Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

Volume 1 of 2
FINAL

PREPARED FOR:

Castaic Lake Water Agency and
Santa Clara River Valley East Subbasin
Salt and Nutrient Management Plan Task Force

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GEOSCIENCE

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THIS REPORT HAS BEEN PREPARED FOR CASTAIC LAKE WATER AGENCY AND THE SANTA CLARA RIVER VALLEY EAST SUBBASIN SALT AND NUTRIENT MANAGEMENT PLAN TASK FORCE BY OR UNDER THE DIRECTION OF THE FOLLOWING PROFESSIONALS LICENSED BY THE STATE OF CALIFORNIA.

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SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

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ACRONYMS AND ABBREVIATIONS

Abbrev.	Description
acre-ft/yr	acre-feet per year
AGR	agricultural supply
amsl	above mean sea level
BIA	Building Industry Association
BMPs	best management practices
b.p.	before present
BVWSD	Buena Vista Water Storage District
Caltrans	California Department of Transportation
CASGEM	California Statewide Groundwater Elevation Monitoring
CDFG	California Department of Fish and Game
CECs	chemicals of emerging concern
CEQA	California Environmental Quality Act
CIMIS	California Irrigation Management Information System
CLWA	Castaic Lake Water Agency
CDPH	California Department of Public Health
CMP	Comprehensive Monitoring Plan
CUAHSI	Consortium of Universities for the Advancement of Hydrologic Sciences
DDW	Division of Drinking Water
DWR	California Department of Water Resources
East Subbasin	Santa Clara River Valley East Groundwater Subbasin

ACRONYMS AND ABBREVIATIONS (continued)

Abbrev.	Description
EIR	Environmental Impact Report
ET	Evapotranspiration
EWMP	Enhanced Watershed Management Plan
FAO	Food and Agriculture Organization of the United Nations
FSCR	Friends of the Santa Clara River
ft	foot, or feet
ftp	file transfer protocol
FW	flow weighted
GAMA	Groundwater Ambient Monitoring and Assessement
GIS	Geographic Information System
gpd	gallons per day
gpd/ft	gallons per day per foot
gpm	gallons per minute
GSI	GSI Water Solutions, Inc.
GWMP	Groundwater Management Plan
HIS	Hydrologic Information System
in./yr	inches per year
IND	Industrial Services Supply
IRWMG	Integrated Regional Water Management Group
IRWMP	Integrated Regional Water Management Plan

ACRONYMS AND ABBREVIATIONS (continued)

Abbrev.	Description
KCWA	Kern County Water Agency
LACDPW	Los Angeles County Department of Public Works
LACFCD	Los Angeles County Flood Control District
LACSD	Los Angeles County Sanitation District
LACWD36	Los Angeles County Water District #36
LARFCCAM	Los Angeles Region Framework for Climate Change Adaptation and Mitigation
LARWQCB	Los Angeles Regional Water Quality Control Board
LARWMP	Los Angeles River Watershed Monitoring Program
LID	low impact development
LSCE	Luhdorff & Scalmanini Consulting Engineers
LUB	Land Use Build-Out
MCL	maximum contaminant level
me/L	milliequivalents per liter
MEP	maximum extent practicable
mg/L	milligrams per liter
MGD	million gallons per day
MOU	Memorandum of Understanding
MUN	Municipal and Domestic Supply
MZ	Management Zone
NAWQA	National Water-Quality Assessment

ACRONYMS AND ABBREVIATIONS (continued)

Abbrev.	Description
NCDC	National Climatic Data Center
NCOD	National Contaminant Occurrence Database
NCWD	Newhall County Water District
NFW	non-flow weighted
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NWIS	National Water Information System (USGS)
OVOV	One Valley One Vision (2012 Santa Clarita Valley Plan)
PROC	industrial process supply
PSC	Project Steering Committee
PWS	public water system
QA	quality assurance
QC	quality control
RCS	Richard C. Slade and Associates LLC
RP	reference point
RRBWSD	Rosedale Rio-Bravo Water Storage District
SCAG	Southern California Association of Governments
SCRWMP	Santa Clara River Watershed Monitoring Program
SCVSD	Santa Clarita Valley Sanitation District of Los Angeles County
SCWD	Santa Clarita Water Division of CLWA

ACRONYMS AND ABBREVIATIONS (continued)

Abbrev.	Description
SDWA	Safe Drinking Water Act
SGRRMP	San Gabriel River Regional Monitoring Program
SMCL	secondary maximum contaminant level
SNMP	Salt and Nutrient Management Plan
SWAMP	Surface Water Management Ambient Monitoring Program
SWP	State Water Project
SWRCB	State Water Resources Control Board
SRWS	self-regenerating water softener
TDS	total dissolved solids
TIN	total inorganic nitrogen
TMDL	Total Maximum Daily Load
UCM	unregulated contaminant monitoring
UCMR	Unregulated Contaminant Monitoring Rule
umhos/cm	micromhos per centimeter
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Services
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VCRCD	Ventura County Resource Conservation District

ACRONYMS AND ABBREVIATIONS (continued)

Abbrev.	Description
VCWPD	Ventura County Watershed Protection District
VWC	Valencia Water Company
WHR	Wayside Honor Rancho
WQO	water quality objective
WRP	water reclamation plant

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

1.0 EXECUTIVE SUMMARY

In accordance with the State Water Resources Control Board's (SWRCB's) Recycled Water Policy, the Upper Santa Clara River Integrated Regional Water Management Group (IRWMG), which is comprised of Castaic Lake Water Agency (CLWA), City of Santa Clarita, CLWA Santa Clarita Water Division (SCWD), Los Angeles County Flood Control District (LACFCD), Newhall County Water District (NCWD), San Gabriel & Lower Los Angeles Rivers and Mountains Conservancy, Santa Clarita Valley Sanitation District (SCVSD) and Valencia Water Company (VWC), have entered into a Memorandum of Understanding (MOU) to prepare a Salt and Nutrient Management Plan (SNMP) for the Santa Clara River Valley East Groundwater Subbasin (East Subbasin). This group of agencies, collectively known as the SNMP Task Force (Task Force) and facilitated by the CLWA, have directed the preparation of this SNMP, which was prepared using guidance set forth by the Los Angeles Regional Water Quality Control Board (LARWQCB).

The purpose of this SNMP is to determine the current (ambient) water quality conditions in the East Subbasin and to ensure that all water management practices, including the use of recycled water, are consistent with water quality objectives. This SNMP is intended to provide the framework for water management practices to ensure protection of beneficial uses, and allow for the sustainability of groundwater resources consistent with the Water Quality Control Plan Los Angeles Region (Basin Plan). Additionally, compliance with the California Environmental Quality Act (CEQA) and approval by LARWQCB staff is required. As part of the SNMP, a monitoring plan has been developed for the East Subbasin which identifies key monitoring locations within each subunit for both surface water and groundwater.

1.1 Background

The East Subbasin, located in northwest Los Angeles County, is part of the larger Santa Clara River Valley Groundwater Basin and consists of six groundwater management zones; five of these management zones are shallow alluvial groundwater basins and the sixth management zone consists of the Saugus Formation. The main surface drainage features include the Santa Clara River, Bouquet Creek, and Castaic Creek. The area is arid to semi-arid with a long-term (1960-2011) average annual precipitation of 18.24 inches (Newhall Rain Gage). Land use in the area includes residential, commercial/office, industrial, public buildings, transportation corridors, open space, and irrigated land. Land use type, the water use associated with it, and the form water enters the groundwater system dictate the salt and nutrient load that is carried into each management zone through activities such as irrigation, septic leakage, permitted discharge, percolation of precipitation or surface water, rising water from the lower Saugus Formation, and underflow from upgradient management zones or basins. Therefore, land use types and area as well as water inflow terms were used to evaluate both historical and current salt and nutrient loads for the SNMP.

The Santa Clara River provides most of the annual groundwater recharge to the groundwater system and has been identified as an impaired water body; it is listed in the Clean Water Act Section 303(d) list published by the US Environmental Protection Agency (USEPA). The quality of the surface water in the Santa Clara River is the product of numerous factors, such as native surface water quality entering the East Subbasin, urban and natural storm flows, discharge of treated wastewater, and effluent discharges from the groundwater system.

The Stakeholders in the East Subbasin and surrounding areas have long been concerned about salinity and nutrient discharges in order to, among other things, allow for the use of recycled water. The optimal use of recycled water is a basic part of planned long-term water supply for the East Subbasin. Compliance with Water Quality Objectives (WQOs) is critical to achieve the goal of the recycled water policy to increase use of recycled water and to meet the projected recycled water supplies in the 2010 Urban Water Management Plan (UWMP; Kennedy/Jenks and LSCE, 2011) and the Recycled Water Master Plan for the region (CLWA, 2002). The principal sources of chloride to the sewage system include potable water supply, self-regenerating water softeners, treatment plant disinfection using chlorine, and other miscellaneous residential, commercial and industrial sources. The SNMP will be used to ensure the protection of beneficial uses in the East Subbasin, and allow for long-term sustainability of groundwater quality and resources consistent with the Basin Plan.

1.2 Existing Salt and Nutrient Groundwater Quality

During the SNMP analysis, ambient concentrations and assimilative capacities for Total Dissolved Solids (TDS), chloride, nitrate, and sulfate were established for all six management zones: Management Zone 1 (MZ-1) - Santa Clara-Mint Canyon, Management Zone 2 (MZ-2) - Placerita Canyon, Management Zone 3 (MZ-1) - South Fork, Management Zone 4 (MZ-4) - Santa Clara-Bouquet and San Francisquito Canyons, Management Zone 5 (MZ-5) - Castaic Subunit, and Management Zone 6 (MZ-6) - Saugus Formation. Each of the management zones (with the exception of Management Zone 6) has established WQOs for TDS, chloride, nitrate, and sulfate. It is important to note that for the purposes of this report, “nitrate” is reported as NO_3. For Management Zone 6, the LARWQCB recommended the interim use of the most conservative basin objective of the alluvial management zones for the calculation of assimilative capacity for TDS, chloride and nitrate. However, due to the lack of supporting historical data for sulfate, no decision has been made with regards to the WQO for sulfate in Management Zone 6.

The significant variability of water quality in the Saugus Formation needs to be further evaluated to establish meaningful WQOs. In addition, after consulting with the LARWQCB, Management Zone 1 was split into two zones in order to isolate a localized area that may be associated with point source contamination. The area in Management Zone 1 with elevated TDS and sulfate levels was designated as Management Zone 1b while the remaining area was designated as Management Zone 1a. Average groundwater concentrations and assimilative capacities were calculated for each of these zones separately.

The average TDS, chloride, nitrate, and sulfate concentrations for each management zone were determined by preparing concentration contours of the median concentration values from wells in each management zone. The average groundwater concentration values were determined based on the areal and vertical distribution of the median concentration contours. The average median concentration value for each constituent in each management zone is considered to be the ambient groundwater concentration. The ambient concentration for each constituent was subtracted from the specific WQO for that constituent and management zone to determine the available assimilative capacity. Calculated ambient groundwater concentrations are provided in Table 1-1 below along with each management zone's WQO.

Table 1-1. Ambient Groundwater Concentrations and Basin Objectives

Management Zone	Groundwater Subunit	Water Quality Status Comparison	TDS [mg/L]	Chloride [mg/L]	Nitrate [mg/L]	Sulfate [mg/L]
1a	Santa Clara-Mint Canyon	Water Quality Objective	800	150	45	150
		Ambient Water Quality	***728***	***89***	***20***	***138***
1b	Santa Clara-Mint Canyon	Water Quality Objective	800	150	45	150
		Ambient Water Quality	***833***	***72***	***21***	***269***
2	Placerita Canyon[1]	Water Quality Objective	700	100	45	150
		Ambient Water Quality	***NA***	***NA***	***NA***	***NA***
3	South Fork[1]	Water Quality Objective	700	100	45	200
		Ambient Water Quality	***NA***	***NA***	***NA***	***NA***
4	Santa Clara-Bouquet and San Francisquito Canyons	Water Quality Objective	700	100	45	250
		Ambient Water Quality	***710***	***77***	***16***	***189***
5	Castaic Valley	Water Quality Objective	1,000	150	45	350
		Ambient Water Quality	***727***	***77***	***8***	***246***
6	Saugus Formation[2]	Water Quality Objective	700	100	45	NA
		Ambient Water Quality	***636***	***28***	***14***	***235***

[1] Insufficient data to establish trend.

[2] WQOs have not been established for the Saugus Formation. Therefore, at the recommendation of the LARWQCB, the most conservative of the alluvial management zone WQOs was used for calculation of assimilative capacity for TDS, chloride and nitrate.

Note: red values indicate exceedance of WQOs.

The SNMP analysis indicates that the average groundwater concentrations (ambient) are generally lower than the WQOs and assimilative capacity is available for all constituents for all management zones with the exception of TDS for Management Zones 1b and 4 and sulfate for Management Zone 1b. Management Zones 2 and 3 have no data set to compare with the basin objectives and, as mentioned previously, no WQO has been set for Management Zone 6 sulfate or any other constituent.

1.3 SNMP Spreadsheet Model and Water Quality Projections

A spreadsheet model prepared by GEOSCIENCE for this study was used to calculate the historical and future salt loads in the management zones, which is based on the equation of hydrologic equilibrium (i.e., Inflow = Outflow ± Change in Storage). A water balance, which takes into account all of the quantifiable hydrologic variables that affect the water resources within the East Subbasin, was established for all inflow and outflow terms. Inflow terms include: daily precipitation infiltration, surface water infiltration within streambeds, permitted direct discharges to the Santa Clara River through a National Pollutant Discharge Elimination System (NPDES), underflow from upgradient subbasins and subunits, return flow from agricultural use and recycled water application, underflow from Castaic Dam leakage, releases from Castaic Lake and Lagoon, domestic use return flow, discharge from septic tanks and leachfields, storm runoff, rising groundwater from the Saugus Formation to overlying alluvial aquifers, infiltration of urban runoff, and infiltration of stream leakage down to the Saugus Formation. Outflow terms include: evapotranspiration, groundwater extraction (pumping), rising groundwater from the alluvium to streams, subsurface outflow to adjacent subbasins and subunits and downward leakage of alluvial groundwater to the underlying Saugus Formation, and upward leakage from the Saugus Formation to overlying alluvial aquifers. A groundwater model prepared by GSI Water Solutions (GSI) was used to obtain water balance terms and their respective volumes.

Salt and nutrients in the East Subbasin come from both natural and anthropogenic sources. The quantification of salt and nutrient loading was developed by determining the potential volume of water coming from each source and applying an appropriate loading factor based on water quality sampling data and the distribution of potential salt loads by land use. The salt and nutrient loads were applied to the annual water balances for each management zone to evaluate the annual and overall changes in salt and nutrient concentrations for the study period.

The spreadsheet model was used to predict future groundwater quality and trends, as well as the percentage of the assimilative capacity to be used by implementation of individual projects and all projects combined, for the period from 2012 through 2035. This 24-year period was selected by the Regional Water Management Group since it falls within the planning range incorporated by the 2010 UWMP and incorporates the time period in which planned projects described herein will be implemented or will be in the process of implementation.

In order to evaluate the impacts of proposed projects, the simulated results were compared to baseline results. The baseline model run represents a predictive scenario for salt and nutrient loading and parameter concentrations under existing conditions ("Land Use Build-Out" conditions) projected into the future. Future hydrologic conditions were simulated using the hydrologic conditions from 1980 through 2003. Future land use changes in the Santa Clarita Valley were also taken into account by using the combined land use planning projected by the 2011 City of Santa Clarita General Plan and the 2012 Santa Clarita Valley Plan - "One Valley One Vision" (OVOV) which plans future land uses in both the City of Santa Clarita and unincorporated Los Angeles County. In addition to the change in land use, the appropriate water use factors were also input into the Regional Model annually for each management zone to simulate the change in water use with change in land use.

The proposed projects were identified by the members of the Regional Water Management Group. Brief project descriptions are provided below.

- **SCVSD Wastewater Treatment Plant Chloride Compliance Program** – SCVSD proposes to produce wastewater effluent that will meet a combined discharge of chloride from the Saugus and Valencia Water Reclamation Plants (WRPs) equal to 100 mg/L as a three-month average. The process will include further treatment and blending of recycled water with water treated using the reverse osmosis process. The Saugus WRP would discharge up to 150 mg/L chloride, while limiting discharges from the Valencia WRP to a concentration less than 100 mg/L – such that the combined discharge from the two plants would be 100 mg/L downstream of the Valencia WRP. Recycled water to be purchased by CLWA is estimated to increase to 10,275 acre-ft/yr by 2035. CLWA-purchased recycled water will remain at current concentrations to be used for landscape irrigation. Therefore, the volume of effluent discharged to the Santa Clara River at 100 mg/L will be less than the ultimate volume estimated to be purchased by CLWA.

- **SCWD Water Use Efficiency Program** – Consists of ten (10) programs designed to conserve 4,437 acre-ft/yr in water use by conserving approximately 634 acre-ft/yr from 2014 through 2020, thereby reducing residential and commercial urban water use and urban run-off. For this analysis, it is assumed that one-half of the water conservation will occur by a reduction of outside applied water, and the other one-half from lower indoor water use, reducing flows to the sewer.

