2 - 21.2	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.117	18.2	1.40	

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WS Regulated Volatiles (cat# 840)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
4375	Benzene	µg/L	14.3	13.7	11.0 - 16.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.656	13.7	0.903	
4455	Carbon tetrachloride	µg/L	5.14	5.10	3.06 - 7.14	Acceptable	EPA 524.3 1 2009	8/22/2013	0.154	5.05	0.611	
4475	Chlorobenzene	µg/L	6.44	6.13	3.68 - 8.58	Acceptable	EPA 524.3 1 2009	8/22/2013	0.372	6.26	0.491	
4610	1,2-Dichlorobenzene	µg/L	9.24	8.58	5.15 - 12.0	Acceptable	EPA 524.3 1 2009	8/22/2013	0.739	8.64	0.812	
4620	1,4-Dichlorobenzene	µg/L	13.3	12.8	10.2 - 15.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.330	12.9	1.24	
4635	1,2-Dichloroethane	µg/L	20.8	19.1	15.3 - 22.9	Acceptable	EPA 524.3 1 2009	8/22/2013	1.20	19.3	1.22	
4640	1,1-Dichloroethylene	µg/L	3.52	3.14	1.88 - 4.40	Acceptable	EPA 524.3 1 2009	8/22/2013	0.162	3.45	0.411	
4645	cis-1,2-Dichloroethylene	µg/L	12.5	12.3	9.84 - 14.8	Acceptable	EPA 524.3 1 2009	8/22/2013	0.101	12.4	0.998	
4700	trans-1,2-Dichloroethylene	µg/L	17.3	15.7	12.6 - 18.8	Acceptable	EPA 524.3 1 2009	8/22/2013	0.675	16.3	1.52	
4655	1,2-Dichloropropane	µg/L	9.69	9.28	5.57 - 13.0	Acceptable	EPA 524.3 1 2009	8/22/2013	0.689	9.33	0.524	
4765	Ethylbenzene	µg/L	7.43	6.98	4.19 - 9.77	Acceptable	EPA 524.3 1 2009	8/22/2013	0.796	7.04	0.489	
4975	Methylene chloride (Dichloromethane)	µg/L	8.70	8.16	4.90 - 11.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.401	8.35	0.871	
5100	Styrene	µg/L	11.9	11.7	9.36 - 14.0	Acceptable	EPA 524.3 1 2009	8/22/2013	0.143	11.7	1.05	
5115	Tetrachloroethylene	µg/L	11.5	11.2	8.96 - 13.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.746	10.6	1.15	
5140	Toluene	µg/L	14.5	13.9	11.1 - 16.7	Acceptable	EPA 524.3 1 2009	8/22/2013	0.584	14.0	0.920	
5155	1,2,4-Trichlorobenzene	µg/L	11.3	10.8	8.64 - 13.0	Acceptable	EPA 524.3 1 2009	8/22/2013	0.656	10.4	1.40	
5160	1,1,1-Trichloroethane	µg/L	11.5	11.2	8.96 - 13.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.493	11.1	0.871	
5165	1,1,2-Trichloroethane	µg/L	14.6	14.1	11.3 - 16.9	Acceptable	EPA 524.3 1 2009	8/22/2013	0.640	14.1	0.806	
5170	Trichloroethylene	µg/L	16.2	16.0	12.8 - 19.2	Acceptable	EPA 524.3 1 2009	8/22/2013	0.576	15.4	1.30	
5235	Vinyl chloride	µg/L	11.4	9.80	5.88 - 13.7	Acceptable	EPA 524.3 1 2009	8/22/2013	0.481	10.7	1.53	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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ERA Customer Number: M327601
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WS Regulated Volatiles (cat# 840) (Continued)												
5260	Xylenes, total	µg/L	18.4	17.7	14.2 - 21.2	Acceptable	EPA 524.3 1 2009	8/22/2013	0.168	18.2	1.40	

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WS Unregulated Volatiles (cat# 841)												
4385	Bromobenzene	µg/L	9.94	10.3	8.24 - 12.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.61	10.5	0.926	
4390	Bromochloromethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	7/25/2013				
4950	Bromomethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	7/25/2013				
5000	tert-Butyl methyl ether (MTBE)	µg/L	17.2	16.2	13.0 - 19.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.0159	17.2	1.68	
4435	n-Butylbenzene	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	7/25/2013				
4440	sec-Butylbenzene	µg/L	6.56	6.68	4.01 - 9.35	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.439	6.91	0.789	
4445	tert-Butylbenzene	µg/L	16.0	16.2	13.0 - 19.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.215	16.4	2.04	
4485	Chloroethane	µg/L	14.2	12.2	7.32 - 17.1	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.491	13.3	1.82	
4960	Chloromethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	7/25/2013				
4535	2-Chlorotoluene	µg/L	4.41	4.81	2.89 - 6.73	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.949	4.97	0.588	
4540	4-Chlorotoluene	µg/L	5.54	5.70	3.42 - 7.98	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.639	5.98	0.693	
4595	Dibromomethane	µg/L	17.7	18.4	14.7 - 22.1	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.963	19.1	1.44	
4615	1,3-Dichlorobenzene	µg/L	10.2	10.7	8.56 - 12.8	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.684	11.0	1.18	
4625	Dichlorodifluoromethane (Freon 12)	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	7/25/2013				
4630	1,1-Dichloroethane	µg/L	9.06	8.18	4.91 - 11.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.618	8.52	0.864	
4660	1,3-Dichloropropane	µg/L	8.68	9.41	5.65 - 13.2	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-1.03	9.46	0.762	
4665	2,2-Dichloropropane	µg/L	15.4	15.0	12.0 - 18.0	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.0305	15.3	1.97	
4670	1,1-Dichloropropene	µg/L	12.9	14.3	11.4 - 17.2	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.674	14.0	1.62	
4680	cis-1,3-Dichloropropene	µg/L	15.1	16.6	13.3 - 19.9	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.48	15.8	1.56	
4685	trans-1,3-Dichloropropene	µg/L	5.43	6.17	3.70 - 8.64	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.692	5.89	0.666	

Nilda B. Cox
QA Officer
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750 Royal Oaks Dr.
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WS Unregulated Volatiles (cat# 841) (Continued)												
5175	Fluorotrichloromethane	µg/L	45.1	38.2	22.9 - 53.5	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.305	42.9	7.17	
4835	Hexachlorobutadiene	µg/L	5.69	7.96	4.78 - 11.1	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-1.53	7.17	0.964	
4900	Isopropylbenzene	µg/L	4.34	4.66	2.80 - 6.52	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.468	4.64	0.644	
4910	4-Isopropyltoluene	µg/L	8.45	8.66	5.20 - 12.1	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.236	8.66	0.911	
5005	Naphthalene	µg/L	34.5	35.9	25.1 - 46.7	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.393	36.4	4.76	
5090	n-Propylbenzene	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	7/25/2013				
5105	1,1,1,2-Tetrachloroethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.2 4.1 1995	7/25/2013				
5110	1,1,2,2-Tetrachloroethane	µg/L	4.22	4.07	2.44 - 5.70	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.171	4.13	0.500	
5150	1,2,3-Trichlorobenzene	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.2 4.1 1995	7/25/2013				
5180	1,2,3-Trichloropropane (TCP)	µg/L	15.7	15.3	12.2 - 18.4	Acceptable	EPA 524.2 4.1 1995	7/25/2013	-0.043	15.8	1.76	
5210	1,2,4-Trimethylbenzene	µg/L	2.45	2.28	1.37 - 3.19	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.164	2.40	0.313	
5215	1,3,5-Trimethylbenzene	µg/L	7.38	6.88	4.13 - 9.63	Acceptable	EPA 524.2 4.1 1995	7/25/2013	0.560	6.93	0.806	

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4385	Bromobenzene	µg/L	10.3	10.3	8.24 - 12.4	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.222	10.5	0.926	
4390	Bromochloromethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	8/22/2013				
4950	Bromomethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	8/22/2013				
5000	tert-Butyl methyl ether (MTBE)	µg/L	18.6	16.2	13.0 - 19.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.819	17.2	1.68	
4435	n-Butylbenzene	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	8/22/2013				
4440	sec-Butylbenzene	µg/L	7.04	6.68	4.01 - 9.35	Acceptable	EPA 524.3 1 2009	8/22/2013	0.169	6.91	0.789	
4445	tert-Butylbenzene	µg/L	17.0	16.2	13.0 - 19.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.276	16.4	2.04	
4485	Chloroethane	µg/L	13.9	12.2	7.32 - 17.1	Acceptable	EPA 524.3 1 2009	8/22/2013	0.326	13.3	1.82	
4960	Chloromethane	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	8/22/2013				
4535	2-Chlorotoluene	µg/L	4.68	4.81	2.89 - 6.73	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.489	4.97	0.588	
4540	4-Chlorotoluene	µg/L	5.83	5.70	3.42 - 7.98	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.221	5.98	0.693	
4595	Dibromomethane	µg/L	19.6	18.4	14.7 - 22.1	Acceptable	EPA 524.3 1 2009	8/22/2013	0.358	19.1	1.44	
4615	1,3-Dichlorobenzene	µg/L	10.7	10.7	8.56 - 12.8	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.26	11.0	1.18	
4625	Dichlorodifluoromethane (Freon 12)	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	8/22/2013				
4630	1,1-Dichloroethane	µg/L	9.05	8.18	4.91 - 11.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.606	8.52	0.864	
4660	1,3-Dichloropropane	µg/L	9.54	9.41	5.65 - 13.2	Acceptable	EPA 524.3 1 2009	8/22/2013	0.103	9.46	0.762	
4665	2,2-Dichloropropane	µg/L	15.4	15.0	12.0 - 18.0	Acceptable	EPA 524.3 1 2009	8/22/2013	0.0305	15.3	1.97	
4670	1,1-Dichloropropene	µg/L	14.2	14.3	11.4 - 17.2	Acceptable	EPA 524.3 1 2009	8/22/2013	0.130	14.0	1.62	
4680	cis-1,3-Dichloropropene	µg/L	16.0	16.6	13.3 - 19.9	Acceptable	EPA 524.3 1 2009	8/22/2013	0.0982	15.8	1.56	
4685	trans-1,3-Dichloropropene	µg/L	5.71	6.17	3.70 - 8.64	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.272	5.89	0.666	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Unregulated Volatiles (cat# 841) (Continued)												
5175	Fluorotrichloromethane	µg/L	45.2	38.2	22.9 - 53.5	Acceptable	EPA 524.3 1 2009	8/22/2013	0.319	42.9	7.17	
4835	Hexachlorobutadiene	µg/L	7.73	7.96	4.78 - 11.1	Acceptable	EPA 524.3 1 2009	8/22/2013	0.583	7.17	0.964	
4900	Isopropylbenzene	µg/L	4.56	4.66	2.80 - 6.52	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.127	4.64	0.644	
4910	4-Isopropyltoluene	µg/L	8.62	8.66	5.20 - 12.1	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.0489	8.66	0.911	
5005	Naphthalene	µg/L	37.8	35.9	25.1 - 46.7	Acceptable	EPA 524.3 1 2009	8/22/2013	0.300	36.4	4.76	
5090	n-Propylbenzene	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	8/22/2013				
5105	1,1,1,2-Tetrachloroethane	µg/L	< 0.50	< 1.20	0.00 - 1.20	Acceptable	EPA 524.3 1 2009	8/22/2013				
5110	1,1,2,2-Tetrachloroethane	µg/L	4.46	4.07	2.44 - 5.70	Acceptable	EPA 524.3 1 2009	8/22/2013	0.652	4.13	0.500	
5150	1,2,3-Trichlorobenzene	µg/L	< 0.50	< 3.00	0.00 - 3.00	Acceptable	EPA 524.3 1 2009	8/22/2013				
5180	1,2,3-Trichloropropane (TCP)	µg/L	17.1	15.3	12.2 - 18.4	Acceptable	EPA 524.3 1 2009	8/22/2013	0.754	15.8	1.76	
5210	1,2,4-Trimethylbenzene	µg/L	2.37	2.28	1.37 - 3.19	Acceptable	EPA 524.3 1 2009	8/22/2013	-0.0908	2.40	0.313	
5215	1,3,5-Trimethylbenzene	µg/L	7.04	6.88	4.13 - 9.63	Acceptable	EPA 524.3 1 2009	8/22/2013	0.138	6.93	0.806	

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750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS Pesticides (cat# 850)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
7005	Alachlor	µg/L	14.0	14.5	7.98 - 21.0	Acceptable	EPA 525.2 2 1995	7/23/2013	0.0286	13.9	2.36	
7025	Aldrin	µg/L	1.60	2.08	0.938 - 2.64	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.147	1.66	0.427	
7065	Atrazine	µg/L	2.75	2.69	1.48 - 3.90	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.5	3.09	0.682	
7120	gamma-BHC (Lindane)	µg/L	0.986	0.994	0.547 - 1.44	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.169	1.02	0.206	
7130	Bromacil	µg/L	< 0.20	< 2.00	0.00 - 2.00	Acceptable	EPA 525.2 2 1995	7/23/2013				
7160	Butachlor	µg/L	11.7	10.5	5.78 - 15.2	Acceptable	EPA 525.2 2 1995	7/23/2013	0.152	11.4	1.68	
7410	Diazinon	µg/L	< 0.10	< 2.00	0.00 - 2.00	Acceptable	EPA 525.2 2 1995	7/23/2013				
7470	Dieldrin	µg/L	1.87	1.90	1.04 - 2.76	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.097	1.89	0.211	
7540	Endrin	µg/L	1.21	1.27	0.889 - 1.65	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.548	1.34	0.228	
7685	Heptachlor	µg/L	0.908	0.950	0.522 - 1.38	Acceptable	EPA 525.2 2 1995	7/23/2013	0.0772	0.896	0.153	
7690	Heptachlor epoxide (beta)	µg/L	1.36	1.58	0.869 - 2.29	Acceptable	EPA 525.2 2 1995	7/23/2013	-1.01	1.59	0.227	
6275	Hexachlorobenzene	µg/L	0.840	0.924	0.440 - 1.18	Acceptable	EPA 525.2 2 1995	7/23/2013	0.129	0.817	0.179	
6285	Hexachlorocyclopentadiene	µg/L	7.80	6.94	2.01 - 9.98	Acceptable	EPA 525.2 2 1995	7/23/2013	0.732	6.18	2.21	
7810	Methoxychlor	µg/L	11.7	11.7	6.44 - 17.0	Acceptable	EPA 525.2 2 1995	7/23/2013	0.109	11.5	1.41	
7835	Metolachlor	µg/L	14.2	12.8	7.04 - 18.6	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.0793	14.5	3.53	
7845	Metribuzin	µg/L	6.85	7.41	3.70 - 11.1	Acceptable	EPA 525.2 2 1995	7/23/2013	0.308	6.44	1.34	
7875	Molinate (Ordram)	µg/L	6.18	6.54	3.77 - 9.00	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.127	6.29	0.854	
8035	Prometon	µg/L		2.86	0.872 - 3.98	Not Reported				2.59	0.908	
8045	Propachlor	µg/L	2.79	2.84	1.56 - 4.12	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.855	3.13	0.403	
8125	Simazine	µg/L	8.84	8.10	4.46 - 11.7	Acceptable	EPA 525.2 2 1995	7/23/2013	0.325	8.04	2.46	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
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WS Pesticides (cat# 850) (Continued)												
8220	Thiobencarb	µg/L	< 0.20	< 2.00	0.00 - 2.00	Acceptable	EPA 525.2 2 1995	7/23/2013				
8295	Trifluralin	µg/L	1.62	1.82	1.00 - 2.64	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.495	1.89	0.549	

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ERA
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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
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Suite 100
Monrovia, CA 91016
626-386-1170

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WS Pesticides (cat# 850)												
7005	Alachlor	µg/L	15.6	14.5	7.98 - 21.0	Acceptable	EPA 505 2.1 1995	7/30/2013	0.708	13.9	2.36	
7025	Aldrin	µg/L	1.93	2.08	0.938 - 2.64	Acceptable	EPA 505 2.1 1995	7/30/2013	0.625	1.66	0.427	
7065	Atrazine	µg/L		2.69	1.48 - 3.90	Not Reported				3.09	0.682	
7120	gamma-BHC (Lindane)	µg/L	1.07	0.994	0.547 - 1.44	Acceptable	EPA 505 2.1 1995	7/30/2013	0.238	1.02	0.206	
7130	Bromacil	µg/L		< 2.00	0.00 - 2.00	Not Reported						
7160	Butachlor	µg/L		10.5	5.78 - 15.2	Not Reported				11.4	1.68	
7410	Diazinon	µg/L		< 2.00	0.00 - 2.00	Not Reported						
7470	Dieldrin	µg/L	1.89	1.90	1.04 - 2.76	Acceptable	EPA 505 2.1 1995	7/30/2013	-0.00219	1.89	0.211	
7540	Endrin	µg/L	1.32	1.27	0.889 - 1.65	Acceptable	EPA 505 2.1 1995	7/30/2013	-0.0661	1.34	0.228	
7685	Heptachlor	µg/L	0.817	0.950	0.522 - 1.38	Acceptable	EPA 505 2.1 1995	7/30/2013	-0.516	0.896	0.153	
7690	Heptachlor epoxide (beta)	µg/L	1.68	1.58	0.869 - 2.29	Acceptable	EPA 505 2.1 1995	7/30/2013	0.399	1.59	0.227	
6275	Hexachlorobenzene	µg/L		0.924	0.440 - 1.18	Not Reported				0.817	0.179	
6285	Hexachlorocyclopentadiene	µg/L		6.94	2.01 - 9.98	Not Reported				6.18	2.21	
7810	Methoxychlor	µg/L	11.9	11.7	6.44 - 17.0	Acceptable	EPA 505 2.1 1995	7/30/2013	0.251	11.5	1.41	
7835	Metolachlor	µg/L		12.8	7.04 - 18.6	Not Reported				14.5	3.53	
7845	Metribuzin	µg/L		7.41	3.70 - 11.1	Not Reported				6.44	1.34	
7875	Molinate (Ordram)	µg/L		6.54	3.77 - 9.00	Not Reported				6.29	0.854	
8035	Prometon	µg/L		2.86	0.872 - 3.98	Not Reported				2.59	0.908	
8045	Propachlor	µg/L		2.84	1.56 - 4.12	Not Reported				3.13	0.403	
8125	Simazine	µg/L		8.10	4.46 - 11.7	Not Reported				8.04	2.46	

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Pesticides (cat# 850) (Continued)												
8220	Thiobencarb	µg/L		< 2.00	0.00 - 2.00	Not Reported						
8295	Trifluralin	µg/L		1.82	1.00 - 2.64	Not Reported				1.89	0.549	
WS Carbamate/Carbamoxyloxime Pesticides (cat# 846)												
7010	Aldicarb	µg/L	26.0	28.0	21.0 - 35.0	Acceptable	EPA 531.2 1 2001	7/26/2013	-0.639	27.6	2.54	
7015	Aldicarb sulfone	µg/L	16.4	16.2	12.2 - 20.2	Acceptable	EPA 531.2 1 2001	7/26/2013	-0.278	16.7	1.10	
7020	Aldicarb sulfoxide	µg/L	27.1	29.6	22.2 - 37.0	Acceptable	EPA 531.2 1 2001	7/26/2013	-0.00734	27.1	2.63	
8080	Baygon	µg/L	69.0	70.1	57.0 - 83.2	Acceptable	EPA 531.2 1 2001	7/26/2013	-0.213	69.9	4.16	
7195	Carbaryl	µg/L	24.6	26.4	19.8 - 33.0	Acceptable	EPA 531.2 1 2001	7/26/2013	0.282	24.2	1.50	
7205	Carbofuran	µg/L	84.1	85.8	47.2 - 124	Acceptable	EPA 531.2 1 2001	7/26/2013	0.0660	83.6	8.05	
7710	3-Hydroxycarbofuran	µg/L	35.1	35.4	28.3 - 42.5	Acceptable	EPA 531.2 1 2001	7/26/2013	0.0220	35.0	2.68	
7800	Methiocarb	µg/L	47.8	47.5	37.1 - 56.7	Acceptable	EPA 531.2 1 2001	7/26/2013	0.886	44.8	3.33	
7805	Methomyl	µg/L	37.0	38.4	30.7 - 46.1	Acceptable	EPA 531.2 1 2001	7/26/2013	-0.132	37.4	3.04	
7940	Oxamyl (vydate)	µg/L	58.0	61.0	45.8 - 76.2	Acceptable	EPA 531.2 1 2001	7/26/2013	0.530	56.4	3.05	
WS Chlordane (cat# 845)												
7250	Chlordane, technical	µg/L	3.19	3.00	1.65 - 4.35	Acceptable	EPA 505 2.1 1995	7/24/2013	0.553	2.90	0.526	
WS Chlordane (cat# 845)												
7250	Chlordane, technical	µg/L	3.09	3.00	1.65 - 4.35	Acceptable	EPA 525.2 2 1995	7/23/2013	0.363	2.90	0.526	
WS Toxaphene (cat# 844)												
8250	Toxaphene	µg/L	14.1	8.66	4.76 - 12.6	Not Acceptable	EPA 505 2.1 1995	7/24/2013	1.65	9.78	2.62	

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QA Officer
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750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

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WS EDB/DBCP/TCP (cat# 847)												
4570	Dibromochloropropane (DBCP)	µg/L	0.811	0.812	0.487 - 1.14	Acceptable	EPA 504.1 1.1 1995	7/30/2013	-0.0924	0.824	0.142	
4585	Ethylene Dibromide (EDB)	µg/L	1.69	1.72	1.03 - 2.41	Acceptable	EPA 504.1 1.1 1995	7/30/2013	0.286	1.61	0.263	
5180	1,2,3-Trichloropropane (TCP)	µg/L	0.940	0.854	0.512 - 1.20	Acceptable	EPA 504.1 1.1 1995	7/29/2013	0.667	0.873	0.100	
WS EDB/DBCP/TCP (cat# 847)												
4570	Dibromochloropropane (DBCP)	µg/L	0.811	0.812	0.487 - 1.14	Acceptable	EPA 8011 1994	7/30/2013	-0.0924	0.824	0.142	
4585	Ethylene Dibromide (EDB)	µg/L	1.69	1.72	1.03 - 2.41	Acceptable	EPA 8011 1994	7/30/2013	0.286	1.61	0.263	
5180	1,2,3-Trichloropropane (TCP)	µg/L		0.854	0.512 - 1.20	Not Reported				0.873	0.100	
WS EDB/DBCP/TCP (cat# 847)												
4570	Dibromochloropropane (DBCP)	µg/L	1.19	0.812	0.487 - 1.14	Not Acceptable	EPA 551.1 1 1992	7/18/2013	2.57	0.824	0.142	
4585	Ethylene Dibromide (EDB)	µg/L	1.85	1.72	1.03 - 2.41	Acceptable	EPA 551.1 1 1992	7/18/2013	0.894	1.61	0.263	
5180	1,2,3-Trichloropropane (TCP)	µg/L		0.854	0.512 - 1.20	Not Reported				0.873	0.100	
WS EDB/DBCP/TCP (cat# 847)												
4570	Dibromochloropropane (DBCP)	µg/L		0.812	0.487 - 1.14	Not Reported				0.824	0.142	
4585	Ethylene Dibromide (EDB)	µg/L		1.72	1.03 - 2.41	Not Reported				1.61	0.263	
5180	1,2,3-Trichloropropane (TCP)	µg/L	0.985	0.854	0.512 - 1.20	Acceptable	EPA 524.2 4.1 1995	7/23/2013	1.12	0.873	0.100	
WS Dioxin (cat# 857)												
9618	2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/L	72.0	71.5	41.1 - 85.5	Acceptable	EPA 1613 1994	7/18/2013	-0.452	75.8	8.34	
WS Dioxin (cat# 857)												
9618	2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/L	72.0	71.5	41.1 - 85.5	Acceptable	EPA 1613B Appendix A 1997	7/18/2013	-0.452	75.8	8.34	

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WS PCBs as Decachlorobiphenyl (cat# 839)												
8880	Aroclor 1016	µg/L	< 0.08	< 0.260	0.00 - 0.260	Acceptable	EPA 505 2.1 1995	7/24/2013				
8885	Aroclor 1221	µg/L	< 0.10	< 0.190	0.00 - 0.190	Acceptable	EPA 505 2.1 1995	7/24/2013				
8890	Aroclor 1232	µg/L	< 0.10	< 0.230	0.00 - 0.230	Acceptable	EPA 505 2.1 1995	7/24/2013				
8895	Aroclor 1242	µg/L	< 0.10	< 0.260	0.00 - 0.260	Acceptable	EPA 505 2.1 1995	7/24/2013				
8900	Aroclor 1248	µg/L	2.71	2.38	1.36 - 2.90	Acceptable	EPA 505 2.1 1995	7/24/2013	0.882	2.46	0.289	
8905	Aroclor 1254	µg/L	< 0.10	< 0.330	0.00 - 0.330	Acceptable	EPA 505 2.1 1995	7/24/2013				
8910	Aroclor 1260	µg/L	< 0.10	< 0.360	0.00 - 0.360	Acceptable	EPA 505 2.1 1995	7/24/2013				
8872	PCB Aroclor Identity	Identity	1248	1248		Acceptable	EPA 505 2.1 1995	7/24/2013	0			
9105	PCB as Decachlorobiphenyl	µg/L		3.98	0.398 - 7.96	Not Reported				3.52	1.07	

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WS Regulated Semivolatiles Ampule #1 (cat# 848)												
5500	Acenaphthene	µg/L	3.29	3.60	1.79 - 4.51	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.109	3.31	0.200	
5505	Acenaphthylene	µg/L	8.60	9.17	4.32 - 12.3	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.374	8.93	0.885	
5555	Anthracene	µg/L	6.24	6.75	2.93 - 8.76	Acceptable	EPA 525.2 2 1995	7/23/2013	0.00373	6.24	0.298	
5575	Benzo(a)anthracene	µg/L	6.45	6.71	3.70 - 8.50	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.145	6.58	0.910	
5585	Benzo(b)fluoranthene	µg/L	4.74	4.88	2.60 - 6.72	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.326	4.94	0.632	
5600	Benzo(k)fluoranthene	µg/L	1.69	1.88	1.02 - 2.54	Acceptable	EPA 525.2 2 1995	7/23/2013	-1.06	2.04	0.329	
5590	Benzo(g,h,i)perylene	µg/L	4.24	4.01	1.81 - 5.73	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.368	4.40	0.451	
5580	Benzo(a)pyrene	µg/L	1.51	1.80	0.744 - 2.30	Acceptable	EPA 525.2 2 1995	7/23/2013	0.0155	1.50	0.321	
5670	Butylbenzylphthalate	µg/L	58.1	47.1	25.6 - 68.4	Acceptable	EPA 525.2 2 1995	7/23/2013	0.932	49.0	9.77	
5855	Chrysene	µg/L	2.46	2.53	1.45 - 3.25	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.0644	2.48	0.311	
5895	Dibenz(a,h)anthracene	µg/L	1.30	1.19	0.552 - 1.71	Acceptable	EPA 525.2 2 1995	7/23/2013	0.242	1.27	0.131	
6070	Diethylphthalate	µg/L	51.7	47.2	25.4 - 66.7	Acceptable	EPA 525.2 2 1995	8/2/2013	0.699	47.0	6.66	
6135	Dimethylphthalate	µg/L	32.8	27.5	13.2 - 37.8	Acceptable	EPA 525.2 2 1995	7/23/2013	1.55	27.5	3.42	
5925	Di-n-butylphthalate	µg/L	35.6	32.2	17.6 - 46.3	Acceptable	EPA 525.2 2 1995	7/23/2013	0.0201	35.4	8.04	
6200	Di-n-octylphthalate	µg/L	34.7	36.9	18.3 - 51.5	Acceptable	EPA 525.2 2 1995	7/23/2013	0.214	32.6	10.1	
6062	bis(2-Ethylhexyl)adipate	µg/L	28.3	29.0	17.9 - 38.2	Acceptable	EPA 525.2 2 1995	7/23/2013	0.102	27.7	5.49	
6065	bis(2-Ethylhexyl)phthalate	µg/L	29.9	28.4	14.4 - 40.6	Acceptable	EPA 525.2 2 1995	7/23/2013	0.0898	29.2	7.21	
6265	Fluoranthene	µg/L	4.84	5.22	2.52 - 7.05	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.388	4.99	0.384	
6270	Fluorene	µg/L	2.91	2.88	1.68 - 3.68	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.412	3.03	0.287	
6315	Indeno(1,2,3-cd)pyrene	µg/L	4.11	4.69	2.04 - 6.71	Acceptable	EPA 525.2 2 1995	7/23/2013	-1.28	4.84	0.574	

WS-204 2003 NELAC Evaluation Final Complete Report

ERA
A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 08/26/13
Study Dates: 07/08/13 - 08/22/13

WS Regulated Semivolatiles Ampule #1 (cat# 848) (Continued)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
5005	Naphthalene	µg/L	3.52	3.48	1.41 - 4.44	Acceptable	EPA 525.2 2 1995	7/23/2013	1.08	3.25	0.248	
6615	Phenanthrene	µg/L	1.72	2.00	1.27 - 2.52	Acceptable	EPA 525.2 2 1995	7/23/2013	-1.12	1.90	0.164	
6665	Pyrene	µg/L	3.13	3.19	1.90 - 4.12	Acceptable	EPA 525.2 2 1995	7/23/2013	-0.153	3.18	0.295	

WS Chlorinated Acid Herbicides (cat# 851)