- **Vista Canyon Water Reclamation Plant** - Will be constructed to serve Vista Canyon Development, located in Management Zone 1. The project will require the use of 190 acre-ft/yr of potable water and will generate 439 acre-ft/yr of treated wastewater. The project proposes to use 190 acre-ft/yr of the treated wastewater for landscape irrigation and the remainder will be placed into sewers. During wet years, when recycled water is not in demand, the project will sewer excess recycled water

- **CLWA Recycled Water Master Plan** – Proposes to incorporate additional recycled water for use in the Valley for landscape irrigation. Currently, approximately 325 acre-ft/yr of recycled water is used for landscape irrigation. In accordance with the intent of the Recycled Water Policy, CLWA is planning to incrementally increase use of recycled water to about 2,000 acre-ft/yr for Phase 2A, 2B, and 2C planning areas by the year 2035. Approximately 1,000 acre-ft/yr will be used in areas upstream of the Saugus WRP and 1,000 acre-ft/yr will be used in the Phase 2C planning area.

- **CLWA Santa Clarita Valley Water Use Efficiency Strategic Plan (SCV WUE SP)** – Plans to conserve 683 acre ft/yr for a total planned reduction of 3,287 acre-ft over a five-year span – which will also result in a decreased need of 380 acre-ft/yr of imported water. The planned reductions will be achieved primarily through reduction in residential use and urban run-off. The full project benefits will be achieved between 2015 and 2026.

- **Newhall Ranch Water Reclamation Plant and Recycled Water Use** – The Newhall WRP will service development in the Newhall Ranch Specific Plan and may also serve Newhall Land-owned Westside Communities and the unincorporated area known as Val Verde, which are included in OVOV. It is anticipated to come online in 2023 and will be constructed initially to treat a flow rate of 2.0 MGD with a 4.0 MGD capability to accommodate full-build-out of the Newhall Ranch Specific Plan by 2033. The plant could also be expanded to accommodate the Westside Communities (0.4 MGD) and Val Verde area (1.3 MGD). However, the SNMP analysis does not include this additional potential capacity. The project will use recycled water primarily for landscape irrigation. However it is anticipated that some recycled water will be discharged to the Santa Clara River – generally during the months of November through March during wet, dry, and average years through 2035. At complete build-out, recycled water demand will be near 7,164 acre-ft/yr with approximately 566 acre-ft/yr of discharge to the Santa Clara River. Recycled water discharged to the river will be treated by reverse osmosis (RO) and will have a maximum average chloride concentration of 100 mg/L, while recycled water used for landscape irrigation is expected to have a chloride concentration of approximately 125 mg/L.

1.4 Future Salt and Nutrient Groundwater Quality

Table 1-2 below summarizes the average TDS, chloride, nitrate and sulfate concentrations as a result of "Land Use Build-Out" conditions (i.e., changes in land use in accordance with local and regional land use plans but without the addition of any new water conservation or recycled water projects for the period 2012 through 2035).

Table 1-2. Salt and Nutrient Concentrations under Land Use Build-Out Conditions

Chemical (Units in mg/L)	Management Zone 1a		Management Zone 1b		Management Zone 2		Management Zone 3		Management Zone 4		Management Zone 5		Management Zone 6	
	WQO	LUB	WQO	LUB	WQO	LUB	WQO	LUB	WQO	LUB	WQO	LUB	WQO	LUB
TDS	*800*	739	*800*	790	*700*	-	*700*	-	*700*	709	*1,000*	728	*700*	636
Chloride	*150*	89	*150*	72	*100*	-	*100*	-	*100*	93	*150*	79	*100*	46
Nitrate	*45*	19	*45*	23	*45*	-	*45*	-	*45*	19	*45*	11	*45*	19
Sulfate	*150*	150	*150*	225	*150*	-	*200*	-	*250*	166	*350*	248	-	251

[1] WQO = Water Quality Objective.
[2] LUB = Land Use Build-Out.
Note: Red value indicates exceedance of WQO.

Review of the table above indicates that only sulfate in Management Zone 1b and TDS in MZ-4 will exceed the WQO under Land Use Build-Out conditions. The spreadsheet model also indicates, in some cases, Land Use Build-Out conditions will use assimilative capacity at a rate greater than the thresholds established by the LARWQCB Recycled Water Policy for projects. However, the addition of all proposed projects will have varying but generally beneficial effect by decreasing the amount of assimilative capacity used, as compared to the projected Land Use Build-Out conditions alone. Implementation of the proposed projects in the East Subbasin will result in a "maximum benefit" to the people of the state by providing additional water supply and conservation activities while decreasing the total amount of assimilative capacity used, as compared to the Land Use Build-Out conditions (i.e., no projects).

1.5 Assimilative Capacity and Anti-Degradation Analysis

The impacts of the proposed projects were evaluated by determining the water quality changes that will occur as a result of implementing the project for the management zone(s) in which the water quality change will occur. Table 1-3 below provides a comparison of the assimilative capacity used between Land Use Build-Out conditions and the "All Projects" scenario.

Table 1-3. Comparison of Assimilative Capacity Used – Land Use Build-Out vs. All Projects

Chemical	Management Zone 1a		Management Zone 1b		Management Zone 2		Management Zone 3		Management Zone 4		Management Zone 5		Management Zone 6	
	LUB[1]	AP[2]	LUB	AP	LUB	AP	LUB	AP	LUB	AP	LUB	AP	LUB	AP
TDS	-15%	14%	129%	143%	-	-	-	-	12%	70%	0%	3%	-1%	-1%
Chloride	0%	6%	0%	1%	-	-	-	-	-71%	-49%	-3%	3%	-24%	-25%
Nitrate	3%	2%	-9%	-9%	-	-	-	-	-10%	-11%	-8%	-8%	-17%	-17%
Sulfate	-102%	-76%	37%	37%	-	-	-	-	39%	41%	-2%	-2%	-	-

[1] LUB = Land Use Build-Out
[2] AP = All Projects
Notes: MZ-2, MZ-3 and sulfate in MZ-6 have insufficient data for preparation of analysis
Negative (-) values denote an *decrease* in assimilative capacity

The anti-degradation analysis shows that in the absence of projects, groundwater constituent concentrations will increase above the ambient plus 10% assimilative capacity concentration threshold by 2035. The implementation of single projects and the combined projects in general will increase assimilative capacity of salt and nutrient concentrations. However, where assimilative capacity is decreased and concentrations are (1) above the ambient plus 10% assimilative capacity concentration for single projects or (2) the ambient plus 20% assimilative capacity concentration for combined projects, the decrease is similar to that resulting from Land Use Build-Out only concentrations. Therefore, if no projects are implemented, assimilative capacity will cross thresholds established in the Recycled Water Policy set forth to evaluate recycled water projects. Implementation of the proposed projects represents a "maximum benefit" to the people of the State by providing beneficial uses for recycled water and decreasing the use of assimilative capacity, as compared to not adding planned projects to the East Subbasin.

Implementation measures, as discussed in Section 10, will serve to lower ambient concentrations of salts and nutrients, though the amount of decrease is unknown and pending further design of the implementation measures. With some or all of the measures in place, the assimilative capacity of all of the groundwater management zones, all other things being equal, would increase.

In summary, this analysis indicates that several approaches to future assessment of assimilative capacity should be considered:

1) Less assimilative capacity is used as a result of implementation of all the projects when compared to Land Use Build-Out conditions only.

2) Water quality in Management Zone 1b will experience a beneficial impact from implementation of all projects as compared to Land Use Build-Out conditions only.

3) Water quality is moved closer to the WQOs as a result of implementation of the proposed projects.

4) Calculated assimilative capacity should be based on comparison of Land Use Build-Out changes with single project and All Projects conditions, since changes from Land Use Build-Out represents actual baseline conditions (i.e., predicted ambient increases from year to year) going forward in the Subbasin.

5) WQOs should be re-evaluated to determine whether existing WQOs are appropriate for current water quality conditions and proposed groundwater management strategies. WQOs for Management Zone 6 should be prepared by the LARWQCB for future assessments.

6) The assimilative capacity, and thus the ambient plus 10% or 20% assimilative capacity concentrations, should be re-calculated when new data sets are collected from the proposed monitoring program (Section 12). New data sets should be used to update and refine the spreadsheet model and confirm the current anti-degradation analysis.

7) Implementation of the proposed projects represents a "maximum benefit" to the people of the State by providing for recycled water and increasing the assimilative capacity for each constituent which will result under Land Use Build-Out conditions.

1.6 Implementation Measures

Due to the importance of the East Subbasin as a water supply source, projects have been implemented over the years to manage salt and nutrient concentrations in the groundwater. Historic aggressive activities conducted to reduce salt and nutrient loads in the East Subbasin have included restrictions on brine discharges from water softeners into sewage systems, prohibition on the installation of new residential self-regenerating water softeners, water softener removal rebate programs, chlorine discharge limits, implementation of total maximum daily loads (TMDLs) for nitrogen compounds in the Santa Clara River, WRP upgrades, and a pilot water softening treatment plant for drinking water in the VWC service area.

The Santa Clarita Valley uses both groundwater and imported water in order to satisfy demand and to attempt to meet WQOs for drinking water. Imported water is normally blended by all four local water retailers with groundwater supplies to reduce hardness. In normal to wet years, imported water is relatively low in TDS, chloride and nutrients and when blended with groundwater reduces salt and nutrient concentrations in the groundwater. However, during dry or drought years, chloride levels in the imported water may increase. This method of operation is expected to continue and represents an additional implementation measure to manage salt and nutrient loads in the groundwater basin. Also, selected wells with higher TDS concentrations have been dedicated for agricultural use only, thus reducing the salt and nutrient loads which enter directly back into the alluvial groundwater system.

The projects simulated within this SNMP represent additional implementation measures to decrease salt and nutrient loading in the future and increase the assimilative capacity in the management zones as compared to Land Use Build-Out conditions.

1.7 Basin Monitoring Program

Historically, while there have been some monitoring programs in an effort to develop a database for the area, there has been no unified monitoring system for groundwater levels and groundwater quality in the East Subbasin. Groundwater levels and groundwater quality sampling and analysis have been conducted by various agencies. There is a need for a groundwater monitoring system for the East Subbasin, to not only address current water quality regulations such as the groundwater basin objectives and drinking water standards, but also to have the facility to evaluate potentially new constituents in groundwater – such as chemicals of emerging concern (CECs).

In accordance with the Recycled Water Policy, this SNMP recommends a system of monitoring groundwater levels, quality, and pumping which will provide the basis for ongoing assessment of basin conditions for salt and nutrient management. According to the Recycled Water Policy, salt and nutrient monitoring programs "*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.*" The plan should allow consistent on-going collection of data to monitor the actual effects of land use changes and groundwater management policies on groundwater quality in the East Subbasin.

Basin-wide baseline groundwater quality will be established to use as a point of reference for the single SNMP monitoring program dataset. The current availability of groundwater quality data indicates that several gaps exist – primarily in Management Zone 2 and Management Zone 3, and locally at the western end of the basins. The data gaps result in an incomplete characterization of the groundwater quality of the East Subbasin.

The SNMP Monitoring Program proposes to collect annual samples of TDS, chloride, nitrate, sulfate and CECs from a set of proposed monitoring wells and surface water sites in the subbasin, as well as incorporating data from existing sampling programs. Basin monitoring will consider point discharges such as stormwater outfalls, NPDES discharge points (both wastewater treatment plants and single point outfalls), areas of unsewered waste discharges, land areas with planned long-term application of recycled water, and the contribution of groundwater from adjacent subbasins. In addition, proposed groundwater level monitoring will occur on a semi-annual basis. The timing and location of the samples should be re-evaluated after sufficient data collection. All collected data is to be stored, organized, and secured in the East Subbasin SNMP Database.

1.8 Benefits of Increased Recycled Water Use in the East Subbasin

As demonstrated by this SNMP, implementation of the proposed projects results in a “maximum benefit” to the people of the state by providing additional water supply and conservation activities while generally increasing assimilative capacity or decreasing the assimilative capacity similar to the magnitude experienced under Land Use Build-Out conditions.

The projected average salt and nutrient concentrations under Land Use Build-Out conditions range below, above, or at those projected for All Projects conditions. In general, however, the results indicate that the implementation of all of the proposed projects will have a net effect of reducing salt and nutrients in the management zones.

1.9 Associated SNMP Documents and Periodic Updates to the SNMP

The Recycled Water Policy requires the SNMP to identify who will collect/submit data and requires submittal at least every 3 years (Section 6.b.(3)(a)(iii)). Therefore, a monitoring report summarizing monitoring data shall be prepared by CLWA and/or a member of the Task Force and submitted to the LARWQCB at least every three years. The report could also be included (1) as a technical memorandum as part of the annual Santa Clara Valley Water Report, (2) as a part of a groundwater plan prepared in response to the Sustainable Groundwater Management Act, or (3) as a stand-alone monitoring document. An assessment of salt and nutrient conditions with regard to projected groundwater quality trends provided in the SNMP should be prepared and provided in the SNMP monitoring report. In addition, all SNMP monitoring data will be uploaded to the SWRCB’s GeoTracker website.

2.0 INTRODUCTION

In February 2009, the California State Water Resources Control Board (SWRCB) adopted the Recycled Water Policy. This Policy encourages the use of recycled water from municipal wastewater sources as a safe alternative source of water supply. The goal of the Recycled Water Policy is to increase the use of recycled water over 2002 levels by at least one million acre-feet per year (acre-ft/yr) by 2020 and at least two million acre-ft/yr by 2030.

The SWRCB recognized that some groundwater basins in the state contain salt and nutrients which exceed, or threaten to exceed, water quality objectives (WQOs) established in the Water Quality Control Plans, and that not all basin plans include adequate implementation procedures for achieving or ensuring compliance with the water quality objectives for salt and nutrients. Therefore, the SWRCB determined that the appropriate way to address salt and nutrient issues is through the development of regional or sub-regional salt and nutrient management plans (SNMPs), rather than through imposing requirements solely on individual recycled water projects. The SNMP development process should include compliance with the California Environmental Quality Act (CEQA) and participation by Regional Water Quality Control Board staff. SNMPs are to be submitted to the appropriate Regional Water Quality Control Board within five years from the effective date of the Recycled Water Policy (i.e., May 14, 2014). The Recycled Water Policy requires Regional Water Boards to review the plans and consider each for adoption as basin plan amendments within one year of submittal.

In compliance with this Policy, the Upper Santa Clara River Integrated Regional Water Management Group (IRWMG), which is comprised of Castaic Lake Water Agency (CLWA), City of Santa Clarita, Santa Clarita Water Division (SCWD), Los Angeles County Flood Control District (LACFCD), Newhall County Water District (NCWD), San Gabriel & Lower Los Angeles Rivers and Mountains Conservancy, Santa Clarita Valley Sanitation District (SCVSD) and Valencia Water Company (VWC), have entered into a Memorandum of Understanding (MOU) to prepare an SNMP for the Santa Clara River Valley East Groundwater Subbasin (East Subbasin). This group of agencies, collectively known as the SNMP Task Force (Task Force) and facilitated by the CLWA, have directed the preparation of this SNMP. The location of the East Subbasin and the management areas of each purveyor are shown on Figure 1. This report was prepared using guidance set forth by the Los Angeles Regional Water Quality Control Board (LARWQCB) and presents an evaluation of salt and nutrient concentrations for current and proposed water resource management practices in the Santa Clarita Valley, located in northwestern Los Angeles County, California.

The California Department of Water Resources (DWR) has designated the region of study as the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin No. 4-4.07), and it lies within the DWR-designated Upper Santa Clara River Hydrologic Area. Two primary aquifers are used for groundwater production in the East Subbasin: a shallow Alluvial Aquifer and an older, underlying geologic unit called the Saugus Formation. The East Subbasin consists of six subunits/management zones. Five of these subunits (Management Zones 1 through 5: Santa Clara-Mint Canyon Subunit, South Fork Subunit, Placerita Canyon Subunit, Santa Clara-Bouquet and San Francisquito Canyon Sunbunit, and Castaic Subunit) are shallow alluvial groundwater basins, while the sixth subunit (Management Zone 6) consists of the Saugus Formation. The water purveyors also have access to other sources of water to supplement groundwater for municipal supply, including imported State Water Project (SWP) water, imported Kern County Water, groundwater banking outside the basin, recycled water, short-term water exchanges, and dry-year water purchase programs. These sources are described in the current 2010 Santa Clara Valley Urban Water Management Plan (UWMP; Kennedy/Jenks and LSCE, 2011).

The following will discuss, in detail, the various practices, quality and quantity of these sources which add and extract salts, nutrients, and other constituents of concern from the East Subbasin.

2.1 Purpose

The purpose of developing a SNMP for the East Subbasin is to determine the current (ambient) water quality conditions and to ensure that all water management practices, including the use of recycled water, are consistent with WQOs. The SNMP is intended to provide the framework for water management practices to ensure protection of beneficial uses, and allow for the sustainability of groundwater resources consistent with the Water Quality Control Plan Los Angeles Region (Basin Plan). Additionally, compliance with CEQA and approval by LARWQCB staff is required. As part of the SNMP, a monitoring plan has been developed for the East Subbasin which identifies key monitoring locations within each subunit for both surface and groundwater. The development of this monitoring plan is discussed in Section 10.

2.2 Protection of Beneficial Uses

Beneficial uses must satisfy all applicable requirements of the California Water Code, Division 7 and the Clean Water Act. California Water Code section 13050(f) describes the beneficial uses of surface and groundwaters that may be designated by the State or Regional Board for protection as follows:

> *"Beneficial uses of the waters of the state that may be protected against quality degradation include, but are not necessarily limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves."*

Beneficial uses of the groundwater basins in the region include Municipal and Domestic Supply (MUN), Agricultural Supply (AGR), Industrial Services Supply (IND), and Industrial Process Supply (PROC). The designated beneficial uses for these basins are shown in the following table from the 1994 Basin Plan (LARWQCB, 1994).

Table 2-1. Beneficial Uses of Groundwater in the Santa Clara River Valley East Subbasin

DWR[1] Basin No.	Subunit	MUN	IND	PROC	AGR
4-4.07	Mint Canyon	X	X	X	X
4-4.07	South Fork	X	X	X	X
4-4.07	Placerita	X	X	X	X
4-4.07	Bouquet and San Francisquito Canyons	X	X	X	X
4-4.07	Castaic Valley	X	X	X	X
4-4.07	Saugus Formation	X			

Source: Table 2-1 of the 1994 Basin Plan (LARWQCB, 1994)

2.3 Sustainability of Water Resources

In 2009, the "Analysis of Groundwater Supplies and Groundwater Basin Yield" (LSCE and GSI, 2009), known as the 2008 Operating Plan, was prepared and established the most recent sustainable groundwater extraction values with the consideration that SWP supplies could be reduced due to regulatory requirements. This 2009 study supersedes the previous 2004 Operating Plan. The 2008 Operating Plan refers to water supply and water resource management practices of the Purveyors[2], which calls for maximizing the use of the Alluvial Aquifer and imported water during years of normal or above-normal availability of these supplies, while limiting the use of the Saugus Formation. During years when supplemental imported water supplies are significantly reduced due to drought conditions, Saugus Formation pumping will be temporarily increased.

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1 Basins are numbered according to DWR Bulletin No. 118-Update 2003 (DWR, 2003).

2 The Santa Clarita Valley Purveyors are comprised of Los Angeles County Waterworks District 36, (LACWD36), NCWD, SCWD (formerly Santa Clarita Water Company, acquired by CLWA in 1999), and VWC.

The 2010 UWMP (Kennedy/Jenks and LSCE, 2011) summarizes the 2008 Operating Plan with respect to the proposed pumping volumes:

- *Alluvium: Pumping from the Alluvial Aquifer in a given year is governed by local hydrologic conditions in the eastern Santa Clara River watershed. Pumping ranges between 30,000 and 40,000 acre-ft/yr during normal and above-normal rainfall years. However, due to hydrogeologic constraints in the eastern part of the Basin, pumping is reduced to between 30,000 and 35,000 acre-ft/yr during locally dry years.*

- *Saugus Formation: Pumping from the Saugus Formation in a given year is tied directly to the availability of other water supplies, particularly from the SWP. During average-year conditions within the SWP system, Saugus pumping ranges between 7,500 and 15,000 acre-ft/yr. Planned dry year pumping from the Saugus Formation ranges between 15,000 and 25,000 acre-ft/yr during a drought year and can increase to between 21,000 and 25,000 acre-ft/yr if SWP deliveries are reduced for two consecutive years, and between 21,000 and 35,000 acre-ft/yr if SWP deliveries are reduced for three consecutive years. Such high pumping would be followed by periods of reduced (average year) pumping, at rates between 7,500 and 15,000 acre-ft/yr, to further enhance the effectiveness of natural recharge processes that would recover water levels and groundwater storage volumes after the higher pumping during dry years.*

Through modeling of all historical conditions of SWP water supply, the 2008 Operating Plan is considered sustainable. The 2008 Operating plan is also sustainable during periods of climate change with wetter than usual conditions, but, during periods of climate change with prolonged drier than usual conditions, long term water levels are expected to decline to a condition where the Operating Plan would be unsustainable (LSCE and GSI, 2009). During the prolonged periods of drier than usual conditions, the 2008 Operating Plan states that pumping redistribution, which reduces pumping in the Mint Canyon area and increases pumping in the west, is both sustainable and achievable.

2.4 Historical Efforts to Reduce Salt and Nutrients in the Upper Santa Clara River Watershed

The region has long been concerned about salinity and nutrient discharges in order to, among other things, allow for the use of recycled water. In the Santa Clarita Valley, the principal sources of chloride to the sewage system include potable water supply, self-regenerating water softeners (SRWSs), treatment plant disinfection using chlorine, and other miscellaneous residential, commercial and industrial sources. Below is a narrative summary of historic aggressive activities conducted to reduce salt and nutrient loads in the East Subbasin.

- Close to the time the Saugus and Valencia Water Reclamation Plants (WRPs) came online in the mid-1960s, SCVSD prohibited the discharge of brine from SRWSs into the sewage system. However, in 1997 the prohibitions on residential SRWS were invalidated due to two appellate court decisions that found that state law did not allow the adoption of more stringent local restrictions. Under new legislation that was enacted in 1999 but did not take effect until January 1, 2003, SCVSD adopted an ordinance prohibiting the installation of new residential SRWSs. This ordinance took effect in March 2003.

- SCVSD launched the first Phase of the Automatic Water Softener Rebate Program in November 2005. Phase I offered residents $100 for the removal of SRWSs, and $150 for the removal of SRWSs and replacement with a qualified non-salt alternative unit. This program led to the removal of 431 SRWSs.

- SCVSD launched Phase II of the Automatic Water Softener Rebate Program in May 2007. This program provided residents with compensation for the reasonable value of their SRWS and for free removal and disposal of their unit if specific plumbers were used. This program implemented the provisions for a voluntary program under the terms of Health and Safety Code Section 116787. Phase II offered rebates for 100 percent of the reasonable value of non-rental SRWSs, up to $2,000. A minimum amount was provided for SRWSs where documentation of the value was not available.

- In 2008, voters passed Measure S, which required the removal and disposal of all remaining active SRWSs connected to SCVSD's sewage system. In accordance with Measure S, beginning in 2009, rebates were reduced to a maximum of 75% of the reasonable value for each residential SRWS removed.

- Since the inception of the rebate programs and since Measure S went into effect, over 8,000 SRWSs have been removed. As a result, chloride loadings from the wastewater treatment plants have been reduced by over 50 mg/L.

- Other source control efforts focus on the commercial and industrial sectors, and include enforcement of the SRWS ban and implementation of chloride discharge limits of 100 mg/L, or performance-based chloride limits that reflect implementation of chloride reduction practices to the extent technologically and economically feasible.

The nitrogen compounds Total Maximum Daily Loads (TMDLs) for Reaches 5 and 6 (previously Reaches 7 and 8) of the Santa Clara River went into effect on March 23, 2004. Reach locations are discussed in

Section 5.2. Nitrogen compounds can cause or contribute to eutrophic effects such as low dissolved oxygen, algae growth and reduced benthic macroinvertebrates. The identified source of nitrogen compounds in the Santa Clara River is wastewater discharges, with possible other sources being agricultural runoff, stormwater runoff, groundwater discharge and atmospheric deposition. Given these sources, wasteload allocations for nitrogen compounds were assigned to the various sources (LARWQCB, 2011).

Total Inorganic Nitrogen (TIN) is the sum of nitrate-nitrogen and nitrite-nitrogen. High nitrate levels in drinking water can cause health problems in humans. Infants are particularly sensitive and can develop methemoglobinemia (blue-baby syndrome). Nitrogen is also considered a nutrient. Excessive amounts of nutrients can lead to other water quality impairments (e.g., algae).

In 2003, SCVSD upgraded the treatment processes at the Valencia and Saugus WRPs to include nitrification/denitrification to address nutrients. The 2011 average nitrate plus nitrite levels in Valencia and Saugus WRP recycled water were 2.60 mg/L and 4.36 mg/L, respectively (Kennedy/Jenks and LSCE, 2011). The Santa Clara River is no longer considered to have impairments related to nitrate; the river no longer appears on the 303(d) list for nitrate.

The 2011 average ammonia levels in the Valencia and Saugus WRP recycled water were 1.02 mg/L and 1.32 mg/L, respectively. The TMDL values for ammonia in the Upper Santa Clara River are summarized in Table 2-2 below.

Table 2-2. TMDL for Ammonia on the Upper Santa Clara River

Reach	One-Hour Average NT (mg-N/L)	Thirty-Day Average NT (mg-N/L)
Reach 8	14.8	3.2
Reach 7 above Saugus	4.8	2.0
Reach 6 above Valencia	5.5	2.0
Reach 5 at County Line	3.4	1.2

Source: 2010 UWMP (Kennedy/Jenks and LSCE, 2011), based on Santa Clara River TMDL for Nitrogen Compounds Staff Report (LARWCB, 2003b).

Other methods of salt reduction have been undertaken in the region. This includes a pilot water softening treatment for drinking water for the VWC service area. This system precipitates out ions of magnesium and other salts, and it is hoped that as a result of the softening, individual home owners will not install, or will remove existing SRWSs.

2.5 Problem Statement

The Santa Clara River provides most of the annual groundwater recharge to the alluvial basins. WQOs for the Upper Santa Clara River reaches are set forth in the LARWQCB 1994 Basin Plan and LARWQCB 2004 TMDLs for Reach 5 and Reach 6. Historical surface water quality is discussed in Section 6. The quality of the surface water in the Santa Clara River is the product of numerous factors, such as native surface water quality entering the East Subbasin, urban and natural storm flows, discharge of treated wastewater, air-borne concentrations of salts and nutrients, discharges from the groundwater system, discharge of imported water, and permitted discharges. The SNMP provides an opportunity to evaluate salt and nutrient loads from various sources to the groundwater system. In the future, strategies to reduce salt and nutrient loads from sources within the watershed will be required to ensure that long-term water quality will continue to meet water quality standards.

The East Subbasin consists of six groundwater management zones. Five of these management zones are shallow alluvial groundwater basins and the sixth management zone consists of the Saugus Formation. The alluvial management zones have WQOs set by the Basin Plan. Basin WQOs have not been set for the Saugus Formation. Since the Santa Clara River is the main source of recharge to the groundwater system, reduction and management of salts and nutrients in the Santa Clara River will directly affect the quality of groundwater. Salt is also added to the groundwater system through treated wastewater discharges from the Valley's two wastewater treatment plants, irrigation return flows and percolation of septage. Therefore, practices that will manage these sources of salt will be a part of the salt and nutrient management in the East Subbasin.

2.6 Salt and Nutrient Management Objectives

Compliance with WQOs is critical to achieve the goal of the Recycled Water Policy to increase use of recycled water and to meet the projected recycled water supplies in the 2010 UWMP. The Santa Clara River in the East Subbasin has been identified as an impaired water body and listed in the Clean Water Act Section 303(d) list published by the US Environmental Protection Agency (USEPA) and has established TMDLs. Additionally, the optimal use of recycled water is a basic part of planned long-term water supply. The objectives of the SNMP is to meet WQOs established by the LARWQCB in the 1994 Basin Plan which support the beneficial uses of surface water in the valley and to meet the objectives set forth in the 2008 Integrated Regional Water Management Plan (IRWMP; Kennedy/Jenks, 2008). Those objectives are:

- Basin-wide water quality monitoring
- Water recycling goals and objectives

- Salt and nutrient source identification
- Basin loading/assimilative capacity estimates
- Salt mitigation strategies
- Anti-degradation analysis
- Chemicals of Emerging Concern (CECs; e.g., pharmaceuticals, personal care products, and endocrine disrupters)

The Task Force was established from among the IRWMG to oversee the development of the SNMP and to report to the IRWMG. When complete, the SNMP will be used to update the IRWMP.

2.7 Regulatory Framework

The current study and preparation of this SNMP is governed and guided by:

- The 2009 SWRCB Recycled Water Policy,
- 1994 Los Angeles Region Basin Plan,
- LARWQCB Resolution No. 04-004,
- DWR Water Plan Update 2009-Bulletin 160-09, Chapter 11
- SWRCB Anti-Degradation Policy (Resolution 68-16), and
- CEQA.

2.8 Stakeholder Roles and Responsibilities

Development of SNMPs by basin stakeholders is intended by the LARWQCB to result in a more holistic approach to basin management. Stakeholders have the opportunity to collectively determine how each basin will be managed in order to meet their operational goals, as well as comply with water quality objectives established to restore and maintain the beneficial use of groundwater.

The LARWQCB states that Stakeholder collaboration and involvement is essential as 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. In preparation of a collaborative effort, the Upper Santa Clara River IRWMG and Task Force have been established to guide the SNMP development. The following Table 2-3 summarizes the IRWMG and the Task Force, and their roles and responsibilities as identified in the updated IRWMP report.

Table 2-3. IRWMG and Task Force Roles and Responsibilities

Agency	Roles and Responsibility	Affiliation
Castaic Lake Water Agency (CLWA)	Wholesale water suppler	IRWMG[1]/Task Force[2]/Stakeholder
City of Santa Clarita	Municipal government that provides open space and land use planning as well as stormwater capture and treatment, and creek restoration within City borders	IRWMG/Task Force/Stakeholder
Los Angeles County Flood Control District (LACFCD)	Provides flood management services within the District's boundaries	IRWMG/ Stakeholder
Newhall County Water District (NCWD)	Provides groundwater and imported water to portions of the City of Santa Clarita and unincorporated communities in Los Angeles County	IRWMG/Task Force/Stakeholder
Rivers and Mountains Conservancy (RMC)	Acquires parks and open space, restores natural parks and open space, provides watershed improvements, and provides low impact recreation improvements within the conservancy area (1,600 square miles in Eastern Los Angeles County and Western Orange County)	IRWMG/ Stakeholder
Santa Clarita Water Division of CLWA (SCWD)	Provides groundwater and imported water to portions of the City of Santa Clarita and unincorporated communities in Los Angeles County	IRWMG/Task Force/Stakeholder
Santa Clarita Valley Sanitation District of Los Angeles County (SCVSD)	Provides wastewater treatment for the City of Santa Clarita and unincorporated communities in Los Angeles County	IRWMG/Task Force/Stakeholder
Valencia Water Company (VWC)	Provides groundwater, imported water, and recycled water to portions of the City of Santa Clarita and unincorporated communities in Los Angeles County	IRWMG/Task Force/Stakeholder

[1]Upper Santa Clara River Integrated Regional Water Management Group
[2]Salt and Nutrient Management Plan Task Force

The following table is a summary of the Stakeholders in the East Subbasin, and their roles and responsibilities.

Table 2-4. East Subbasin Stakeholder Roles and Responsibilities

Stakeholder	Mission Statement
Municipal and County Government Agencies	
City of Santa Clarita	To deliver the best and most cost-efficient municipal service to the citizens and City Council of Santa Clarita.
County of Ventura	To provide public infrastructure, services, and support so that all residents have the opportunity to achieve a high quality of life and enjoy the benefits of a healthy economy.
Los Angeles County Department of Public Works (LACDPW)	Enhancing our communities through responsive and effective public works services.
Los Angeles County Supervisor's Office	To support the Board of Supervisors in serving the people of Los Angeles County.
Los Angeles County Department of Regional Planning	To improve the quality of life through innovative and resourceful physical and environmental planning, balancing individual rights and community needs.
Water Suppliers/Wastewater Management/Special Districts	
CLWA	A public agency providing reliable, quality water at a reasonable cost to the Santa Clarita Valley.
LACFCD	Enhancing our communities through responsive and effective public works services.
SCWD	A public agency providing reliable, quality water at a reasonable cost to the Santa Clarita Valley.
SCVSD	To provide environmentally sound, cost-effective wastewater management, and in the process, convert wastewater into recycled water, a valuable water resource for the Santa Clarita Valley.
NCWD	To provide quality water service at a reasonable cost by practicing careful stewardship of natural resources, utilizing innovative measures, and providing a quality working environment.
VWC	To deliver a dependable supply of safe reliable water to existing and future customers at a reasonable cost.
Business Organizations	
Building Industry Association (BIA)	To promote and protect the industry to ensure our members' success in providing homes for all Southern Californians.
Newhall Land and Farming Company	To provide a better quality of life for those who live and work in the master planned communities of Valencia and Newhall Ranch.
Atkins Environmental	To be a resource for environmental, health & safety issues. To provide sparkling service with professionalism, honesty, integrity, trust, and respect. To seek to balance the demand for resources with the needs of the community.
Recreational and Open Space Entities	
Rivers and Mountains Conservancy	To preserve open space and habitat in order to provide for low-impact recreation and educational uses, wildlife habitat restoration and protection, and watershed improvements within our jurisdiction.
Nature Conservancy	To preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.