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
8505	Acifluorfen	µg/L	69.4	58.9	29.4 - 88.4	Acceptable	EPA 515.4 1 2000	7/26/2013	0.912	63.5	6.42	
8530	Bentazon	µg/L	15.0	17.4	9.01 - 23.7	Acceptable	EPA 515.4 1 2000	7/25/2013	-1.67	17.6	1.56	
8540	Chloramben	µg/L		37.3	9.99 - 50.6	Not Reported				30.4	5.86	
8545	2,4-D	µg/L	16.9	13.8	6.90 - 20.7	Acceptable	EPA 515.4 1 2000	7/26/2013	1.49	13.8	2.08	
8550	Dacthal diacid (DCPA)	µg/L	48.6	40.5	15.1 - 65.7	Acceptable	EPA 515.4 1 2000	7/26/2013	1.24	39.5	7.34	
8555	Dalapon	µg/L	27.8	28.7	14.4 - 43.0	Acceptable	EPA 515.4 1 2000	7/25/2013	-0.274	29.2	5.15	
8560	2,4-DB	µg/L	38.9	47.5	23.8 - 71.2	Acceptable	EPA 515.4 1 2000	7/25/2013	-0.702	43.3	6.27	
8595	Dicamba	µg/L	29.2	27.9	14.0 - 41.8	Acceptable	EPA 515.4 1 2000	7/26/2013	1.46	26.0	2.16	
8600	3,5-Dichlorobenzoic acid	µg/L	15.4	17.4	8.29 - 23.0	Acceptable	EPA 515.4 1 2000	7/25/2013	-0.418	16.7	3.01	
8605	Dichlorprop	µg/L	24.8	20.4	9.34 - 28.1	Acceptable	EPA 515.4 1 2000	7/26/2013	0.382	22.8	5.31	
8620	Dinoseb	µg/L	16.6	16.3	6.09 - 23.2	Acceptable	EPA 515.4 1 2000	7/26/2013	0.410	15.8	1.97	
6500	4-Nitrophenol	µg/L		21.6	2.16 - 29.2	Not Reported				14.6	3.18	
6605	Pentachlorophenol	µg/L	14.5	14.1	7.05 - 21.2	Acceptable	EPA 515.4 1 2000	7/26/2013	-0.182	14.9	2.20	
8645	Picloram	µg/L	25.5	23.6	11.8 - 35.4	Acceptable	EPA 515.4 1 2000	7/26/2013	1.14	21.8	3.22	
8655	2,4,5-T	µg/L	30.3	34.5	17.2 - 51.8	Acceptable	EPA 515.4 1 2000	7/26/2013	-0.411	31.3	2.47	
8650	2,4,5-TP (Silvex)	µg/L	23.9	24.6	12.3 - 36.9	Acceptable	EPA 515.4 1 2000	7/26/2013	0.0848	23.6	3.58	

WS-204 2003 NELAC Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 08/26/13
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Chlorinated Acid Herbicides (cat# 851)												
8505	Acifluorfen	µg/L		58.9	29.4 - 88.4	Not Reported				63.5	6.42	
8530	Bentazon	µg/L		17.4	9.01 - 23.7	Not Reported				17.6	1.56	
8540	Chloramben	µg/L		37.3	9.99 - 50.6	Not Reported				30.4	5.86	
8545	2,4-D	µg/L		13.8	6.90 - 20.7	Not Reported				13.8	2.08	
8550	Dacthal diacid (DCPA)	µg/L		40.5	15.1 - 65.7	Not Reported				39.5	7.34	
8555	Dalapon	µg/L		28.7	14.4 - 43.0	Not Reported				29.2	5.15	
8560	2,4-DB	µg/L		47.5	23.8 - 71.2	Not Reported				43.3	6.27	
8595	Dicamba	µg/L		27.9	14.0 - 41.8	Not Reported				26.0	2.16	
8600	3,5-Dichlorobenzoic acid	µg/L		17.4	8.29 - 23.0	Not Reported				16.7	3.01	
8605	Dichlorprop	µg/L		20.4	9.34 - 28.1	Not Reported				22.8	5.31	
8620	Dinoseb	µg/L		16.3	6.09 - 23.2	Not Reported				15.8	1.97	
6500	4-Nitrophenol	µg/L		21.6	2.16 - 29.2	Not Reported				14.6	3.18	
6605	Pentachlorophenol	µg/L	15.9	14.1	7.05 - 21.2	Acceptable	EPA 525.2 2 1995	7/23/2013	0.453	14.9	2.20	
8645	Picloram	µg/L		23.6	11.8 - 35.4	Not Reported				21.8	3.22	
8655	2,4,5-T	µg/L		34.5	17.2 - 51.8	Not Reported				31.3	2.47	
8650	2,4,5-TP (Silvex)	µg/L		24.6	12.3 - 36.9	Not Reported				23.6	3.58	

WS-204 2003 NELAC Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	CA00006
ERA Customer Number:	M327601
Report Issued:	08/26/13
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Chlorinated Acid Herbicides (cat# 851)												
8505	Acifluorfen	µg/L		58.9	29.4 - 88.4	Not Reported				63.5	6.42	
8530	Bentazon	µg/L		17.4	9.01 - 23.7	Not Reported				17.6	1.56	
8540	Chloramben	µg/L		37.3	9.99 - 50.6	Not Reported				30.4	5.86	
8545	2,4-D	µg/L		13.8	6.90 - 20.7	Not Reported				13.8	2.08	
8550	Dacthal diacid (DCPA)	µg/L		40.5	15.1 - 65.7	Not Reported				39.5	7.34	
8555	Dalapon	µg/L	28.7	28.7	14.4 - 43.0	Acceptable	EPA 552.3 1 2003	7/26/2013	-0.0993	29.2	5.15	
8560	2,4-DB	µg/L		47.5	23.8 - 71.2	Not Reported				43.3	6.27	
8595	Dicamba	µg/L		27.9	14.0 - 41.8	Not Reported				26.0	2.16	
8600	3,5-Dichlorobenzoic acid	µg/L		17.4	8.29 - 23.0	Not Reported				16.7	3.01	
8605	Dichlorprop	µg/L		20.4	9.34 - 28.1	Not Reported				22.8	5.31	
8620	Dinoseb	µg/L		16.3	6.09 - 23.2	Not Reported				15.8	1.97	
6500	4-Nitrophenol	µg/L		21.6	2.16 - 29.2	Not Reported				14.6	3.18	
6605	Pentachlorophenol	µg/L		14.1	7.05 - 21.2	Not Reported				14.9	2.20	
8645	Picloram	µg/L		23.6	11.8 - 35.4	Not Reported				21.8	3.22	
8655	2,4,5-T	µg/L		34.5	17.2 - 51.8	Not Reported				31.3	2.47	
8650	2,4,5-TP (Silvex)	µg/L		24.6	12.3 - 36.9	Not Reported				23.6	3.58	
WS Regulated Semivolatiles #2 Herbicides (cat# 849)												
9390	Diquat	µg/L	7.11	13.2	6.60 - 19.8	Acceptable	EPA 549.2 1 1997	8/9/2013	-1.86	10.7	1.91	
7525	Endothall	µg/L	136	168	84.0 - 252	Acceptable	EPA 548.1 1 1992	8/8/2013	-0.417	150	33.8	
9411	Glyphosate	µg/L	413	387	310 - 464	Acceptable	EPA 547 1990	7/30/2013	1.02	386	26.4	
9528	Paraquat	µg/L	14.6	30.6	13.4 - 38.4	Acceptable	EPA 549.2 1 1997	8/9/2013	-1.68	21.3	4.00	

Nilda B. Cox
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016

WS-201 Final Report

WatR™ Supply Proficiency Testing

WatR™Supply Study

Open Date: 04/08/13

Close Date: 05/23/13

Report Issued Date: 06/06/13

A Waters Company

June 6, 2013

Nilda B. Cox
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016

Enclosed is your final report for ERA's WS-201 WatR™Supply Proficiency Testing (PT) study. Your final report includes an evaluation of all results submitted by your laboratory to ERA.

Data Evaluation Protocols: All analytes in ERA's WS-201 WatR™Supply Proficiency Testing (PT) study have been evaluated using the following tiered approach. If the analyte is listed in the current TNI Fields of Proficiency Testing (FoPT) tables, the evaluation was completed by comparing the reported result to the acceptance limits generated using the criteria contained in the TNI FoPT tables. If the analyte is not included in the TNI FoPT tables, the reported result has been evaluated using the procedures outlined in ERA's Standard Operating Procedure for the Generation of Performance Acceptance Limits (SOP 0260).

Corrective Action Help: As part of your accreditation(s), you may be required to identify the root cause of any "Not Acceptable" results, implement the necessary corrective actions, and then satisfy your PT requirements by participating in a Supplemental (QuiK™Response) or future ERA PT study. ERA's technical staff is available to help your laboratory resolve any technical issues that may be impairing your PT performance and possibly affecting your routine data quality. Our laboratory and technical staff have many years of collective experience in performing the full range of environmental analyses. As part of our technical support, ERA offers QC samples that can be useful in helping you work through your technical issues.

Please note the following changes to our final reports:

• At the request of the TNI Accreditation Council, we have included a Laboratory Exception Report that includes a list of all analytes reported with less than qualifiers when the assigned value was greater than "0." In addition, because we have received many requests from laboratories, this report also includes a list of all analytes with "Not Acceptable" evaluations.

• Some states have elected not to convert to the 2009 TNI Standards at this time. If you have released your results to a state that has retained the 2003 NELAC Evaluation Criteria, your final report will include a section that evaluates the results according to the 2003 Standard in addition to the 2009 TNI Standards.

Thank you for your participation in ERA's WS-201 WatR™Supply Proficiency Testing study. If you have any questions, please contact our Proficiency Testing Department at 1-800-372-0122.

Sincerely,

Kristina Sanchez
Quality Officer

attachments

ERA

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Report Recipient	Contact/Phone Number	Reporting Type	Evaluation Type
Alabama	Tom DeLoach / 334-271-7791	All Analytes	2009 TNI
Alaska	Lance Morris / 907-375-8210	All Analytes	2009 TNI
Arizona	Ali Mayfield / (602) 364-0728	All Analytes	2009 TNI
California	Fred Choske / 510-620-3175	All Analytes	2009 TNI
Colorado	Ben Chouaf / 303-692-3045	All Analytes	2009 TNI
Connecticut	Environmental Lab Certification / 860-509-7388	All Analytes	2009 TNI
Delaware	Brenda Haire / 302-741-8630	All Analytes	2009 TNI
EPA Region 8	Marcie Tidd / (303) 312-7764	All Analytes	2009 TNI
Georgia	Lynne Grubb / 404-657-3189	All Analytes	2009 TNI
Guam	Rodolfo Paulino / 671-475-1655	All Analytes	2009 TNI
Hawaii	Richard Kiyokane / 808-453-6679	All Analytes	2009 TNI
Idaho	Ernie Bader / 208-334-2235 x 290	All Analytes	2009 TNI
Indiana	Phil Zillinger / 317-921-5571	All Analytes	2009 TNI
Kentucky	Patrick Garrity / 502-564-3410 ext 4968	All Analytes	2009 TNI
Maine	Jennifer Jamison / 207-287-1929	All Analytes	2009 TNI
Mariana Island	Vinson Sablan / 670-664-8520	All Analytes	2009 TNI
Maryland	Linda Ames / 410-537-3712	All Analytes	2009 TNI
Massachusetts	Ann Marie Allen / 978-682-5237 x 51333	All Analytes	2009 TNI
Michigan (WS)	Greg Lundy / 517-335-9219	All Analytes	2009 TNI
Mississippi	Phyllis Givens / 601-576-7582	All Analytes	2009 TNI
Montana	Russell Leu / 406-444-5259	All Analytes	2009 TNI
Nebraska	Laurie Wieting / 402-471-8407	All Analytes	2009 TNI
Nevada	Sara Rairick / 775-687-9490	All Analytes	2003 NELAC
New Jersey	Rachel Ellis / 609-777-1749	All Analytes	2009 TNI
New Mexico (WS)	Paul W. Gray / 505-383-9120	All Analytes	2009 TNI
New York	Dan Dickinson / 518-485-5570	All Analytes	2003 NELAC
North Carolina (WS)	Chris Goforth / 919-807-8871	All Analytes	2009 TNI
North Dakota	Errol Erickson / 701-328-6172	All Analytes	2009 TNI
South Carolina	Carol Smith / 803-896-0992	All Analytes	2003 NELAC
South Dakota	Mike Smith / 605-773-4757	All Analytes	2009 TNI
Tennessee	Craig LaFever / 615-532-0181	All Analytes	2009 TNI
Vermont (WS)	George Mills / 802-863-7335	All Analytes	2009 TNI
Virginia	Cathy Westerman / 804-648-4480 x391	All Analytes	2003 NELAC

A Waters Company

Washington	Alan Rue / (360) 895-6178	All Analytes	2009 TNI
West Virginia (WS)	Greg Young / 304-965-2694 X2222	All Analytes	2003 NELAC
Wisconsin	Rick Mealy / 608-264-6006	All Analytes	2009 TNI

WS-201 Definitions & Study Discussion

Study Dates: 04/08/13 - 05/23/13 **Report Issued: 06/06/13**

WS Study Definitions

The Reported Value is the value that the laboratory reported to ERA.

The ERA Assigned Values are compliant with the current TNI Fields of Proficiency Testing (FoPT) tables. A parameter not added to the standard is given an Assigned Value of "< PTRL" per the guidelines contained in the 2009 TNI Standards. The assigned values are directly traceable to the commercially prepared starting materials used to manufacture the PT standards.

The Acceptance Limits are established per the criteria contained in the most current TNI FoPT tables, or ERA's SOP for the Generation of Performance Acceptance Limits™ as applicable.

The Performance Evaluation:

Acceptable	= Reported Value falls within the Acceptance Limits.
Not Acceptable	= Reported Value falls outside the Acceptance Limits.
No Evaluation	= Reported Value cannot be evaluated.
Not Reported	= No Value reported.

The Method Description is the method the laboratory reported to ERA.

WS Study Discussion

ERA's WS-201 WatR™Supply Proficiency Testing study has been reviewed by ERA senior management and certified compliant with the requirements of the 2009 TNI PT Standards and the criteria contained in the most current TNI Fields of Proficiency Testing (FoPT) tables.

ERA's WS-201 WatR™Supply study standards were examined for any anomalies. A full review of all homogeneity, stability and accuracy verification data was completed. All analytical verification data for all analytes in the standards met the acceptance criteria contained in the 2009 TNI PT Standard and the criteria contained in the most current TNI FoPT tables.

The data submitted by participating laboratories was also examined for study anomalies. There were no anomalies observed during the statistical review of the data.

ERA's WS-201 WatR™Supply study reports shall not be reproduced except in their entirety and not without the permission of the participating laboratories. The report must not be used by the participating laboratories to claim product endorsement by any agency of the U. S. government.

The data contained herein are confidential and intended for your use only.

If you have any questions or concerns regarding your assessment in ERA's WatR™Supply Proficiency Testing program, please contact our Proficiency Testing Department at 1-800-372-0122.

ERA

A Waters Company

WS-201 Laboratory Exception Report

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1117

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
Report Issued:	**06/06/13**
Study Dates:	**04/08/13 - 05/23/13**

2009 TNI Evaluation Checks

There are no values reported with < where the assigned value was greater than 0.

2009 TNI Not Acceptable Evaluations

There were no Not Acceptable evaluations for this study.

ERA

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Final Report Results For Laboratory
Eurofins Eaton Analytical, Inc - Monrovia

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

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A Waters Company

2009 TNI Evaluation Report

Study: **WS-201**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

Inorganic Results

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

WS-201 2009 TNI Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1117

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 06/06/13
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Inorganics (cat# 591)												
1505	Alkalinity as CaCO3	mg/L		164	148 - 180	Not Reported				162	4.44	
1575	Chloride	mg/L		54.6	46.4 - 62.8	Not Reported				52.8	1.91	
1610	Conductivity at 25°C	µmhos/cm		871	784 - 958	Not Reported				886	16.5	
1730	Fluoride	mg/L	7.30	7.60	6.84 - 8.36	Acceptable	EPA 300.0 2.1 1993	4/16/2013	-0.214	7.37	0.314	
1820	Nitrate + Nitrite as N	mg/L		4.70	4.00 - 5.40	Not Reported				4.50	0.210	
1810	Nitrate as N	mg/L		4.70	4.23 - 5.17	Not Reported				4.52	0.224	
1125	Potassium	mg/L		28.8	24.5 - 33.1	Not Reported				28.1	1.84	
2000	Sulfate	mg/L		160	136 - 184	Not Reported				157	6.95	
1955	Total Dissolved Solids at 180°C	mg/L		733	586 - 880	Not Reported				718	23.8	

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A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1117

EPA ID: CA00006
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Metals (cat# 590)												
1000	Aluminum	µg/L		628	534 - 722	Not Reported				629	30.1	
1005	Antimony	µg/L		37.2	26.0 - 48.4	Not Reported				36.9	1.82	
1010	Arsenic	µg/L		46.4	32.5 - 60.3	Not Reported				45.1	2.97	
1015	Barium	µg/L		1640	1390 - 1890	Not Reported				1620	61.2	
1020	Beryllium	µg/L		3.09	2.63 - 3.55	Not Reported				3.04	0.195	
1025	Boron	µg/L		1680	1430 - 1930	Not Reported				1650	97.8	
1030	Cadmium	µg/L		17.4	13.9 - 20.9	Not Reported				17.2	0.697	
1040	Chromium	µg/L	53.7	58.7	49.9 - 67.5	Acceptable	EPA 200.8 5.4 1994	4/25/2013	-2.0	58.7	2.49	
1055	Copper	µg/L		227	204 - 250	Not Reported				228	12.1	
1070	Iron	µg/L		1240	1050 - 1430	Not Reported				1250	57.8	
1075	Lead	µg/L		61.7	43.2 - 80.2	Not Reported				61.2	3.50	
1090	Manganese	µg/L		304	258 - 350	Not Reported				308	12.3	
1100	Molybdenum	µg/L		39.1	33.2 - 45.0	Not Reported				38.4	1.95	
1105	Nickel	µg/L	53.8	55.7	47.3 - 64.0	Acceptable	EPA 200.8 5.4 1994	4/25/2013	-0.633	55.3	2.42	
1140	Selenium	µg/L		79.4	63.5 - 95.3	Not Reported				78.5	5.56	
1150	Silver	µg/L		283	198 - 368	Not Reported				282	11.8	
1165	Thallium	µg/L		9.36	6.55 - 12.2	Not Reported				9.23	0.566	
1185	Vanadium	µg/L		308	262 - 354	Not Reported				304	12.4	
1190	Zinc	µg/L		242	206 - 278	Not Reported				243	14.8	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

WS-201 2009 TNI Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1117

EPA ID:	CA00006
ERA Customer Number:	M327601
Report Issued:	06/06/13
Study Dates:	04/08/13 - 05/23/13

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Metals (cat# 590)												
1000	Aluminum	µg/L		628	534 - 722	Not Reported				629	30.1	
1005	Antimony	µg/L		37.2	26.0 - 48.4	Not Reported				36.9	1.82	
1010	Arsenic	µg/L		46.4	32.5 - 60.3	Not Reported				45.1	2.97	
1015	Barium	µg/L		1640	1390 - 1890	Not Reported				1620	61.2	
1020	Beryllium	µg/L		3.09	2.63 - 3.55	Not Reported				3.04	0.195	
1025	Boron	µg/L		1680	1430 - 1930	Not Reported				1650	97.8	
1030	Cadmium	µg/L		17.4	13.9 - 20.9	Not Reported				17.2	0.697	
1040	Chromium	µg/L	53.7	58.7	49.9 - 67.5	Acceptable	EPA 200.8 5.5 1998	4/25/2013	-2.0	58.7	2.49	
1055	Copper	µg/L		227	204 - 250	Not Reported				228	12.1	
1070	Iron	µg/L		1240	1050 - 1430	Not Reported				1250	57.8	
1075	Lead	µg/L		61.7	43.2 - 80.2	Not Reported				61.2	3.50	
1090	Manganese	µg/L		304	258 - 350	Not Reported				308	12.3	
1100	Molybdenum	µg/L		39.1	33.2 - 45.0	Not Reported				38.4	1.95	
1105	Nickel	µg/L	53.8	55.7	47.3 - 64.0	Acceptable	EPA 200.8 5.5 1998	4/25/2013	-0.633	55.3	2.42	
1140	Selenium	µg/L		79.4	63.5 - 95.3	Not Reported				78.5	5.56	
1150	Silver	µg/L		283	198 - 368	Not Reported				282	11.8	
1165	Thallium	µg/L		9.36	6.55 - 12.2	Not Reported				9.23	0.566	
1185	Vanadium	µg/L		308	262 - 354	Not Reported				304	12.4	
1190	Zinc	µg/L		242	206 - 278	Not Reported				243	14.8	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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WS-201 2009 TNI Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1117

EPA ID: CA00006
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Study Dates: 04/08/13 - 05/23/13

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Organic Carbon (cat# 557)												
1710	Dissolved Organic Carbon (DOC)	mg/L	11.2	11.0	9.79 - 12.1	Acceptable	SM5310C 20th ED 1996	4/12/2013	0.316	11.1	0.419	
2040	Total Organic Carbon (TOC)	mg/L	11.4	11.0	8.80 - 13.2	Acceptable	SM5310C 20th ED 1996	4/12/2013	0.662	11.1	0.398	
WS Organic Carbon (cat# 557)												
1710	Dissolved Organic Carbon (DOC)	mg/L	11.2	11.0	9.79 - 12.1	Acceptable	SM5310C 21st ED 2000	4/12/2013	0.316	11.1	0.419	
2040	Total Organic Carbon (TOC)	mg/L	11.4	11.0	8.80 - 13.2	Acceptable	SM5310C 21st ED 2000	4/12/2013	0.662	11.1	0.398	
WS UV 254 Absorbance (cat# 904)												
2060	UV 254 Absorbance	cm-1	0.228	0.202	0.163 - 0.247	Acceptable	SM5910B 20th ED 1994	4/12/2013	1.20	0.204	0.0205	
WS UV 254 Absorbance (cat# 904)												
2060	UV 254 Absorbance	cm-1	0.228	0.202	0.163 - 0.247	Acceptable	SM5910B 21st ED 2000	4/12/2013	1.20	0.204	0.0205	

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2009 TNI Evaluation Report

Study: **WS-201**

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Microbiology Results

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Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS WS SourceWatR™ MicrobE™ (cat# 595)												
2500	Total Coliforms (MF)	CFU/100mL		51.0	26.0 - 62.0	Not Reported				40.3	8.80	
2530	Fecal Coliforms (MF)	CFU/100mL		51.0	12.0 - 61.0	Not Reported				27.6	12.1	
2525	E.coli (MF)	CFU/100mL		51.0	12.0 - 79.0	Not Reported				31.1	16.8	
2500	Total Coliforms (MPN)	MPN/100mL		83.0	39.4 - 110	Not Reported				65.8	17.6	
2530	Fecal Coliforms (MPN)	MPN/100mL		83.0	15.2 - 198	Not Reported				54.9	45.7	
2525	E.coli (MPN)	MPN/100mL		83.0	41.6 - 106	Not Reported				66.5	16.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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2009 TNI Evaluation Report

Study: **WS-201**

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Organic Results

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WS-201 2009 TNI Evaluation Final Complete Report

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Halomethanes (THMs) (cat# 842)												
4395	Bromodichloromethane	µg/L	30.5	27.7	22.2 - 33.2	Acceptable	EPA 524.3 1 2009	5/2/2013	0.614	29.1	2.23	
4400	Bromoform	µg/L	28.7	28.1	22.5 - 33.7	Acceptable	EPA 524.3 1 2009	5/2/2013	0.212	28.2	2.15	
4575	Chlorodibromomethane	µg/L	26.2	26.0	20.8 - 31.2	Acceptable	EPA 524.3 1 2009	5/2/2013	-0.157	26.5	1.79	
4505	Chloroform	µg/L	22.5	20.8	16.6 - 25.0	Acceptable	EPA 524.3 1 2009	5/2/2013	0.782	21.1	1.81	

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QA Officer
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750 Royal Oaks Dr.
Suite 100
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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Unregulated Volatiles (cat# 841)												
4385	Bromobenzene	µg/L		19.6	15.7 - 23.5	Not Reported				19.4	1.74	
4390	Bromochloromethane	µg/L		9.34	5.60 - 13.1	Not Reported				9.70	1.14	
4950	Bromomethane	µg/L		12.6	7.56 - 17.6	Not Reported				11.8	3.85	
5000	tert-Butyl methyl ether (MTBE)	µg/L		23.7	19.0 - 28.4	Not Reported				24.6	2.34	
4435	n-Butylbenzene	µg/L		4.84	2.90 - 6.78	Not Reported				4.67	0.581	
4440	sec-Butylbenzene	µg/L		4.91	2.95 - 6.87	Not Reported				4.94	0.467	
4445	tert-Butylbenzene	µg/L		13.6	10.9 - 16.3	Not Reported				13.6	1.59	
4485	Chloroethane	µg/L		< 3.00	0.00 - 3.00	Not Reported						
4960	Chloromethane	µg/L		< 3.00	0.00 - 3.00	Not Reported						
4535	2-Chlorotoluene	µg/L		5.76	3.46 - 8.06	Not Reported				5.69	0.553	
4540	4-Chlorotoluene	µg/L		5.38	3.23 - 7.53	Not Reported				5.63	0.491	
4595	Dibromomethane	µg/L		< 1.20	0.00 - 1.20	Not Reported						
4615	1,3-Dichlorobenzene	µg/L		3.52	2.11 - 4.93	Not Reported				3.50	0.322	
4625	Dichlorodifluoromethane (Freon 12)	µg/L		< 3.00	0.00 - 3.00	Not Reported						
4630	1,1-Dichloroethane	µg/L		18.3	14.6 - 22.0	Not Reported				18.6	1.54	
4660	1,3-Dichloropropane	µg/L		< 1.20	0.00 - 1.20	Not Reported						
4665	2,2-Dichloropropane	µg/L	13.2	16.4	13.1 - 19.7	Acceptable	EPA 524.2 4.1 1995	5/17/2013	-1.71	16.4	1.89	
4670	1,1-Dichloropropene	µg/L		3.82	2.29 - 5.35	Not Reported				3.72	0.423	
4680	cis-1,3-Dichloropropene	µg/L		7.33	4.40 - 10.3	Not Reported				6.98	0.908	
4685	trans-1,3-Dichloropropene	µg/L		18.7	15.0 - 22.4	Not Reported				18.5	1.96	

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1117

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TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Unregulated Volatiles (cat# 841) (Continued)												
5175	Fluorotrichloromethane	µg/L		9.43	5.66 - 13.2	Not Reported				10.2	1.41	
4835	Hexachlorobutadiene	µg/L		12.7	10.2 - 15.2	Not Reported				12.8	1.46	
4900	Isopropylbenzene	µg/L		13.3	10.6 - 16.0	Not Reported				13.8	1.28	
4910	4-Isopropyltoluene	µg/L		< 1.20	0.00 - 1.20	Not Reported						
5005	Naphthalene	µg/L		9.50	5.70 - 13.3	Not Reported				9.23	1.64	
5090	n-Propylbenzene	µg/L		< 1.20	0.00 - 1.20	Not Reported						
5105	1,1,1,2-Tetrachloroethane	µg/L		14.7	11.8 - 17.6	Not Reported				15.3	1.28	
5110	1,1,2,2-Tetrachloroethane	µg/L		18.0	14.4 - 21.6	Not Reported				18.2	1.69	
5150	1,2,3-Trichlorobenzene	µg/L		< 3.00	0.00 - 3.00	Not Reported						
5180	1,2,3-Trichloropropane (TCP)	µg/L		< 1.20	0.00 - 1.20	Not Reported						
5210	1,2,4-Trimethylbenzene	µg/L		< 1.20	0.00 - 1.20	Not Reported						
5215	1,3,5-Trimethylbenzene	µg/L		9.68	5.81 - 13.6	Not Reported				10.1	1.00	

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Final Report Results For Laboratory
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2003 NELAC Evaluation Report

Study: **WS-201**

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Inorganic Results

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Inorganics (cat# 591)												
1505	Alkalinity as CaCO3	mg/L		164	148 - 180	Not Reported				162	4.44	
1575	Chloride	mg/L		54.6	46.4 - 62.8	Not Reported				52.8	1.91	
1610	Conductivity at 25°C	µmhos/cm		871	784 - 958	Not Reported				886	16.5	
1730	Fluoride	mg/L	7.30	7.60	6.84 - 8.36	Acceptable	EPA 300.0 2.1 1993	4/16/2013	-0.214	7.37	0.314	
1820	Nitrate + Nitrite as N	mg/L		4.70	4.00 - 5.40	Not Reported				4.50	0.210	
1810	Nitrate as N	mg/L		4.70	4.23 - 5.17	Not Reported				4.52	0.224	
1125	Potassium	mg/L		28.8	24.5 - 33.1	Not Reported				28.1	1.84	
2000	Sulfate	mg/L		160	136 - 184	Not Reported				157	6.95	
1955	Total Dissolved Solids at 180°C	mg/L		733	586 - 880	Not Reported				718	23.8	

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750 Royal Oaks Dr.
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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Metals (cat# 590)												
1000	Aluminum	µg/L		628	534 - 722	Not Reported				629	30.1	
1005	Antimony	µg/L		37.2	26.0 - 48.4	Not Reported				36.9	1.82	
1010	Arsenic	µg/L		46.4	32.5 - 60.3	Not Reported				45.1	2.97	
1015	Barium	µg/L		1640	1390 - 1890	Not Reported				1620	61.2	
1020	Beryllium	µg/L		3.09	2.63 - 3.55	Not Reported				3.04	0.195	
1025	Boron	µg/L		1680	1430 - 1930	Not Reported				1650	97.8	
1030	Cadmium	µg/L		17.4	13.9 - 20.9	Not Reported				17.2	0.697	
1040	Chromium	µg/L	53.7	58.7	49.9 - 67.5	Acceptable	EPA 200.8 5.4 1994	4/25/2013	-2.0	58.7	2.49	
1055	Copper	µg/L		227	204 - 250	Not Reported				228	12.1	
1070	Iron	µg/L		1240	1050 - 1430	Not Reported				1250	57.8	
1075	Lead	µg/L		61.7	43.2 - 80.2	Not Reported				61.2	3.50	
1090	Manganese	µg/L		304	258 - 350	Not Reported				308	12.3	
1100	Molybdenum	µg/L		39.1	33.2 - 45.0	Not Reported				38.4	1.95	
1105	Nickel	µg/L	53.8	55.7	47.3 - 64.0	Acceptable	EPA 200.8 5.4 1994	4/25/2013	-0.633	55.3	2.42	
1140	Selenium	µg/L		79.4	63.5 - 95.3	Not Reported				78.5	5.56	
1150	Silver	µg/L		283	198 - 368	Not Reported				282	11.8	
1165	Thallium	µg/L		9.36	6.55 - 12.2	Not Reported				9.23	0.566	
1185	Vanadium	µg/L		308	262 - 354	Not Reported				304	12.4	
1190	Zinc	µg/L		242	206 - 278	Not Reported				243	14.8	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1117

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1025	Boron	µg/L		1680	1430 - 1930	Not Reported				1650	97.8	
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2060	UV 254 Absorbance	cm-1	0.228	0.202	0.163 - 0.247	Acceptable	SM5910B 20th ED 1994	4/12/2013	1.20	0.204	0.0205	
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2003 NELAC Evaluation Report

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750 Royal Oaks Dr.
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2500	Total Coliforms (MF)	CFU/100mL		51.0	26.0 - 62.0	Not Reported				40.3	8.80	
2530	Fecal Coliforms (MF)	CFU/100mL		51.0	12.0 - 61.0	Not Reported				27.6	12.1	
2525	E.coli (MF)	CFU/100mL		51.0	12.0 - 79.0	Not Reported				31.1	16.8	
2500	Total Coliforms (MPN)	MPN/100mL		83.0	39.4 - 110	Not Reported				65.8	17.6	
2530	Fecal Coliforms (MPN)	MPN/100mL		83.0	15.2 - 198	Not Reported				54.9	45.7	
2525	E.coli (MPN)	MPN/100mL		83.0	41.6 - 106	Not Reported				66.5	16.2	

Per Section 6.4.3 a of the 2009 TNI Standard, "The assigned values for quantitative microbiology analytes shall be equal to the mean of the assigned value verification and/or homogeneity testing per Sections 7.1 and 7.2". The final acceptance limits are derived from the calculated study mean and study standard deviation from laboratory-reported results. Disagreement between the assigned values and study means/acceptance limits are due to the inherent variability of microbiology methods and differences in the methods used by ERA and participant laboratories. For quantitative microbiology analytes, the assigned value is not used in the evaluation of laboratories.