Stakeholder	Mission Statement
Los Angeles County Department of Parks and Recreation	To provide the residents and visitors of Los Angeles County with quality recreational opportunities that promote a healthy lifestyle and strengthen the community through diverse physical, educational, and cultural programming; and to enhance the community environment by acquiring, developing, and maintaining County parks, gardens, golf courses, trails, and open space areas.
Mountains Recreation and Conservation Authority	To acquire, develop, and conserve additional park and open space lands with special emphasis on recreation and conservation projects, the protection and conservation of watersheds, and the development of river parkways.
Regulatory and Resource Agencies- State and Federal	
California Department of Fish and Game (CDFG)	To manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public.
California Department of Transportation (Caltrans)	Improve mobility across California.
California Department of Water Resources (DWR)	To manage the water resources of California in cooperation with other agencies, to benefit the State's people, and to protect, restore, and enhance the natural and human environments.
Los Angeles Regional Water Quality Control Board (LARWQCB)	To preserve and enhance the quality of California's water resources for the benefit of present and future generations.
Natural Resources Conservation Service (NRCS)	"Helping People Help the Land," by providing products and services that enable people to be good stewards of the Nation's soil, water, and related natural resources on non-Federal lands.
US Army Corps of Engineers (USACE)	To provide quality, responsive engineering services to the nation including: planning, designing, building, and operating water resources and other civil works projects (Navigation, Flood Control, Environmental Protection, Disaster Response, etc.); designing and managing the construction of military facilities for the Army and Air Force (Military Construction); providing design and construction management support for other Defense and federal agencies (Support for Others).
US Fish and Wildlife Service (USFWS)	To work with others to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.
US Forest Service- Angeles National Forest	To sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations.
Non-Profit Organizations and Other Stakeholders	
Acton Town Council	To provide a stronger local voice in community development, and to try to ensure the continuation of Acton's country lifestyle.
Association of Water Agencies of Ventura County	To develop and encourage cooperation among entities for the development, protection, conservation and improvement of the total water resources for Ventura County.
Agua Dulce/Acton Country Journal	To be a resource for existing, new, and future residents of the Agua Dulce/Acton community.

Stakeholder	Mission Statement
Agua Dulce Town Council	To serve as a common meeting place for the free expression of all views and for the coming together of diverse opinions into a consensus; to discuss issues concerning Agua Dulce, to invite participation by the public, civic, and private organizations; to serve as Agua Dulce's representatives and to speak on behalf of the community; to review public and private proposals that may affect the community; to neither support nor oppose any political party or candidate.
Castaic Area Town Council	To act as an advisory board presenting community points of view to the Los Angeles County Board of Supervisors and various County departments such as Regional Planning, Public Works, and Parks & Recreation.
Santa Clarita Organization for Planning the Environment	To promote, protect, and preserve the environment, ecology, and quality of life in the Santa Clarita Valley.
Santa Clarita Valley Well Owners Association	Preserve our present and future water supply by working together to promote sustainable water consumption by all stakeholders in the aquifer's resource; protect our rights as private well owners and our collective parity as stakeholders in the management of the areas' subterranean water resources; educate our members in matters relative to water rights, quality, resources, historical data and any other information relevant to owning and maintaining a private water well system; advocate on behalf of the rights of private well owners collectively and individually.
University of California Cooperative Extension	The welfare, development, and protection of California agriculture, natural resources, and people.
Ventura County Resource Conservation District (VCRCD)	To provide assistance to help both rural and urban communities to conserve, protect, and restore natural resources.

2.9 Process to Develop Salt and Nutrient Management Plan

This SNMP was developed through the following essential steps:

- Initial meeting with SNMP Task Force held on October 17, 2011,
- Collection and synthesis of data,
- Determination of ambient water quality,
- Determination and quantification of sources of salt and nutrients,
- Review of existing East Subbasin water quality monitoring efforts,
- Development of basin-wide salt and nutrient monitoring program,
- Development of salt and nutrient management strategies,
- Preparation of anti-degradation analysis, and

- Preparation of implementation plan for salt and nutrient management.

Discussion, inputs, comments, and suggestions have been received from the Stakeholders throughout the process to ensure that future management of salt and nutrient loadings in the basin will be managed collectively.

Chapter Summary

The Upper Santa Clara River Integrated Regional Water Management Group (IRWMG), which is comprised of Castaic Lake Water Agency (CLWA), City of Santa Clarita, Santa Clarita Water Division (SCWD), Los Angeles County Flood Control District (LACFCD), Newhall County Water District (NCWD), San Gabriel & Lower Los Angeles Rivers and Mountains Conservancy, Santa Clarita Valley Sanitation District (SCVSD) and Valencia Water Company (VWC), have created a Salt and Nutrient Management Plan (SNMP) Task Force (Task Force) to prepare a SNMP for the Santa Clara River Valley East Groundwater Subbasin (East Subbasin). The SNMP includes an evaluation of the salt and nutrient loads from the various sources to the groundwater system for each of the six groundwater management zones and will provide the framework for water management practices and strategies to reduce salt and nutrient loads from within the watershed. This framework includes the use of recycled water to supplement future water supply. Through the use of the SNMP, the IRWMG hopes to ensure protection of beneficial uses in the East Subbasin, and allow for long-term sustainability of groundwater quality and resources consistent with the Basin Plan.

3.0 STUDY AREA

The East Subbasin, part of the larger Santa Clara River Valley Groundwater Basin, encompasses approximately 66,200 acres (103 square miles)[3] in the northwestern portion of Los Angeles County, California. It is bound to the north by the Piru Mountains, to the south by the Santa Susana Mountains, to the south and east by the San Gabriel Mountains, and to the west by the outcrops consisting of the Modelo and Saugus Formations. The main surface drainage features include the Santa Clara River, Bouquet Creek, and Castaic Creek.

3.1 Topography and Physiography

Elevations range from approximately 800 feet above mean sea level (ft amsl) on the valley floor, to approximately 6,500 ft amsl in the San Gabriel Mountains. The headwaters of the Santa Clara River are at an elevation of approximately 3,200 ft amsl at the divide that separates the Upper Santa Clara River Watershed from the Antelope Valley to the east (see Figure 1). The Santa Clara River flows westward, towards the Pacific Ocean.

3.2 Climate, Temperature, Precipitation, and Evaporation

The 2008 IRWMP (Kennedy/Jenks, 2008) describes the climate within the watershed as follows:

> *The watershed is characterized by an arid climate. Summers are dry with temperatures as high as 110°F. Winters are somewhat cool with temperatures as low as 20°F.*

Intermittent periods of less than average precipitation are typically followed by periods of greater than average precipitation in a cyclical pattern, with each wetter or drier period typically lasting from one to five years. The long-term average precipitation is 18.24 inches (1960-2011), as shown on inset Figure 3-1 for the Newhall 32°C gage. The National Climatic Data Center (NCDC) and LACDPW have maintained records for the Newhall-Soledad 32°C gage since 1931. In general, periods of less than average precipitation are longer and more moderate than periods of greater than average precipitation.

The periods from 1971 to 1976, 1984 to 1991, and 1999 to 2003 have been drier than average, while the periods from 1977 to 1983 and 1992 to 1996 have been wetter than average (see inset Figure 3-1). Slightly higher than average precipitation fell in 2004, with precipitation totaling approximately

[3] DWR Bulletin 118 (2006c)

23 inches; approximately five inches above average. These wet conditions that began in late 2004 continued into early 2005. Significant storm events in January 2005 produced over 13 inches of measured precipitation, or more than 70% of average annual precipitation in the first month of the year. Significant storm events continued in February, resulting in nearly 17 inches of additional measured precipitation, or 93% of average annual precipitation. In total, 2005 had approximately 37 inches of measured precipitation, or slightly more than 200% of long-term average precipitation. Both 2006 and 2007 were extremely dry years, with an annual precipitation in 2006 of less than 14 inches, and less than one inch of precipitation measured at the Newhall-Soledad gage in 2007. According to LSCE (2010), the dry conditions that began in 2006 persisted through 2009. 2010 was an above average year (125% of normal) with a total of 24.3 inches of precipitation. It should be noted that almost half of that amount came in the last quarter of the year, with 8.6 inches in December. Early year precipitation in 2011 was approximately 11.6 inches through March, or close to long-term average for that part of the year. The cumulative departure from the mean annual precipitation plot shown on inset Figure 3-1 below indicates that average rainfall was 18.2 inches from 1960 through 2011.

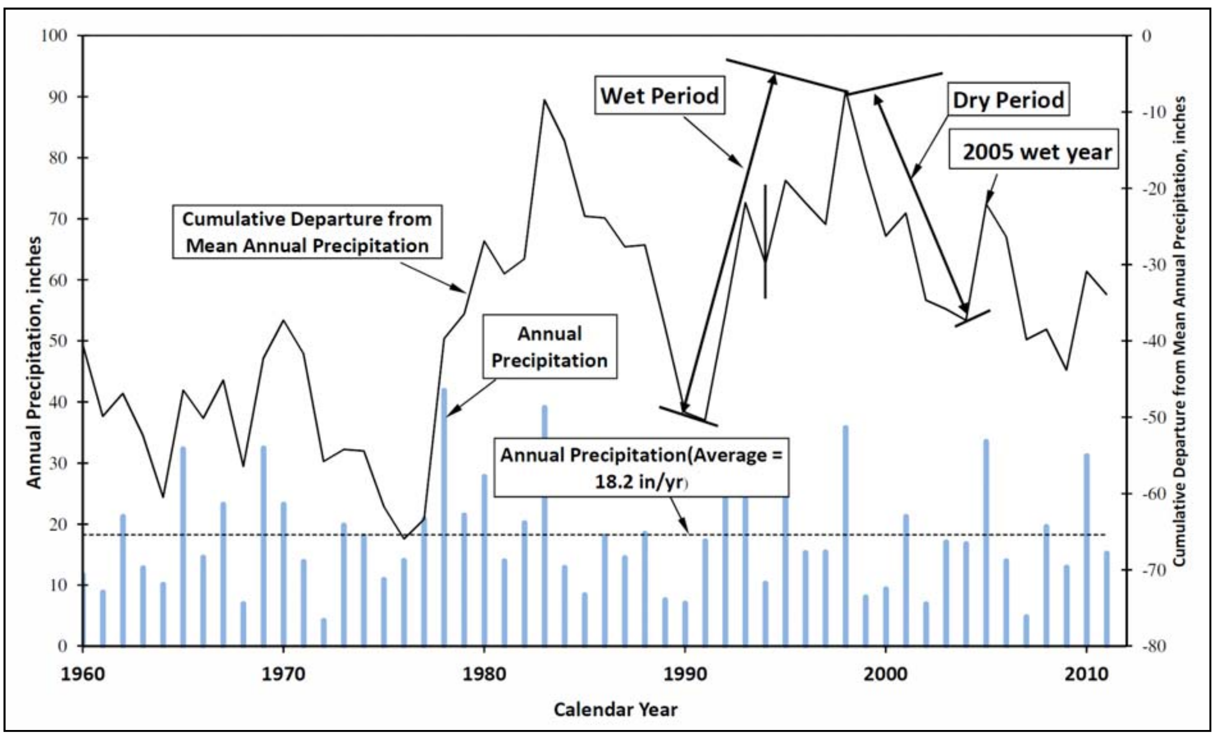

Figure 3-1. Annual Precipitation and Cumulative Departure from the Mean Annual Precipitation Newhall 32°C – Newhall California (1960-2011)

The closest active evaporation station to the East Subbasin is located in Bakersfield, California. From 1958 to 2010, the average monthly evaporation from the Class A Pan in the irrigated pasture environment ranged from 1.35 inches per month (December) to 9.94 inches per month (July). The average total annual evaporation was 65.11 inches for this period. A shorter record available for the Castaic Dam headquarters for the period 1968 through 1978 indicated an annual average evaporation of 81 inches for this period. Currently, pan evapotranspiration (ETo) is measured at the CLWA California Irrigation Management Information System (CIMIS) station located at the CLWA headquarters and was included as part of the data gathering and analysis.

3.3 Land Cover and Land Use

3.3.1 Land Cover

The land surface in the East Subbasin is covered with native vegetation in slopes and drainages, residential and commercial properties, transportation corridors, farm areas, the undeveloped Santa Clara River and tributary drainages, engineered flood control channels, and school and recreational facilities. The distribution of land cover is shown on Figure 2 (SCAG, 2008).

3.3.2 Land Use

The 2008 IRWMP (Kennedy/Jenks, 2008) describes land use in the East Subbasin area as follows:

> *Major existing land use categories identified in the 2004 Santa Clarita Valley General Plan Technical Background Report encompass most of the Region and have been compared with the land use categories of the Los Angeles County General Plan and the City of Santa Clarita General Plan. The categories include:*
>
> - *Residential: Residential uses include a mix of housing developed at varying densities and types. Residential uses in the Region include single-family, multiple-family, condominium, mobile home, low-density "ranchettes," and senior housing.*
> - *Commercial/Office: This category includes commercial uses that offer goods for sale to the public (retail) and service and professional businesses housed in offices (e.g., doctors, accountants, regional offices/headquarters, office complexes, etc.). Retail and commercial businesses include those that serve local needs, such as restaurants, neighborhood markets and dry cleaners, and those that serve community or regional needs, such as entertainment complexes, auto dealers, and furniture stores.*
> - *Industrial: The industrial category includes heavy manufacturing and light industrial uses found in business, research, and development parks. Light industrial activities include warehousing and some types of assembly work. This category also includes oil and gas and mineral extraction and wholesaling.*

- *Public Services/Special Use Facilities: Government buildings, libraries, schools, and other public institutions are found in this category. Uses in this category support the civic, cultural, and educational needs of residents. Special uses such as correctional facilities are also grouped in this category.*
- *Transportation, Communication, and Utilities: This category includes freeways and major roads, railroads, park and ride lots, truck terminals, airports, communication facilities, electrical power and natural gas facilities, solid waste and liquid waste disposal, transfer facilities, and maintenance yards.*
- *Open Space: This category encompasses the Angeles National Forest and land used for agriculture, private and public recreational open spaces, and local and regional parks. Recreational areas, including golf courses and water bodies and water storage, and some agricultural use within unincorporated Los Angeles County areas also contribute to open space uses in the Region.*

Table 3-1 below summarizes the land area in acres occupied by specific land use types in each groundwater subunit/management zone and provides the total acreage by land use type for the entire East Subbasin. The land use types and areas are used to evaluate both historical and current salt and nutrient loads, as discussed in Section 7 of this SNMP.

Table 3-1. Land Use Area by Groundwater Subunit/Management Zone

Management Zone (MZ)	Groundwater Subunit	Agricultural/ Parks/Golf Courses	Commercial/ Industrial	Residential	Open Space	Impervious	Water Bodies	Total Acres of MZ
		[acres]						
1	Santa Clara-Mint Canyon	476	2,574	4,525	39,842	18	0	**47,435**
2	Placerita Canyon	5	339	243	2,698	0	0	**3,286**
3	South Fork	269	1,472	1,453	13,457	78	0	**16,729**
4	Santa Clara-Bouquet and San Francisquito Canyons	542	2,567	2,156	60,037	65	136	**65,503**
5	Castaic Valley	840	3,357	973	27,801	21	527	**33,520**
6	Saugus Formation	521	4,127	4,789	23,543	26	0	**33,006**
Total Acres of Land Use		**2,653**	**14,437**	**14,140**	**167,377**	**208**	**663**	**199,477**

Table 3-2 below provides a summary of the percent of land use by land use type for each groundwater subunit/management zone and provides a total percentage of land use type for the entire East Subbasin. The greatest area of land use in the East Subbasin is open space (84%) followed by commercial/industrial (7%) and residential (7%).

Table 3-2. Land Use Percent by Groundwater Subunit/Management Unit

Management Zone (MZ)	Groundwater Subunit	Agricultural/ Parks/Golf Courses	Commercial/ Industrial	Residential	Open Space	Impervious	Water Bodies
1	Santa Clara-Mint Canyon	1%	5%	10%	84%	0.04%	0%
2	Placerita Canyon	0.16%	10%	7%	82%	0%	0%
3	South Fork	2%	9%	9%	80%	0.46%	0%
4	Santa Clara-Bouquet and San Francisquito Canyons	1%	4%	3%	92%	0.10%	0.21%
5	Castaic Valley	3%	10%	3%	83%	0.06%	2%
6	Saugus Formation	2%	13%	15%	71%	0.08%	0%
Land Use Percent of Total Subbasin Area		**1%**	**7%**	**7%**	**84%**	**0.10%**	**0.33%**

3.4 Land Use Policy

According to the IRWMP, there are two jurisdictions: 1) the City of Santa Clarita, and 2) the unincorporated areas of Los Angeles County, within the Santa Clara River Watershed. The "One Valley, One Vision" (OVOV) is a joint effort between the County, the City of Santa Clarita, and Santa Clarita Valley residents and businesses to create a single vision and defining guidelines for the future growth of the Valley, and the preservation of natural resources. The result of the OVOV will be a long-range General Plan document and Environmental Impact Report (EIR) for the entire Valley Planning Area. The City of Santa Clarita has adopted the OVOV plan, and approval by the County of Los Angeles is pending.

3.5 Water Use by Land Use

Water is used in the East Subbasin to supply residential (domestic), commercial/office, industrial, public services/special use facilities such as government buildings, libraries, schools, and other public institutions, transportation, communication, and utilities, open space, or irrigated acreage. Impervious areas are associated with several land uses including parking lots, roadways, paved areas, and areas of concrete which are included in residential, commercial, and industrial developments.

Water supply is provided by either groundwater wells or treated SWP water provided to individual water purveyors and delivered through each purveyor's water system. The pathway by which water initially enters or reenters the groundwater systems will determine the salt load it will contribute. As an example, in an area that is unsewered, water may be provided to a residence via the local purveyor water system or by a private well. The water quality of the water entering the residence will be that of the local purveyor and/or the groundwater. The water used in the house either by washing or through toilets or showers will flow to a septic system or leach field and infiltrate to the groundwater system – carrying with it salt and nutrients such as total dissolved solids (TDS) and nitrates. In contrast, water exiting a residence connected to a sewer system will eventually take on the water quality of the discharge from the wastewater treatment plant and enter the groundwater system as applied recycled water or discharged as recycled water to the Santa Clara River. Land use type and the form water enters the groundwater system dictates the salt and nutrient load that is carried into the system.

Table 3-3 below summarizes how water enters the groundwater system based on land use. Impervious areas are included within residential, commercial/office, industrial, and transportation corridors. Impervious areas will result in the run-off of precipitation to storm drains, which in turn is discharged by permit into surface water drainages to percolate back into the groundwater system.

Table 3-3. Water Use by Land Use Type

Water Use	Land Use						
	Residential	Commercial/ Office	Industrial	Public Buildings	Transportation Corridors	Open Space	Irrigated Land
Septic Discharge	X						
Applied Water	X	X	X	X	X		X
Stream Leakage						X	
Percolation from Precipitation	X	X	X	X	X	X	X

3.6 Salt and Nutrient Sources Contribution to the Study Area

Salt loading occurs as a result of particular types of water use associated with each land use. Section 7 of this SNMP will discuss specific salt loading factors based upon the water use for specific land use within the management zones.

All management zones will experience salt loading from precipitation that falls upon open-space areas as well as on landscaped areas of residential (domestic), commercial, industrial, transportation corridors, and other structures with landscaped areas. Only areas outside sewered areas will incur salt loads from septic discharge. Management zones will receive salt from adjacent upgradient management zones (or in the case of Management Zone 1, from Acton Subbasin) as groundwater flows into the management zone from the upgradient direction. Those management zones that have surface water will receive salt and nutrients from the surrounding surface water drainage in the form of surface water percolating into the subsurface. The East Subbasin has a unique situation in that the Saugus Formation Aquifer, which underlies all of the alluvial groundwater subunits/management zones recharges both the overlying alluvium and provides surface water to the Santa Clara River as rising water. The types of inflow supplying salt and nutrient loading to each management zone are shown in Table 3-4 below.

Table 3-4. Salt and Nutrients Inflow to Management Zones by Water Inflow Term

Subunit Name	Santa Clara - Mint Canyon	Placerita	South Fork	Santa Clara - Bouquet and San Francisquito Canyon	Castaic	Saugus
Management Zone (MZ) No.	**1**	**2**	**3**	**4**	**5**	**6**
Water Inflow Term						
Deep Percolation from Precipitation	X	X	X	X	X	X
Septic Water	X	X	X	X	X	X
Applied Water	X	X	X	X	X	X
Stream Leakage	X	X	X	X	X	X
Upward Leakage from Saugus	X	X	X	X	X	
Subsurface Inflow From Acton Subbasin	X					
Subsurface Inflow From MZ-1				X	X	
Subsurface Inflow From MZ-2			X			
Subsurface Inflow From MZ-3				X		
Subsurface Inflow From MZ-4					X	
Castaic Dam Underflow					X	
Downward Leakage From all MZs						X

Chapter Summary

The East Subbasin located in northwest Los Angeles County, is part of the larger Santa Clara River Valley Groundwater Basin. The main surface drainage features include the Santa Clara River, Bouquet Creek, and Castaic Creek. The area is arid to semi-arid with a long-term (1960-2011) average annual precipitation of 18.24 inches. Land use in the area includes residential, commercial/office, industrial, public buildings, transportation corridors, open space, and irrigated land. Land use type, the water use associated with it, and the form water enters the groundwater system dictate the salt and nutrient load that is carried into each management zone through activities such as irrigation, septic leakage, permitted discharge, percolation of precipitation or surface water, rising water from the lower Saugus Formation, and underflow from upgradient management zones or basins. Therefore, land use types and area as well as water inflow terms were used to evaluate both historical and current salt and nutrient loads for the SNMP.

4.0 GEOLOGY

4.1 Regional Geology

The East Subbasin lies within the southeastern portion of a geologic sedimentary structural basin identified as the Ventura Basin. The Ventura Basin is located within the Transverse Ranges Geomorphic Province, an east-west trending series of steep mountain ranges and valleys. The east-west structure of the Transverse Ranges is oblique to the normal northwest trend of coastal California, hence the name "Transverse". The province extends offshore to include San Miguel, Santa Rosa, and Santa Cruz Islands. Its eastern extension, the San Bernardino Mountains, has been displaced to the south along the San Andreas Fault.

The Ventura Basin is an east-west trending elongated sedimentary trough which is folded and faulted. This basin contains sedimentary rocks that range in age from Eocene (56 to 34 million years before present; b.p.) to Holocene (<11,000 years b.p.). The sedimentary sequences have been faulted and folded and are underlain by a pre-Cretaceous basement complex composed of plutonic and metamorphic rock. Although sedimentary rocks are present, much of the East Subbasin drainage area is largely non-water bearing, as the majority of the sedimentary rocks yield very little water to wells (Winterer and Durham, 1962).

The upper portion of the watershed area is mountainous and is underlain by igneous and sedimentary rocks ranging in age from Jurassic (208 million years b.p.) to Pliocene (5 million years b.p.). The igneous rock is primarily granite and yields only small quantities of water to wells from cracks and joints. The sedimentary rock is mainly well-consolidated siltstone, mudstone, sandstone, and conglomerate which yields only small quantities of water to wells from scattered intermittent moderately consolidated zones. The non-water-bearing rocks surround the water-bearing deposits in the study area to form a cup-like basin. The water-bearing deposits that fill the basin are as much as 7,000 ft thick near Castaic Junction (Winterer and Durham, 1962).

4.2 Study Area Geology

The significant geologic units for this study area are the Holocene alluvium, Pleistocene terrace deposits, and Plio-Pleistocene Saugus Formation. A brief description of these geologic units is provided below. The distribution of geologic units in the East Subbasin is shown on Figure 3.

4.2.1 Alluvium

Holocene-age alluvium consists of unconsolidated, poorly bedded, poorly sorted to well sorted sand, gravel, silt, and clay with cobbles and boulders. These deposits are thickest below the channel of the

Santa Clara River, thinning laterally away from the channel, and east and west of the community of Acton (RCS, 1990). The maximum reported thickness is approximately 240 ft and specific yield is estimated to range from approximately nine to 19 percent (RCS, 2002).

4.2.2 Terrace Deposits

Pleistocene-age terrace deposits consist of crudely stratified, poorly consolidated, weakly cemented, gravel, sand and silt (RCS, 2002). They can be found on the low-lying flanks of the foothills and upper reaches of the Santa Clara River tributaries. Terrace deposits attain a maximum thickness of 200 ft near Saugus, Agua Dulce, and Acton (RCS, 1990). These deposits generally lie above the water table and likely have limited ability to supply groundwater to wells (RCS, 2002).

4.2.3 Saugus Formation

The late Pliocene- to early Pleistocene-age Saugus Formation consists of as much as 8,500 ft of poorly consolidated, weakly indurated, poorly sorted, sandstone, siltstone, and conglomerate. The lower portion of the Saugus Formation is termed the “Sunshine Ranch Member”, which consists of as much as 3,500 ft of sand and silt deposited in a brackish marine to terrestrial environment (RCS, 2002). Groundwater is not widely produced from this member for municipal and irrigation uses because well yield is typically low, approximately 100 gallons per minute (gpm) and the groundwater can be brackish (RCS, 2002). The upper member of the Saugus Formation contains lenses of conglomerate and sandstone interbedded with sandy mudstone deposited in a terrestrial environment (RCS, 2002). Wells in the upper member typically have higher yields, reaching more than 3,000 gpm, and better water quality than the Sunshine Ranch Member (RCS, 2002). The maximum depth to the base of fresh water is approximately 1,500 ft northeast of the San Gabriel Fault, 5,500 ft between the San Gabriel and Holser Faults, and approximately 5,000 ft southwest of the Holser Fault (RCS, 2002). Specific yield is estimated to range from approximately five to eight percent (RCS, 2002).

4.2.4 Bedrock Complex

In the East Subbasin, the basement complex rocks consisting primarily of Mesozoic granite form outcrops on the south side of the San Gabriel Fault, while pre-Cambrian metamorphic rocks, gabbro, and anorthosite are exposed at the surface on the north side of the fault. The basement rock is considered to be non-water bearing, with only limited volumes of water in joints and fractures.

4.2.5 Faults and Folds

Robson (1972) reports that two major faults cross the water-bearing materials in the basin: the San Gabriel Fault, which trends northwestward; and the Holser Fault, which trends eastward. The San

Gabriel Fault is a right-lateral fault and is the major structural feature in the East Subbasin. The San Gabriel Fault crosses the Santa Clara River near the community of Saugus. There is evidence that the San Gabriel Fault has produced approximately 2,300 ft of vertical displacement in the base of the Saugus Formation near the community of Saugus. Right-lateral displacement of approximately 15 to 25 miles has occurred along the fault after late Miocene time (Winterer and Durham, 1962). The Holser Fault is a reverse fault[4]. Maximum vertical displacement at the base of the Saugus Formation from this fault is approximately 1,000 ft, and the fault is inferred to intersect the San Gabriel Fault just east of Saugus. According to DWR, the San Gabriel and Holser Faults cross through the East Subbasin but do not offset the Holocene age alluvial deposits; therefore, groundwater moving through the alluvium is reportedly not affected by these faults (DWR, 2003).

Along the trend of the Santa Clara River in the East Subbasin, the sedimentary rocks are folded into a gentle north-south trending syncline[5], with the axis of the syncline located near Castaic. West of Castaic, the sedimentary beds dip to the east. East of Castaic, the beds dip to the west. South of the Santa Clara River, the sedimentary rocks form a northward-dipping homocline[6]. North of the Santa Clara River, the sedimentary rocks are faulted and folded into east-west trending anticlines and synclines.

Chapter Summary

The East Subbasin lies within the southeastern portion of a geologic sedimentary structural basin identified as the Ventura Basin, which lies within the Transverse Ranges Geomorphic Province. The east-west trending elongate sedimentary trough has been folded and faulted by the presence of faults such as the San Gabriel Fault and Holser Fault, which cross the basin. Water-bearing materials in the basin consist of Holocene-age alluvium which has a maximum thickness of approximately 240 ft beneath the Santa Clara River Channel, the late Pliocene- to early Pleistocene-age Saugus Formation which can reach thicknesses of 8,500 ft, and Pleistocene-age terrace deposits found on the low-lying flanks of the foothills and upper reaches of the Santa Clara River tributaries. This latter unit has limited water-bearing ability. The bedrock complex in the East Subbasin consists of Mesozoic granite, pre-Cambrian metamorphic rocks, gabbro and anorthosite, and is considered to be predominantly non-water-bearing.

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4 A reverse fault is defined as a geologic fault in which the hanging wall has moved upward relative to the footwall. Reverse faults occur where two blocks of rock are forced together by compression.

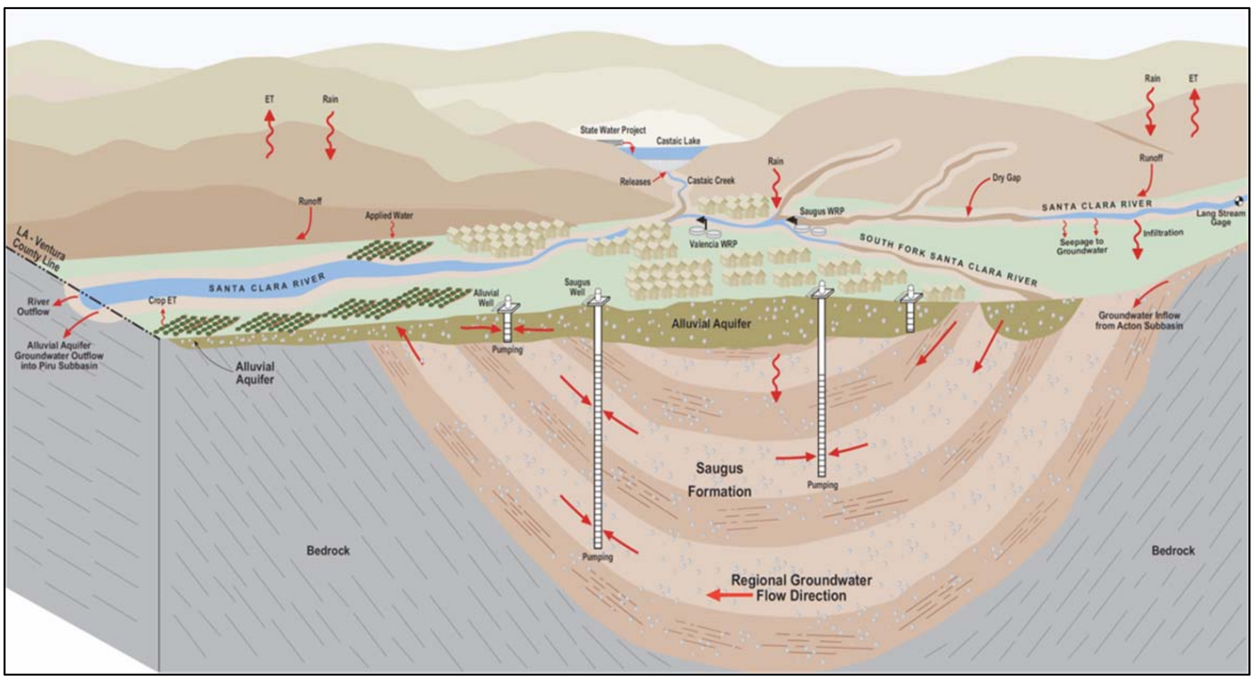
5 A syncline is defined as a fold in rocks in which the rock layers dip inward from both sides toward the axis.

6 A homocline is defined as a layer of stratified rock (as one limb of an anticline or syncline) in which the strata dip consistently in one general direction though the angle of dip may vary greatly from place to place.

5.0 GEOHYDROLOGY

5.1 Hydrologic Subunits

The East Subbasin lies within the Upper Santa Clara River watershed (see Figure 4), which encompasses approximately 786 square miles within Los Angeles County, approximately 243 square miles within Ventura County, and one square mile within Kern County. The Santa Clara River system originates at Pacifico Mountain in the San Gabriel Mountains, and flows westward for approximately 84 miles to the Pacific Ocean. It is one of the few natural river systems remaining in Southern California. Approximately 90% of the watershed consists of mountains with elevations up to 8,800 ft amsl, while the remaining 10% consists of valleys and coastal plain (VCWPD and LACDPW, 1996). In the Upper Santa Clara River watershed, the principal tributary is Castaic Creek, which has a watershed area of approximately 197 square miles. Tributary watershed areas that feed into the Upper Santa Clara River in the East Subbasin include San Francisquito Canyon, Bouquet Canyon, Mint Canyon, South Fork of the Santa Clara River, and the watershed area above the United States Geological Survey (USGS) Lang Gage. There are two major reservoirs located within the East Subbasin, which include Castaic Lake on Castaic Creek and the Bouquet Reservoir on Bouquet Creek. Figure 4 shows the watershed areas that contribute to surface run-off in the Upper Santa Clara River watershed within the East Subbasin.



Source: Figure C-4 from GSI (2014; see Appendix D)

Figure 5-1. Interaction of Surface and Groundwater in the East Subbasin

Figure 5-1 schematically illustrates the interaction of surface water and groundwater in the East Subbasin. Surface water in the Santa Clara River enters the East Subbasin area near Lang Station at the east end of the subbasin. Surface water flowing into the subbasin percolates into the highly permeable alluvial sediments which underlie the Santa Clara River. Groundwater in the alluvial units percolates farther downward into the Saugus Formation which underlies the alluvium. The geologic structure controls the movement of groundwater in the Saugus Formation; downward in the eastern portion of the subbasin and upwards in the western portion. Groundwater in the Saugus Formation in the western portion of the basin rises into the alluvial portion of the Castaic Subunit, becoming surface water again and flowing westerly out of the East Subbasin. Therefore, percolation of either natural surface water and/or treated wastewater is minimal in the western portion of the subbasin due to rising water. The sections below provide a description of surface and groundwater in the East Subbasin.

5.2 Surface Water

The LARWQCB issued the Basin Plan for the Santa Clara River in 1994, which was designed to preserve and enhance water quality and protect the beneficial uses of water within the region. The Basin Plan divides major surface waters into subcategories for planning purposes which exhibit consistent hydrological, water quality or adjacent land use characteristics. The surface waters of the Upper Santa Clara River within the East Subbasin are designated as Reaches 7, 6, and 5 (see Figure 4). Table 5-1 provides a description of the Santa Clara River Reach designations in the study area

Table 5-1. Santa Clara Reach Designations

Santa Clara River Reach Designation	Reach Description
5 (Blue Cut)	Upstream of the USGS Blue Cut Gaging Station to the West Pier Highway 99 (now the Old Road Bridge)
6 (Highway 99)	Upstream of Highway 99 (now Old Road Bridge) to Bouquet Canyon Bridge
7 (Bouquet Canyon)	Upstream of Bouquet Canyon to Lang Gaging Station

Streamflow in some portions of the Santa Clara River and its tributaries is seasonal and can be of high intensity following rainfall events. Other portions of the river have surface flows year-round. Controlled water conservation releases, recycled water discharges, agricultural runoff, "rising" groundwater and other flows contribute to the year-round flow. The annual mean flow at the Los Angeles-Ventura County line gaging station (the most downstream gage in the East Subbasin – Blue Cut 11108500) has increased from 25,700 acre-ft/yr in 1972 (20 year average) to 35,360 acre-ft/yr in 1988 (36 year average)

(VCWPD and LACDPW, 1996). Average annual stream discharge for the County Line at Piru Gage for the period 1956 to 2010 is 47,400 acre-ft/yr (LSCE, 2012).