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NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Halomethanes (THMs) (cat# 842)												
4395	Bromodichloromethane	µg/L	30.5	27.7	22.2 - 33.2	Acceptable	EPA 524.3 1 2009	5/2/2013	0.614	29.1	2.23	
4400	Bromoform	µg/L	28.7	28.1	22.5 - 33.7	Acceptable	EPA 524.3 1 2009	5/2/2013	0.212	28.2	2.15	
4575	Chlorodibromomethane	µg/L	26.2	26.0	20.8 - 31.2	Acceptable	EPA 524.3 1 2009	5/2/2013	-0.157	26.5	1.79	
4505	Chloroform	µg/L	22.5	20.8	16.6 - 25.0	Acceptable	EPA 524.3 1 2009	5/2/2013	0.782	21.1	1.81	

WS-201 2003 NELAC Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1117

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 06/06/13
Study Dates: 04/08/13 - 05/23/13

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Unregulated Volatiles (cat# 841)												
4385	Bromobenzene	µg/L		19.6	15.7 - 23.5	Not Reported				19.4	1.74	
4390	Bromochloromethane	µg/L		9.34	5.60 - 13.1	Not Reported				9.70	1.14	
4950	Bromomethane	µg/L		12.6	7.56 - 17.6	Not Reported				11.8	3.85	
5000	tert-Butyl methyl ether (MTBE)	µg/L		23.7	19.0 - 28.4	Not Reported				24.6	2.34	
4435	n-Butylbenzene	µg/L		4.84	2.90 - 6.78	Not Reported				4.67	0.581	
4440	sec-Butylbenzene	µg/L		4.91	2.95 - 6.87	Not Reported				4.94	0.467	
4445	tert-Butylbenzene	µg/L		13.6	10.9 - 16.3	Not Reported				13.6	1.59	
4485	Chloroethane	µg/L		< 3.00	0.00 - 3.00	Not Reported						
4960	Chloromethane	µg/L		< 3.00	0.00 - 3.00	Not Reported						
4535	2-Chlorotoluene	µg/L		5.76	3.46 - 8.06	Not Reported				5.69	0.553	
4540	4-Chlorotoluene	µg/L		5.38	3.23 - 7.53	Not Reported				5.63	0.491	
4595	Dibromomethane	µg/L		< 1.20	0.00 - 1.20	Not Reported						
4615	1,3-Dichlorobenzene	µg/L		3.52	2.11 - 4.93	Not Reported				3.50	0.322	
4625	Dichlorodifluoromethane (Freon 12)	µg/L		< 3.00	0.00 - 3.00	Not Reported						
4630	1,1-Dichloroethane	µg/L		18.3	14.6 - 22.0	Not Reported				18.6	1.54	
4660	1,3-Dichloropropane	µg/L		< 1.20	0.00 - 1.20	Not Reported						
4665	2,2-Dichloropropane	µg/L	13.2	16.4	13.1 - 19.7	Acceptable	EPA 524.2 4.1 1995	5/17/2013	-1.71	16.4	1.89	
4670	1,1-Dichloropropene	µg/L		3.82	2.29 - 5.35	Not Reported				3.72	0.423	
4680	cis-1,3-Dichloropropene	µg/L		7.33	4.40 - 10.3	Not Reported				6.98	0.908	
4685	trans-1,3-Dichloropropene	µg/L		18.7	15.0 - 22.4	Not Reported				18.5	1.96	

WS-201 2003 NELAC Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1117

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 06/06/13
Study Dates: 04/08/13 - 05/23/13

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
WS Unregulated Volatiles (cat# 841) (Continued)												
5175	Fluorotrichloromethane	µg/L		9.43	5.66 - 13.2	Not Reported				10.2	1.41	
4835	Hexachlorobutadiene	µg/L		12.7	10.2 - 15.2	Not Reported				12.8	1.46	
4900	Isopropylbenzene	µg/L		13.3	10.6 - 16.0	Not Reported				13.8	1.28	
4910	4-Isopropyltoluene	µg/L		< 1.20	0.00 - 1.20	Not Reported						
5005	Naphthalene	µg/L		9.50	5.70 - 13.3	Not Reported				9.23	1.64	
5090	n-Propylbenzene	µg/L		< 1.20	0.00 - 1.20	Not Reported						
5105	1,1,1,2-Tetrachloroethane	µg/L		14.7	11.8 - 17.6	Not Reported				15.3	1.28	
5110	1,1,2,2-Tetrachloroethane	µg/L		18.0	14.4 - 21.6	Not Reported				18.2	1.69	
5150	1,2,3-Trichlorobenzene	µg/L		< 3.00	0.00 - 3.00	Not Reported						
5180	1,2,3-Trichloropropane (TCP)	µg/L		< 1.20	0.00 - 1.20	Not Reported						
5210	1,2,4-Trimethylbenzene	µg/L		< 1.20	0.00 - 1.20	Not Reported						
5215	1,3,5-Trimethylbenzene	µg/L		9.68	5.81 - 13.6	Not Reported				10.1	1.00	

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A Waters Company

Nilda B. Cox
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016

RAD-92 Final Report

RadCheM™ Proficiency Testing

RadCheM™ Study

Reference Date: 01/07/13

Open Date: 01/07/13

Close Date: 02/21/13

Report Issued Date: 02/28/13

ERA
A Waters Company

February 28, 2013

Nilda B. Cox
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016

Enclosed is your final report for ERA's RadCheM™ Proficiency Testing (PT) study, RAD-92. Your final report includes an evaluation of all results submitted by your laboratory to ERA.

Data Evaluation Protocols: All of the analytes in ERA's RAD-92 study have been evaluated by comparing your results to the acceptance limits and evaluation criteria contained in the current TNI FoPT tables.

Corrective Action Help: As part of your accreditation(s), you may be required to identify the root cause of any "Not Acceptable" results, implement the necessary corrective actions, and then satisfy your PT requirements by participating in a Supplemental (QuiK™Response) or future ERA PT study. If you need help, ERA's technical staff is available to help your laboratory resolve any technical issues that may be impairing your PT performance and possibly affecting your routine data quality. Our laboratory and technical staff have many years of collective experience in performing the full range of environmental analyses. As part of our technical support, ERA offers QC samples that can be useful in helping you work through your technical issues.

Please note the following changes to our final reports:

• At the request of the TNI Accreditation Council, we have included a Laboratory Exception Report that includes a list of all analytes reported with less than qualifiers when the assigned value was greater than “0.” In addition, because we have received many requests from laboratories, this report also includes a list of all analytes with "Not Acceptable" evaluations.

• Some states have elected not to convert to the 2009 TNI Standards at this time. If you have released your results to a state that has retained the 2003 NELAC Evaluation Criteria, your final report will include a section that evaluates the results according to the 2003 Standard in addition to the 2009 TNI Standards.

Thank you for your participation in ERA's RadCheM™ Proficiency Testing study, RAD-92. If you have any questions, please contact our Proficiency Testing Department at 1-800-372-0122.

Sincerely,

Kristina Sanchez
Quality Officer

attachments

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Report Recipient	Contact/Phone Number	Reporting Type	Evaluation Type
Alabama	Tom DeLoach / 334-271-7791	All Analytes	2009 TNI
Alaska	Lance Morris / 907-375-8210	All Analytes	2009 TNI
Arizona	Ali Mayfield / (602) 364-0728	All Analytes	2009 TNI
California	Fred Choske / 510-620-3175	All Analytes	2009 TNI
Colorado	Ben Chouaf / 303-692-3045	All Analytes	2009 TNI
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Nevada	Sara Rairick / 775-687-9490	All Analytes	2003 NELAC
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Tennessee	Craig LaFever / 615-532-0181	All Analytes	2009 TNI

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Vermont (WS)	George Mills / 802-863-7335	All Analytes	2009 TNI
Virginia	Cathy Westerman / 804-648-4480 x391	All Analytes	2003 NELAC
Washington	Alan Rue / (360) 895-6178	All Analytes	2009 TNI
West Virginia (WS)	Greg Young / 304-965-2694 X2222	All Analytes	2003 NELAC

RAD-92 Definitions & Study Discussion

Study Dates: 01/07/13 - 02/21/13

Report Issued: 02/28/13

RAD Study Definitions

The Reported Value is the value that the laboratory reported to ERA.

The ERA Assigned Values are compliant with the most current TNI Fields of Proficiency Testing (FoPT) tables. The assigned values are directly traceable to the commercially prepared starting materials used to manufacture the PT standards.

The Acceptance Limits are established per the criteria contained in the most current TNI FoPT tables.

The Performance Evaluation:

Acceptable	= Reported Value falls within the Acceptance Limits.
Not Acceptable	= Reported Value falls outside the Acceptance Limits.
No Evaluation	= Reported Value cannot be evaluated.
Not Reported	= No Value reported.

The Method Description is the method the laboratory reported to ERA.

RAD Study Discussion

ERA's RAD-92 RadCheM™ Proficiency Testing (PT) study has been reviewed by ERA senior management and certified compliant with the requirements of the 2009 TNI PT Standard and the criteria contained in the most current TNI Fields of Proficiency Testing (FoPT) tables.

ERA's RAD-92 RadCheM™ PT study standards were examined for any anomalies. A full review of all homogeneity, stability and accuracy verification data was completed. All analytical verification data for all analytes met the acceptance criteria contained in the 2009 TNI PT Standard and the criteria contained in the most current TNI FoPT tables.

The data submitted by participating laboratories was also examined for study anomalies. There were no anomalies observed during the statistical review of the data.

If you have any questions or concerns regarding your assessment in ERA's RadCheM™ Proficiency Testing program, please contact our Proficiency Testing Department at 1-800-372-0122.

ERA

A Waters Company

RAD-92 Laboratory Exception Report

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1117

EPA ID:	CA00006
ERA Customer Number:	M327601
Report Issued:	02/28/13
Study Dates:	01/07/13 - 02/21/13

2009 TNI Evaluation Checks

There are no values reported with < where the assigned value was greater than 0.

2009 TNI Not Acceptable Evaluations

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
RAD GroSS™ Alpha/Beta (cat# 809)							
2830	Gross Alpha	pCi/L	40.2	24.8	12.5 - 33.0	Not Acceptable	EPA 900.0 GPC 1980

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

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Final Report Results For Laboratory
Eurofins Eaton Analytical, Inc - Monrovia

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

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2009 TNI Evaluation Report

Study: **RAD-92**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

RAD Results

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

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RAD-92 2009 TNI Evaluation Final Complete Report

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1117

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 02/28/13
Study Dates: 01/07/13 - 02/21/13

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
RAD GroSS™ Alpha/Beta (cat# 809)												
2830	Gross Alpha	pCi/L	40.2	24.8	12.5 - 33.0	Not Acceptable	EPA 900.0 GPC 1980	1/31/2013	3.40	23.6	4.89	
2840	Gross Beta	pCi/L	17.2	19.3	11.3 - 27.5	Acceptable	EPA 900.0 GPC 1980	1/31/2013	-0.207	17.7	2.59	
RAD NaturalS™ (cat# 811)												
2965	Radium-226	pCi/L	10.3	9.91	7.42 - 11.6	Acceptable	GA Tech RA-226/228 1.2 2004	2/7/2013	0.289	9.93	1.28	
2970	Radium-228	pCi/L	5.00	5.22	3.14 - 6.96	Acceptable	GA Tech RA-226/228 1.2 2004	2/7/2013	-0.0536	5.05	0.932	
3055	Uranium (Nat)	pCi/L		5.96	4.47 - 7.13	Not Reported				5.84	0.433	
3055	Uranium (Nat) mass	µg/L	8.83	8.69	6.50 - 10.4	Acceptable	EPA 200.8 5.4 1994	2/7/2013	-0.0728	8.89	0.826	
RAD NaturalS™ (cat# 811)												
2965	Radium-226	pCi/L		9.91	7.42 - 11.6	Not Reported				9.93	1.28	
2970	Radium-228	pCi/L		5.22	3.14 - 6.96	Not Reported				5.05	0.932	
3055	Uranium (Nat)	pCi/L		5.96	4.47 - 7.13	Not Reported				5.84	0.433	
3055	Uranium (Nat) mass	µg/L	8.83	8.69	6.50 - 10.4	Acceptable	EPA 200.8 5.5 1998	2/7/2013	-0.0728	8.89	0.826	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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A Waters Company

Final Report Results For Laboratory
Eurofins Eaton Analytical, Inc - Monrovia

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ERA
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2003 NELAC Evaluation Report

Study: **RAD-92**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

RAD Results

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

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A Waters Company

RAD-92 2003 NELAC Evaluation Final Complete Report

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1117

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 02/28/13
Study Dates: 01/07/13 - 02/21/13

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
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ERA
A Waters Company

Nilda B. Cox
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016

RAD-93 *Final Report*

RadCheM™ Proficiency Testing

RadCheM™ Study

Reference Date: 04/08/13

Open Date: 04/08/13

Close Date: 05/23/13

Report Issued Date: 06/03/13

ERA

A Waters Company

June 3, 2013

Nilda B. Cox
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016

Enclosed is your final report for ERA's RadCheM™ Proficiency Testing (PT) study, RAD-93. Your final report includes an evaluation of all results submitted by your laboratory to ERA.

Data Evaluation Protocols: All of the analytes in ERA's RAD-93 study have been evaluated by comparing your results to the acceptance limits and evaluation criteria contained in the current TNI FoPT tables.

Corrective Action Help: As part of your accreditation(s), you may be required to identify the root cause of any "Not Acceptable" results, implement the necessary corrective actions, and then satisfy your PT requirements by participating in a Supplemental (QuiK™Response) or future ERA PT study. If you need help, ERA's technical staff is available to help your laboratory resolve any technical issues that may be impairing your PT performance and possibly affecting your routine data quality. Our laboratory and technical staff have many years of collective experience in performing the full range of environmental analyses. As part of our technical support, ERA offers QC samples that can be useful in helping you work through your technical issues.

Please note the following changes to our final reports:

• At the request of the TNI Accreditation Council, we have included a Laboratory Exception Report that includes a list of all analytes reported with less than qualifiers when the assigned value was greater than "0." In addition, because we have received many requests from laboratories, this report also includes a list of all analytes with "Not Acceptable" evaluations.

• Some states have elected not to convert to the 2009 TNI Standards at this time. If you have released your results to a state that has retained the 2003 NELAC Evaluation Criteria, your final report will include a section that evaluates the results according to the 2003 Standard in addition to the 2009 TNI Standards.

Thank you for your participation in ERA's RadCheM™ Proficiency Testing study, RAD-93. If you have any questions, please contact our Proficiency Testing Department at 1-800-372-0122.

Sincerely,

Kristina Sanchez
Quality Officer

attachments

ERA
A Waters Company

Report Recipient	Contact/Phone Number	Reporting Type	Evaluation Type
Alabama	Tom DeLoach / 334-271-7791	All Analytes	2009 TNI
Alaska	Lance Morris / 907-375-8210	All Analytes	2009 TNI
Arizona	Ali Mayfield / (602) 364-0728	All Analytes	2009 TNI
California	Fred Choske / 510-620-3175	All Analytes	2009 TNI
Colorado	Ben Chouaf / 303-692-3045	All Analytes	2009 TNI
Connecticut	Environmental Lab Certification / 860-509-7388	All Analytes	2009 TNI
Delaware	Brenda Haire / 302-741-8630	All Analytes	2009 TNI
EPA Region 5 (WS)	Dr. Al Alwan / 312-353-2004	All Analytes	2009 TNI
EPA Region 8	Marcie Tidd / (303) 312-7764	All Analytes	2009 TNI
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RAD-93 Definitions & Study Discussion

Study Dates: 04/08/13 - 05/23/13

Report Issued: 06/03/13

RAD Study Definitions

The Reported Value is the value that the laboratory reported to ERA.

The ERA Assigned Values are compliant with the most current TNI Fields of Proficiency Testing (FoPT) tables. The assigned values are directly traceable to the commercially prepared starting materials used to manufacture the PT standards.

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Not Acceptable	= Reported Value falls outside the Acceptance Limits.
No Evaluation	= Reported Value cannot be evaluated.
Not Reported	= No Value reported.

The Method Description is the method the laboratory reported to ERA.

RAD Study Discussion

ERA's RAD-93 RadCheM™ Proficiency Testing (PT) study has been reviewed by ERA senior management and certified compliant with the requirements of the 2009 TNI PT Standard and the criteria contained in the most current TNI Fields of Proficiency Testing (FoPT) tables.

ERA's RAD-93 RadCheM™ PT study standards were examined for any anomalies. A full review of all homogeneity, stability and accuracy verification data was completed. All analytical verification data for all analytes met the acceptance criteria contained in the 2009 TNI PT Standard and the criteria contained in the most current TNI FoPT tables.

The data submitted by participating laboratories was also examined for study anomalies. There were no anomalies observed during the statistical review of the data.

ERA's RAD-93 RadCheM™ study reports shall not be reproduced except in their entirety and not without the permission of the participating laboratories. The report must not be used by the participating laboratories to claim product endorsement by any agency of the U. S. government.

The data contained herein are confidential and intended for your use only.

If you have any questions or concerns regarding your assessment in ERA's RadCheM™ Proficiency Testing program, please contact our Proficiency Testing Department at 1-800-372-0122.

RAD-93 Laboratory Exception Report

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1117

EPA ID:	CA00006
ERA Customer Number:	M327601
Report Issued:	06/03/13
Study Dates:	04/08/13 - 05/23/13

2009 TNI Evaluation Checks

There are no values reported with < where the assigned value was greater than 0.

2009 TNI Not Acceptable Evaluations

There were no Not Acceptable evaluations for this study.

A Waters Company

Final Report Results For Laboratory
Eurofins Eaton Analytical, Inc - Monrovia

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

A Waters Company

2009 TNI Evaluation Report

Study: **RAD-93**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

RAD Results

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

RAD-93 2009 TNI Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1117

EPA ID:	CA00006
ERA Customer Number:	M327601
Report Issued:	06/03/13
Study Dates:	04/08/13 - 05/23/13

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
RAD GroSS™ Alpha/Beta (cat# 809)												
2830	Gross Alpha	pCi/L	31.9	40.8	21.1 - 51.9	Acceptable	EPA 900.0 GPC 1980	5/17/2013	-0.655	36.4	6.93	
2840	Gross Beta	pCi/L		21.6	13.0 - 29.7	Not Reported				19.9	4.30	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

A Waters Company

Final Report Results For Laboratory
Eurofins Eaton Analytical, Inc - Monrovia

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

A Waters Company

2003 NELAC Evaluation Report

Study: **RAD-93**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

RAD Results

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

RAD-93 2003 NELAC Evaluation Final Complete Report

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1117

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 06/03/13
Study Dates: 04/08/13 - 05/23/13

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
RAD GroSS™ Alpha/Beta (cat# 809)												
2830	Gross Alpha	pCi/L	31.9	40.8	21.1 - 51.9	Acceptable	EPA 900.0 GPC 1980	5/17/2013	-0.655	36.4	6.93	
2840	Gross Beta	pCi/L		21.6	13.0 - 29.7	Not Reported				19.9	4.30	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

A Waters Company

Nilda B. Cox
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016

RAD-94 Final Report

RadCheM™ Proficiency Testing

RadCheM™ Study

Reference Date: 07/08/13

Open Date: 07/08/13

Close Date: 08/22/13

Report Issued Date: 08/26/13

ERA
A Waters Company

August 26, 2013

Nilda B. Cox
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016

Enclosed is your final report for ERA's RadCheM™ Proficiency Testing (PT) study, RAD-94. Your final report includes an evaluation of all results submitted by your laboratory to ERA.

Data Evaluation Protocols: All of the analytes in ERA's RAD-94 study have been evaluated by comparing your results to the acceptance limits and evaluation criteria contained in the current TNI FoPT tables.

Corrective Action Help: As part of your accreditation(s), you may be required to identify the root cause of any "Not Acceptable" results, implement the necessary corrective actions, and then satisfy your PT requirements by participating in a Supplemental (QuiK™Response) or future ERA PT study. If you need help, ERA's technical staff is available to help your laboratory resolve any technical issues that may be impairing your PT performance and possibly affecting your routine data quality. Our laboratory and technical staff have many years of collective experience in performing the full range of environmental analyses. As part of our technical support, ERA offers QC samples that can be useful in helping you work through your technical issues.

Please note the following changes to our final reports:

• At the request of the TNI Accreditation Council, we have included a Laboratory Exception Report that includes a list of all analytes reported with less than qualifiers when the assigned value was greater than “0.” In addition, because we have received many requests from laboratories, this report also includes a list of all analytes with "Not Acceptable" evaluations.

• Some states have elected not to convert to the 2009 TNI Standards at this time. If you have released your results to a state that has retained the 2003 NELAC Evaluation Criteria, your final report will include a section that evaluates the results according to the 2003 Standard in addition to the 2009 TNI Standards.

Thank you for your participation in ERA's RadCheM™ Proficiency Testing study, RAD-94. If you have any questions, please contact our Proficiency Testing Department at 1-800-372-0122.

Sincerely,

Kristina Sanchez
Quality Officer

attachments

Report Recipient	Contact/Phone Number	Reporting Type	Evaluation Type
Alabama	Tom DeLoach / 334-271-7791	All Analytes	2009 TNI
Alaska	Lance Morris / 907-375-8210	All Analytes	2009 TNI
Arizona	Ali Mayfield / (602) 364-0728	All Analytes	2009 TNI
California ELAP	Fred Choske / 510-620-3175	All Analytes	2009 TNI
Colorado	Ben Chouaf / 303-692-3045	All Analytes	2009 TNI
Connecticut	Environmental Lab Certification / 860-509-7388	All Analytes	2009 TNI
Delaware	Brenda Haire / 302-741-8630	All Analytes	2009 TNI
EPA Region 4	Marilyn Maycock / 706-355-8553	All Analytes	2009 TNI
EPA Region 5 (WS)	Dr. Al Alwan / 312-353-2004	All Analytes	2009 TNI
EPA Region 8	Marcie Tidd / (303) 312-7764	All Analytes	2009 TNI
Georgia	Lynne Grubb / 404-657-3189	All Analytes	2009 TNI
Guam (Radchem)	Administrator / 671-475-1622	All Analytes	2009 TNI
Hawaii	Richard Kiyokane / 808-453-6679	All Analytes	2009 TNI
Idaho	Ernie Bader / 208-334-2235 x 290	All Analytes	2009 TNI
Illinois (Radchem)	Dr. Lih-Ching Chu / 217-786-6363	All Analytes	2009 TNI
Indiana	Phil Zillinger / 317-921-5571	All Analytes	2009 TNI
Kentucky	Patrick Garrity / 502-564-3410 ext 4968	All Analytes	2009 TNI
Maine	Jennifer Jamison / 207-287-1929	All Analytes	2009 TNI
Mariana Island	Vinson Sablan / 670-664-8520	All Analytes	2009 TNI
Maryland	Linda Ames / 410-537-3712	All Analytes	2009 TNI
Massachusetts	Ann Marie Allen / 978-682-5237 x 51333	All Analytes	2009 TNI
Michigan (WS)	Greg Lundy / 517-335-9219	All Analytes	2009 TNI
Mississippi	Phyllis Givens / 601-576-7582	All Analytes	2009 TNI
Montana	Russell Leu / 406-444-5259	All Analytes	2009 TNI
Nebraska	Laurie Wieting / 402-471-8407	All Analytes	2009 TNI
Nevada	Sara Rairick / 775-687-9490	All Analytes	2003 NELAC
New Jersey	Rachel Ellis / 609-777-1749	All Analytes	2009 TNI
New Mexico (WS)	Paul W. Gray / 505-383-9120	All Analytes	2009 TNI
New York	Dan Dickinson / 518-485-5570	All Analytes	2003 NELAC
North Carolina (WS)	Chris Goforth / 919-807-8871	All Analytes	2009 TNI
North Dakota	Errol Erickson / 701-328-6172	All Analytes	2009 TNI
South Carolina	Carol Smith / 803-896-0992	All Analytes	2003 NELAC
South Dakota	Mike Smith / 605-773-4757	All Analytes	2009 TNI

Tennessee	Craig LaFever / 615-532-0181	All Analytes	2009 TNI
Vermont (WS)	George Mills / 802-863-7335	All Analytes	2009 TNI
Virginia	Cathy Westerman / 804-648-4480 x391	All Analytes	2003 NELAC
Washington	Alan Rue / (360) 871-8844	All Analytes	2009 TNI
West Virginia (WS)	Greg Young / 304-965-2694 X2222	All Analytes	2003 NELAC
Commonwealth of Northern Mariana Islands-DEQ	Clarissa T. Bearden /	All Analytes	2009 TNI
North Dakota Department of Health	Cindy Auen /	All Analytes	2009 TNI

RAD-94 Definitions & Study Discussion

Study Dates: 07/08/13 - 08/22/13

Report Issued: 08/26/13

RAD Study Definitions

The Reported Value is the value that the laboratory reported to ERA.

The ERA Assigned Values are compliant with the most current TNI Fields of Proficiency Testing (FoPT) tables. The assigned values are directly traceable to the commercially prepared starting materials used to manufacture the PT standards.

The Acceptance Limits are established per the criteria contained in the most current TNI FoPT tables.

The Performance Evaluation:

Acceptable	= Reported Value falls within the Acceptance Limits.
Not Acceptable	= Reported Value falls outside the Acceptance Limits.
No Evaluation	= Reported Value cannot be evaluated.
Not Reported	= No Value reported.

The Method Description is the method the laboratory reported to ERA.

RAD Study Discussion

ERA's RAD-94 RadCheM™ Proficiency Testing (PT) study has been reviewed by ERA senior management and certified compliant with the requirements of the 2009 TNI PT Standard and the criteria contained in the most current TNI Fields of Proficiency Testing (FoPT) tables.

ERA's RAD-94 RadCheM™ PT study standards were examined for any anomalies. A full review of all homogeneity, stability and accuracy verification data was completed. All analytical verification data for all analytes met the acceptance criteria contained in the 2009 TNI PT Standard and the criteria contained in the most current TNI FoPT tables.

The data submitted by participating laboratories was also examined for study anomalies. There were no anomalies observed during the statistical review of the data.

ERA's RAD-94 RadCheM™ study reports shall not be reproduced except in their entirety and not without the permission of the participating laboratories. The report must not be used by the participating laboratories to claim product endorsement by any agency of the U. S. government.

The data contained herein are confidential and intended for your use only.

If you have any questions or concerns regarding your assessment in ERA's RadCheM™ Proficiency Testing program, please contact our Proficiency Testing Department at 1-800-372-0122.

RAD-94 Laboratory Exception Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
Report Issued:	**08/26/13**
Study Dates:	**07/08/13 - 08/22/13**

2009 TNI Evaluation Checks

There are no values reported with < where the assigned value was greater than 0.

2009 TNI Not Acceptable Evaluations

There were no Not Acceptable evaluations for this study.

A Waters Company

Final Report Results For Laboratory
Eurofins Eaton Analytical, Inc - Monrovia

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

A Waters Company

2009 TNI Evaluation Report

Study: **RAD-94**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

RAD Results

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

RAD-94 2009 TNI Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID:	**CA00006**
ERA Customer Number:	**M327601**
Report Issued:	**08/26/13**
Study Dates:	**07/08/13 - 08/22/13**

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
RAD GroSS™ Alpha/Beta (cat# 809)												
2830	Gross Alpha	pCi/L	46.7	57.1	29.8 - 71.2	Acceptable	EPA 900.0 GPC 1980	7/23/2013	-0.688	55.4	12.7	
2840	Gross Beta	pCi/L	29.2	41.8	27.9 - 49.2	Acceptable	EPA 900.0 GPC 1980	7/23/2013	-1.28	36.7	5.88	
RAD NaturalS™ (cat# 811)												
2965	Radium-226	pCi/L	16.9	17.2	12.8 - 19.7	Acceptable	GA Tech RA-226/228 1.2 2004	8/19/2013	0.0338	16.8	1.63	
2970	Radium-228	pCi/L	4.26	3.86	2.18 - 5.40	Acceptable	GA Tech RA-226/228 1.2 2004	8/19/2013	0.696	3.84	0.598	
3055	Uranium (Nat)	pCi/L		21.4	17.1 - 24.1	Not Reported				20.4	1.37	
3055	Uranium (Nat) mass	µg/L	29.4	31.2	25.0 - 35.2	Acceptable	EPA 200.8 5.4 1994	7/25/2013	-0.716	30.6	1.75	

ERA

A Waters Company

Final Report Results For Laboratory
Eurofins Eaton Analytical, Inc - Monrovia

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

ERA

A Waters Company

2003 NELAC Evaluation Report

Study: **RAD-94**

ERA Customer Number: **M327601**

Laboratory Name: **Eurofins Eaton Analytical, Inc - Monrovia**

RAD Results

16341 Table Mountain Pkwy • Golden, CO 80403 • 800.372.0122 • 303.431.8454 • fax 303.421.0159 • www.eraqc.com

RAD-94 2003 NELAC Evaluation Final Complete Report

A Waters Company

Nilda B. Cox
QA Officer
Eurofins Eaton Analytical, Inc - Monrovia
750 Royal Oaks Dr.
Suite 100
Monrovia, CA 91016
626-386-1170

EPA ID: CA00006
ERA Customer Number: M327601
Report Issued: 08/26/13
Study Dates: 07/08/13 - 08/22/13

NELAC Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description	Analysis Date	Z Score	Study Mean	Study Standard Deviation	Analyst Name
RAD GroSS™ Alpha/Beta (cat# 809)												
2830	Gross Alpha	pCi/L	46.7	57.1	29.8 - 71.2	Acceptable	EPA 900.0 GPC 1980	7/23/2013	-0.688	55.4	12.7	
2840	Gross Beta	pCi/L	29.2	41.8	27.9 - 49.2	Acceptable	EPA 900.0 GPC 1980	7/23/2013	-1.28	36.7	5.88	
RAD NaturalS™ (cat# 811)												
2965	Radium-226	pCi/L	16.9	17.2	12.8 - 19.7	Acceptable	GA Tech RA-226/228 1.2 2004	8/19/2013	0.0338	16.8	1.63	
2970	Radium-228	pCi/L	4.26	3.86	2.18 - 5.40	Acceptable	GA Tech RA-226/228 1.2 2004	8/19/2013	0.696	3.84	0.598	
3055	Uranium (Nat)	pCi/L		21.4	17.1 - 24.1	Not Reported				20.4	1.37	
3055	Uranium (Nat) mass	µg/L	29.4	31.2	25.0 - 35.2	Acceptable	EPA 200.8 5.4 1994	7/25/2013	-0.716	30.6	1.75	

NEW YORK
state department of
HEALTH

Nirav R. Shah, M.D., M.P.H.
Commissioner

Sue Kelly
Executive Deputy Commissioner

April 25, 2013

LAB ID: 11320
DR. ANDREW EATON
EUROFINS EATON ANALYTICAL, INC
750 ROYAL OAKS DRIVE
STE 100
MONROVIA, CA 91016-3629

Dear Dr. Eaton:

Your laboratory's scores for the Environment Laboratory Approval Program (ELAP) Asbestos by Transmission Electron Microscopy Proficiency Test are enclosed.