As shown on Figure 4, there are several key active gaging stations located within or just outside the East Subbasin. The following will discuss these key gaging stations and how their continued monitoring will support the management of water resources within the East Subbasin. USGS Station 11107745 (Santa Clara River near Lang) serves as the most upstream data point for surface water entering the East Subbasin. USGS Station 11108134 (Castaic Creek below MWD Diversion, below Castaic Lake) provides data of flows released from Castaic Lake into Castaic Creek. USGS Station 11108500 (Santa Clara River at Blue Cut), and USGS Station 11109000 (Las Brisas Bridge) both serve as the most downstream data points within the East Subbasin located approximately at the Los Angeles/Ventura County line. Figure 5-2 below shows the surface flow at Las Brisas Bridge from 1996-2012.

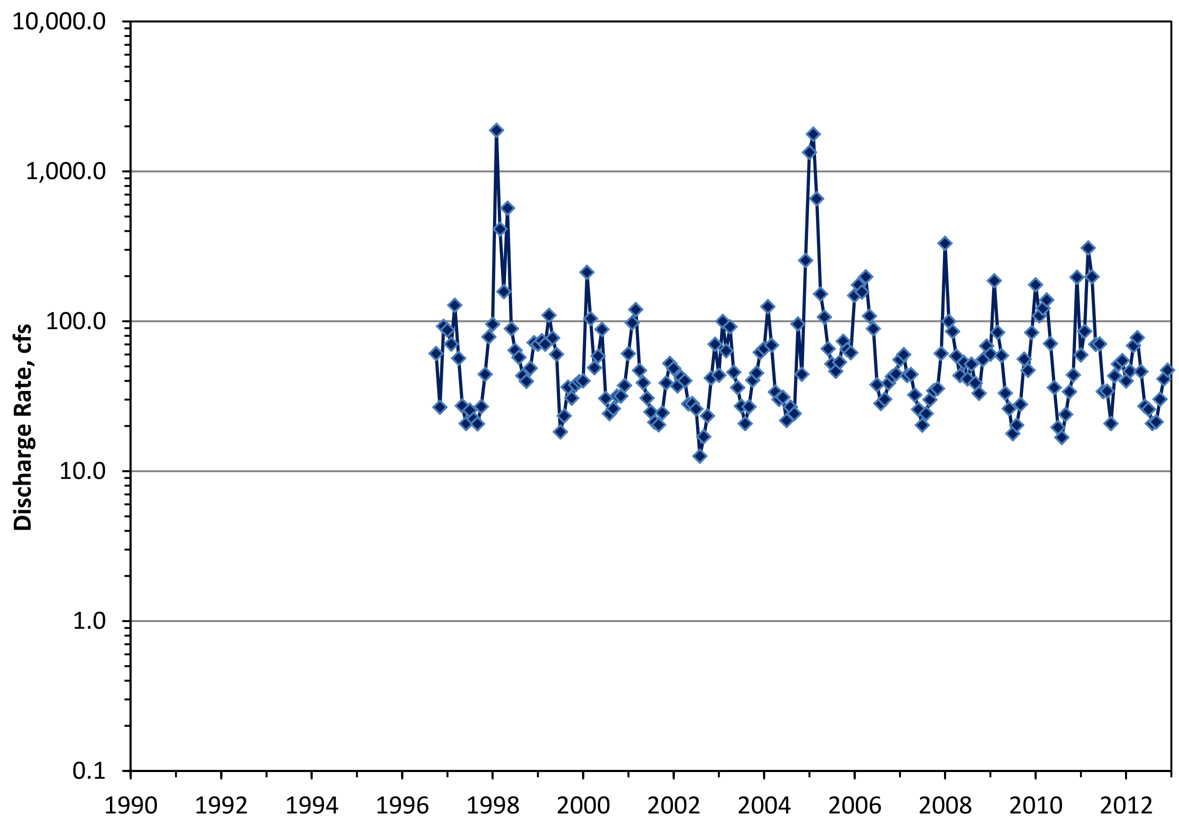


Figure 5-2. Monthly Mean Streamflow for Piru (Las Brisas Bridge) Stream Gage Site: 1996-2012

In addition to the USGS gages, there are three additional stations that are being operated by the LACDPW. These three stations include F377-R (Bouquet Canyon Creek at Urbandale Avenue), F328-B (Mint Canyon Creek at Fitch Avenue), and F92-R (LADPW S29; Santa Clara River at Old Road Bridge). These are also shown on Figure 4. All three LACDPW stations were transferred to the USGS for their operation and maintenance in Water Year 2002. These three gages offer data from upstream surface waters in Bouquet Canyon (F377-R) and Mint Canyon (F328-B), as well as surface water flows and quality within the Santa Clara River between the Saugus and Valencia Water Treatment Plants (WTPs). Figure 5-3 below shows the surface flow at Old Road Bridge from 1990-2012.

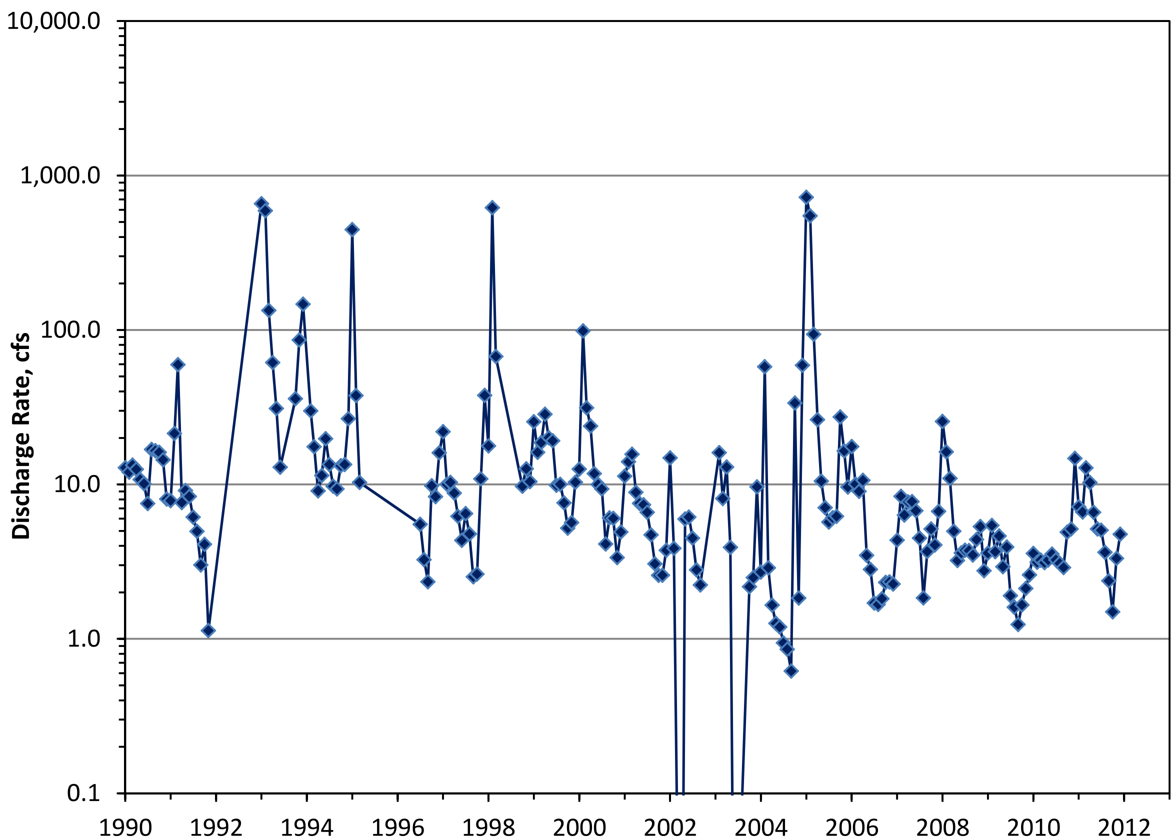


Figure 5-3. Monthly Mean Streamflow for Old Road Bridge Stream Gage Site: 1990-2012

5.3 Groundwater

According to the 2010 UWMP, the sole source of local groundwater for water supply in the Valley is the East Subbasin (Kennedy/Jenks and LSCE, 2011). The Subbasin is comprised of two aquifer systems, the Alluvial Aquifer and the Saugus Formation. The Alluvial Aquifer generally underlies the Santa Clara River and its several tributaries, to maximum depths of approximately 200 ft. Some of the SCWD wells extend to a depth of 250 ft. However, there is uncertainty as to whether the lower portion of the wells are screened in the Alluvial Aquifer. The Saugus Formation underlies practically the entire Upper Santa Clara River area, to depths of at least 2,000 ft. There are also some scattered outcrops of terrace deposits in the Subbasin that likely contain limited amounts of groundwater. However, since these deposits are located in limited areas situated at elevations above the regional water table, and are also of limited thickness, they are of no practical significance as aquifers for municipal water supply. Consequently, these deposits have not been developed for any significant water supply in the Subbasin, and are therefore not included as part of the existing or planned groundwater supplies (DWR, 2006a).

The LARWQCB's Basin Plan divides major groundwater basins into subcategories for planning purposes. These subdivisions exhibit consistent hydrological, water quality or adjacent land use characteristics. The Basin Plan divides the East Subbasin into six management zones. Five of the management zones have the alluvial aquifer as the principal water bearing unit. The five alluvial management zones are: Santa Clara–Mint Canyon (Management Zone 1), Placerita Canyon (Management Zone 2), South Fork, (Management Zone 3), Santa Clara–Bouquet and San Francisquito Canyons (Management Zone 4), and Castaic Valley (Management Zone 5). The Saugus Formation as a discrete aquifer has been designated as Management Zone 6. Figure 5 shows the locations of the management zones. All but Management Zone 6 have been assigned WQOs by the LARWQCB. For SNMP reporting purposes, the LARWQCB management zone designation will be used when referring to specific management zones.

5.4 Aquifer Systems

The Alluvial Aquifer underlies all of the tributary drainages and the Santa Clara River within the East Subbasin. The Pliocene Saugus Formation underlies the alluvial areas, as well as some of the hillside areas adjacent to the alluvium-filled valleys (DWR, 2006c). The following descriptions of both the Alluvial Aquifer and Saugus Formations are from Appendix C of the 2005 UWMP (Black & Veatch et al., 2005).

5.4.1 Alluvial Aquifer

The Alluvial Aquifer system, of Quaternary to Holocene (recent) geologic age, consists primarily of stream channel and flood plain deposits of the Santa Clara River and its tributaries. The aquifer is deepest along the center of the present river channel, with a maximum thickness of approximately 200 ft near the Saugus area. It thins toward the flanks of the adjoining hills and toward the eastern and western boundaries of the East Subbasin and, in the tributaries, becomes a mere veneer in their upper reaches (Black & Veatch et al., 2005). The spatial extent of the Alluvial Aquifer throughout the East Subbasin is illustrated on Figure 5.

Groundwater generally moves westward toward the outlet of the East Subbasin, which is also the outlet of the Upper Santa Clara River Hydrologic Area. Thus, groundwater movement in the alluvium beneath the tributaries is toward their confluence with the Santa Clara River and then westward. From approximately Castaic Junction to Blue Cut, the Alluvium thins and narrows (Geomatrix, 2006; SCVSD, 2008). This configuration forces groundwater to rise, keeping the depth to water at or approaching land surface. The general groundwater flow direction has remained unchanged whether groundwater levels are high or intermittently depressed. The San Gabriel and Holser Faults traverse the East Subbasin, but neither fault measurably affects groundwater levels or flows in the Alluvial Aquifer (DWR, 2006).

Alluvial wells are distributed throughout the East Subbasin along the Santa Clara River and its southwest draining tributaries. The Alluvial Aquifer is the most permeable of the local aquifer systems. Based on well yields and aquifer testing, estimated transmissivity values of 50,000 to 500,000 gallons per day per foot (gpd/ft) of drawdown have been reported for the aquifer, with the higher values occurring where the alluvium is thickest in the center of the Valley and generally west of Bouquet Canyon (Kennedy/Jenks, 2008). The amount of groundwater in storage in the Alluvial Aquifer can vary due to the effects of recharge, discharge, and pumping. The maximum storage capacity has been estimated to be 240,000 acre-ft (DWR, 2006).

The Alluvial Aquifer is capable of rapid recovery of water levels and storage in wet periods. As with many groundwater basins, it is possible to intermittently exceed the long-term average yield for one or more years without long-term adverse effects. In the eastern part of the aquifer, pumping during dry periods results in intermittently lower water levels (LSCE, 2012). However, management of pumping during dry periods limits the lowering of water levels, and normal-to-wet period recharge results in a rapid return of groundwater levels to historic highs.

Historical groundwater data collected from the Alluvial Aquifer over many hydrologic cycles provides assurance that groundwater elevations return to normal in average or wet years following periods during which the groundwater elevations have declined. In addition, high rainfall totals in only one to two years generally will cause water levels within the aquifer to rise quickly, and by a relatively large amount (LSCE, 2012). Such water level response to rainfall is a significant characteristic of permeable, porous, alluvial aquifer systems that occur within large watersheds.

5.4.2 Saugus Formation

The Saugus Formation, of Pliocene to Pleistocene geologic age, has traditionally been divided into two stratigraphic units: the lowermost, geologically older Sunshine Ranch Member, which is of mixed marine to terrestrial (non-marine) origin; and, the overlying, or upper, portion of the Saugus Formation, which is entirely terrestrial in origin (Winterer and Durham, 1962). The Sunshine Ranch Member has a maximum thickness of approximately 3,000 to 3,500 ft in the central part of the Valley (Kennedy/Jenks, 2008); however, due to its marine origin and fine-grained nature, it is not considered to be a viable source of groundwater for municipal or other water supply. Overlying the Sunshine Ranch Member, the upper portion of the Saugus Formation is coarser grained, consisting mainly of lenticular beds of sandstone and conglomerate that are interbedded with lesser amounts of sandy mudstone. These units were deposited in stream channels, flood plains, and alluvial fans by one or more ancestral drainage systems in the Valley. The sand and gravel units that represent aquifer materials in the upper part of the Saugus Formation are generally located between depths of approximately 300 and 2,500 ft. The spatial extent of the Saugus Formation throughout the Basin is shown on Figure 5.

The Saugus Formation is much thicker and more spatially extensive throughout the East Subbasin when compared to the Alluvial Aquifer. It is also significant in terms of groundwater storage and individual well capacity. However, the Saugus Formation has typically lower values of transmissivity (i.e., in the range of 80,000 to 160,000 gpd/ft), with the higher values in the upper portions (Kennedy/Jenks, 2008). The storage capacity of the Saugus Formation has most recently been estimated to be 1.65 million acre-ft (DWR, 2006c) between depths of 300 ft and approximately 2,500 ft (to the base of the Saugus Formation, or to the base of fresh water if deeper than 2,500 ft).

5.5 Groundwater Occurrence, Mixing and Movement

5.5.1 Occurrence of Groundwater

The 2003 Groundwater Management Plan (CLWA, 2003) provides the following description of the occurrence of groundwater in the East Subbasin.

Groundwater in the Alluvial Aquifer is the result of surface water recharge from the Santa Clara River, subsurface flow from the upgradient adjacent management zones, or subbasin (i.e., Management Zone 1 receives underflow from Acton Subbasin), recharge from the Saugus Formation, and mountain front recharge. However, the amount of groundwater in storage can vary considerably because of the effects of recharge, discharge and pumping from the aquifer. Groundwater in the alluvium moves from east to west along the Santa Clara River. Figure 6 shows the average groundwater elevation contours for the management zones for the period 2001 through 2011 as obtained from the GSI Water Solutions (GSI) groundwater model (see Appendix D).

Groundwater recharge to the Saugus Formation comes from the overlying alluvium, areal recharge from precipitation, and to a much lesser extent subsurface inflow from adjacent geologic units. Groundwater in the Saugus Formation generally flows to the north in the southern portion of the East Subbasin, and to the south in the northwest portion of the East Subbasin towards the Santa Clara River. Groundwater in the Saugus Formation recharges the shallow alluvial aquifers as rising water in the western portion of the study area west of the County line, resulting in surface water that flows westward out of the watershed. Groundwater elevations limited to the vicinity of wells extracting groundwater from the Saugus Formation for the period 2001 through 2011 are shown in Figure 7.

5.6 Groundwater Level Trends

Groundwater levels in the East Subbasin are discussed by management zone in the following subsections. Groundwater levels in the management zones have been measured in wells owned and operated by the water purveyors. Well locations are shown on Figure 8 and Figure 9 for the Alluvial Aquifer and Saugus Formation, respectively. Hydrographs of wells representing historical groundwater levels in the management zones are present and discussed below. Groundwater level hydrographs for all wells with available groundwater level data and for each management zone are provided in Appendix A. Figure A-1 shows the location of all wells that have hydrographs in Appendix A.