ELAP validates the fitness for use of each sample/analyte used in it's PT studies. All analytes passed the assigned value verification and homogeneity evaluations prior to shipment for this study. After the study close date samples/analytes are evaluated again for stability in conjunction with historic pass/fail rates. The evaluation procedures used to establish the assigned value are discussed in the ELAP Certification Manual Item 300. All analytes were determined to be fit for use as PT materials for this study.

The assigned value is the 'made to' value for the analyte using the counting rules of the method. The mean for scoring is the participant consensus mean. The acceptance limits are centered on the mean for scoring. The acceptance limits are calculated as plus/minus two times the standard deviation for Potable Water Asbestos, and three times the standard deviation for all other analytes.

Sample 6262 was generated using the actinolite specimen in NIST SRM 1867. A large percentage of the participating laboratories misidentified these deposited fibers as tremolite. Differentiating the tremolite and actinolite in NIST SRM 1867 is always challenging because they occupy the mid-range in the tremolite-actinolite solid-solution series. Thus it is critical that laboratories carefully calibrate their TEM-EDX k-factors for Mg, Si, Ca, and Fe. Furthermore, laboratories are required to collect at least six spectra from each of the asbestos minerals on their own TEM-EDX systems and use these as guides in identification (ELAP Certification Manual Item 236, Section 6.2). Spectra collected on TEM-EDX systems other than their own are not helpful in distinguishing actinolite from tremolite in NIST SRM 1867.

The statistical procedures used to establish study means, standard deviations and acceptance limits are described in the ELAP Certification Manual Item 330.

ELAP does not limit the usage of proficiency test reports by individuals or organizations. ELAP only distributes PT reports to the participant and any organization selected by the participant for distribution.

Summary statistics by method, as well as, assigned value uncertainties may be requested by contacting the PT Program. Also, please provide us with your feedback on any issues related to the PT Program, including the current study. Direct any comments, requests, feedback, or questions to us at dehspt@health.state.ny.us.

Sincerely,

Daniel Dickinson , PT Program Coordinator
NYS DOH - Wadsworth Center
PO BOX 509, Albany NY 12201-0509

Phone: (518) 473-3383, Fax: (518) 473-8117

WADSWORTH CENTER
NEW YORK STATE DEPARTMENT OF HEALTH

TNI-EL-V3-2009 Proficiency Test Compliant Report

Lab Id: 11320

EPA Lab Code: CA00006

EUROFINS EATON ANALYTICAL, INC
750 ROYAL OAKS DRIVE
STE 100
MONROVIA, CA 91016-3629
(626) 386-1100
Director: DR. ANDREW EATON

Shipment Date : 19-Feb-2013
Closing Date : 04-Apr-2013
Score Date : 24-Apr-2013

NYSDOH Wadsworth Center is an A2LA accredited Proficiency Testing Provider. Certificate Number 1785.01

Shipment: 361 Asbestos in Air, Water, and NonFriable Samples by Electron Microscopy

Analyte Name	Units	Sample ID	Test Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Potable Water								
Asbestos in Water by TEM								
Asbestos in Water by TEM	MF/L	7348	EPA 100.2	8.81	9.95	6.08	1.10 - 22.1	Satisfactory
Analyte Code: 1520				3/4/13	10.9		*24 passed out of 24 reported results.*	

NEW YORK
state department of
HEALTH

Nirav R. Shah, M.D., M.P.H.
Commissioner

Sue Kelly
Executive Deputy Commissioner

October 31, 2013

LAB ID: 11320
DR. ANDREW EATON
EUROFINS EATON ANALYTICAL, INC
750 ROYAL OAKS DRIVE
STE 100
MONROVIA, CA 91016-3629

Dear Dr. Eaton:

Your laboratory's scores for the NYSDOH Asbestos by Transmission Electron Microscopy Proficiency Test are enclosed.

The NYSDOH Environmental PT Program validates the fitness for use of each sample/analyte used in it's PT studies. All analytes passed the assigned value verification and homogeneity evaluations prior to shipment for this study. After the study close date samples/analytes are evaluated again for stability in conjunction with historic pass/fail rates. The evaluation procedures used to establish the assigned value are discussed in the ELAP Certification Manual Item 300. All analytes were determined to be fit for use as PT materials for this study.

The assigned value is the 'made to' value for the analyte using the counting rules of the method. The mean for scoring is the participant consensus mean. The acceptance limits are centered on the mean for scoring. The acceptance limits are calculated as plus/minus two times the standard deviation for Potable Water Asbestos, and three times the standard deviation for all other analytes.

The statistical procedures used to establish study means, standard deviations and acceptance limits are described in the ELAP Certification Manual Item 330.

The NYSDOH Environmental PT Program does not limit the usage of proficiency test reports by individuals or organizations. The NYSDOH Environmental PT Program only distributes PT reports to the participant and any organization selected by the participant for distribution.

Summary statistics by method, as well as, assigned value uncertainties may be requested by contacting the NYSDOH Environmental PT Program. Also, please provide us with your feedback on any issues related to the PT Program, including the current study. Direct any comments, requests, feedback, or questions to us at dehspt@health.state.ny.us.

Sincerely,

Dan Dickinson

Daniel Dickinson , PT Program Coordinator
NYS DOH - Wadsworth Center
PO BOX 509, Albany NY 12201-0509
Phone: (518) 473-3383, Fax: (518) 473-8117

WADSWORTH CENTER
NEW YORK STATE DEPARTMENT OF HEALTH

New York ELAP Proficiency Test Report

Lab Id: 11320

EPA Lab Code:
CA00006

EUROFINS EATON ANALYTICAL, INC
750 ROYAL OAKS DRIVE
STE 100
MONROVIA, CA 91016-3629
(626) 386-1100
Director: DR. ANDREW EATON

Shipment Date : 27-Aug-2013
Closing Date : 10-Oct-2013
Score Date : 30-Oct-2013

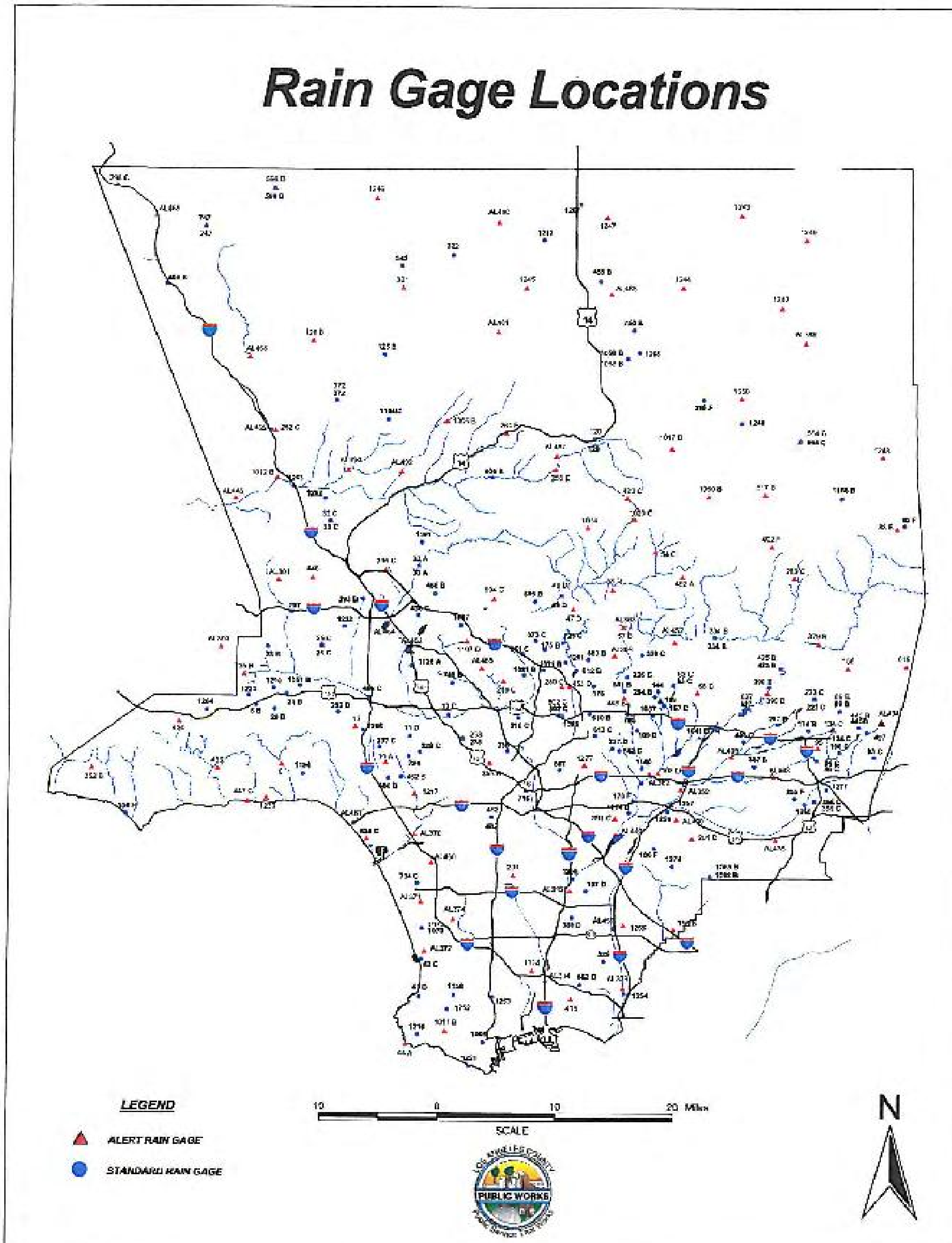
NYSDOH Wadsworth Center is an A2LA accredited Proficiency Testing Provider. Certificate Number 1785.01

Shipment: 366 Asbestos in Air, Water, and NonFriable Samples by Electron Microscopy

Analyte Name	Units	Sample ID	Test Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Potable Water								
Asbestos in Water by TEM								
Asbestos in Water by TEM	MF/L	8598	EPA 100.2	7.32	7.09	2.52	2.05 - 12.1	Satisfactory
Analyte Code: 1520				9/13/13	8.8		*21 passed out of 23 reported results.*	

Attachment K-O
Climatological Monitoring Information

PRECIPITATION



PRECIPITATION

Public Works operates and maintains a network of 244 standard and automatic rain gages to collect rainfall (precipitation) data for the purposes of in-house engineering and design of flood control and water conservation facilities

RAINFALL AMOUNTS

Daily and annual rainfall amounts for the reporting period collected by Public Works' active standard rain gages are published in this volume. Although Public Works operates and maintains both standard and automatic rain gages whose recording durations range from 5 minutes to 24 hours, only daily and annual amounts from standard rain gages are published herein. Additional data (e.g., intensities, automatic rain gage data, partial data) may be obtained by contacting the custodian of hydrologic records. Active rain gage stations whose records are incomplete are denoted accordingly and no data is published.

ALERT SYSTEM
Automated Local Evaluation in Real Time

Public Works operates and maintains a state-of-the-art ALERT computer system to monitor meteorological conditions in the County and Southern California in real time, i.e., as they occur. The system includes a network of field sensors that monitor and receive precipitation amounts including rainfall data from the Corps of Engineers' Los Angeles Telemetry System.

COOPERATION

The cooperation of observers in furnishing rainfall data to Public Works as a public service is appreciated. The efforts of the many agencies and individuals who have so freely cooperated with us in the collection of this data have resulted in the large number of complete records for the period covered by this report.

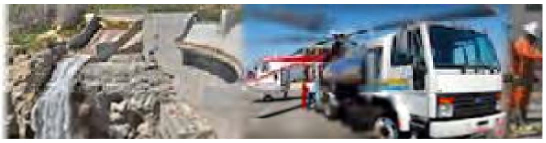
Data from 22 stations of Public Works' records are reported and published by the National Oceanic and Atmospheric Administration (NOAA)

CUSTODIAN

Unpublished information may be obtained by contacting:

County of Los Angeles
Department of Public Works
Water Resources Division
P.O. Box 1460
Alhambra, CA 91802-1460
(626) 458-6120

Department of Public Works
dpw.lacounty.gov



ALERT RAINGAGES

STATION NAME	ALERT ID	AUTO RAINGAGE REF. ID	LAT.	LONG.	ELEV.
Acton Camp Precip	384	250D	34-27-02	118-11-54	2,625.0
Acton Escond Precip	387	261F	34-29-41	118-16-22	2,960.0
Agoura Precip	317	434	34-08-08	118-45-07	800.0
Aliso Canyon Precip	302	446	34-19-42	118-33-17	2,367.0
Angeles Crest Aliso Cyn Precip	357	423C	34-24-57	118-05-26	3,920.0
Antelope Valley Water Precip	485	AL485	34-40-02	118-07-31	
Avek Precip	359	1250	34-32-21	117-55-23	2,825.0
Ballona Crk Precip	370	AL370	33-59-55	118-24-05	38.0
Bel Air Hotel Precip	323	10A	34-05-11	118-26-44	540.0
Bell Canyon (Rocketdyne) Precip	300	AL300	34-13-41	118-41-27	2,260.0
Bell Cyn Debris Basin Precip	308	735H	34-11-39	118-39-23	895.0
Big Dalton Dam Precip	419	223C	34-10-13	117-48-34	1,587.0
Big Pines Recreation Park Pcp	365	83B	34-22-44	117-41-20	6,860.0
Big Rock Mesa Precip	320	1239	34-02-21	118-37-00	300.0
Big Tujunga Dam Precip	334	46D	34-17-35	118-11-02	2,315.0
Big Tujunga-camp15 Precip	307	694G	34-17-21	118-17-17	1,525.0
Bouquet Cyn @ Urban Precip	390	AL390	34-26-54	118-30-21	1,300.0
Brand Park Precip	449	210C	34-11-17	118-16-19	1,250.0
Brown's Canyon Precip	301	AL301	34-18-42	118-36-26	2,400.0
Camp Hi Hill Precip	368	AL368	34-15-20	118-05-53	4,320.0
Castaic Junct Precip	385	1012B	34-26-17	118-36-42	1,005.0
Castic Powerhouse Precip	466	AL466	34-35-17	118-39-24	2,286.0
Cedar Springs Precip	363	402F	34-21-21	117-52-34	6,780.0
Chiloa-St Hwy Precip	437	492A	34-19-04	118-00-29	5,275.0
Clear Crk School Precip	408	47D	34-16-37	118-10-12	3,150.0
Cogswell Dam Precip	411	334B	34-14-36	117-57-48	2,300.0
Colby's Precip	445	53D	34-18-05	118-06-38	3,620.0
County Fire Station 112 Precip	480	AL480	34-45-14	118-17-13	
County Fire Station 140 Precip	481	AL481	34-37-12	118-17-11	3,160.0
County Fire Station 81 Precip	486	1005B	34-31-09	118-17-13	
Crystal Lake Precip	399	283C	34-19-02	117-50-30	5,370.0
Del Valle Training Center Precip	446	AL446	34-25-46	118-40-01	1,406.0
Devils Gate Dam Precip	337	453D	34-11-08	118-10-24	1,000.0
Domin Wat Co Precip	315	1113	33-49-53	118-13-29	30.0
Eagle Rock Rsvr Precip	311	802C	34-08-44	118-11-24	1,085.0
Eaton Dam Precip	343	449B	34-10-08	118-05-27	880.0
Eaton Wash Precip	382	AL382	34-04-29	118-03-17	261.0
Eighty-third Street Yard Precip	460	AL460	33-57-48	118-22-34	128.0
El Monte Fire Station 166	354	108D	34-04-31	118-02-33	275.0
El Segondo Yard Precip	371	AL371	33-55-01	118-23-14	
Electric Ave Pumping Plnt Precip	461	AL461	33-59-35	118-28-23	397.0
Elizabeth Lake-Warm Springs Cmp Pcp	394	128B	34-36-28	118-33-40	2,075.0
Fire Station 077 Precip	468	AL468	34-45-34	118-47-50	3,459.0
Fire Station 114 (Lake LA) Precip	388	AL388	34-36-24	117-49-32	2,851.0
Fire Station 115 Precip	459	AL459	33-53-05	118-06-24	79.0
Fire Station 149 Precip	465	AL465	34-29-48	118-36-47	1,697.0
Fire Station 80	488	120	34-28-17	118-08-30	3,157.0
Flintridge Precip	453	280C	34-10-54	118-11-08	1,600.0
Fremont Hdqtrs Precip	456	1277	34-05-05	118-08-56	480.0
G-168 Pump Station Precip	441	1249	34-44-04	117-49-42	2,932.0
Gorman-Sheriff Precip	404	298C	34-47-47	118-51-27	185.0
Hacienda Hgts Precip	328	201D	33-59-39	117-59-27	875.0
Hollywood Rsrv Precip	312	238	34-07-04	118-19-53	720.0
Imperial Yard South FMD Precip	383	AL383	33-55-49	118-10-22	138.0
Inspiration Pnt Precip	309	AL309	34-13-12	118-06-26	4,480.0
Irwindale Spreading Basin Precip	435	AL435	34-05-46	117-56-02	449.0
LA 96th & Cen. Precip	316	291	33-56-56	118-15-16	121.0
LA Ducommun St Precip	377	716	34-03-09	118-14-12	306.0
La Habra Hgts Precip	327	1088B	33-56-54	117-57-51	445.0
La Mirada Precip	326	156B	33-52-59	118-01-00	75.0

La Rvr @ Wardlow Precip	314	AL314	33-49-11	118-12-20	25.0
La Tuna DB Precip	451	1107D	34-14-12	118-19-36	1,160.0
Lancaster Roper Precip	483	1244	34-40-47	118-00-37	2,400.0
Lechuza Pat Sta Precip	454	352B	34-04-37	118-52-46	1,620.0
Lewis Ranch Precip	361	517B	34-25-12	117-53-11	4,615.0
Little Gleason Precip	439	1074	34-22-42	118-08-57	5,600.0
Little Rock Crk Above Dam Percip	358	1017B	34-28-41	118-01-24	3,267.0
Little Rock-Sycamore Camp Pcp	360	1060B	34-25-02	117-58-13	4,012.0
Live Oak Dam Precip	431	445B	34-08-00	117-44-39	
Llano Precip	423	564C	34-29-13	117-50-02	3,872.0
Loomis Ranch Precip	438	54C	34-20-54	118-02-53	4,325.0
Los Angeles City College Precip	310	355B	34-05-14	118-17-32	300.0
Los Angeles Hillcrest Precip	403	462B	34-03-07	118-24-17	185.0
Malibu Fire Precip	378	447C	34-02-20	118-39-01	-18.0
Manhattan Beach Precip	373	1070	33-52-58	118-23-16	249.0
Mescal Smith Precip	364	1248	34-28-03	117-42-40	3,810.0
Mint Cyn @ Fitch Precip	402	AL402	34-26-48	118-25-39	1,652.0
Monte Nido Fire Precip	319	435	34-04-40	118-41-32	600.0
Montebello Fire Station HQ. Precip	381	391C	34-01-07	118-06-16	212.0
Morris Dam Precip	416	390B	34-10-29	117-52-50	1,210.0
Neenach Check 43 Precip	469	598D	34-47-40	118-37-15	2,975.0
Newhall-Sol Precip	406	32C	34-25-33	118-34-42	1,243.0
North Lancaster Precip	484	1247	34-45-41	118-07-30	2,310.0
Northridge- LADPW Precip	463	25C	34-13-52	118-32-28	1,117.0
Opids Camp	3355	57B	34-15-18	118-05-41	4,320.0
Pacoima Dam Precip	331	33A	34-19-48	118-23-58	1,950.0
Pacoima Wash S.B. H.W. Precip	464	AL464	34-15-43	118-26-37	1,009.0
Palmdale Water Dist Precip	482	1058B	34-35-41	118-05-31	2,595.0
Pine Canyon Patrol Station Pcp	393	321	34-40-24	118-25-45	3,286.0
Pnt Vicen Ligh Precip	321	44A	33-44-30	118-24-38	125.0
Pudd Dam Precip	428	96C	34-05-27	117-48-28	988.0
Pudd Div Precip	425	134C	34-07-45	117-46-51	1,130.0
Quartz Hill Precip	475	1245	34-38-53	118-14-24	2,395.0
RD 232A Precip	374	AL374	33-48-16	118-18-43	
Redman Precip	443	1243	34-45-52	117-55-30	2,360.0
Redondo Yard Precip	372	AL372	33-51-24	118-23-00	
Rio Hondo Spreading Ground Precip	440	AL440	33-59-30	118-06-34	264.0
Road Mant. Yard 417 Precip	436	AL436	33-59-42	117-52-03	582.0
Rocky Buttes Precip	442	1242	34-39-00	117-51-48	2,540.0
RollingHills Fire Station Precip	376	1011B	33-45-25	118-21-16	
Rose Hills ISD Repeater Precip	400	AL400	34-01-05	118-00-54	
San Antonio Cyn-Sierra Pw House Pcp	458	619	34-12-29	117-40-26	3,110.0
San Dimas Dam Precip	422	89B	34-09-08	117-46-17	1,350.0
San Dimas Fire Station 64 Precip	356	95	34-06-19	117-48-07	955.0
San Francisquito Powerhouse Pcp	395	372	34-32-02	118-31-27	1,580.0
San Gab @ Spring Precip	379	AL379	33-48-38	118-05-25	36.0
San Gab Pow House Precip	349	627	34-09-20	117-54-28	744.0
San Gabriel @ Vallay Precip	352	AL352	34-03-20	118-00-29	299.0
San Gabriel Dam Precip	413	425B	34-12-20	117-51-38	1,481.0
San Gabriel East Fork Percip	457	379B	34-14-09	117-48-18	1,600.0
Sanberg Airways Station Precip	467	747	34-44-47	118-43-27	3,635.0
Santa Anita Dam Precip	346	63C	34-11-03	118-01-11	1,400.0
Sawpit Dam Precip	340	68C	34-10-30	117-59-07	1,378.0
School House D.B. Precip	450	395C	34-19-32	118-27-29	1,540.0
Scott Ranch Precip	362	1246	34-46-59	118-28-10	2,710.0
Sepulv cyn @ Mulholland Precip	322	17	34-07-50	118-29-25	1,425.0
Signal Hill City Hall Precip	325	415	33-47-48	118-10-03	140.0
Spadra Precip	350	356C	34-02-30	117-48-34	690.0
Tanbark Precip	444	158	34-12-19	117-45-39	2,750.0
Thompson Crk. Dam Precip	434	AL434	34-08-26	117-42-39	1,670.0
Topanga Canyon Patrol Station Pcp	318	6	34-05-03	118-35-57	745.0
Tujunga Mill Precip	306	1029C	34-23-18	118-05-16	
Tujunga Spreading Ground Precip	462	AL462	34-14-06	118-24-27	1,084.0
USC Precip	375	482	34-01-21	118-17-27	
Verdugo Hill- Harvard Fire Precip	455	AL455	34-13-12	118-17-24	
Walnut Crk Precip	448	AL448	34-04-14	117-52-14	520.0
West Fk Heli Precip	452	AL452	34-14-12	118-01-06	4,000.0

Department of Public Works
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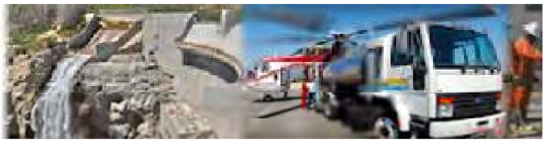


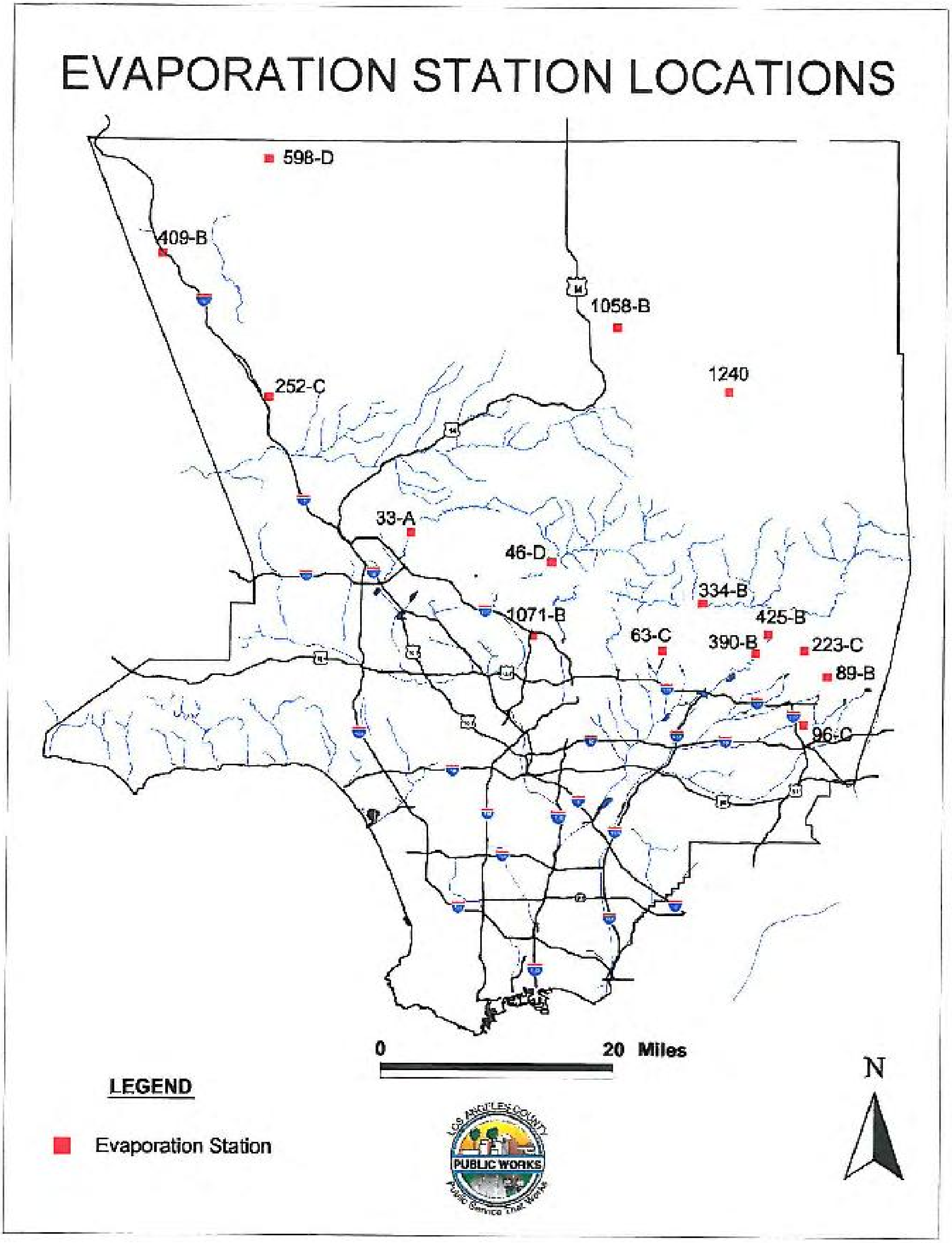
STANDARD NON-RECORDING RAINGAGES

STATION ID	STATION LOCATION	LATITUDE	LONGITUDE	ELEV OF GAGE
176	Altadena - Rubio Canyon	34-10-55	118-08-15	1,125.0
726C	Angeles Crest Guard Station	34-14-01	118-11-04	2,300.0
1037	Arcadia - Arboretum	34-08-48	118-02-59	565.0
167C	Arcadia Pumping Plant No. 1	34-09-31	118-02-02	611.0
807	Ascot Reservoir	34-04-46	118-11-14	620.0
1191	Bear Divide	34-21-35	118-23-37	2,700.0
228C	Beverly Hills City Hall	34-06-00	118-23-40	250.0
223C	Big Dalton Dam	34-10-06	117-48-36	1,587.0
63C	Big Santa Anita Dam	34-11-03	118-01-12	1,400.0
46D	Big Tujunga Dam	34-17-40	118-11-14	2,315.0
373C	Briggs Terrace	34-14-17	118-13-27	2,200.0
749B	Burbank Valley Pump Plant	34-11-11	118-20-54	655.0
5B	Calabasas	34-09-24	118-38-14	924.0
1264	Calabasas Landfill	34-08-25	118-42-35	800.0
1051B	Canoga Park - Pierce College	34-10-51	118-34-23	800.0
447C	Carbon Canyon	34-02-18	118-38-56	50.0
252C	Castaic Lake	34-29-53	118-36-53	1,150.0
23B	Chatsworth Reservoir	34-13-44	118-37-18	900.0
497	Claremont - Slaughter	34-07-35	117-43-55	1,350.0
93C	Claremont Police Station	34-05-45	117-43-18	1,170.0
334B	Cogswell Dam	34-14-37	117-57-35	2,300.0
387B	Covina City Yard	34-05-02	117-53-57	508.0
797	De Soto Reservoir	34-16-17	118-35-12	1,127.0
1071B	Descanso Gardens	34-12-07	118-12-46	1,325.0
269D	Diamond Bar Fire Station	33-59-50	117-48-55	870.0
107D	Downey - Fire Department	33-55-48	118-08-47	110.0
802C	Eagle Rock Reservoir	34-08-47	118-11-20	970.0
292D	Encino Reservoir	34-08-56	118-30-57	1,075.0
1140	Fire Station 42 - Rosemead	34-04-53	118-03-55	305.0
1277	Fremont Hdqtrs.	34-05-05	118-05-56	480.0
20B	Girard Reservoir	34-09-07	118-36-36	986.0
1081B	Glendale - Gregg	34-11-45	118-14-30	1,350.0
216C	Glendale-Jackson	34-09-54	118-15-01	550.0
174B	Glendora	34-07-43	117-49-08	930.0
287B	Glendora - City Hall	34-08-09	117-51-52	785.0
1087	Green - Verdugo Pumping Plant	34-15-25	118-20-11	1,340.0
436C	Hansen Dam	34-16-08	118-23-59	1,110.0
235C	Henniger Flats	34-11-38	118-05-17	2,550.0
238	Hollywood Dam	34-07-04	118-19-53	720.0
488B	Kagel Canyon Patrol Station	34-17-45	118-22-30	1,450.0
1278	La Canada	34-13-22	118-12-17	0.0
175B	La Canada Irrigation District	34-13-39	118-12-40	2,020.0
1261	La Canada Reclamation Plant	34-13-00	118-11-14	1,800.0
251C	La Crescenta	34-13-20	118-14-40	1,440.0
1088B	La Habra Heights Mutual Water Co.	33-56-55	117-57-51	445.0
196C	La Verne - Fire Station	34-06-06	117-46-20	1,050.0
455B	Lancaster - State Hwy. Maintenance Sta.	34-40-57	118-08-02	2,395.0
1212	Lancaster Fss/Faa	34-44-00	118-13-00	2,320.0
1267	Lancaster Reclamation Plant	34-46-38	118-09-11	2,302.0
299F	Little Rock - Schwab	34-32-12	117-58-43	2,800.0
1072B	Little Tujunga Ranger Station	34-17-37	118-21-38	1,275.0
564C	Llano	34-29-13	117-50-02	3,390.0
662D	Long Beach Airport	33-49-00	118-09-00	105.0
1254	Long Beach Reclamation Plant	33-48-11	118-05-20	20.0
716	Los Angeles - Ducommun St.	34-03-09	118-14-13	306.0
482	Los Angeles - U.S.C.	34-01-14	118-17-15	208.0
1217	Los Angeles Country Club	34-04-10	118-25-17	380.0
734C	Los Angeles International Airport	33-56-25	118-23-44	105.0
293B	Los Angeles Reservoir	34-17-18	118-28-54	1,150.0
1126A	Los Angeles-East Valley	34-12-30	118-24-35	780.0