In general, groundwater levels in the management zones respond to climatic conditions, such as increased rainfall and subsequent groundwater recharge, as well as groundwater pumping from the aquifers. Long-term groundwater level trends indicate that overall, groundwater pumping balances groundwater recharge through both natural and artificial recharge.

5.6.1 Historical and Current Water Levels

Groundwater level hydrographs were prepared for selected wells in each management zone for the period 1990 through 2011. This period includes both wet and dry climactic periods. The plot of cumulative departure from mean annual precipitation for data from the Newhall 32C precipitation station (inset Figure 3-1) shows a wet climatic period occurred between 1990 and 1998 – which was followed by decreased rainfall for the period 1999 through 2004. As shown, Water Year 2004-05 was a wet year that was followed by decreased rainfall from 2005 through 2011. The historical groundwater levels for this period of record correlate well with recorded rainfall.

5.6.1.1 Management Zone 1 (MZ-1) - Santa Clara-Mint Canyon

The groundwater level trend for the NCWD-3 Pinetree well for the period 1984 through 2011 is shown on inset Figure 5-4 below. The well is located in the eastern portion of Management Zone 1. The groundwater levels increase in response to the wet period that occurred between 1990 and 1998. Likewise, the decrease in rainfall between 1998 and 2004 can be correlated with decreasing groundwater levels. The wet period of 2004/2005 is indicated by a sharp increase in groundwater levels filling the groundwater basin, followed by a downward trend through 2010 ending in a slightly upward trend through 2011 (see Figure 8 for the well location).

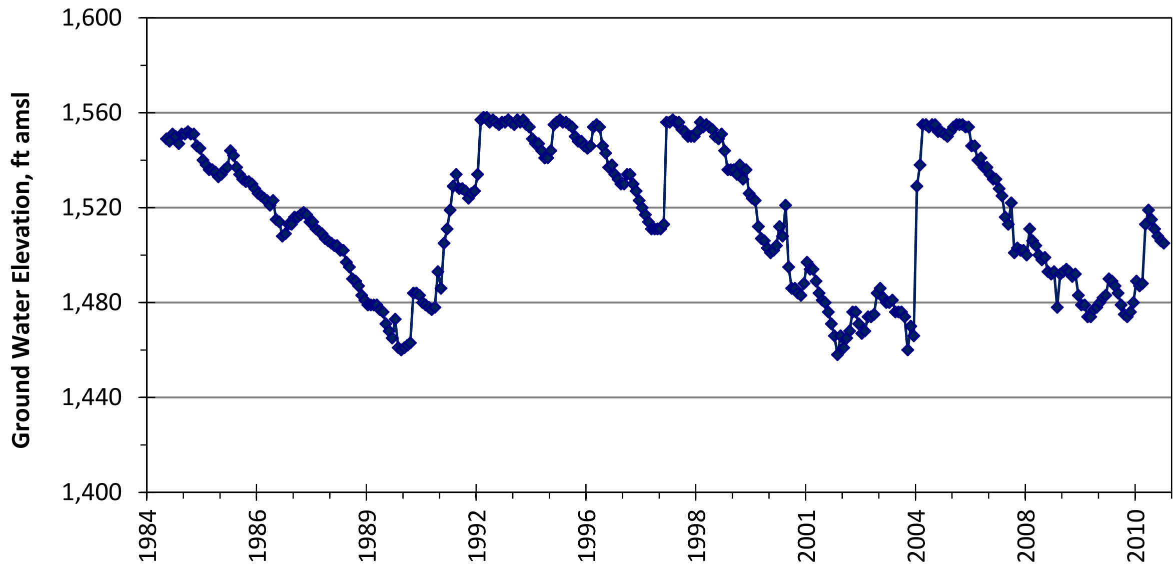


Figure 5-4. Hydrograph NCWD-3 Pinetree – Santa Clara-Mint Canyon

The groundwater level change for the VWC Well-U4 for the period 1956 through 2011, located in the western portion of Management Zone 1, is shown on the hydrograph on Figure 5-5 below. The groundwater levels are consistent with the rainfall record. The groundwater level trend from 1984 through 2011 matches that from the NCWD-Pinetree 3 well, indicating that groundwater levels are directly associated with infiltration of rainfall and that surface water infiltration occurs rapidly.

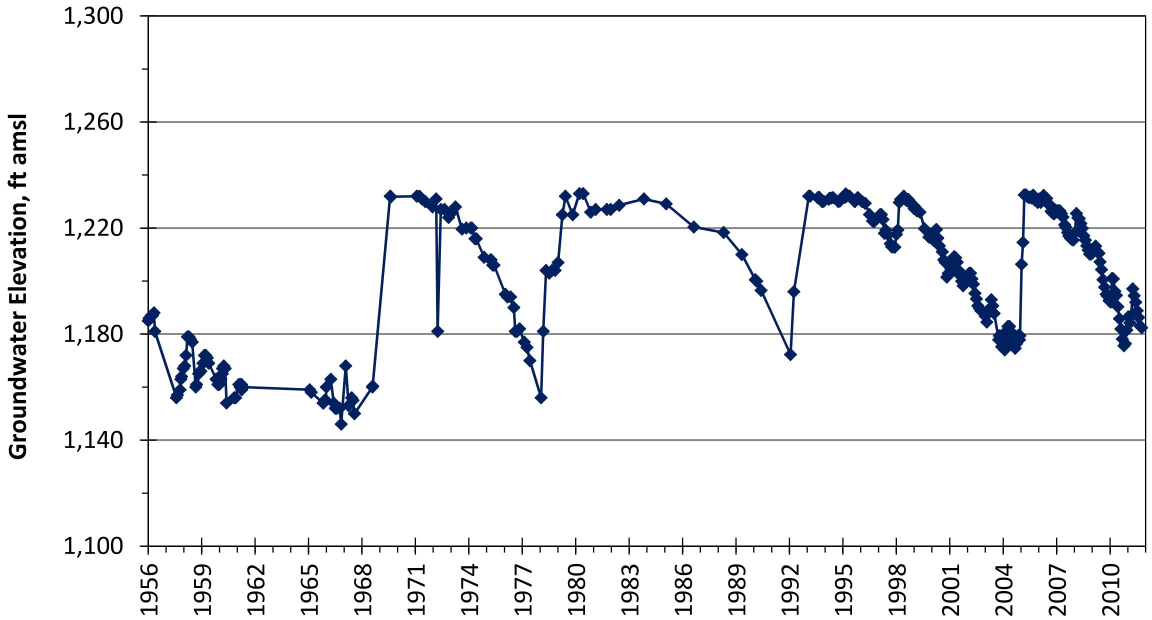


Figure 5-5. Hydrograph of VWC-Well U4 – Santa Clara-Mint Canyon

Hydrographs for additional Management Zone 1 wells for their period of record are presented in Appendix A. Groundwater levels show a similar pattern as the wells shown above for the same periods. Locations of wells in Management Zone 1 are shown on Figure 8.

5.6.1.2 Management Zone 2 (Placerita)

Groundwater level data in Management Zone 2 is currently only available from two LACFCD wells (5912A and 5932). An assessment of groundwater levels is not appropriate for this version of the SNMP since at least three monitoring wells should be located in the management zone to allow collection of data for groundwater level, groundwater gradient and flow direction, and groundwater quality. According to CLWA, the scarcity of wells in Management Zone 2 is due to the fact that the alluvial materials are present only as a thin unit in this management zone and Management Zone 3. In comparison, the alluvial materials that provide groundwater in Management Zone 1, Management Zone 4, and Management Zone 5 can reach several hundred feet in thickness. The monitoring plan discussed in Section 11 includes a recommendation for a new monitoring well. In addition, the status of these wells needs to be confirmed. The well hydrographs are provided in Appendix A.

5.6.1.3 Management Zone 3 (South Fork)

Groundwater level data in the South Fork subunit is available for several LACFCD wells and one VWC well. However, only the status of VWC-Well T2 is known; the status of the LACFCD wells needs to be confirmed. VWC-Well T2 has groundwater measurements from 1954 through 2005. The well is located in the northeastern portion of the management zone east of the South Fork of the Santa Clara River (see Figure 8). The historical groundwater level trends for VWC-Well T2 are shown in Figure 5-6 below, as well as in Appendix A.

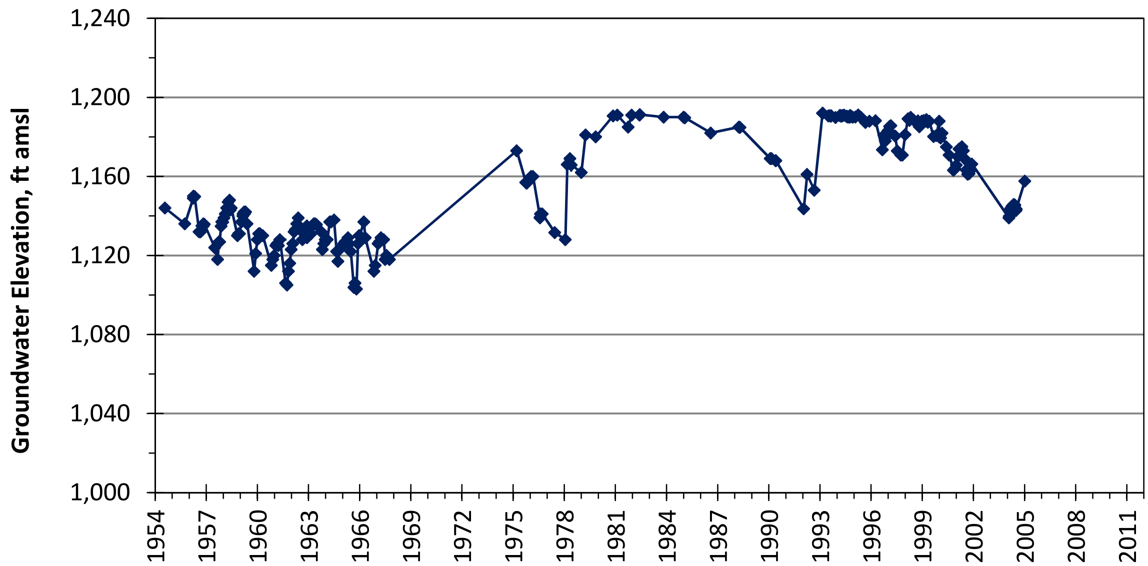


Figure 5-6. Hydrograph of VWC-Well T2 – South Fork

As with Management Zone 2, the scarcity of wells in this management zone is due to the fact that the alluvial materials are thin and therefore have not been targeted for groundwater development. The monitoring plan discussed in Section 11 includes a recommendation for two new monitoring wells in this management zone.

5.6.1.4 Management Zone 4 (MZ-4) - Santa Clara-Bouquet and San Francisquito Canyons

The groundwater levels in SCWD Clark Well for the period 1973 through 2011 are shown on Figure 5-7 below. The Clark well is located in Management Zone 4 within Bouquet Canyon – approximately 2 miles upstream from the confluence of the Santa Clara River and Bouquet Canyon Creek. The groundwater levels in Management Zone 4 differ in that the wetter period of 1990 through 1998 are reflected in rising groundwater levels from 1990 through 1994 followed by a downward trend until 2004. This is likely due to pumping in excess of groundwater recharge for the period 1994 through 1998 in this portion of the management zone. However, recovering groundwater levels are clearly indicated as a result of the wet 2004/2005 season.

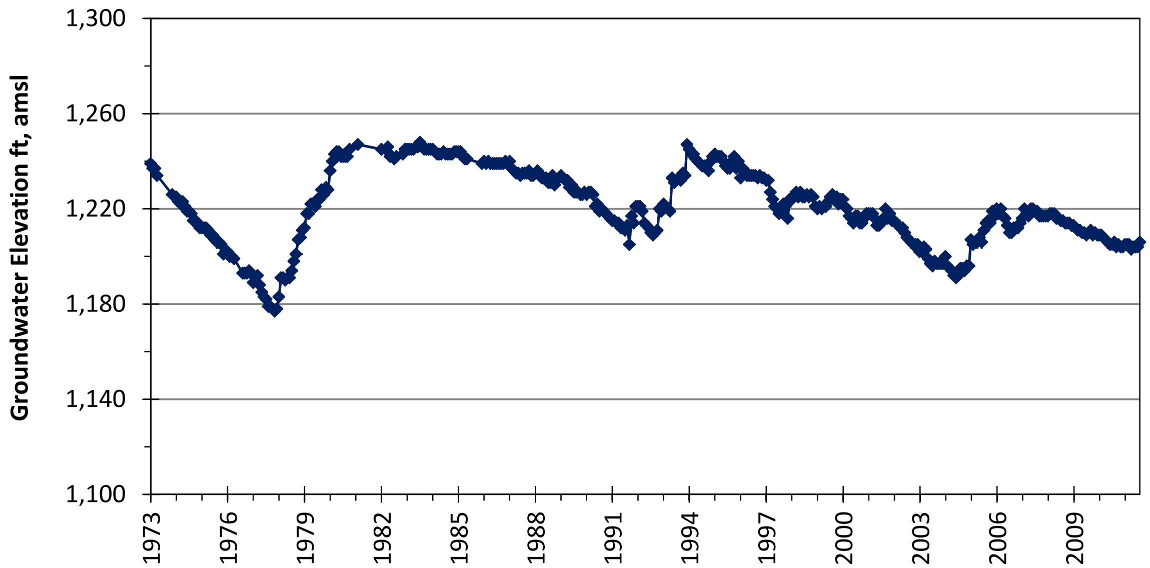


Figure 5-7. Hydrograph of SCWD Clark Well – Bouquet Canyon

Other wells in Management Zone 4 show a similar pattern as the wells in Management Zone 1. The groundwater level trends for the VWC-Well Q2 near the confluence of the Santa Clara River and Bouquet Canyon Creek for the period 1955 through 2010 is shown in Figure 5-8 below (see Figure 8 for well location). The groundwater trend in VWC-Well Q2 is similar to those shown above; but the magnitude of groundwater level change is subdued, likely due to the effects of groundwater recharge from recycled water discharges from the Saugus WRP in the vicinity of the well. The constant recycled water source discharged to the river helps maintain groundwater in storage, and subdue the downward trend of groundwater levels.

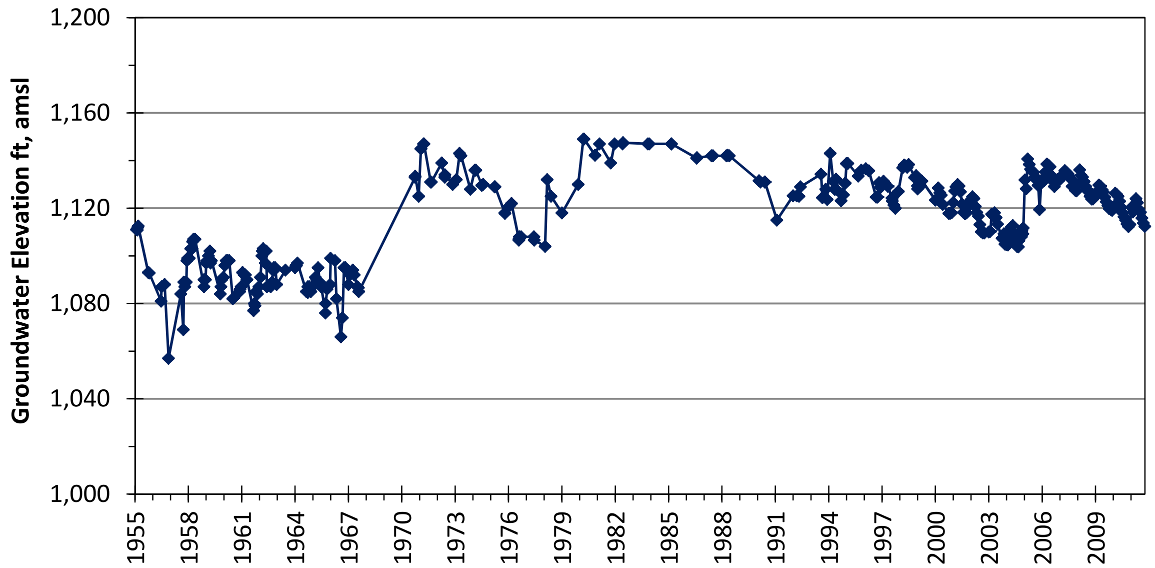


Figure 5-8. Hydrograph of VWC-Well Q2 – Santa Clara-Bouquet Canyon

The groundwater level trends for the VWC-Well W10 located in the western portion of Management Zone 4 for the relatively short period between 2003 through 2012 is shown in Figure 5-9 below. The well is located upstream from the confluence of the Santa Clara River and San Francisquito Creek in San Francisquito Canyon (see Figure 8). The historical groundwater levels show the impact from the wet 2004/2005 year. After 2005, the groundwater levels are characterized by seasonal variations of both rising and falling groundwater levels.

Other wells with hydrographs in Management Zone 4 include VWC-S6, S7, S8, N, W9, and I. The hydrographs of the wells are provided in Appendix A. Groundwater levels in Wells VWC-S6, S7, S8, and N declined from 2001 through 2004, and recovered during the wet period of 2004/2005. The groundwater level in Well VWC-I showed a very slight decline from 2005 through 2011. Groundwater levels in Wells VWC-S6, S7, S8, and N steadily declined from 2005 through 2011. The groundwater level in Well VWC-W9 declined from 2005 through 2009 and increased from 2009/2010 through to 2011.