1255	Los Coyotes Reclamation Plant	33-53-05	118-06-24	70.0
794	Lower Franklin Reservoir	34-05-43	118-24-40	585.0
801B	Magic Mountain	34-23-52	118-19-27	4,720.0
1166B	Mile High Ranch	34-24-40	117-46-15	5,280.0
1005B	Mint Canyon Fire Station	34-30-35	118-21-40	2,300.0
1266	Mission Canyon Landfill	34-08-40	118-28-45	1,150.0
225	Montana Ranch - Lakewood	33-50-35	118-07-09	47.0
390B	Morris Dam	34-10-53	117-52-43	1,210.0
338C	Mt. Wilson	34-14-07	118-04-28	5,709.0
322	Munz Valley Ranch	34-42-50	118-21-15	2,600.0
598D	Neenach - Check 43 - California D.W.R.	34-47-40	118-37-15	2,965.0
598C	Neenach-Erstad	34-46-28	118-46-28	3,062.0
32C	Newhall - Soledad Div. Hdqtrs.	34-23-07	118-31-54	1,243.0
1129B	Nicholas Canyon	34-02-52	118-54-57	340.0
13C	North Hollywood - Lakeside	34-08-46	118-21-13	550.0
25C	Northridge - L.A.W.P.	34-13-52	118-32-28	810.0
1222	Northridge-Garland	34-15-15	118-30-33	911.0
1095	Orange County Reservoir	33-56-07	117-52-58	660.0
491D	Pacific Palisades	34-02-22	118-31-43	293.0
33A	Pacoima Dam	34-19-48	118-23-59	1,500.0
1268	Palmdale Reclamation Plant	34-35-30	118-05-10	2,565.0
1058B	Palmdale W.D.	34-35-17	118-05-31	2,595.0
43D	Palos Verdes Estates	33-47-58	118-23-29	216.0
1011B	Palos Verdes Fire Station	33-45-25	118-21-11	1,272.0
1252	Palos Verdes Landfill	33-45-40	118-20-03	400.0
1251	Palos Verdes-Whites Point	33-42-50	118-19-02	100.0
388D	Paramount - County Fire Department	33-53-50	118-10-02	80.0
612B	Pasadena - Chlorine Plant	34-12-04	118-09-49	1,160.0
610B	Pasadena - City Hall	34-08-54	118-08-36	864.0
795	Pasadena - Jourdan	34-08-52	118-05-14	705.0
613C	Pasadena Fire Station	34-07-15	118-08-05	779.0
1240	Pearblossom-CALI.DW.R. Booste	34-30-32	117-55-15	3,050.0
1253	Point Water Polution Control	33-48-11	118-16-58	40.0
1271	Pomona Waste Reclamation Plant	34-03-18	117-47-34	786.0
170F	Potrero Heights	34-02-32	118-04-44	285.0
96C	Puddingstone Dam	34-05-31	117-48-24	1,030.0
134C	Puddingstone Diversion	34-07-52	117-46-55	1,160.0
1258	Puente Hills Landfill	34-01-35	118-01-49	300.0
409B	Pyramid Reservoir	34-40-34	118-46-47	2,505.0
1216	Rancho Palos Verdes	33-45-10	118-23-32	780.0
42C	Redondo Beach City Hall	33-50-43	118-23-20	70.0
1115	San Antonio Dam	34-09-24	117-40-20	2,120.0
95	San Dimas - Fire Warden	34-06-26	117-48-19	955.0
89B	San Dimas Dam	34-09-10	117-46-17	1,350.0
125B	San Francisquito Canyon Power House No.	34-35-25	118-27-15	2,105.0
372	San Francisquito Power House No. 2	34-32-02	118-31-27	1,580.0
227D	San Gabriel - Bruington - Orton	34-06-18	118-06-32	472.0
627	San Gabriel Canyon - Power House	34-09-20	117-54-28	744.0
425B	San Gabriel Dam	34-12-19	117-51-38	1,481.0
742C	San Gabriel Fire Department	34-06-11	118-05-56	445.0
1257	San Jose Creek Reclamation Plant	34-01-55	118-01-16	275.0
1006	San Pedro - City Reservoir	33-44-37	118-17-47	150.0
591B	Santa Anita Reservoir	34-11-08	118-06-16	1,205.0
1041B	Santa Fe Dam	34-07-04	117-58-24	427.0
634C	Santa Monica	34-00-43	118-29-27	94.0
1194	Santa Ynez Reservoir	34-04-23	118-33-59	735.0
1262	Saugus Reclamation Plant	34-24-48	118-32-23	1,150.0
277	Sawmill Mountain	34-43-15	118-35-00	3,700.0
1265	Scholl Canyon Landfill	34-08-40	118-11-07	1,000.0
465C	Sepulveda Dam	34-10-06	118-28-11	683.0
294B	Sierra Madre - Mira Monte Pumping Plant	34-10-11	118-02-51	985.0
144	Sierra Madre Dam	34-10-34	118-02-32	1,100.0
169	Sierra Madre Pumping Plant	34-09-47	118-02-21	700.0
336	Silver Lake Reservoir	34-06-08	118-15-54	445.0
405B	Soledad Canyon	34-26-23	118-17-33	2,150.0
1256	South Gate Transfer Station	33-56-40	118-09-56	100.0
356C	Spadra - Lanterman Hospital	34-02-31	117-48-35	690.0
1260	Spadra Landfill	34-02-36	117-49-50	700.0
237C	Stone Canyon Reservoir	34-06-21	118-27-13	865.0
683B	Sunset Ridge	34-12-53	118-08-47	2,110.0

82F	Table Mountain	34-22-56	117-40-39	7,420.0
434AL	Thompson Creek Dam	34-08-26	117-42-39	1,670.0
1158	Torrance Municiple Airport	33-47-59	118-20-08	102.0
695B	Tujunga Canyon - Vogel Flat	34-17-12	118-13-32	1,850.0
11D	Upper Franklin Canyon Reservoir	34-07-10	118-24-35	867.0
1263	Valencia Reclamation Plant	34-25-55	118-37-13	1,000.0
120	Vincent Patrol Station	34-29-17	118-08-27	3,135.0
109D	West Arcadia	34-07-42	118-04-22	547.0
406C	West Azusa	34-06-53	117-54-56	505.0
680B	Westwood (U.C.L.A.)	34-04-10	118-26-30	430.0
1274	Whittier - Valna Drive	33-57-39	118-01-10	255.0
106F	Whittier City Hall	33-58-57	118-02-50	300.0
1114B	Whittier Narrows Dam	34-01-29	118-05-02	239.0
1259	Whittier Narrows Reclamation	34-03-59	118-03-54	225.0
21B	Woodland Hills	34-10-14	118-35-33	875.0
1223	Woodland Hills - Sherman	34-10-06	118-38-57	1,035.0
306H	Zuma Beach	34-01-15	118-49-42	15.0

EVAPORATION



EVAPORATION

Public Works, the Metropolitan Water District, Palmdale Water District, the California Dept. of Water Resources, and Descanso Gardens provided daily evaporation data for 15 evaporation stations during the reporting period. Monthly and Seasonal summaries are provided in the report. Daily records of active and inactive stations are available in Public Works' files, along with some data for other agencies and districts. This data can be obtained by contacting the custodian of hydrologic records.

LENGTH OF RECORD

The Los Angeles County Flood Control District (now administered by Public Works) installed its first evaporation pan in March 1929 at Santa Anita Dam. Public Works has data for 37 evaporation stations which have monthly evaporation for more than 15 seasons.

CUSTODIAN

Unpublished information may be obtained by contacting:

County of Los Angeles
Department of Public Works
Water Resources Division
P.O. Box 1460
Alhambra, CA 91802-1460
(626) 458-6120

ACTIVE STATIONS

ID	Station Name	Equipment	Pan Elev.	Thomas Guide	North Latitude	West Longitude
33-A	Pacoima Dam	24X36 S	1500 ft.	482 F1	34-19-48	118-23-59
46-D	Big Tujunga Dam	24X36 S	2315 ft.	xi	34-17-40	118-11-14
63-C	Santa Anita Dam	24X36 S	1400 ft.	710 B2	34-11-03	118-01-12
89-B	San Dimas Dam	24X36 S	1350 ft.	470 F2	34-09-10	117-46-17
96-C	Puddingstone Dam	24X36 S	1030 ft.	600 A4	34-05-31	117-48-24
223-B	Big Dalton Dam	24X36 S	1587 ft.	570 B4	34-10-06	117-48-36
252-C	Castaic Reservoir	48X10 S	1150 ft.	4369 H6	34-29-53	118-36-53
334-B	Cogswell Dam	24X36 S	2300 ft.	ix	34-14-37	117-57-35
390-B	Morris Dam	72X36 US	1210 ft.	ix	34-10-53	117-52-43
409-B	Pyramid Reservoir	48X10 S	2505 ft.	593 E1	34-40-34	118-46-47
425-B	San Gabriel Dam	24X36 S	1481 ft.	ix	34-12-19	117-51-38
598-D	Check 43	24X36 S	2999 ft.	1001	34-47-40	118-37-15
1058-B	Palmdale	24X36 S	2595 ft.	4196 E6	34-35-17	118-05-31
1071-B	Descanso Gardens	24X36 S	1325 ft.	535 B4	34-12-07	118-12-46
1240	Pearblossom	24X36 S	3030 ft.	4378 F3	34-30-32	117-55-15

FOOTNOTES

24X36 S Screened land pan, 24 inches in diameter by 36 inches deep.
48X10 S Screened land pan, 48 inches in diameter by 10 inches deep.
72X36 US Unscreened land pan, 72 inches in diameter by 36 inches deep.

CALIFORNIA THE GOLDEN STATE

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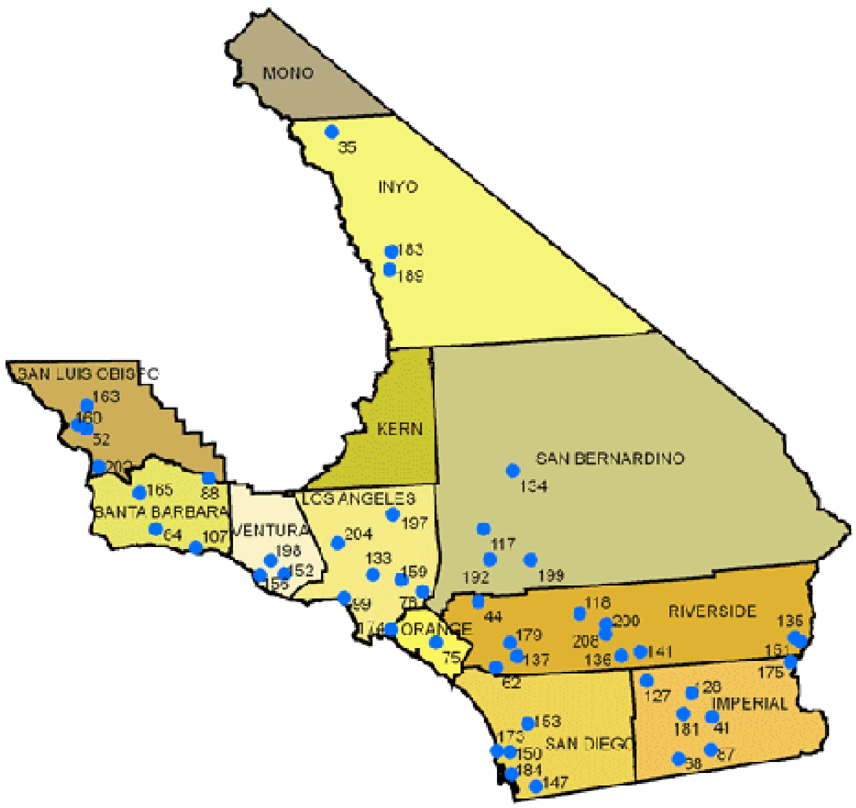
Southern District

Click on any station to view its detailed station description.



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Station Detail Report

The **Station Detail Report** provides detailed information on CIMIS stations including the region in which they are located, nearby city, installation dates, termination dates (if inactive), geographic locations (latitude and longitude), elevations above see level, zip codes, surface types (grass or alfalfa), station site descriptions, and photographs of the stations.

Long Beach #174

Los Angeles Basin Region Los Angeles County Southern District
Nearby city is Long Beach

- Activated On September 22, 2000
- Station is Active
- ETo Reported
- Reference Surface is Grass
- Datalogger is CR10

Station 174
North | South | East | West |

Geographic Information

Elevation (ft):	17
Latitude:	33°47'50"N / 33.8
Longitude:	118°05'38"W / -118.09

Associated Zip Codes

90745, 90746, 90747, 90749, 90801, 90802, 90803, 90804, 90805, 90806, 90807, 90808, 90809, 90810, 90813, 90814, 90822, 90831, 90832, 90833, 90834, 90835, 90840, 90842, 90845, 90846, 90847, 90848, 90853, 90888, 90899

Station Siting Description

Sorry, this information is not available at this time.

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Station Detail Report

The **Station Detail Report** provides detailed information on CIMIS stations including the region in which they are located, nearby city, installation dates, termination dates (if inactive), geographic locations (latitude and longitude), elevations above see level, zip codes, surface types (grass or alfalfa), station site descriptions, and photographs of the stations.

Santa Monica #99

Los Angeles Basin Region Los Angeles County Southern District
Nearby city is Santa Monica

- Activated On December 11, 1992
- Station is Active
- ETo Reported
- Reference Surface is Grass
- Datalogger is CR10x

Station 99
North | South | East | West |

Geographic Information

Elevation (ft):	340
Latitude:	34°02'28"N / 34.04
Longitude:	118°28'34"W / -118.48

Associated Zip Codes

90401, 90402, 90403, 90404, 90405, 90406, 90407, 90408, 90409, 90410, 90411

Station Siting Description

DATE: 5-9-03

STATION #: 99
STATION NAME: SANTA MONICA
ETo ZONE: 2-3
This is an example of a CIMIS urban site.

http://www.epa.gov/epafiles/templates/v4.htmlhttp://java.epa.gov/castnet/site.do

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CASTNET

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Data Type: Edit

Concentration - Annual

Time Frame: Edit

Concentration - Annual
2000 -2013

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☐ California	
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Last updated on Friday, September 28th, 2012.

Attachment K-P

SDLAC CEC Report

COUNTY SANITATION DISTRICTS
OF LOS ANGELES COUNTY

1955 Workman Mill Road, Whittier, CA 90601-1400
Mailing Address: P.O. Box 4998, Whittier, CA 90607-4998
Telephone: (562) 699-7411, FAX: (562) 699-5422
www.lacsd.org

GRACE ROBINSON CHAN
Chief Engineer and General Manager

December 13, 2012
File No. 31-370-40.4A

Mr. Samuel Unger, Executive Officer
California Regional Water Quality Control Board
Los Angeles Region
320 West Fourth Street, Suite 200
Los Angeles, CA 90013

Dear Mr. Unger:

Compilation and Analysis of Constituents of Emerging Concern Monitoring Results

The purpose of this letter is to transmit a compilation and analysis of monitoring results obtained over the past five years by the Sanitation Districts of Los Angeles County (Sanitation Districts) for constituents of emerging concern (CECs). To fulfill their mission to protect public health and the environment, the Sanitation Districts have been a leader in addressing the issue of CECs. The Sanitation Districts were one of the first public agencies in the nation to develop the capability to analyze water quality for CECs such as pharmaceuticals, personal care products (PPCPs), and endocrine disrupting compounds (EDCs). The Sanitation Districts have since conducted extensive monitoring of CECs in effluents from their wastewater treatment facilities.

In the past five years, the Sanitation Districts have obtained over 5,500 analytical results of CECs in samples collected from nine of their wastewater treatment plants. The plants sampled included the Long Beach, Los Coyotes, Pomona, San Jose Creek East, San Jose Creek West, Saugus, Valencia, and Whittier Narrows Water Reclamation Plants (WRPs), as well as the Joint Water Pollution Control Plant (JWPCP). The eight WRPs provide recycled water and discharge to inland surface waters while the remaining plant, JWPCP, discharges to the Pacific Ocean. Analytical methods used to monitor CECs in the Sanitation Districts' effluents are based on those published by the United State Environmental Protection Agency (EPA) and are described in the report. This report summarizes data that has been collected through July 2012 and provides an analysis of the results with respect to any potential impacts on human health and aquatic life. Pyrethroid monitoring and the development of bioanalytical methods are also discussed.

If you have any questions regarding this communication, please contact the undersigned at (562) 908-4288, extension 2803.

Very truly yours,

Grace Robinson Chan

Ann T. Heil
Supervising Engineer
Technical Services Department

ATH:lmb
Enclosure

DOC #2439686

Sanitation Districts of Los Angeles County
Constituents of Emerging Concern Monitoring Summary
2007 to 2012

The Sanitation Districts of Los Angeles County (Sanitation Districts) provide for the wastewater and solid waste management needs of about 5.4 million people in 78 cities and unincorporated areas within Los Angeles County. The Sanitation Districts operate 11 wastewater treatment plants, which treat approximately 500 million gallons of wastewater per day. To fulfill their mission to protect public health and the environment, the Sanitation Districts have been a leader in addressing the issue of constituents of emerging concern (CECs). The Sanitation Districts were one of the first public agencies in the nation to develop the capability to analyze water quality for CECs such as pharmaceuticals, personal care products (PPCPs), and endocrine disrupting compounds (EDCs). The Sanitation Districts have since conducted extensive monitoring of CECs in effluents from their wastewater treatment facilities.

In the past five years, the Sanitation Districts have obtained over 5,500 analytical results of CECs in samples collected from nine of their wastewater treatment plants. The plants included in this study are eight Water Reclamation Plants (WRPs), including the Long Beach, Los Coyotes, Pomona, San Jose Creek East, San Jose Creek West, Saugus, Valencia, and Whittier Narrows WRPs, as well as the Joint Water Pollution Control Plant (JWPCP). The eight WRPs provide recycled water and discharge to inland surface waters while the remaining plant, JWPCP, discharges to the Pacific Ocean. Analytical methods used to monitor CECs in the Sanitation Districts' effluents are based on those published by the United State Environmental Protection Agency (EPA) and are described in this report. This report summarizes data that has been collected through July 2012 and provides an analysis of the results with respect to any potential impacts on human health and aquatic life. Pyrethroid monitoring and the development of bioanalytical methods are also discussed.

Analytical Methods

The Sanitation Districts' Water Quality Laboratory has developed and validated modified versions of EPA Methods 539, 625, 1625, 1694, and 8270D for the analysis of compounds collectively referred to as CECs, which consist of EDCs, pharmaceutical compounds, PPCPs, and other compounds. In addition, some of the analyses are performed by contract laboratories that employ EPA methods such as Methods 524 and 8141A. The analytical methods cover several distinct groups of CECs that include: hormones; surfactant metabolites: alkylphenols (APs) and alkylphenolethoxylates (APEOs); PPCPs; polybrominated diphenyl ethers (PBDEs); nitrosamines; phthalates; volatiles; organophosphorous pesticides; and hydrazine and quinoline. The methods for each of these groups are discussed below.

Hormones, Alkylphenols and Alkylphenolethoxylates

The hormones (17-α-ethinylestradiol, 17-β-estradiol, estriol, estrone, androstenedione and testosterone), APs (4-nonylphenol-technical mixture, 4-tert Octylphenol), and APEOs (nonylphenol monoethoxylate, nonylphenol diethoxylate, octylphenol monoethoxylate, and octylphenol diethoxylate) are extracted together using a solid phase extraction cartridge containing 500 milligrams (mg) of polymeric reversed-phase resin and 100% methanol as the eluting solvent. The extracts are then analyzed by three separate analyses using a high performance liquid chromatograph (HPLC) for separation and a triple quadrupole mass spectrometer (MS/MS) for detection. The isotope dilution technique is used for quantification and has been the technique of choice for the analysis of CECs in environmental samples. These methods are similar to those used by Southern Nevada Water Authority, MWH Laboratories, and Orange County Water District. For each analytical batch, one method blank, one laboratory control standard, one matrix spike, and one matrix spike duplicate are included to satisfy the quality assurance/quality control

(QA/QC) requirements. Analyses are no longer conducted by the Sanitation Districts for the compound progesterone, as it has never been detected in the Sanitation Districts' effluent.

Pharmaceutical Compounds and Personal Care Product Ingredients

The pharmaceutical compounds and personal care product ingredients [acetaminophen, amoxicillin, atenolol, atorvastatin (Lipitor), azithromycin, bisphenol-A, caffeine, carbamazepine, ciprofloxacin HCl, N,N-diethyl-meta-toluamide (DEET), Dilantin (phenytoin), diclofenac, erythromycin[-H_2O], fluoxetine, furosemide, gemfibrozil, ibuprofen, iohexol, iopromide, meprobamate, metoprolol, naproxen, primidone, propranolol, salicylic acid, sulfamethoxazole, tris 2-chloroethyl phosphate (TCEP), triclocarban, triclosan, and trimethoprim] as well as the artificial sweetener sucralose are extracted together using a solid-phase extraction (SPE) cartridge containing 200 mg of polymeric reversed-phase resin and 30%/70% methylene chloride/methanol mixture as the eluting solvent. The extracts are then analyzed by two separate electrospray ionization analyses (ESI+ and ESI-) using an HPLC for separation and MS/MS for detection. Isotope dilution technique is used for quantification. These methods are similar to the proposed EPA Method 1694, and other published EPA research methods. For each analytical batch, one method blank, one laboratory control standard, one matrix spike, and one matrix spike duplicate are included to satisfy the QA/QC requirements. Analyses are no longer conducted by the Sanitation Districts for the compounds ketoprofen, *o*-hydroxy atorvastatin, and *p*-hydroxy atorvastatin because reliable quantifications of these compounds could not be made. In particular, no deuterated internal standards are available.

Polybrominated Diphenyl Ethers

The PBDEs (BDE-28: 22'4-triBDE; BDE-47: 22'44'-tetraBDE; BDE-99: 22'44'5-pentaBDE; BDE-100: 22'44'6-pentaBDE; BDE-153: 22'44'55'-hexaBDE; BDE-154: 22'44'56-hexaBDE; BDE-183: 22'344'56-heptaBDE; and BDE-209: decaBDE) are extracted together using an SPE cartridge containing 1000 mg of C18 and dichloromethane (DCM) as the eluting solvent. Extracts are analyzed by using gas chromatography-mass spectrometry (GC-MS), and analytical data are acquired in the selected ion-monitoring mode. This method is a modified version of EPA Method 8270D. Isotope dilution is applied to increase the precision and accuracy of the analysis. For each batch, one method blank, two laboratory control standards, one matrix spike, and one matrix spike duplicate are included to satisfy QA/QC requirements.

Nitrosamines

The nitrosamines, including N-Nitrosodimethylamine and N-Nitrosopyrrolidine, are analyzed using a modified version of EPA Method 1625C. The nitrosamines are extracted together using liquid-liquid extractors and DCM as a solvent. The samples are adjusted to a pH above 12 and a surrogate standard solution is added to each sample prior to extraction. The samples are then extracted for at least 14 hours then concentrated to 1 milliliter (mL). An internal standard solution is added to the extraction concentration prior to analysis by GC-MS and analytical data are acquired in the selected ion-monitoring mode. Isotope dilution technique is used for quantification to increase the precision and accuracy of the analysis. For each batch, one method blank, two laboratory control standards, one matrix spike, and one matrix spike duplicate are included to satisfy QA/QC requirements.

Phthalates

The phthalates (bis(2-ethylhexyl)phthalate and butyl benzyl phthalate) are analyzed using EPA Method 625. They are extracted for at least 18 hours using liquid-liquid extractors and DCM as a solvent. The extracts are concentrated to 1mL, and then analyzed by GC-MS.

Volatile Organics

Analysis of the volatile organic compound 1,2,3-trichloropropane is conducted for the Sanitation Districts by Test America. Test America uses EPA Method 524, which is a purge and trap GC-MS method.

Organophosphorus Pesticides

Analysis of the organophosphorus pesticides chlorpyrofos is conducted for the Sanitation Districts by Weck Laboratories. Weck Laboratories uses EPA Method 8141A, which involves extraction by separatory funnel, using DCM as a solvent, and analysis via gas chromatography with a thermionic specific detector (GC-TSD).

Hydrazine and Quinoline

Analysis of both hydrazine and quinoline were conducted for the Sanitation Districts by Montgomery Watson Harza Laboratories (now Eurofins Eaton Analytical). Hydrazine was analyzed using gas chromatography tandem mass spectrometry (GC-MS-MS). Quinoline was analyzed using liquid chromatography tandem mass spectrometry (LC-MS-MS).

Monitoring Results

The Sanitation Districts began analyzing for CECs in their wastewater treatment plants' effluents in September 2007. Data from September 2007 to July 2012 are included in this report. Chlorinated final effluent samples collected from the Long Beach, Los Coyotes, Pomona, San Jose Creek East and West sides, Saugus, and Valencia WRPs and dechlorinated final effluent samples collected from the Whittier Narrows WRP were analyzed. All samples from these plants were 24-hour composites except for the instantaneous grab samples used to analyze hydrazine and quinoline. Secondary effluent samples were collected and analyzed from the JWPCP as follows: a 24-hour composite sample was collected in August 2009 and four grab samples were collected in February and March of 2011. Summaries of the monitoring results for JWPCP are provided in Table 1 and for the WRPs in Tables 2 through 5. Summaries of analytical results for each treatment plant are provided in Attachment A and detailed results are included in Appendix A.

This report also includes results for N-nitrosodimethylamine (NDMA), butyl benzyl phthalate, bis(2-ethylhexyl)phthalate, and chlorpyrifos. Although these are not typically classified as CECs, they were treated as CECs by expert panels investigating CECs for the State Water Resources Control Board (State Water Board) and thus are included in this evaluation. Routine monitoring is conducted at all of the Sanitation Districts' wastewater treatment plants for NDMA, butyl benzyl phthalate, and bis(2-ethyl hexyl)phthalate, because these are considered priority pollutants[1] by the EPA. Additionally, effluent monitoring for 1,2,3-trichloropropane and chlorpyrifos has been conducted at several of the Sanitation Districts' WRPs in accordance with National Pollutant Discharge Elimination System (NPDES) permit monitoring requirements adopted by the California Regional Water Quality Control Board, Los Angeles Region (Regional Board). For NDMA, only results analyzed using low-level modified EPA Method 1625, with a detection limit of 2 nanograms per liter (ng/L), are included in this report. Results for analyses using EPA Method 625 are not included because the method is not sensitive enough to provide meaningful results (detection limit of 5,000 ng/L). Results for a second nitrosamine, N-Nitrosopyrrolidine are analyzed in this report because this constituent was addressed by a State Water Resources Control Board (State Water Board) expert panel on CECs. Results for several additional nitrosamines (N-Nitrosodiethylamine, N-Nitrosodi-n-butylamine, N-Nitrosomethylethylamine, N-Nitroso-n-propylamine, and N-Nitrosopiperidine) and included in the appendix for reference but not analyzed in this report.

[1] A list of priority pollutants is provided as Appendix A to Title 40 of the Code of Federal Regulations Part 423.

During the five years covered by this report, the Sanitation Districts conducted monitoring for 64 CECs and over 5,500 analytical results were obtained. For the WRPs, some analytes were run over 200 times in total. Summaries of the relative occurrence of the CECs monitored in the Sanitation Districts' effluent are presented in Tables 6 and 7. For JWPCP, the summary includes only results for constituents analyzed at least four times (27 in total). Of those constituents, six were rarely or never detected and the remaining 21 compounds were found most or all of the time. Of the 64 CECs evaluated in the Sanitation District's WRP effluents, 16 were not detected in any samples at any WRP and 24 CECs were detected always or almost always in the WRP effluents. The remaining CECs were detected at intermediate frequencies.

Evaluation of Potential Human Health Significance

In order to evaluate the results with respect to potential human health significance, the methodology developed by the State Water Board's Science Advisory Panel for CECs in recycled water (Recycled Water CEC Panel) was used. This methodology is described in detail in the Recycled Water CEC Panel report, "*Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water*" (Recycled Water CEC Panel Report).[2] It is a risk-based approach, wherein measured concentrations of CECs are compared to thresholds that are derived based on human health endpoints.

The Recycled Water CEC Panel derived a series of initial monitoring trigger levels (MTLs) for various CECs. These MTLs were meant to serve as screening levels that could be used to determine when a particular constituent should be prioritized for monitoring and to interpret the results from the monitoring. The initial MTLs were derived from seven sources, including California drinking water notification levels (NLs) established by the California Department of Public Health, predicted no effects concentrations taken from the EPA Contaminant Candidate List 3 (CCL3), Australian Guidelines for Water Recycling, and several scientific papers. Measured environmental concentrations (MECs) are then divided by the initial MTLs. A resulting fraction, termed the monitoring trigger quotient (MTQ), greater than 1.0 indicates that the constituent is present at concentrations that potentially may be relevant to human health, although it should be noted that the MTLs for indirect potable reuse contain between 6 to 11 orders of magnitude of conservatism for indirect potable reuse projects,[3] and an additional one to two orders of magnitude of conservatism for incidental recharge of groundwater. Fractions less than 1.0 indicate that the constituent is not likely present at levels of concern.

Consistent with the Recycled Water CEC Panel Report, the MECs were taken as 90th percentile values of effluent data. Use of the 90th percentile is more appropriate than use of maximum values, for several reasons. Use of the 90th percentile eliminates any outlier values that may be suspect. It also eliminates values that may be elevated only rarely or for short periods of time, which is appropriate because the endpoints for human health data are based on chronic exposures. It provides a more conservative analysis than comparing median values to the endpoints. It should be noted that for small data sets, the 90th percentile is equal to the maximum value.

This report includes comparisons of recycled water quality at the WRPs to both indirect potable reuse and irrigation thresholds. Data collected at all the WRPs was considered, because all of the WRPs except the Saugus WRP currently supply recycled water to indirection potable reuse and/or irrigation projects and projects to utilize the Saugus WRP recycled water are being investigated. However, this is a highly conservative analysis because further treatment is applied to the water before it is supplied for indirect potable reuse (either soil aquifer treatment at the Montebello Forebay groundwater recharge project or reverse osmosis at the Alamitos Barrier project). Additionally, the indirect potable reuse thresholds can be used to assess the potential for human health risk for discharges to waterbodies with a groundwater recharge (GWR) beneficial use (only applicable to the Pomona, San Jose Creek, Whittier Narrows,

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[2] State Water Resources Control Board, *Final Report, Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water,* June 25, 2010. Sacramento, CA.
[3] *Ibid.*, page 61.

Saugus and Valencia WRPs), although this provides a very conservative analysis because there is further dilution of the water discharged from the WRPs before it enters groundwater, and additional dilution before the groundwater is pumped for drinking water purposes. JWPCP effluent was not compared to human health thresholds, as there are no projects currently moving forward to recycle water from JWPCP and there is no GWR beneficial use for the JWPCP ocean receiving waters.

A summary of this analysis is presented in Table 8. The MTQs for irrigation were less than one for all constituents and, with the exception of NDMA and 17β-estradiol, the initial MTL-based MTQs for potable reuse were less than 1.0 for all constituents. For 17β-estradiol, the potable reuse initial MTL-based MTQ was < 2.2, but could not be definitively established due to the reporting level (2 ng/L) being higher than the MTL (0.9 ng/L). Per the Recycled Water CEC Panel Report, the majority of 17β-estradiol in wastewater is a result of human excretion, rather than use of pharmaceuticals, and it is not predicted to be associated with adverse effects in drinking water. The initial MTL in the Recycled Water CEC Panel Report was based on the California Office of Environmental Health Hazard Assessment (OEHHA) cancer slope factor and a 1 x 10^{-6} excess lifetime cancer risk level. However, the mechanism by which tumors were induced in the study used to derive the cancer slope factor has no equivalent in humans. Therefore, the Recycled Water CEC Panel believes that use of the Australian drinking water guideline value for 17β-estradiol, which in turn is derived from a value developed by the World Health Organization (WHO), may have greater validity.[4] The WHO value is about 2000-fold higher than the OEHHA value, and use of the WHO value would result in the initial MTL-based MTQ being much less than one in all cases. It should be noted that, based on the OEHHA value, many common dietary items that contain naturally occurring 17β-estradiol pose a potentially unacceptable cancer risk.[5] Furthermore, 17-β-estradiol is rarely detected in Sanitation Districts' WRP effluent. Of the 205 samples analyzed, only 9 had detected values. However, as mentioned earlier, the reporting limit of 2 ng/L for the vast majority of samples is above the initial MTL of 0.9 ng/L for potable use. Samples collected in May 2012 at all of the WRPs had a detection limit of 0.5 ng/L, and there were no detections. Therefore, it was clear in May 2012 that 17β-estradiol was not present at concentrations above the potable reuse initial MTL. The Sanitation Districts intend to continue to use the lower detection limit for future analyses of 17β-estradiol, to better establish whether results are consistently below the MTL.

For NMDA, the MTQ for potable reuse was well above 1.0 at a value of 62. The Sanitation Districts have been aggressively working to investigate NDMA and reduce NDMA concentrations for over eight years. Summaries of these efforts were transmitted to the Regional Board in April 2004 and July 2006.[6] Additionally, the Sanitation Districts have additionally completed a thorough study of attenuation and dilution of NDMA in the Montebello Forebay area.[7] The study included extensive NDMA monitoring of groundwater wells in the Montebello Forebay area and the development of a model to predict subsurface NDMA concentrations. Both the monitoring and modeling activities indicate that there are no production wells exceeding or predicted to exceed the NL for NDMA. Therefore, NDMA is not present at concentrations of concern for recharge in the Montebello Forebay. The other potable reuse application using the Sanitation Districts' recycled water is the Alamitos Barrier. Water receives advanced treatment, including UV treatment, before being delivered to the Barrier, and thus the NL of less than 10 ng/L for NMDA is met prior to delivery.

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[4] *Ibid*., page 32.
[5] *Ibid.*
[6] "*Summary of Districts' Efforts Investigating and Reducing N-Nitrosodimethylamine (NDMA) Concentrations in Water Reclamation Plan Effluents*," April 15, 2004, Victoria Conway and "*Update on Districts Efforts to Reduce N-Nitrosodimethylamine (NDMA) Concentrations in Water Reclamation Plant Effluents*," July 25, 2006, Ann Heil.
[7] "*Final Project Report, Montebello Forebay Attenuation and Dilution Studies*," March 2008, prepared by Lawrence Berkeley National Laboratory and Kennedy/Jenks/Todd LLC.

Evaluation of Potential Aquatic Life Effects

In order to evaluate the significance of the results from this study with respect to potential aquatic life effects, the methodology developed by the State Water Board's Science Advisory Panel for Chemicals of Emerging Concern in California's Aquatic Ecosystems (Ecosystem CEC Panel) was used. The methodology is described in detailed in the Ecosystem CEC Panel report, "*Monitoring Strategies for Chemicals of Emerging Concern (CECs) in California's Aquatic Ecosystems*" (Ecosystem CEC Panel Report).[8] As with the Recycled Water CEC Panel Report, the methodology relies upon a risk-based approach, wherein measured concentrations of CECs are compared to thresholds that indicate potential risk to aquatic life.

The thresholds, or MTLs, were developed by the Ecosystem CEC Panel using a literature review to compile no observed effects concentrations (NOECs) and/or predicted no effect concentrations (PNECs) for a number of fish and other aquatic species including algae and invertebrates. The Ecosystem CEC Panel relied heavily on studies that examined survival, growth, and reproduction. A safety factor of 10 was applied to constituents where a potential endocrine disrupting mode of action was not incorporated into the NOEC/PNEC or where there was an unknown mode of action. An additional safety factor of 10 was applied to extrapolate the NOEC/PNEC from freshwater to saltwater. For anti-microbials such as antibiotics, minimum inhibitory concentrations (MICs) were used as the threshold to assess potential antibiotic resistance effects, with a safety factor of 100 applied (a safety factor of 10 to account for uncertainty associated with the use of indicator bacteria that are not aquatic/marine combined with a safety factor of 10 to account for the uncertainty of development of antibiotic resistant bacteria from plasmids or other molecular constituents). MICs are the antibiotic concentrations that generally cause microbial death.

The Ecosystem CEC Panel Report lists only MTLs for constituents it found to have MTQs greater than 1.0, based on the occurrence data reviewed by the Panel. To provide a comprehensive analysis of Sanitation Districts' data, MTLs were derived using the Panel's literature review values for NOECs/PNECs, with application of appropriate safety factors. The resulting MTLs are listed in Table 9, along with the PNEC/NOEC used and safety factors applied. For compounds with NOECs based on both aquatic toxicity and antibiotic resistance, the more conservative of the two NOECs was used. Where there was some question about whether a particular toxicity endpoint should be used, the Ecosystem CEC Panel Report was consulted to see if the Ecosystem CEC Panel had used the endpoint in its analysis. In particular, the Ecosystem CEC Panel did not appear to use Comet Assay-based LOEC for furosemide in its analysis, so this endpoint was not considered in this analysis.

To determine where there is a potential for aquatic life impacts, predicted environmental concentrations (PECs) are compared to the MTLs. The PEC divided by the MTL is the MTQ, and values less than 1.0 for the MTQ mean that it is not likely that there is a potential for adverse aquatic life impacts. Since the Sanitation Districts' WRPs discharge to effluent-dominated waterbodies, no dilution was considered. Instead, the predicted environmental concentrations (PECs) were assumed to be equivalent to the measured environmental concentrations (MECs) in the effluent. For the JWPCP, the PECs were calculated from the MECs in accordance with the Ecosystem CEC Panel Report, assuming a nominal 1000-fold dilution as observed at near-bottom marine outfalls located at 50 to 100 meter depths in the mid-Shelf.[9] The 1000-fold dilution factor incorporates the initial dilution of 166 to 1 from the JWPCP

[8] Southern California Coastal Water Research Project, *Monitoring Strategies for Chemicals of Emerging Concern (CECs) in California's Aquatic Ecosystems: Recommendations of a Science Advisory Panel*, Technical Report 692, April 2012.
[9] *Ibid.*, pages 22 and 40.

outfalls as well as secondary dilution due to vertical and horizontal dispersal of the discharge plume, and has been field verified for several CECs.[10]

For the WRPs, where a robust data set was available, the 90th percentile value of all samples at all of the WRPs was used as the MEC. As described above, use of the 90th percentile is more appropriate than use of maximum values, because it eliminates any outlier values that may be suspect, eliminates values that may be elevated only rarely or for short periods of time, and provides a more conservative analysis than comparing median values to the endpoints. For JWPCP, only a limited data set was available so the MECs were taken as the maximum effluent concentrations, as the maximum effluent concentrations are equal to the 90th percentiles for smaller data sets.

The MTQs for JWPCP are presented in Table 10. All of the MTQs are less than 1.0, indicating that there is no potential CEC risk to aquatic life due to discharges from the JWPCP through water column exposure.

For the WRPs, the MTQs are presented in Table 11. The MTQs for all of the constituents that were detected at the WRPs were less than 1.0, with the exception of the MTQ for one constituent, estrone. The MTQ for estrone was 1.1, with a 90th percentile concentration of 6.8 ng/L as compared to the MTL of 6 ng/L. This is consistent with the Ecosystem CEC Panel Report, which also found an MTQ greater than 1.0 for estrone. The MTL for estrone is taken from a paper by Cadwell.[11] This paper reviewed *in vivo* vitellogenin (VTG) induction studies to determine the potency of estrone to induce VTG relative to other steroid hormones, and then derived a PNEC for long-term estriol exposure based on species sensitivity distributions of chronic aquatic toxicity data for other steroid hormones. The PNEC is for long term exposures (i.e., greater than 60 days); a higher PNEC is recommended for shorter term exposures (i.e., a few days or weeks). Long term exposure is better represented by median, rather than 90th percentile values. The overall median estrone concentration at the WRPs is < 2 ng/L, with individual medians at the WRPs varying from < 2 ng/L to 4.8 ng/L. In all cases, the median values are less than the MTL. Thus, it does not appear that estrone is present at concentrations likely to have adverse impacts on aquatic life.

Analyses for Pyrethroids

The Sanitation Districts have recently completed validation of a method for pyrethroid analysis. Seven pyrethroids (bifenthrin, lambda-cyhalothrin, permethrin, cyfluthrin, cypermethrin, esfenvalerate, deltamethrin) are analyzed using an Agilent 7890A series GC equipped with dual 63Ni micro-electron capture detectors (ECD) with electronic pneumatics control, dual capillary columns, and a pre-column that is connected to the capillary columns via a splitter. Pyrethroids are extracted from water samples (1liter) using 3MTM EmporeTM extraction disks, and are eluted from the solid-phase extraction disks with hexanes, followed by silica gel chromatography to remove matrix interferences. To monitor the efficiency of SPE extraction, a surrogate, 2,2',3,3',4,4',5,5',6,6'-decachlorobiphenyl (PCB-209), is spiked into water samples before extraction. Concentrations of pyrethroids in final extracts (1 mL) are determined using calibration curves obtained on the dual capillary columns. Reporting limits (RLs) for the seven pyrethroids are 5 ng/L. To meet the QA/QC requirements, one method blank, one laboratory control standard, one matrix spike, and one matrix spike duplicate are included in each analytical batch.

During the validation process, final effluent discharged from San Jose Creek East WRP was sampled in April, June and July 2012; and the concentrations of the seven pyrethroids in these samples were below

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[10] Vidal-Dorsch, D.E., S.M. Bay, K.A. Maruya, S.A. Snyder, R.A. Trenholm, and B.J. Vanderford. 2011. Contaminants of emerging concern in municipal wastewater effluents and marine receiving water. *Southern California Coastal Water Research Project 2011 Annual Report*, pages 351-364.
[11] Caldwell, D.J., F. Mastrocco, P.D. Anderson, R. Lange, and J.P. Sumpter. 2012. Predicted no effect concentrations for the steroid estrogens estrone, 17β-estradiol, estriol, and 17α-ethinylestradiol. *Environmental Toxicology Chemistry*. 31:1396-1406.

the reporting limit of 5 ng/L. Beginning in the fall of 2012, the Sanitation Districts plan to conduct a one year study of pyrethroid concentrations that will include quarterly effluent analyses at the eight WRPs mentioned in this report.

Development of Bioanalytical Methods

In order to better understand the potential impacts of the Sanitation Districts' recycled water and to address unknown effects, the Sanitation Districts have been exploring both *in vitro* and *in vivo* bioassays. The Sanitation Districts' San Jose Creek Water Quality Laboratory (SJCWQL) has been using the EPA's 21-day short-term fathead minnow assay to evaluate effluent from the San Jose Creek East WRP. This bioassay measures reproductive fitness in fish and evaluates the effects of EDCs on the endocrine system. This short-term reproduction assay is designed to detect changes in morphology, spawning, and various biochemical endpoints. Endpoints assessed within the protocol include: adult survival, reproductive behavior, secondary sex characteristics, gonadosomatic index (GSI), gonadal histology, plasma concentrations of vitellogenin, fecundity, and fertility. Fish are exposed to 100% and 50% effluent concentrations, as well as a positive and negative control using a flow-through test design. Presently, the SJCWQL Biology group has conducted two screenings of the effluent. In addition to the fathead minnow assay, the SJCWQL Microbiology group has been using an in vitro cell-based bioassay (T47D-KBluc) to screen the effluent for estrogenicity in parallel with the fish testing. The T47D-KBluc bioassay, developed by the EPA, is a reporter gene assay that is used to test for the presence of estrogenic compounds within a sample that are capable of binding to the nuclear estrogen receptor. The assay uses a mammalian breast cancer cell line that has been stably transfected with an estrogen-responsive luciferase reporter gene construct. Binding to the estrogen receptor triggers the production of luciferase and the corresponding luminescence is quantified using a 96-well plate reader. To date, two screenings of San Jose Creek WRP effluent have been performed. Data from the two screenings are currently being evaluated.

Conclusion

In its mission to protect public health and the environment, the Sanitation Districts have been pursuing a better understanding of CECs through extensive monitoring of effluents from its wastewater treatment plants. In the past five years, the Sanitation Districts have obtained considerable amounts of data and analyses conducted to date on these data indicate that the Sanitation Districts are not discharging CECs at levels that are a risk to human health or aquatic life.

Table 1. Summary of JWPCP Secondary Effluent CEC Monitoring

Constituent	No. Samples	Median, ng/L	Maximum, ng/L
1,2,3-Trichloropropane	0	NA	NA
17α-Ethinylestradiol	5	< 10	< 10
17β-Estradiol	5	< 10	7.3
4-Nonylphenol (tech mix)	5	1,110	3,840
4-tert Octylphenol	5	630	821
Acetaminophen	5	16	31
Amoxicillin	0	NA	NA
Androstenedione	0	NA	NA
Atenolol	0	NA	NA
Atorvastatin	1	116	116
Azithromycin	5	984	1,010
Bisphenol A	5	123	403
Bis(2-ethylhexyl)phthalate	23	2,300	16,600
Butyl benzyl phthalate	20	< 10,000	< 10,000
Caffeine	4	373	515
Carbamazepine	5	< 10	269
Chlorpyrifos	0	NA	NA
Ciprofloxacin HCl	0	NA	NA
DEET	4	447	518
Diclofenac	1	114	114
Dilantin (phenytoin)	4	309	323
Erythromycin-H2O	1	245	245
Estriol	0	NA	NA
Estrone	5	23	32
Fluoxetine	1	< 10	< 10
Furosemide	1	882	882
Gemfibrozil	5	1,180	3,280
Hydrazine	0	NA	NA
Ibuprofen	5	< 10	306
Iohexol	0	NA	NA
Iopromide	5	763	1,010
Ketoprofen	0	NA	NA
Meprobamate	4	391	414
Metoprolol	0	NA	NA
Naproxen	1	1,040	1,040
N-Nitrosdimethylamine	9	280	650
N-Nitrosopyrrolidine	4	11	17
Nonylphenol diethoxylate	4	8,825	9,700
Nonylphenol monoethoxylate	4	2,645	3,280
Octylphenol diethoxylate	4	4,003	4,850
Octylphenol monoethoxylate	4	1,170	1,400
o-OH Atorvastatin	0	NA	NA
p-OH Atorvastatin	0	NA	NA
PBDE-28	0	NA	NA
PBDE-47	0	NA	NA
PBDE-99	0	NA	NA
PBDE-100	0	NA	NA
PBDE-153	0	NA	NA

Constituent	No. Samples	Median, ng/L	Maximum, ng/L
PBDE-154	0	NA	NA
PBDE-183	0	NA	NA
PBDE-209	0	NA	NA
Primidone	1	113	113
Progesterone	5	< 5.0	< 5.0
Propanolol	0	NA	NA
Quinoline	0	NA	NA
Salicylic acid	0	NA	NA
Sucralose	4	20,350	21,000
Sulfamethoxazole	5	978	1,270
Tris (2-chloroethyl) phosphate (TCEP)	4	389	418
Testosterone	0	NA	NA
Triclocarban	0	NA	NA
Triclosan	5	466	499
Trimethoprim	1	547	547

NA = Not available.

Table 2. Number of Analytical Results, Sanitation Districts' WRP Effluent CEC Monitoring

Constituent	LB	LC	POM	SAUG	SJCE	SJCW	VAL	WN	Total
1,2,3-Trichloropropane	12	11	12	14	11	11	14	7	92
17α-Ethinylestradiol	30	5	34	14	39	39	14	31	206
17β-Estradiol	30	5	34	14	39	39	14	31	206
4-Nonylphenol (tech mix)	29	5	32	14	37	37	14	29	197
4-tert Octylphenol	29	5	32	14	37	37	14	29	197
Acetaminophen	22	5	25	15	28	28	14	22	159
Amoxicillin	2	2	4	3	4	4	2	4	25
Androstenedione	1	1	1	1	1	1	1	1	8
Atenolol	2	2	2	2	3	3	2	2	18
Atorvastatin	22	5	25	15	28	28	14	22	159
Azithromycin	22	5	25	15	28	28	14	22	159
Bisphenol A	22	5	25	15	28	28	14	22	159
Bis(2-ethylhexyl)phthalate	14	22	64	14	33	32	43	34	256
Butyl benzyl phthalate	12	13	12	14	12	10	13	12	98
Caffeine	6	5	7	6	7	7	6	6	50
Carbamazepine	22	5	25	15	28	28	14	22	159
Chlorpyrifos	0	0	7	7	1	1	7	0	23
Ciproflaxin	2	2	4	3	4	4	2	4	25
DEET	6	5	7	6	7	7	6	6	50
Diclofenac	22	5	23	13	26	26	12	20	147
Dilantin (Phenytoin)	6	5	7	6	7	7	6	6	50
Equilin	1	1	1	1	1	1	1	1	8
Erythromycin-H2O	19	2	21	11	23	23	10	17	126
Estriol	1	1	1	1	1	1	1	1	8
Estrone	30	5	34	14	39	39	14	31	206
Fluoxetine	22	5	23	13	26	26	12	20	147
Furosemide	19	2	21	11	24	24	10	18	129
Gemfibrozil	22	5	25	15	28	28	14	22	159
Hydrazine	2	2	2	0	2	2	0	2	12
Ibuprofen	22	5	25	15	28	28	14	22	159
Iohexol	4	4	6	6	7	7	6	6	46
Iopromide	22	5	25	15	28	28	14	22	159
Ketoprofen	3	2	3	2	3	3	2	2	20
Meprobamate	3	3	4	4	4	4	4	4	30
Metoprolol	2	2	2	2	3	3	2	2	18
Naproxen	19	2	21	11	24	24	10	18	129
N-Nitrosodimethylamine	60	2	57	17	59	61	6	55	317
N-Nitrosopyrrolidine	3	3	2	2	2	2	2	2	18
Nonylphenol diethoxylate	3	3	4	4	4	4	4	4	30
Nonylphenol monoethoxylate	3	3	4	4	4	4	4	4	30
Octylphenol diethoxylate	3	3	4	4	4	4	4	4	30
Octylphenol monoethoxylate	3	3	4	4	4	4	4	4	30
o-OH Atorvastatin	2	2	2	2	3	3	2	2	18
p-OH Atorvastatin	2	2	2	2	3	3	2	2	18
PBDE-28	2	2	4	3	4	4	2	4	25
PBDE-47	2	2	4	3	4	4	2	4	25
PBDE-99	2	2	4	3	4	4	2	4	25
PBDE-100	2	2	4	3	4	4	2	4	25

Constituent	LB	LC	POM	SAUG	SJCE	SJCW	VAL	WN	Total
PBDE-153	2	2	4	3	4	4	2	4	25
PDBE-154	2	2	4	3	4	4	2	4	25
PBDE-183	2	2	4	3	4	4	2	4	25
PBDE-209	2	2	4	3	4	4	2	4	25
Primidone	19	2	21	11	24	24	10	18	129
Progesterone	29	4	32	12	37	37	12	29	192
Propanolol	5	5	4	4	5	5	4	4	36
Quinoline	2	2	2	1	2	2	0	2	13
Salicylic acid	2	2	4	3	4	4	2	4	25
Sucralose	3	3	2	2	2	2	2	2	18
Sulfamethoxazole	22	5	25	15	28	28	14	22	159
TCEP	6	5	7	6	7	7	6	6	50
Testosterone	1	1	1	1	1	1	1	1	8
Triclocarban	6	5	5	4	5	5	4	4	38
Triclosan	22	5	25	15	28	28	14	22	159
Trimethoprim	21	4	25	15	28	28	14	22	157
Grand Total									5474

LB = Long Beach WRP
LC = Los Coyotes WRP
POM = Pomona WRP
SAUG = Saugus WRP
SJCE = San Jose Creek East WRP
SJCW = San Jose Creek West WRP
VAL = Valencia WRP
WN = Whittier Narrows WRP

Table 3. Median of Analytical Results, Sanitation Districts' WRP Effluent CEC Monitoring, ng/L

Constituent	LB	LC	POM	SAUG	SJCE	SJCW	VAL	WN	Overall Median
1,2,3-Trichloropropane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
17α-Ethinylestradiol	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
17β-Estradiol	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
4-Nonylphenol (tech mix)	179	266	124	37	130	95	44	132	117
4-tert Octylphenol	46	40	10.5	< 5	19	8.2	< 5	7	11
Acetaminophen	< 10	18	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Amoxicillin	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
Androstenedione	1.9	3	3	2	2.2	1.8	0.90	2.7	2.1
Atenolol	1,650	540	650	500	390	430	175	220	415
Atorvastatin	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Azithromycin	317	380	396	55	311.5	89.5	17	405	237
Bisphenol A	< 25	<25	< 25	< 25	<25	< 25	< 25	< 25	< 25
Bis(2-ethylhexyl) phthalate	< 2,000	< 2,000	< 2,000	< 2,000	< 2,000	< 2,000	< 2,000	< 2,000	< 2,000
Butyl benzyl phthalate	< 10,000	<10,000	<10,000	<10,000	<10,000	< 10,000	< 10,000	<10,000	<10,000
Caffeine	< 10	< 10	100	< 10	10	< 10	< 10	62	< 10
Carbamazepine	231	259	247	230	270	263	278	199.5	249
Chlorpyrifos	NA	NA	< 50	< 100	< 100	< 100	<100	NA	< 100
Ciproflaxin	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100
DEET	282.5	470	216	268.5	163	133	186	217	214
Diclofenac	23	207	23	< 10	34	< 10	< 10	43.5	16
Dilantin (Phenytoin)	257.5	282	280	178.5	220	210	278	141.5	228.5
Equilin	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Erythromycin-H2O	88	130	122	23	150	68	< 10	113	87
Estriol	< 0.5	0.54	1.2	< 0.5	< 0.5	< 0.5	< 0.5	0.95	< 0.5
Estrone	< 2	4.8	2.6	< 2	3.5	< 2	< 2	< 2	< 2
Fluoxetine	28	19	27	38	24	30	28	18	26
Furosemide	34	425	98	< 10	75.5	< 10	< 10	31	27
Gemfibrozil	430	276	233	143	339	63	52.5	51	172
Hydrazine	< 5	< 5	< 5	NA	< 5	< 5	NA	< 5	<5
Ibuprofen	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	<10
Iohexol	3,580	16,800	9,300	12,000	12,300	3,000	6,200	3,755	7,100
Iopromide	130	99	10,800	< 30	2020	159	164	66	260
Ketoprofen	40	< 25	30	< 25	< 25	< 25	< 25	< 25	< 25
Meprobamate	903	495	699	977	438	465.5	884.5	320	601
Metoprolol	430	295	300	320	270	270	245	195	270
Naproxen	39	27.5	84	< 10	45	< 10	< 10	21.5	23
N-Nitrosodimethylamine	455	200	120	99	190	180	435	56	180
N-Nitroso pyrrolidine	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Nonylphenol diethoxylate	379	829	540	264	697	551	266	213	429
Nonylphenol monoethoxylate	333	748	310	243	561.5	434	231.5	116	370
Octylphenol diethoxylate	65.8	108	107.45	31.9	116	67.95	< 25	< 25	65
Octylphenol monoethoxylate	125	154	66.8	78.3	179.5	117	45.6	< 25	98
o-OH Atorvastatin	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
p-OH Atorvastatin	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
PBDE-28	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PBDE-47	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5

Constituent	LB	LC	POM	SAUG	SJCE	SJCW	VAL	WN	Overall Median
PBDE-99	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PBDE-100	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PBDE-153	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PDBE-154	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PBDE-183	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PBDE-209	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100
Primidone	159	210	169	130	147	185	100	106	150
Progesterone	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	<1
Propanolol	33	38	37	30	23	25	14	28	30
Quinoline	< 5	< 5	< 5	< 5	< 5	< 5	NA	< 5	< 5
Salicylic acid	219	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100
Sucralose	34,500	52,600	48,750	42,400	31,300	26,400	40,000	20,150	35,900
Sulfamethoxazole	196	1400	366	43	304.5	31	32	539	175
TCEP	435	543	470	425	420	419	475	415	430.5
Testosterone	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Triclocarban	230	122	122	266	112	102	145	74.5	138
Triclosan	< 25	40	< 25	< 25	< 25	< 25	< 25	< 25	< 25
Trimethoprim	24	335	100	< 10	29	< 10	< 10	24	19

NA = Not available
LB = Long Beach WRP
LC = Los Coyotes WRP
POM = Pomona WRP
SAUG = Saugus WRP
SJCE = San Jose Creek East WRP
SJCW = San Jose Creek West WRP
VAL = Valencia WRP
WN = Whittier Narrows WRP

Table 4. 90th Percentile of Analytical Results, Sanitation Districts' WRP Effluent CEC Monitoring, ng/L

Constituent	LB	LC	POM	SAUG	SJCE	SJCW	VAL	WN	90th Percentile
1,2,3-Trichloropropane	< 5	< 5	5	< 5	< 5	< 5	< 5	< 5	< 5
17α-Ethinylestradiol	< 2.0	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
17β-Estradiol	< 2.0	< 2	< 2	6.2	< 2	< 2	< 2	2.7	< 2
4-Nonylphenol (tech mix)	280	370	227	78	206	155	84	1260	241
4-tert Octylphenol	68	88.5	40	< 5	32	16.1	6	210	48
Acetaminophen	< 10	24	32	< 10	11	< 10	< 10	43	16
Amoxicillin	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
Androstenedione	1.9	3	3	2	2.2	1.8	0.90	2.7	3
Atenolol	1,800	680	760	600	590	510	180	260	760
Atorvastatin	< 10	< 10	15	< 10	< 10	< 10	< 10	35	< 10
Azithromycin	580	680	590	204	683	236	110	760	544
Bisphenol A	< 25	28	< 25	< 25	< 25	< 25	< 25	31	< 25
Bis(2-ethylhexyl)phthalate	< 2,000	< 2,000	3,000	< 2,000	< 2,000	< 2,000	< 2,000	2,900	< 2,000
Butyl benzyl phthalate	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000	< 10,000
Caffeine	13	11	212	< 10	12	< 10	12	112	108
Carbamazepine	278	308	300	361	303	306	339	338	306
Chlorpyrifos	NA	NA	< 50	< 100	< 100	< 100	< 100	NA	< 100
Ciproflaxin	< 100	< 100	< 100	< 100	< 100	< 100	< 100	155	< 100
DEET	558	660	320	424	240	206	358	271	470
Diclofenac	65	370	110	23	70	13	< 10	132	75
Dilantin (Phenytoin)	264	380	715	200	280	232	330	260	330
Equilin	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Erythromycin-H2O	165	150	247	40	267	165	42	210	200
Estriol	< 0.5	0.54	1.2	< 0.5	< 0.5	< 0.5	< 0.5	0.95	0.95
Estrone	4	10	7.4	< 2	9.1	3.4	< 2	7.3	6.8
Fluoxetine	34	25	32	51	27	38	37	33	37
Furosemide	197	670	160	25	254	64	16	240	190
Gemfibrozil	930	900	549	221	866	172	160	1640	564
Hydrazine	< 5	< 5	< 5	NA	< 5	< 5	NA	< 5	< 5
Ibuprofen	15	< 10	24	40	25	< 10	12	11	16
Iohexol	7,490	18,900	11,600	14,100	13,200	4,790	10,200	7,800	14,100
Iopromide	520	186	17,800	688	3,390	296	420	470	10,080
Ketoprofen	56	< 25	40	99	130	75	< 25	< 25	75
Meprobamate	930	522	711	1,200	460	490	1,010	350	930
Metoprolol	480	340	340	360	340	320	260	230	360
Naproxen	87	44	190	27	116	13	18	76	118
N-Nitrosodimethylamine	1,000	280	680	470	360	480	970	260	620
N-Nitrosopyrrolidine	3.5	4	2.1	14	< 2	2.7	14	< 2	4
Nonylphenol diethoxylate	794	981	1,100	570	856	680	436	2,940	856
Nonylphenol monoethoxylate	410	756	470	360	762	539	398	1,030	748
Octylphenol diethoxylate	87.6	120	166	76	150	88.6	99.7	306	150
Octylphenol	126	236	91.1	80.4	190	135	204	151	180

Constituent	LB	LC	POM	SAUG	SJCE	SJCW	VAL	WN	90th Percentile
monoethoxylate									
o-OH Atorvastatin	< 10	< 10	23	< 10	< 10	< 10	< 10	< 10	< 10
p-OH Atorvastatin	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
PBDE-28	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PBDE-47	< 5	< 5	11	8.5	< 5	< 5	< 5	< 5	< 5
PBDE-99	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PBDE-100	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PBDE-153	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PDBE-154	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PBDE-183	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PBDE-209	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100
Primidone	183	220	192	151	170	206	116	125	192
Progesterone	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 2
Propanolol	41	52	47	34	36	32	28	33	41
Quinoline	< 5	12	8.6	< 5	< 5	< 5	NA	< 5	8.6
Salicylic acid	221	181	141	< 100	268	186	< 100	200	217
Sucralose	38,000	58,300	56,100	50,900	32,800	27,300	42,700	20,300	52,600
Sulfamethoxazole	810	1,860	1350	158	569	153	120	1,320	870
TCEP	446	630	526	660	450	500	600	580	614
Testosterone	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Triclocarban	234	150	200	310	190	150	214	98	230
Triclosan	< 25	79	33	< 25	< 25	< 25	< 25	132	< 25
Trimethoprim	141	400	190	11	114	26	18	439	170

NA = Not available
LB = Long Beach WRP
LC = Los Coyotes WRP
POM = Pomona WRP
SAUG = Saugus WRP
SJCE = San Jose Creek East WRP
SJCW = San Jose Creek West WRP
VAL = Valencia WRP
WN = Whittier Narrows WRP

Table 5. Maximums of Analytical Results, Sanitation Districts' WRP Effluent CEC Monitoring, ng/L

Constituent	LB	LC	POM	SAUG	SJCE	SJCW	VAL	WN	Overall Maximum
1,2,3-Trichloropropane	< 5	< 5	5	< 5	< 5	5.6	< 5	< 5	5.6
17α-Ethinylestradiol	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
17β-Estradiol	2.3	< 2	< 2	7.2	3.6	< 2	2.3	2.7	7.2
4-Nonylphenol (tech mix)	427	370	420	130	311	338	89	1,260	1,260
4-tert Octylphenol	83	88.5	78.6	< 5	45	44	9	210	210
Acetaminophen	15	24	36	12	17	29	11	43	43
Amoxicillin	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
Androstenedione	1.9	3	3	2	2.2	1.8	0.90	2.7	3
Atenolol	1,800	680	760	600	590	510	180	260	1,800
Atorvastatin	< 10	< 10	28	< 10	< 10	< 10	< 10	35	35
Azithromycin	660	680	646	237	761	440	262	760	761
Bisphenol A	< 25	28	< 25	< 25	< 25	410	< 25	31	410
Bis(2-ethylhexyl)phthalate	< 2,000	< 2,000	3,000	< 2,000	< 2,000	< 2,000	< 2,000	2,900	3,000
Butyl benzyl phthalate	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000
Caffeine	32	11	750	12	15	< 10	15	112	750
Carbamazepine	306	308	947	1,610	315	322	641	338	1,610
Chlorpyrifos	NA	NA	< 100	< 100	< 100	< 100	< 100	NA	< 100
Ciproflaxin	< 100	< 100	< 100	< 100	< 100	< 100	< 100	155	155
DEET	940	660	344	690	464	283	400	271	940
Diclofenac	110	370	168	29	136	55	40	132	370
Dilantin (Phenytoin)	320	380	910	269	290	232	360	260	910
Equilin	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Erythromycin-H2O	290	150	320	73	361	448	47	210	448
Estriol	< 0.5	0.54	1.2	< 0.5	< 0.5	< 0.5	< 0.5	0.95	1.2
Estrone	9.5	10	15	13	18	10.4	4	15.9	18
Fluoxetine	42	25	34	53	34	49	38	33	53
Furosemide	430	670	240	37	316	307	54	240	670
Gemfibrozil	1,556	900	564	346	1,320	1,010	238	1,640	1,640
Hydrazine	< 5	< 5	< 5	NA	< 5	< 5	NA	< 5	< 5
Ibuprofen	31	< 10	60	42	98	48	44	11	98
Iohexol	7,490	18,900	12,600	22,000	13,700	5,010	11,300	7,800	22,000
Iopromide	1,360	186	20,000	1,370	4,000	625	460	470	20,000
Ketoprofen	56	< 25	40	99	130	75	< 25	< 25	130
Meprobamate	930	522	711	1,200	460	490	1,010	350	1,200
Metoprolol	480	340	340	360	340	320	260	230	480
Naproxen	233	44	292	56	235	45	55	76	292
N-Nitrosodimethylamine	1,500	280	900	640	650	1,000	1,100	970	1,500
N-Nitrosopyrrolidine	3.5	4	2.1	14	< 2	2.7	14	< 2	14
Nonylphenol diethoxylate	794	981	1,100	570	856	680	436	2,940	2,940
Nonylphenol monoethoxylate	410	756	470	360	762	539	398	1,030	1,030
Octylphenol diethoxylate	87.6	120	166	76	150	88.6	99.7	306	306
Octylphenol	126	236	91.1	80.4	190	135	204	151	236

Constituent	LB	LC	POM	SAUG	SJCE	SJCW	VAL	WN	Overall Maximum
monoethoxylate									
o-OH Atorvastatin	< 10	< 10	23	< 10	< 10	< 10	< 10	< 10	23
p-OH Atorvastatin	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
PBDE-28	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PBDE-47	< 5	< 5	11	8.5	< 5	< 5	< 5	< 5	11
PBDE-99	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PBDE-100	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PBDE-153	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PDBE-154	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PBDE-183	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PBDE-209	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100
Primidone	223	220	200	163	175	245	150	125	245
Progesterone	< 1	< 1	< 2	< 1	< 1	< 1	< 1	< 1	< 2
Propanolol	41	52	47	34	36	32	28	33	52
Quinoline	< 5	12	8.6	< 5	< 5	< 5	NA	< 5	12
Salicylic acid	221	181	141	< 100	268	186	< 100	200	268
Sucralose	38,000	58,300	56,100	50,900	32,800	27,300	42,700	20,300	58,300
Sulfamethoxazole	920	1,860	2,870	241	870	829	453	1,320	2,870
TCEP	530	630	820	730	530	506	720	580	820
Testosterone	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Triclocarban	236	150	200	310	190	150	214	98	310
Triclosan	45	79	42	< 25	34	35	< 25	132	132
Trimethoprim	190	400	376	16	170	189	24	439	439

NA = Not available
LB = Long Beach WRP
LC = Los Coyotes WRP
POM = Pomona WRP
SAUG = Saugus WRP
SJCE = San Jose Creek East WRP
SJCW = San Jose Creek West WRP
VAL = Valencia WRP
WN = Whittier Narrows WRP

Table 6. Occurrence Summary of CECs in JWPCP Effluent

Not Detected	Usually Not Detected (Detected in 40% or less of samples)	Usually Detected (Detected in more than 40% but less than 80% of samples)	Always or Almost Always Detected
17α-Ethinylestradiol	17β-Estradiol	Acetaminophen	4-Nonylphenol
Progesterone	Carbamazepine	Bis(2-ethylhexyl) phthalate	4-tert Octylphenol
Butyl benzyl phthalate	Ibuprofen		Azithromycin
			Bisphenol A
			Caffeine
			DEET
			Dilantin (Phenytoin)
			Estrone
			Gemfibrozil
			Iopromide
			Meprobamate
			Nonylphenol monoethoxylate
			Nonylphenol diethoxylate
			Octylphenol monoethoxylate
			Octylphenol diethoxylate
			Sucralose
			Sulfamethoxazole
			TCEP
			Triclosan

Note: Summary includes only constituents monitored in the effluent at least four times.

Table 7. Occurrence Summary of CECs in Sanitation Districts' WRP Effluent

Not Detected	Usually Not Detected (Detected in 40% or less of samples)	Usually Detected (Detected in more than 40% but less than 80% of samples)	Always or Almost Always Detected
17α-Ethinylestradiol	1,2,3-Trichloropropane	4-tert Octylphenol	4-Nonylphenol
Amoxicillin	17β-Estradiol	Caffeine	Androstenedione
Butylbenzyl phthalate	Acetaminophen	Diclofenac	Atenolol
Chorpyrifos	Atorvastatin	Furosemide	Azithromycin
Equilin	Bisphenol A	Naproxen	Carbamazepine
Hydrazine	Bis(2-ethylhexyl)phthalate	Trimethoprim	DEET
p-OH Atorvastatin	Ciprofloxacin HCl		Dilantin (Phenytoin)
PBDE-28	Erythromycin-H2O		Fluoxetine
PBDE-99	Estriol		Gemfibrozil
PBDE-100	Estrone		Iohexol
PBDE-153	Ibuprofen		Iopromide
PBDE-154	Ketoprofen		Meprobamate
PBDE-183	N-Nitrosopyrrolidine		Metoprolol
PBDE-209	o-OH Atorvastatin		NDMA
Progesterone	PBDE-47		Nonylphenol monoethoxylate
Testosterone	Quinoline		Nonylphenol diethoxylate
	Salicylic acid		Octylphenol monoethoxylate
	Triclosan		Octylphenol diethoxylate
			Primidone
			Propanolol
			Sucralose
			Sulfamethoxazole
			TCEP
			Triclocarban

Table 8. Initial MTL Human-Health Based Assessment of Sanitation Districts' WRP Effluent

Constituent	90th Percentile in WRP Effluent, ng/L	Initial MTL, ng/L		Initial MTL-Based MTQ	
		Potable Reuse	Irrigation	Potable Reuse	Irrigation
1,2,3-Trichloropropane	< 5	5	500	< 1	< 0.01
17α-Ethinylestradiol	< 2	350	35,000	< 0.0057	< 0.000057
17β-Estradiol	< 2	0.9	90	< 2.2	< 0.022
4-Nonylphenol (tech mix)	241	500,000	50,000,000	0.00048	0.0000048
4-tert Octylphenol	48	50,000	5,000,000	0.00096	0.0000096
Acetaminophen	16	350,000	35,000,000	0.000046	0.00000046
Amoxicillin	< 50	1,500	150,000	< 0.033	< 0.00033
Androstenedione	3	14,000	1,400,000	0.00021	0.0000021
Atenolol	760	70,000	7,000,000	0.011	0.00011
Atorvastatin	<10	5,000	500,000	< 0.002	< 0.00002
Azithromycin	544	3,900	390,000	0.14	0.0014
Bisphenol A	< 25	350,000	3,000,000	< 0.000071	< 0.00000071
Bis(2-ethylhexyl)phthalate	< 2,000	24,000	2,400,000	< 0.083	< 0.00083
Butyl benzyl phthalate	< 10,000	1,200,000	120,000,000	< 0.0083	< 0.000083
Caffeine	108	350	35,000	0.31	0.0031
Carbamazepine	306	1,000	100,000	0.31	0.0031
Chlorpyrifos	< 100	10,000	1,000,000	< 0.01	< 0.0001
Ciprofloxacin HCl	< 100	17,000	1,700,000	< 0.0059	< 0.000059
DEET	470	2,500	250,000	0.19	0.0019
Diclofenac	75	1,800	180,000	0.042	0.00042
Dilantin (phenytoin)	330	6,800	680,000	0.049	0.00049
Equilin	< 0.5	350	35,000	< 0.0014	< 0.000014
Erythromycin-H2O	200	4,900	490,000	0.041	0.00041
Estriol	0.95	350	35,000	0.0027	0.000027
Estrone	6.8	350	35,000	0.019	0.00019
Fluoxetine	37	10,000	1,000,000	0.0037	0.000037
Furosemide	190	NA	NA	NQ	NQ
Gemfibrozil	564	45,000	4,500,000	0.013	0.00013
Hydrazine	<5	10	1,000	< 0.5	< 0.005
Ibuprofen	16	34,000	3,400,000	0.00047	0.0000047
Iohexol	14,100	720,000	72,000,000	0.020	0.00020
Iopromide	10,080	750,000	75,000,000	0.013	0.00013
Ketoprofen	75	3,500	350,000	0.021	0.00021
Meprobamate	930	260,000	26,000,000	0.0036	0.000036
Metoprolol	360	25,000	2,500,000	0.014	0.00014
Naproxen	118	220,000	22,000,000	0.00054	0.0000054
N-Nitrosdimethylamine	**620**	**10**	**1,000**	**62**	**0.62**
N-Nitrosopyrrolidine	4	20	2,000	0.2	0.002
Nonylphenol diethoxylate	856	NA	NA	NQ	NQ
Nonylphenol monoethoxylate	748	NA	NA	NQ	NQ
Octylphenol diethoxylate	150	NA	NA	NQ	NQ
Octylphenol monoethoxylate	180	NA	NA	NQ	NQ
o-OH Atorvastatin	< 10	NA	NA	NQ	NQ
p-OH Atorvastatin	< 10	NA	NA	NQ	NQ
PBDE-28	< 5	NA	NA	NQ	NQ
PBDE-47	< 5	NA	NA	NQ	NQ
PBDE-99	< 5	NA	NA	NQ	NQ

Constituent	90th Percentile in WRP Effluent, ng/L	Initial MTL, ng/L		Initial MTL-Based MTQ	
		Potable Reuse	Irrigation	Potable Reuse	Irrigation
PBDE-100	< 5	NA	NA	NQ	NQ
PBDE-153	< 5	NA	NA	NQ	NQ
PBDE-154	< 5	NA	NA	NQ	NQ
PBDE-183	< 5	NA	NA	NQ	NQ
PBDE-209	< 100	NA	NA	NQ	NQ
Primidone	192	NA	NA	NQ	NQ
Progesterone	< 1	110,000	11,000,000	< 0.0000090	< 0.000000090
Propanolol	41	40,000	4,000,000	0.0010	0.000010
Quinoline	8.6	10	1,000	0.86	0.0086
Salicylic acid	217	29,000	2,900,000	0.0075	0.000075
Sucralose	52,600	NA	NA	NQ	NQ
Sulfamethoxazole	870	35,000	3,500,000	0.025	0.00025
Tris (2-chloroethyl) phosphate (TCEP)	614	2,500	250,000	0.25	0.0025
Testosterone	< 0.5	7,000	700,000	< 0.000071	< 0.00000071
Triclocarban	231	NA	NA	NQ	NQ
Triclosan	< 25	350	35,000	< 0.071	< 0.00071
Trimethoprim	170	61,000	6,100,000	0.0028	0.000028

NA = Not available. NQ = Not quantifiable.
Bold values indicate risk factor >1.

Table 9. Derivation of Aquatic Life-Based MTLs

Constituent	NOEC or PNEC, ng/L	Safety Factor, Mode of Action	Safety Factor, Freshwater to Saltwater	Freshwater MTL, ng/L	Marine MTL, ng/L	Endpoint
1,2,3-Trichloropropane	NA	10	10	NQ	NQ	NA
17α-Ethinylestradiol	1	1	10	1	0.1	Fathead minnow NOEC
17β-Estradiol	2	1	10	2	0.2	PNEC
4-Nonylphenol (tech mix)	5,000	10	10	500	50	Atlantic Salmon LOEC
4-tert Octylphenol	3,200	10	10	320	32	Zebrafish NOEC
Acetaminophen	9,200,000	10	10	920,000	92,000	Daphnia NOEC
Amoxicillin	NA	100	1	NQ	NQ	NA
Androstenedione	40	1	10	40	4	Mosquitofish gondopdium
Atenolol	19,000	10	10	1,900	190	Lemna EC10
Atorvastatin	26,000	10	10	2,600	260	Lemna EC10
Azithromycin	250,000	100	1	2,500	250	MIC
Bisphenol A	60	1	10	60	6	PNEC
Bis(2-ethylhexyl)phthalate	160,000	10	10	16,000	1,600	Fathead minnow LC50
Butylbenzyl phthalate	105,000	10	10	10,500	1,050	EcoSAR chronic fish
Caffeine	NA	10	10	NQ	NQ	NA
Carbamazepine	25,000	10	10	2,500	250	C. dubia repro
Chlorpyrifos, freshwater	50	10	1	5	NA	C. dubia survival
Chlorpyrifos, saltwater	10	10	1	NA	1	Palaemon macrodactylus survival
Ciproflaxin	60,000	100	1	600	600	MIC
DEET	5,835,000	10	10	583,500	58,350	EcoSAR chronic daphnids
Diclofenac	1,000	10	10	100	10	Zebrafish embryo NOEC
Dilantin (phenytoin)	3,350,000	10	10	335,000	33,500	EcoSAR chronic fish
Erythromycin-H20	8,000,000	100	1	80,000	80,000	MIC
Estriol	NA	10	10	NQ	NQ	NA
Estrone	6	1	10	6	0.6	In vivo VTG induction PNEC
Fluoxetine	NA	10	10	NQ	NQ	NA
Furosemide	12,924,000	10	10	1,292,400	129,240	EcoSAR chronic daphnids

Gemfibrozil	78,000	10	10	7,800	780	C. dubia NOEC
Hydrazine	NA	10	10	NQ	NQ	NA
Ibuprofen	1,000	10	10	100	10	NOEC medaka egg production
Iohexol	NA	10	10	NQ	NQ	NA
Iopromide	10^{10}	10	10	1,000,000,000	100,000,000	LC50 Zebrafish
Ketoprofen	NA	10	10	NQ	NQ	NA
Meprobamate	75,000,000	10	10	7,500,000	750,000	EcoSAR chronic algae
Metoprolol	NA	10	10	NQ	NQ	NA
Naproxen	793	1	10	793	79	Fathead minnow NOEC full life cycle
N-Nitrosodimethylamine	NA	10	10	NQ	NQ	NA
N-Nitrosopyrrolidine	NA	10	10	NQ	NQ	NA
Nonylphenol monoethoxylate	19,000	10	10	1,900	190	EcoSAR chronic fish
Nonylphenol diethoxylate	NA	10	10	NQ	NQ	NA
Octylphenol monoethoxylate	NA	10	10	NQ	NQ	NA
Octylphenol diethoxylate	NA	10	10	NQ	NQ	NA
o-OH Atorvastatin	200,000,000	10	10	20,000,000	2,000,000	Cytotoxicity, Rainbow Trout hepatocytes
p-OH Atorvastatin	200,000,000	10	10	20,000,000	2,000,000	Cytotoxicity, Rainbow Trout hepatocytes
PBDE-28	NA	10	10	NQ	NQ	NA
PBDE-47	1000	10	10	100	10	Frog development NOEL
PBDE-99	1000	10	10	100	10	Frog development NOEL
PBDE-100	NA	10	10	NQ	NQ	NA
PBDE-153	NA	10	10	NQ	NQ	NA
PBDE-154	NA	10	10	NQ	NQ	NA
PBDE-183	NA	10	10	NQ	NQ	NA
PBDE-209	NA	10	10	NQ	NQ	NA
Primidone	NA	10	10	NQ	NQ	NA
Progesterone	10,000	1	10	10,000	1,000	Dapnia gender shift NOEC
Propanolol	NA	10	10	NQ	NQ	NA
Quinoline	NA	10	10	NQ	NQ	NA
Salicylic acid	NA	10	10	NQ	NQ	NA
Sucralose	NA	10	10	NQ	NQ	NA
Sulfamethoxazole	59,000	10	10	5,900	590	Algae NOEC
Tris (2-chloroethyl) phosphate (TCEP)	5,079,000	10	10	507,900	50,790	EcoSAR chronic daphnids

Testosterone	100	1	10	100	10	Enzyme regulation
Triclocarban	3600	10	10	360	36	Bluegill
Triclosan	25,000	100	1	250	250	MIC
Trimethoprim	4,000,000	100	1	40,000	40,000	MIC

NA = Not available. NQ = Not quantifiable.

Table 10. Aquatic Life-Based MTL Assessment for JWPCP

Constituent	No. Samples	Maximum Effluent Concentration, ng/L	Maximum Predicted Environmental Concentration, ng/L	Marine MTL, ng/L	Marine MTQ
1,2,3-Trichloropropane	0	NA	NA	NA	NQ
17α-Ethinylestradiol	5	< 10	< 0.01	0.1	< 0.01
17β-Estradiol	5	7.3	0.0073	0.2	0.037
4-Nonylphenol (tech mix)	5	3,840	3.8	50	0.077
4-tert Octylphenol	5	821	0.82	32	0.026
Acetaminophen	5	31	0.031	92,000	0.00000034
Amoxicillin	0	NA	NA	NA	NQ
Androstenedione	0	NA	NA	4	NQ
Atenolol	0	NA	NA	190	NQ
Atorvastatin	1	116	0.12	260	0.00045
Azithromycin	5	1,010	1.0	250	0.0040
Bisphenol A	5	403	0.40	6	0.067
Bis(2-ethylhexyl)phthalate	23	16,600	17	1,600	0.011
Butylbenzyl phthalate	20	< 10,000	< 10	1,050	< 0.0095
Caffeine	4	515	0.52	NA	NQ
Carbamazepine	5	269	0.27	250	0.001
Chlorpyrifos	0	NA	NA	1	NQ
Ciproflaxin	0	NA	NA	600	NQ
DEET	4	518	0.52	58,350	0.0000089
Diclofenac	1	114	0.14	10	0.014
Dilantin (phenytoin)	4	323	0.32	33,500	0.000010
Erythromycin-H2O	1	245	0.25	80,000	0.0000031
Estriol	0	NA	NA	NA	NQ
Estrone	5	32	0.032	0.6	0.053
Fluoxetine	1	< 10	< 0.01	NA	NQ
Furosemide	1	882	0.88	129,240	0.0000068
Gemfibrozil	5	3,280	3.3	780	0.0042
Hydrazine	0	NA	NA	NA	NQ
Ibuprofen	5	306	0.31	10	0.031
Iohexol	0	NA	NA	NA	NQ
Iopromide	5	1,010	1.0	100,000,000	0.000000010
Ketoprofen	0	NA	NA	NA	NQ
Meprobamate	4	414	0.41	750,000	0.00000055
Metoprolol	0	NA	NA	NA	NQ
Naproxen	1	1,040	1.0	79	0.013
N-Nitrosodimethylamine	9	650	0.65	NA	NQ
N-Nitrosopyrrolidine	4	17	0.017	NA	NQ
Nonylphenol monoethoxylate	4	9,700	9.7	190	0.017
Nonylphenol diethoxylate	4	3,280	3.3	NA	NQ
Octylphenol monoethoxylate	4	4,850	4.9	NA	NQ
Octylphenol diethoxylate	4	1,400	1.4	NA	NQ
o-OH Atorvastatin	0	NA	NA	2,000,000	NQ
p-OH Atorvastatin	0	NA	NA	2,000,000	NQ
PBDE-28	0	NA	NA	NA	NQ
PBDE-47	0	NA	NA	10	NQ
PBDE-99	0	NA	NA	10	NQ
PBDE-100	0	NA	NA	NA	NQ

PBDE-153	0	NA	NA	NA	NQ
PBDE-154	0	NA	NA	NA	NQ
PBDE-183	0	NA	NA	NA	NQ
PBDE-209	0	NA	NA	NA	NQ
Primidone	1	113	0.11	NA	NQ
Progesterone	5	< 5.0	< 0.005	1,000	< 0.000005
Propanolol	0	NA	NA	NA	NQ
Quinoline	0	NA	NA	NA	NQ
Salicylic acid	0	NA	NA	NA	NQ
Sucralose	4	21,000	21	NA	NQ
Sulfamethoxazole	5	1,270	1.3	590	0.0022
Tris (2-chloroethyl) phosphate (TCEP)	4	418	0.42	50,790	0.0000082
Testosterone	0	NA	NA	10	NQ
Triclocarban	0	NA	NA	36	NQ
Triclosan	5	499	0.50	250	0.0020
Trimethoprim	1	547	0.55	40,000	0.000014

NA = Not available. NQ = Not quantifiable.

Table 11. Aquatic Life-Based MTL Assessment for Sanitation Districts' WRPs

Constituent	Total No. Samples	90th Percentile WRP Effluent Concentration, ng/L	Freshwater MTL, ng/L	Freshwater MTQ
1,2,3-Trichloropropane	92	< 5	NA	NQ
17α-Ethinylestradiol	206	< 2	1	< 2
17β-Estradiol	206	< 2	2	< 1
4-Nonylphenol (tech mix)	197	241	500	0.48
4-tert Octylphenol	197	48	320	0.15
Acetaminophen	159	16	920,000	0.000017
Amoxicillin	25	< 50	NA	NQ
Androstenedione	8	3	40	0.075
Atenolol	18	760	1900	0.4
Atorvastatin	159	<10	2600	< 0.0038
Azithromycin	159	544	2500	0.22
Bisphenol A	159	< 25	60	< 0.42
Bis(2-ethylhexyl)phthalate	256	< 2,000	16,000	< 0.125
Butylbenzyl phthalate	98	< 10,000	10,500	< 0.95
Caffeine	50	108	NA	NQ
Carbamazepine	159	306	2,500	0.12
Chlorpyrifos	23	< 100	5	< 20
Ciproflaxin	25	< 100	600	< 0.17
DEET	50	470	583,500	0.00081
Diclofenac	147	75	100	0.75
Dilantin (phenytoin)	50	330	335,000	0.00099
Equilin	8	< 0.5	NA	NQ
Erythromycin-H2O	126	200	80,000	0.0025
Estriol	8	0.95	NA	NQ
Estrone	**206**	**6.8**	**6**	**1.1**
Fluoxetine	147	37	NA	NQ
Furosemide	129	190	1,292,400	0.00015
Gemfibrozil	159	564	7,800	0.072
Hydrazine	12	< 5	NA	NQ
Ibuprofen	159	16	100	0.16
Iohexol	46	14,100	NA	NQ
Iopromide	159	10,080	1,000,000,000	0.000010
Ketoprofen	20	75	NA	NQ
Meprobamate	30	930	7,500,000	0.00012
Metoprolol	18	360	NA	NQ
Naproxen	129	118	793	0.15
N-Nitrosodimethylamine	317	620	NA	NQ
N-Nitrosopyrrolidine	18	4	NA	NQ
Nonylphenol monoethoxylate	30	856	1,900	0.45
Nonylphenol diethoxylate	30	748	NA	NQ
Octylphenol monoethoxylate	30	150	NA	NQ
Octylphenol diethoxylate	30	180	NA	NQ
o-OH Atorvastatin	18	< 10	20,000,000	< 0.0000005
p-OH Atorvastatin	18	< 10	20,000,000	< 0.0000005
PBDE-28	25	< 5	NA	NQ
PBDE-47	25	< 5	100	< 0.05
PBDE-99	25	< 5	100	< 0.05
PBDE-100	25	< 5	NA	NQ

PBDE-153	25	< 5	NA	NQ
PBDE-154	25	< 5	NA	NQ
PBDE-183	25	< 5	NA	NQ
PBDE-209	25	< 100	NA	NQ
Primidone	129	192	NA	NQ
Progesterone	192	< 1	10,000	< 0.0001
Propanolol	36	41	NA	NQ
Quinoline	13	8.6	NA	NQ
Salicylic acid	25	217	NA	NQ
Sucralose	18	52,600	NA	NQ
Sulfamethoxazole	159	870	5,900	0.14
Tris (2-chloroethyl) phosphate (TCEP)	50	614	507,900	0.0012
Testosterone	8	< 0.5	100	< 0.005
Triclocarban	38	231	360	0.64
Triclosan	159	< 25	250	< 0.1
Trimethoprim	157	170	40,000	0.0043

NA = Not available. NQ = Not quantifiable.
Bold values indicate MTQ >1.

Attachment A

Treatment Plant Result Summaries and Analyses

All WRPs

Compound	Results			
	No.	Median	90th %	Maximum
1,2,3-Trichloropropane	92	< 5	< 5	5.6
17-Alpha Ethinylestradiol	206	< 2	< 2	< 2
17-Beta Estradiol	206	< 2	< 2	7.2
4-Nonylphenol (tech mix)	197	117	241	1,260
4-tert Octylphenol	197	11	48	210
Acetaminophen	159	< 10	16	43
Amoxicillin	25	< 50	< 50	< 50
Androstenedione	8	2.1	3	3
Atenolol	18	415	760	1,800
Atorvastatin	159	< 10	< 10	35
Azithromycin	159	237	544	761
Bisphenol A	159	< 25	< 25	410
Bis(2-ethylhexyl)phthalate	256	< 2,000	< 2,000	3,000
Butyl benzyl phthalate	98	<10,000	< 10,000	<10,000
Caffeine	50	< 10	108	750
Carbamazepine	159	249	306	1,610
Chlorpyrifos	23	< 100	< 100	< 100
Ciproflaxin	25	< 100	< 100	155
DEET	50	214	470	940
Diclofenac	147	13	75	370
Dilantin (Phenytoin)	50	228.5	330	910
Equilin	8	< 0.5	< 0.5	<0.5
Erythromycin-H2O	126	87	200	448
Estriol	8	< 0.5	0.95	1.2
Estrone	206	< 2	6.8	18
Fluoxetine	147	26	37	53
Furosemide	129	27	190	670
Gemfibrozil	159	172	564	1,640
Hydrazine	12	<5	< 5	< 5
Ibuprofen	159	<10	16	98
Iohexol	46	7,100	14,100	22,000
Iopromide	159	260	10,080	20,000
Ketoprofen	20	< 25	75	130
Meprobamate	30	601	930	1,200
Metoprolol	18	270	360	480
Naproxen	129	23	118	292
N-Nitrosodimethylamine	317	180	620	1,500
N-Nitrosopyrrolidine	18	< 2	4	14
Nonylphenol diethoxylate	30	429	856	2,940
Nonylphenol monoethoxylate	30	370	748	1,030
Octylphenol diethoxylate	30	65	150	306
Octylphenol monoethoxylate	30	98	180	236
o-OH Atorvastatin	18	< 10	< 10	23
p-OH Atorvastatin	18	< 10	< 10	< 10
PBDE-28	25	< 5	< 5	< 5
PBDE-47	25	< 5	< 5	11
PBDE-99	25	< 5	< 5	< 5
PBDE-100	25	< 5	< 5	< 5
PBDE-153	25	< 5	< 5	< 5
PDBE-154	25	< 5	< 5	< 5
PBDE-183	25	< 5	< 5	< 5
PBDE-209	25	< 100	< 100	< 100

All WRPs

Compound	Results			
	No.	Median	90th %	Maximum
Primidone	129	150	192	245
Progesterone	192	<1	<1	< 2
Propanolol	36	30	41	52
Quinoline	13	< 5	8.6	12
Salicylic acid	25	< 100	217	268
Sucralose	18	35,900	52,600	58,300
Sulfamethoxazole	159	175	870	2,870
TCEP	50	430.5	614	820
Testosterone	8	< 0.5	< 0.5	< 0.5
Triclocarban	38	138	231	310
Triclosan	159	< 25	< 25	132
Trimethoprim	157	19	170	439

Notes:
All samples are tertiary effluent.
Samples collected September 2007 through July 2012.
All samples are 24-hour composites except hydazine and quinoline, which are grabs.
All units are ng/L
NA = Not Analyzed

Joint Water Pollution Control Plant

Compound	Results - MEC		
	No.	Median	Maximum
17-Alpha Ethinylestradiol	5	<10	<10
17-Beta Estradiol	5	<10	7.3
4-Nonylphenol (tech mix)	5	1,110	3,840
4-tert Octylphenol	5	630	821
Acetaminophen	5	16	31
Atorvastatin	1	116	116
Azithromycin	5	984	1,010
Bisphenol A	5	123	403
Bis(2-ethylhexyl)phthalate	23	2,900	16,600
Butyl benzyl phthalate	20	<10,000	<10,000
Caffeine	4	373	515
Carbamazepine	5	<10	269
DEET	4	447	518
Diclofenac	1	144	144
Dilantin (Phenytoin)	4	309	323
Erythromycin-H2O	1	245	245
Estrone	5	23	32
Fluoxetine	1	<10	<10
Furosemide	1	882	882
Gemfibrozil	5	1,180	3280
Ibuprofen	5	<10	306
Iopromide	5	763	1,010
Meprobamate	4	391	414
Naproxen	1	1,040	1,040
N-Nitrosodimethylamine (NDMA)	9	280	650
N-Nitrosopyrrolidine (NPYR)	4	11	17
Nonylphenol diethoxylate	4	8,825	9,700
Nonylphenol monoethoxylate	4	2,645	3,280
Octylphenol diethoxylate	4	4,005	4,850
Octylphenol monoethoxylate	4	1,170	1,400
Primidone	1	113	113
Progesterone	5	<5.0	<5.0
Sucralose	4	20,350	21,000
Sulfamethoxazole	5	978	1,270
TCEP	4	389	418
Triclosan	5	466	499
Trimethoprim	1	547	547

Notes:
All samples are secondary effluent.
One sample collected in February 2009 and four samples collected February to March 2011.
2009 sample is a composite; 2011 samples are grabs.
All units are ng/L.

Long Beach WRP

Compound	Results			
	No.	Median	90th %	Maximum
1,2,3-Trichloropropane	12	<5	<5	<5
17-Alpha Ethinylestradiol	30	<2.0	<2.0	<2.0
17-Beta Estradiol	30	<2.0	< 2.0	2.3
4-Nonylphenol (tech mix)	29	179	280	427
4-tert Octylphenol	29	46	68	83
Acetaminophen	22	<10	<10	15
Amoxicillin	2	<50	<50	<50
Androstenedione	1	1.9	1.9	1.9
Atenolol	2	1,650	1,800	1,800
Atorvastatin	22	<10	<10	<10
Azithromycin	22	317	580	660
Bisphenol A	22	<25	<25	<25
Bis(2-ethylhexyl)phthalate	14	<2,000	<2,000	<2,000
Butyl benzyl phthalate	12	<10,000	<10,000	<10,000
Caffeine	6	<10	13	32
Carbamazepine	22	231	278	306
Chlorpyrifos	0	NA	NA	NA
Ciproflaxin	2	<100	<100	<100
DEET	6	283	558	940
Diclofenac	22	23	65	110
Dilantin (Phenytoin)	6	258	264	320
Equilin	1	<0.5	<0.5	<0.5
Erythromycin-H2O	19	88	165	290
Estriol	1	<0.5	<0.5	<0.5
Estrone	30	<2	4	9.5
Fluoxetine	22	28	34	42
Furosemide	19	34	197	430
Gemfibrozil	22	430	930	1,556
Hydrazine	2	<5	<5	<5
Ibuprofen	22	<10	15	31
Iohexol	4	3,580	7,490	7,490
Iopromide	22	130	520	1,360
Ketoprofen	3	40	56	56
Meprobamate	3	903	930	930
Metoprolol	2	430	480	480
Naproxen	19	39	87	233
N-Nitrosodimethylamine	60	455	1,000	1,500
N-Nitrosopyrrolidine	3	<2.0	3.5	3.5
Nonylphenol diethoxylate	3	379	794	794
Nonylphenol monoethoxylate	3	333	410	410
Octylphenol diethoxylate	3	65.8	87.6	87.6
Octylphenol monoethoxylate	3	125	126	126
o-OH Atorvastatin	2	<10	<10	<10
p-OH Atorvastatin	2	<10	<10	<10
PBDE-28	2	< 5	< 5	< 5
PBDE-47	2	< 5	< 5	< 5
PBDE-99	2	< 5	< 5	< 5
PBDE-100	2	< 5	< 5	< 5
PBDE-153	2	< 5	< 5	< 5
PDBE-154	2	< 5	< 5	< 5
PBDE-183	2	< 5	< 5	< 5
PBDE-209	2	<100	<100	<100
Primidone	19	159	183	223
Progesterone	29	<1.0	<1.0	<1.0
Propanolol	5	33	41	41

Long Beach WRP

Compound	Results			
	No.	Median	90th %	Maximum
Quinoline	2	<5	<5	<5
Salicylic acid	2	219	221	221
Sucralose	3	34,500	38,000	38,000
Sulfamethoxazole	22	196	810	920
TCEP	6	435	446	530
Testosterone	1	<0.5	<0.5	<0.5
Triclocarban	6	230	234	236
Triclosan	22	<25	<25	45
Trimethoprim	21	24	141	190

Notes:
All samples are tertiary effluent.
Samples collected September 2007 through July 2012.
All samples are 24-hour composites except hydazine and quinoline, which are grabs.
All units are ng/L
NA = Not Analyzed

Los Coyotes WRP

Compound	Results			
	No.	Median	90th %	Maximum
1,2,3-Trichloropropane	11	<5	<5	<5
17-Alpha Ethinylestradiol	5	<2	<2	<2
17-Beta Estradiol	5	<2	<2	<2
4-Nonylphenol (tech mix)	5	266	370	370
4-tert Octylphenol	5	40	88.5	88.5
Acetaminophen	5	18	24	24
Amoxicillin	2	<50	<50	<50
Androstenedione	1	3	3	3
Atenolol	2	540	680	680
Atorvastatin	5	<10	<10	<10
Azithromycin	5	380	680	680
Bisphenol A	5	<25	28	28
Bis(2-ethylhexyl)phthalate	22	<2,000	<2,000	<2,000
Butyl benzyl phthalate	13	<10,000	<10,000	<10,000
Caffeine	5	<10	11	11
Carbamazepine	5	259	308	308
Chlorpyrifos	0	NA	NA	NA
Ciproflaxin	2	<100	<100	<100
DEET	5	470	660	660
Diclofenac	5	207	370	370
Dilantin (Phenytoin)	5	282	380	380
Equilin	1	<0.5	<0.5	<0.5
Erythromycin-H2O	2	130	150	150
Estriol	1	0.54	0.54	0.54
Estrone	5	4.8	10	10
Fluoxetine	5	19	25	25
Furosemide	2	425	670	670
Gemfibrozil	5	276	900	900
Hydrazine	2	<5	<5	<5
Ibuprofen	5	<10	<10	<10
Iohexol	4	16,800	18,900	18,900
Iopromide	5	99	186	186
Ketoprofen	2	<25	<25	<25
Meprobamate	3	495	522	522
Metoprolol	2	295	340	340
Naproxen	2	27.5	44	44
N-Nitrosodimethylamine	2	200	280	280
N-Nitrosopyrrolidine	3	<2	4	4
Nonylphenol diethoxylate	3	829	981	981
Nonylphenol monoethoxylate	3	748	756	756
Octylphenol diethoxylate	3	108	120	120
Octylphenol monoethoxylate	3	154	236	236
o-OH Atorvastatin	2	<10	<10	<10
p-OH Atorvastatin	2	<10	<10	<10
PBDE-28	2	<5	<5	<5
PBDE-47	2	<5	<5	<5
PBDE-99	2	<5	<5	<5
PBDE-100	2	<5	<5	<5
PBDE-153	2	<5	<5	<5
PDBE-154	2	<5	<5	<5
PBDE-183	2	<5	<5	<5
PBDE-209	2	<100	<100	<100
Primidone	2	210	220	220
Progesterone	4	<1	<1	<1
Propanolol	5	38	52	52

Los Coyotes WRP

Compound	Results			
	No.	Median	90th %	Maximum
Quinoline	2	<5	12	12
Salicylic acid	2	<100	181	181
Sucralose	3	52,600	58,300	58,300
Sulfamethoxazole	5	1,400	1,860	1,860
TCEP	5	543	630	630
Testosterone	1	<0.5	<0.5	<0.5
Triclocarban	5	122	150	150
Triclosan	5	40	79	79
Trimethoprim	4	335	400	400

Notes:
All samples are tertiary effluent.
Samples collected September 2007 through July 2012.
All samples are 24-hour composites except hydazine and quinoline, which are grabs.
All units are ng/L
NA = Not Analyzed

Pomona WRP

Compound	Results			
	No.	Median	90th %	Maximum
1,2,3-Trichloropropane	12	<5	5	5
17-Alpha Ethinylestradiol	34	<2	<2	<2
17-Beta Estradiol	34	<2	<2	<2
4-Nonylphenol (tech mix)	32	124	227	420
4-tert Octylphenol	32	10.5	40	78.6
Acetaminophen	25	<10	32	36
Amoxicillin	4	<50	<50	<50
Androstenedione	1	3	3	3
Atenolol	2	650	760	760
Atorvastatin	25	<10	15	28
Azithromycin	25	396	590	646
Bisphenol A	25	<25	<25	<25
Bis(2-ethylhexyl)phthalate	64	<2,000	<2,000	3,000
Butyl benzyl phthalate	12	<10,000	<10,000	<10,000
Caffeine	7	100	212	750
Carbamazepine	25	247	300	947
Chlorpyrifos	7	<100	<50	<100
Ciproflaxin	4	<100	<100	<100
DEET	7	216	320	344
Diclofenac	23	23	110	168
Dilantin (Phenytoin)	7	280	715	910
Equilin	1	<0.5	<0.5	<0.5
Erythromycin-H2O	21	122	247	320
Estriol	1	1.2	1.2	1.2
Estrone	34	2.6	7.4	15
Fluoxetine	23	27	32	34
Furosemide	21	98	160	240
Gemfibrozil	25	233	549	564
Hydrazine	2	<5	<5	<5
Ibuprofen	25	<10	24	60
Iohexol	6	9,300	11,600	12,600
Iopromide	25	10,800	17,800	20,000
Ketoprofen	3	30	40	40
Meprobamate	4	699	711	711
Metoprolol	2	300	340	340
Naproxen	21	84	190	292
N-Nitrosodimethylamine	57	120	680	900
N-Nitrosopyrrolidine	2	<2	2.1	2.1
Nonylphenol diethoxylate	4	540	1,100	1,100
Nonylphenol monoethoxylate	4	310	470	470
Octylphenol diethoxylate	4	107.45	166	166
Octylphenol monoethoxylate	4	66.8	91.1	91.1
o-OH Atorvastatin	2	<10	23	23
p-OH Atorvastatin	2	<10	<10	<10
PBDE-28	4	<5	<5	<5
PBDE-47	4	<5	11	11
PBDE-99	4	<5	<5	<5
PBDE-100	4	<5	<5	<5
PBDE-153	4	<5	<5	<5
PBDE-154	4	<5	<5	<5
PBDE-183	4	<5	<5	<5
PBDE-209	4	<100	<100	<100
Primidone	21	169	192	200
Progesterone	32	<1	<1	<2
Propanolol	4	36.5	47	47

Pomona WRP

Compound	Results			
	No.	Median	90th %	Maximum
Quinoline	2	<5	8.6	8.6
Salicylic acid	4	<100	141	141
Sucralose	2	48,750	56,100	56,100
Sulfamethoxazole	25	366	1,350	2,870
TCEP	7	470	526	820
Testosterone	1	<0.5	<0.5	<0.5
Triclocarban	5	122	200	200
Triclosan	25	<25	33	42
Trimethoprim	25	100	190	376

Notes:
All samples are tertiary effluent.
Samples collected September 2007 through July 2012.
All samples are 24-hour composites except hydazine and quinoline, which are grabs.
All units are ng/L
NA = Not Analyzed

Saugus WRP

Compound	Results			
	No.	Median	90th %	Maximum
1,2,3-Trichloropropane	14	<5	<5	<5
17-Alpha Ethinylestradiol	14	<2	<2	<2
17-Beta Estradiol	14	<2	6.2	7.2
4-Nonylphenol (tech mix)	14	37	78	130
4-tert Octylphenol	14	<5	<5	<5
Acetaminophen	15	<10	<10	12
Amoxicillin	3	<50	<50	<50
Androstenedione	1	2	2	2
Atenolol	2	500	600	600
Atorvastatin	15	<10	<10	<10
Azithromycin	15	55	204	237
Bisphenol A	15	<25	<25	<25
Bis(2-ethylhexyl)phthalate	14	<2,000	<2,000	<2,000
Butyl benzyl phthalate	14	<10,000	<10,000	<10,000
Caffeine	6	<10	<10	12
Carbamazepine	15	230	361	1,610
Chlorpyrifos	7	<100	<100	<100
Ciproflaxin	3	<100	<100	<100
DEET	6	268.5	424	690
Diclofenac	13	<10	23	29
Dilantin (Phenytoin)	6	178.5	200	269
Equilin	1	<0.5	<0.5	<0.5
Erythromycin-H2O	11	23	40	73
Estriol	1	<0.5	<0.5	<0.5
Estrone	14	<2	<2	13
Fluoxetine	13	38	51	53
Furosemide	11	<10	25	37
Gemfibrozil	15	143	221	346
Hydrazine	0	NA	NA	NA
Ibuprofen	15	<10	40	42
Iohexol	6	12,000	14,100	22,000
Iopromide	15	<30	688	1,370
Ketoprofen	2	<25	99	99
Meprobamate	4	977	1,200	1,200
Metoprolol	2	320	360	360
Naproxen	11	<10	27	56
N-Nitrosodimethylamine	17	99	470	640
N-Nitrosopyrrolidine	2	<2	14	14
Nonylphenol diethoxylate	4	263.5	570	570
Nonylphenol monoethoxylate	4	243	360	360
Octylphenol diethoxylate	4	31.9	76	76
Octylphenol monoethoxylate	4	78.3	80.4	80.4
o-OH Atorvastatin	2	<10	<10	<10
p-OH Atorvastatin	2	<10	<10	<10
PBDE-28	3	<5	<5	<5
PBDE-47	3	<5	8.5	8.5
PBDE-99	3	<5	<5	<5
PBDE-100	3	<5	<5	<5
PBDE-153	3	<5	<5	<5
PDBE-154	3	<5	<5	<5
PBDE-183	3	<5	<5	<5
PBDE-209	3	<100	<100	<100

Saugus WRP

Compound	Results No.	Median	90th %	Maximum
Primidone	11	130	151	163
Progesterone	12	<1	<1	<1
Propanolol	4	29.5	34	34
Quinoline	1	<5	<5	<5
Salicylic acid	3	<100	<100	<100
Sucralose	2	42,400	50,900	50,900
Sulfamethoxazole	15	43	158	241
TCEP	6	425	660	730
Testosterone	1	<0.5	<0.5	<0.5
Triclocarban	4	265.5	310	310
Triclosan	15	<25	<25	<25
Trimethoprim	15	<10	11	16

Notes:
All samples are tertiary effluent.
Samples collected September 2007 through July 2012.
All samples are 24-hour composites except hydazine and quinoline, which are grabs.
All units are ng/L
NA = Not Analyzed

San Jose Creek East WRP

Compound	Results			
	No.	Median	90th %	Maximum
1,2,3-Trichloropropane	11	<5	<5	<5
17-Alpha Ethinylestradiol	39	<2	<2	<2
17-Beta Estradiol	39	<2	<2	3.6
4-Nonylphenol (tech mix)	37	130	206	311
4-tert Octylphenol	37	19	32	45
Acetaminophen	28	<10	11	17
Amoxicillin	4	<50	<50	<50
Androstenedione	1	2.2	2.2	2.2
Atenolol	3	390	590	590
Atorvastatin	28	<10	<10	<10
Azithromycin	28	311.5	683	761
Bisphenol A	28	<25	<25	<25
Bis(2-ethylhexyl)phthalate	33	<2,000	<2,000	<2,000
Butyl benzyl phthalate	12	<10,000	<10,000	<10,000
Caffeine	7	10	12	15
Carbamazepine	28	270	303	315
Chlorpyrifos	1	<100	<100	<100
Ciproflaxin	4	<100	<100	<100
DEET	7	163	240	464
Diclofenac	26	34	70	136
Dilantin (Phenytoin)	7	220	280	290
Equilin	1	<0.5	<0.5	<0.5
Erythromycin-H2O	23	150	267	361
Estriol	1	<0.5	<0.5	<0.5
Estrone	39	3.5	9.1	18
Fluoxetine	26	24	27	34
Furosemide	24	75.5	254	316
Gemfibrozil	28	339	866	1,320
Hydrazine	2	<5	<5	<5
Ibuprofen	28	<10	25	98
Iohexol	7	12,300	13,200	13,700
Iopromide	28	2,020	3,390	4,000
Ketoprofen	3	<25	130	130
Meprobamate	4	438	460	460
Metoprolol	3	270	340	340
Naproxen	24	45	116	235
N-Nitrosodimethylamine	59	190	360	650
N-Nitrosopyrrolidine	2	<2	<2	<2
Nonylphenol diethoxylate	4	696.5	856	856
Nonylphenol monoethoxylate	4	561.5	762	762
Octylphenol diethoxylate	4	116	150	150
Octylphenol monoethoxylate	4	179.5	190	190
o-OH Atorvastatin	3	<10	<10	<10
p-OH Atorvastatin	3	<10	<10	<10
PBDE-28	4	<5	<5	<5
PBDE-47	4	<5	<5	<5
PBDE-99	4	<5	<5	<5
PBDE-100	4	<5	<5	<5
PBDE-153	4	<5	<5	<5
PDBE-154	4	<5	<5	<5
PBDE-183	4	<5	<5	<5
PBDE-209	4	<100	<100	<100
Primidone	24	147	170	175
Progesterone	37	<1	<1	<1
Propanolol	5	23	36	36

San Jose Creek East WRP

Compound	Results			
	No.	Median	90th %	Maximum
Quinoline	2	<5	<5	<5
Salicylic acid	4	<100	268	268
Sucralose	2	31,300	32,800	32,800
Sulfamethoxazole	28	304.5	569	870
TCEP	7	420	450	530
Testosterone	1	<0.5	<0.5	<0.5
Triclocarban	5	112	190	190
Triclosan	28	<25	<25	34
Trimethoprim	28	28.5	114	170

Notes:
All samples are tertiary effluent.
Samples collected September 2007 through July 2012.
All samples are 24-hour composites except hydazine and quinoline, which are grabs.
All units are ng/L
NA = Not Analyzed

San Jose Creek West WRP

Compound	Results			
	No.	Median	90th %	Maximum
1,2,3-Trichloropropane	11	<5	<5	5.6
17-Alpha Ethinylestradiol	39	<2	<2	<2
17-Beta Estradiol	39	<2	<2	<2
4-Nonylphenol (tech mix)	37	95	155	338
4-tert Octylphenol	37	8.2	16.1	44
Acetaminophen	28	<10	<10	29
Amoxicillin	4	<50	<50	<50
Androstenedione	1	1.8	1.8	1.8
Atenolol	3	430	510	510
Atorvastatin	28	<10	<10	<10
Azithromycin	28	89.5	236	440
Bisphenol A	28	<25	<25	410
Bis(2-ethylhexyl)phthalate	32	<2,000	<2,000	<2,000
Butyl benzyl phthalate	10	<10,000	<10,000	<10,000
Caffeine	7	<10	<10	<10
Carbamazepine	28	263	306	322
Chlorpyrifos	1	<100	<100	<100
Ciproflaxin	4	<100	<100	<100
DEET	7	133	206	283
Diclofenac	26	<10	13	55
Dilantin (Phenytoin)	7	210	232	232
Equilin	1	<0.5	<0.5	<0.5
Erythromycin-H2O	23	68	165	448
Estriol	1	<0.5	<0.5	<0.5
Estrone	39	<2	3.4	10.4
Fluoxetine	26	29.5	38	49
Furosemide	24	<10	64	307
Gemfibrozil	28	63	172	1,010
Hydrazine	2	<5	<5	<5
Ibuprofen	28	<10	<10	48
Iohexol	7	3,000	4,790	5,010
Iopromide	28	158.5	296	625
Ketoprofen	3	<25	75	75
Meprobamate	4	465.5	490	490
Metoprolol	3	270	320	320
Naproxen	24	<10	13	45
N-Nitrosodimethylamine	61	180	480	1,000
N-Nitrosopyrrolidine	2	<2	2.7	2.7
Nonylphenol diethoxylate	4	551	680	680
Nonylphenol monoethoxylate	4	434	539	539
Octylphenol diethoxylate	4	67.95	88.6	88.6
Octylphenol monoethoxylate	4	117	135	135
o-OH Atorvastatin	3	<10	<10	<10
p-OH Atorvastatin	3	<10	<10	<10
PBDE-28	4	<5	<5	<5
PBDE-47	4	<5	<5	<5
PBDE-99	4	<5	<5	<5
PBDE-100	4	<5	<5	<5
PBDE-153	4	<5	<5	<5
PDBE-154	4	<5	<5	<5
PBDE-183	4	<5	<5	<5
PBDE-209	4	<100	<100	<100
Primidone	24	184.5	206	245
Progesterone	37	<1	<1	<1
Propanolol	5	25	32	32

San Jose Creek West WRP

Compound	Results			
	No.	Median	90th %	Maximum
Quinoline	2	<5	<5	<5
Salicylic acid	4	<100	186	186
Sucralose	2	26,400	27,300	27,300
Sulfamethoxazole	28	31	153	829
TCEP	7	419	500	506
Testosterone	1	<0.5	<0.5	<0.5
Triclocarban	5	102	150	150
Triclosan	28	<25	<25	35
Trimethoprim	28	<10	26	189

Notes:
All samples are tertiary effluent.
Samples collected September 2007 through July 2012.
All samples are 24-hour composites except hydazine and quinoline, which are grabs.
All units are ng/L
NA = Not Analyzed

Valencia WRP

Compound	Results			
	No.	Median	90th %	Maximum
1,2,3-Trichloropropane	14	<5	<5	<5
17-Alpha Ethinylestradiol	14	<2	<2	<2
17-Beta Estradiol	14	<2	<2	2.3
4-Nonylphenol (tech mix)	14	44	84	89
4-tert Octylphenol	14	<5	6	9
Acetaminophen	14	<10	<10	11
Amoxicillin	2	<50	<50	<50
Androstenedione	1	0.896	0.896	0.896
Atenolol	2	175	180	180
Atorvastatin	14	<10	<10	<10
Azithromycin	14	17	110	262
Bisphenol A	14	<25	<25	<25
Bis(2-ethylhexyl)phthalate	43	<2,000	<2,000	<2,000
Butyl benzyl phthalate	13	<10,000	<10,000	<10,000
Caffeine	6	<10	12	15
Carbamazepine	14	278	339	641
Chlorpyrifos	7	<100	<100	<100
Ciproflaxin	2	<100	<100	<100
DEET	6	186	358	400
Diclofenac	12	<10	<10	40
Dilantin (Phenytoin)	6	278	330	360
Equilin	1	<0.5	<0.5	<0.5
Erythromycin-H2O	10	<10	42	47
Estriol	1	<0.5	<0.5	<0.5
Estrone	14	<2	<2	4
Fluoxetine	12	28	37	38
Furosemide	10	<10	16	54
Gemfibrozil	14	52.5	160	238
Hydrazine	0	NA	NA	NA
Ibuprofen	14	<10	12	44
Iohexol	6	6,200	10,200	11,300
Iopromide	14	164	420	460
Ketoprofen	2	<25	<25	<25
Meprobamate	4	884.5	1,010	1,010
Metoprolol	2	245	260	260
Naproxen	10	<10	18	55
N-Nitrosodimethylamine	6	435	970	1,100
N-Nitrosopyrrolidine	2	<2	14	14
Nonylphenol diethoxylate	4	266	436	436
Nonylphenol monoethoxylate	4	231.5	398	398
Octylphenol diethoxylate	4	<25	99.7	99.7
Octylphenol monoethoxylate	4	45.6	204	204
o-OH Atorvastatin	2	<10	<10	<10
p-OH Atorvastatin	2	<10	<10	<10
PBDE-28	2	<5	<5	<5
PBDE-47	2	<5	<5	<5
PBDE-99	2	<5	<5	<5
PBDE-100	2	<5	<5	<5
PBDE-153	2	<5	<5	<5
PDBE-154	2	<5	<5	<5
PBDE-183	2	<5	<5	<5
PBDE-209	2	<100	<100	<100
Primidone	10	100	116	150
Progesterone	12	<1	<1	<1
Propanolol	4	14	28	28

Valencia WRP

Compound	Results			
	No.	Median	90th %	Maximum
Quinoline	0	NA	NA	NA
Salicylic acid	2	<100	<100	<100
Sucralose	2	40,000	42,700	42,700
Sulfamethoxazole	14	32	120	453
TCEP	6	475	600	720
Testosterone	1	<0.5	<0.5	<0.5
Triclocarban	4	145	214	214
Triclosan	14	<25	<25	<25
Trimethoprim	14	<10	18	24

Notes:
All samples are tertiary effluent.
Samples collected September 2007 through July 2012.
All samples are 24-hour composites except hydazine and quinoline, which are grabs.
All units are ng/L
NA = Not Analyzed

Whittier Narrows WRP

Compound	Results			
	No.	Median	90th %	Maximum
1,2,3-Trichloropropane	7	<5	<5	<5
17-Alpha Ethinylestradiol	31	<2	<2	<2
17-Beta Estradiol	31	<2	<2	2.7
4-Nonylphenol (tech mix)	29	132	440	1,260
4-tert Octylphenol	29	7	96	210
Acetaminophen	22	<10	26	43
Amoxicillin	4	<50	<50	<50
Androstenedione	1	2.7	2.7	2.7
Atenolol	2	220	260	260
Atorvastatin	22	<10	<10	35
Azithromycin	22	405	578	760
Bisphenol A	22	<25	<25	31
Bis(2-ethylhexyl)phthalate	34	<2,000	2900	2900
Butyl benzyl phthalate	12	<10,000	<10,000	<10,000
Caffeine	6	62	110	112
Carbamazepine	22	199.5	283	338
Chlorpyrifos	0	NA	NA	NA
Ciproflaxin	4	<100	155	155
DEET	6	217	240	271
Diclofenac	20	43.5	80	132
Dilantin (Phenytoin)	6	141.5	166	260
Equilin	1	<0.5	<0.5	<0.5
Erythromycin-H2O	17	113	166	210
Estriol	1	0.95	0.95	0.95
Estrone	31	<2	7.3	15.9
Fluoxetine	20	17.65	23	33
Furosemide	18	31	150	240
Gemfibrozil	22	51	360	1640
Hydrazine	2	<5	<5	<5
Ibuprofen	22	<10	<10	11
Iohexol	6	3,755	5,220	7,800
Iopromide	22	66	240	470
Ketoprofen	2	<25	<25	<25
Meprobamate	4	320	350	350
Metoprolol	2	195	230	230
Naproxen	18	21.5	57	76
N-Nitrosodimethylamine	55	56	260	970
N-Nitrosopyrrolidine	2	<2	<2	<2
Nonylphenol diethoxylate	4	212.5	2,940	2,940
Nonylphenol monoethoxylate	4	116	1,030	1,030
Octylphenol diethoxylate	4	<25	306	306
Octylphenol monoethoxylate	4	<25	151	151
o-OH Atorvastatin	2	<10	<10	<10
p-OH Atorvastatin	2	<10	<10	<10
PBDE-28	4	<5	<5	<5
PBDE-47	4	<5	<5	<5
PBDE-99	4	<5	<5	<5
PBDE-100	4	<5	<5	<5
PBDE-153	4	<5	<5	<5
PDBE-154	4	<5	<5	<5
PBDE-183	4	<5	<5	<5
PBDE-209	4	<100	<100	<100
Primidone	18	106	120	125
Progesterone	29	<1	<1	<1
Propanolol	4	27.5	33	33

Whittier Narrows WRP

Compound	Results			
	No.	Median	90th %	Maximum
Quinoline	2	<5	<5	<5
Salicylic acid	4	<100	200	200
Sucralose	2	20,150	20,300	20,300
Sulfamethoxazole	22	538.5	1,030	1,320
TCEP	6	414.5	530	580
Testosterone	1	<0.5	<0.5	<0.5
Triclocarban	4	74.5	98	98
Triclosan	22	<25	<25	132
Trimethoprim	22	23.5	110	439

Notes:
All samples are tertiary effluent.
Samples collected September 2007 through July 2012.
All samples are 24-hour composites except hydazine and quinoline, which are grabs.
All units are ng/L
NA = Not Analyzed