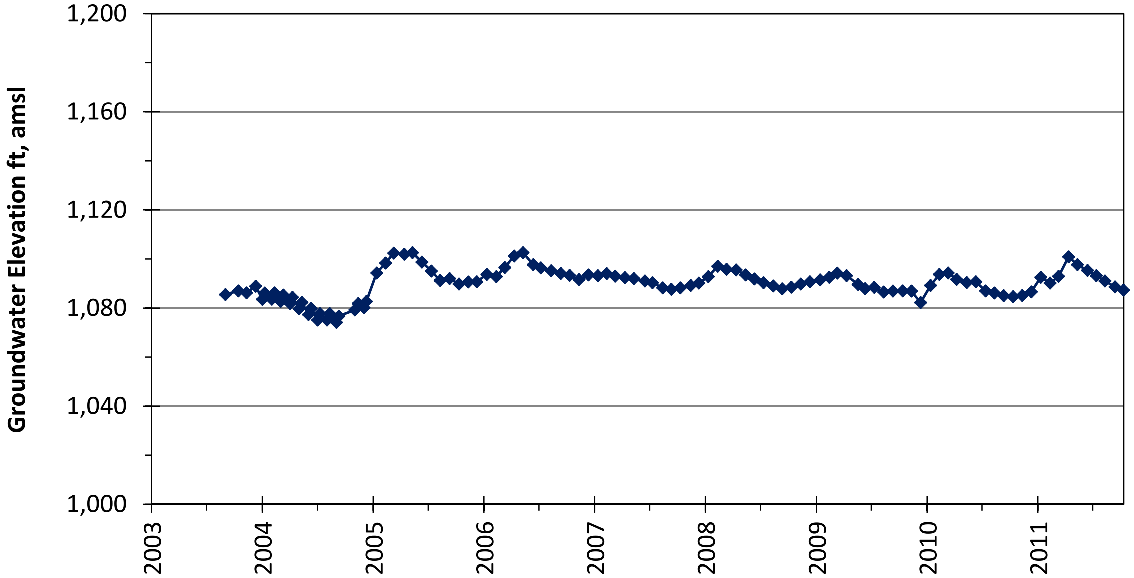


Figure 5-9. Hydrograph of VWC-Well W10 – San Francisquito Canyon

5.6.1.5 Management Zone 5 (MZ-5) Castaic Valley

The groundwater level trend for the VWC-Well D for the period 1956 through 2008 is shown in the inset Figure 5-10 below. The well is located upstream of the confluence of the Santa Clara River and Castaic Creek in Castaic Valley (see Figure 8). The groundwater levels show fluctuations but remain stable within a range of seasonal groundwater levels that increase as a result of winter run-off, and decrease throughout the drier summer months.

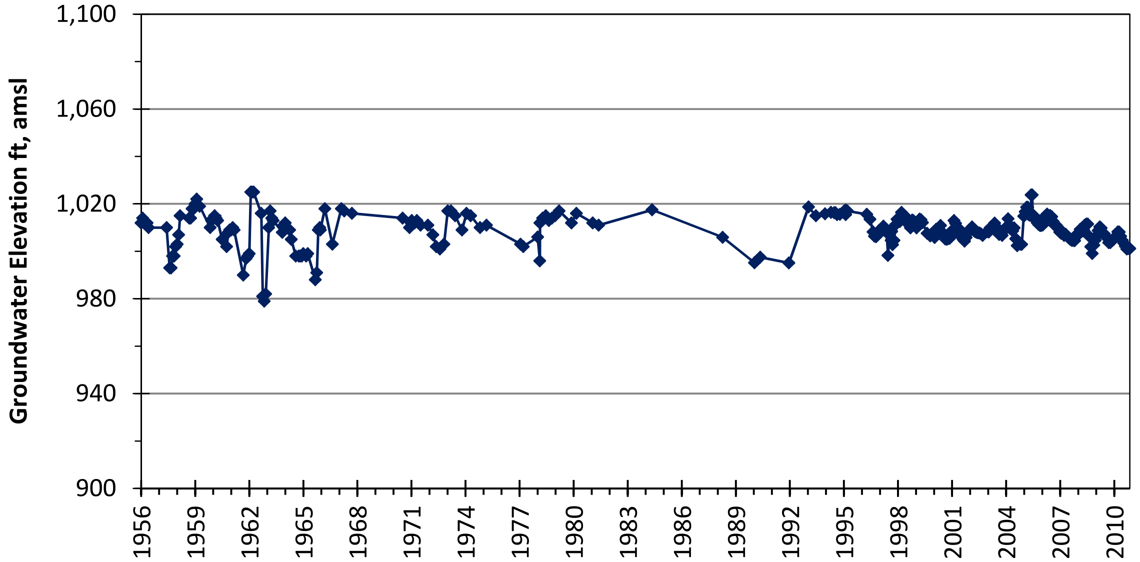


Figure 5-10. Hydrograph of VWC-Well D – Castaic Valley

Other wells in Management Zone 5 show a different pattern from those of Management Zone 1 and Management Zone 4 for the period 2001 through 2010. Hydrographs for Wells NLF-C4, B10, NCWD-1, NCWD-2, NCWD-4, and NCWD-7 located in the Castaic Valley subunit are presented in Appendix A. For the period 2001 through 2010, the groundwater levels in NLF-C4 and VWC-D decline, recover, and decline again similar to water levels in Mint Canyon and Bouquet and San Francisquito Canyon Subunits. Groundwater levels in Wells B10, NCWD-2, NCWD-4, and NCWD-7 are essentially stable through the 10-year period between 2001 and 2010.

5.6.1.6 Management Zone 6 (MZ-6) - Saugus Formation

The groundwater levels for the VWC-Well 205 for the period 2000 through 2011 is shown in inset Figure 5-11 below. The well is located in the Community of Valencia northwest of Valencia Boulevard and McBean Parkway (see Figure 9). Historical groundwater level trends indicate that groundwater levels do not immediately respond to climatic changes.

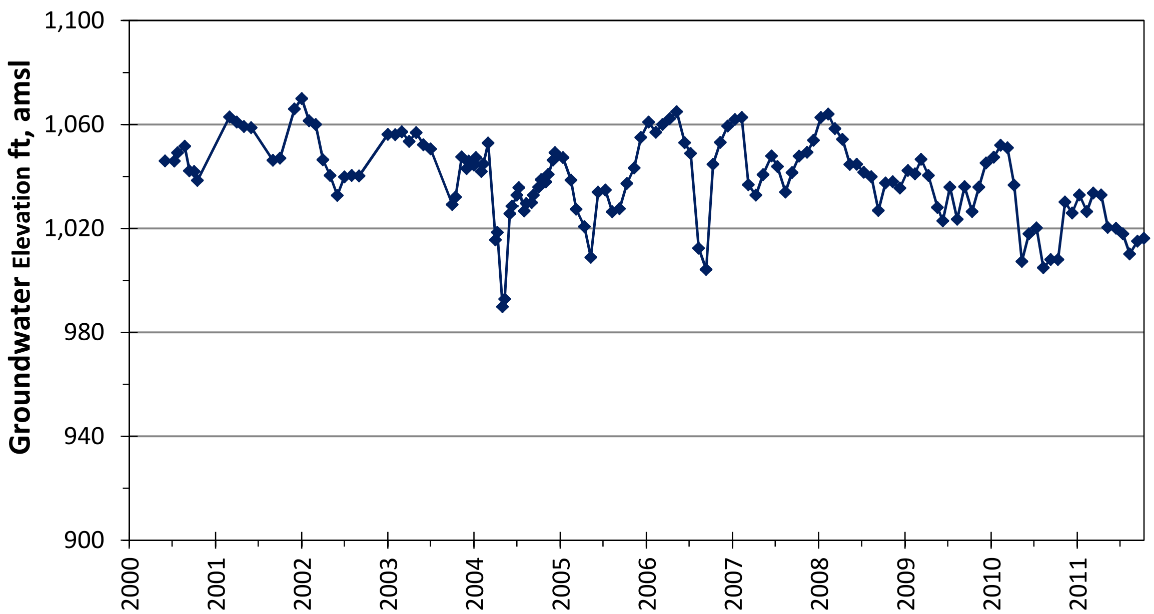


Figure 5-11. Hydrograph of VWC-Well 205 – Saugus Aquifer

The groundwater level trend for the NCWD Well-7 for the period 1959 through 2008 is shown in inset Figure 5-12 below. The groundwater level rose to the current level starting in 1999, and has remained steady at approximately the current level since 2002. However, seasonal fluctuations in the groundwater level trend are evident – indicating that recharge to the Saugus Formation does occur seasonally. Hydrographs for wells NCWD-10, 11, 12, 13, VWC-159, 201, and W160 also completed in the Saugus Formation are provided as Appendix A. Historically, groundwater levels in the Saugus Formation within seasonal variations have remained stable.

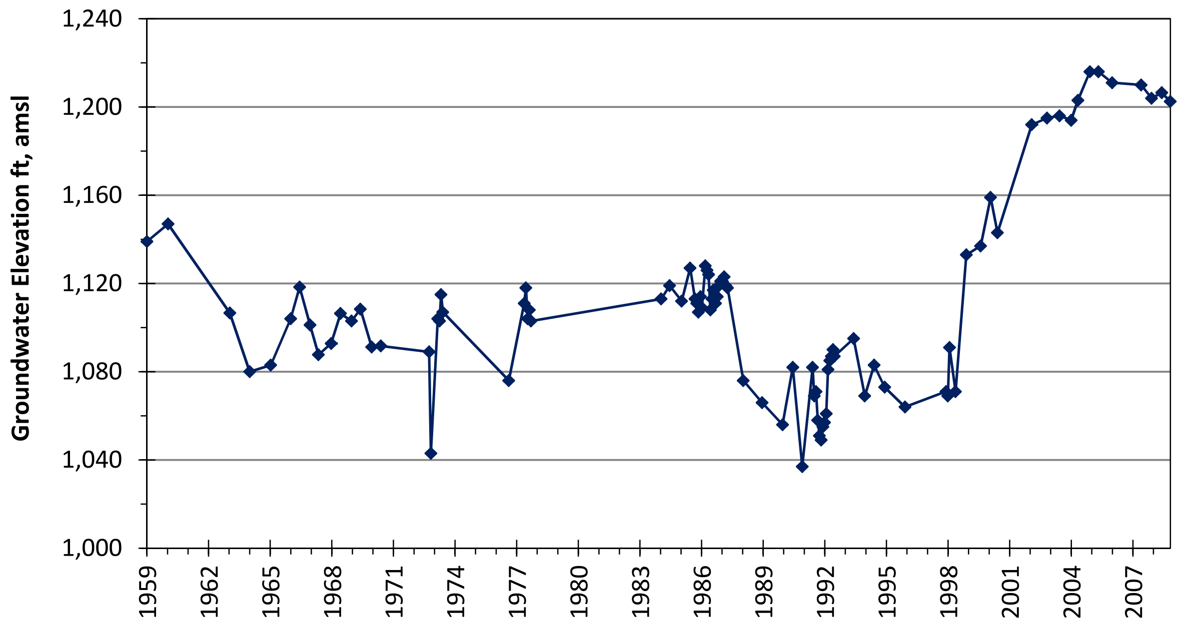


Figure 5-12. Hydrograph of NCWD Well-7 – Saugus Aquifer

5.6.2 Regional Changes

The hydrographs for the groundwater levels in the management zones do not indicate a regional change. Groundwater levels in the subunits respond to climatic conditions such as increased rainfall and subsequent groundwater recharge as well as groundwater pumping from the aquifers. Long-term groundwater level trends indicate that overall, groundwater pumping balances groundwater recharge through both natural and artificial recharge. The effect of groundwater management policies instituted by the local groundwater purveyors is an overall stabilization of groundwater levels in the management zones.

5.7 Groundwater Production

5.7.1 Historical

Groundwater production for the period 2005 through 2009 in the East Subbasin is summarized by purveyor in Table 5-2 below. This table has been reproduced from Table 3-6 of the 2010 UWMP (Kennedy/Jenks and LSCE, 2011). The table shows that pumping from the Alluvial Aquifer ranged from approximately 38,600 acre-ft/yr to 43,000 acre-ft/yr for that period. For the Saugus Formation (subunit), pumping from 2005 through 2009 ranged from approximately 6,500 acre-ft/yr to 7,700 acre-ft/yr.

Table 5-2. East Subbasin Recent Historical Production

Basin Name	Groundwater Pumped (AF) 2005	2006	2007	2008	2009
Santa Clara River Valley East Subbasin					
SCWD	12,408	13,156	10,686	11,878	10,077
Alluvium	12,408	13,156	10,686	11,878	10,077
Saugus Formation	0	0	0	0	0
LACWWD 36	343	0	0	0	0
Alluvium	343	0	0	0	0
Saugus Formation	0	0	0	0	0
NCWD	4,824	5,572	5,497	5,912	5,728
Alluvium	1,389	2,149	1,806	1,717	1,860
Saugus Formation	3,435	3,423	3,691	4,195	3,868
VWC	14,741	14,333	15,570	16,094	15,295
Alluvium	12,228	11,884	13,140	14,324	12,459
Saugus Formation	2,513	2,449	2,367	1,770	2,836
Total Purveyor	**32,316**	**33,061**	**31,690**	**33,884**	**31,100**
Alluvium	**26,368**	**27,189**	**25,632**	**27,919**	**24,396**
Saugus Formation	**5,948**	**5,872**	**6,058**	**5,965**	**6,704**
Agricultural and Other[(b)]	12,785	17,312	14,768	14,750	16,564
Alluvium	12,280	15,872	13,141	13,797	15,590
Saugus Formation	505	1,440	1,627	953	974
Total Basin	**45,101**	**50,373**	**46,458**	**48,634**	**47,664**
Alluvium	**38,648**	**43,061**	**38,773**	**41,716**	**39,986**
Saugus Formation	**6,453**	**7,312**	**7,685**	**6,918**	**7,678**
Groundwater Fraction of Total Municipal Water Supply	**46%**	**45%**	**41%**	**45%**	**44%**

Notes:
(a) From 2009 Santa Clarita Valley Water Report (May 2010).
(b) Includes agricultural and other small private well pumping.

Source: Table 3-6 of 2010 UWMP (Kennedy/Jenks and LSCE, 2011)

5.7.2 Current and Projected

The current groundwater production (2011) from the Alluvial Aquifer is approximately 35,700 acre-ft. The current groundwater production from the Saugus Formation is approximately 5,500 acre-ft. Projected groundwater production from both the Alluvial Aquifer and Saugus Formation in the East Subbasin through 2050 is summarized in Table 5-3 below, as reproduced in the 2010 UWMP (Kennedy/Jenks and LSCE, 2011).

Table 5-3. Projected Groundwater Production

Basin Name	Groundwater Pumping (AF)							
	2015	2020	2025	2030	2035	2040	2045	2050
Santa Clara River Valley								
East Subbasin								
LACWWD 36								
Alluvium	0	0	0	0	0	0	0	0
Saugus Formation	500	500	500	500	500	500	500	500
NCWD								
Alluvium	1,825	1,825	1,825	1,825	1,825	1,825	1,825	1,825
Saugus Formation	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400
SCWD								
Alluvium	10,500	10,500	10,500	11,500	11,500	11,500	11,500	11,500
Saugus Formation	2,850	3,350	3,350	3,350	3,350	3,350	3,350	3,350
VWC								
Alluvium	11,675	12,675	13,675	14,675	15,675	16,675	17,675	18,675
Saugus Formation	2,850	3,350	3,350	3,350	3,350	3,350	3,350	3,350
Total Purveyor								
Alluvium	**24,000**	**25,000**	**26,000**	**28,000**	**29,000**	**30,000**	**31,000**	**32,000**
Saugus Formation	**10,600**	**11,600**	**11,600**	**11,600**	**11,600**	**11,600**	**11,600**	**11,600**
Agricultural and Other(b)								
Alluvium	14,500	13,500	12,500	10,100	9,100	8,100	7,100	6,600
Saugus Formation	900	900	900	900	900	900	900	900
Total Basin								
Alluvium	**38,500**	**38,500**	**38,500**	**38,100**	**38,100**	**38,100**	**38,100**	**38,600**
Saugus Formation	**11,500**	**12,500**	**12,500**	**12,500**	**12,500**	**12,500**	**12,500**	**12,500**

Notes:
(a) Existing and planned pumping by individual purveyors is shown in Appendix C. The distribution of pumping does not represent a formal allocation of water resources among the retail purveyors.
(b) Agricultural and other small private well pumping, including Newhall Land, Robinson Ranch Golf Course, Wayside Honor Rancho, Valencia Golf Course and proposed Palmer Golf Course.

Source: Table 3-7 of 2010 UWMP (Kennedy/Jenks and LSCE, 2011)

Table 5-3 shows that groundwater use will remain nearly the same in the future with a slight increase in production from the Saugus Formation. Long-term groundwater levels have remained stable with minor fluctuations during dry climactic cycles. Therefore, the projected groundwater use will result in continued stable long-term groundwater levels and groundwater storage, absent any significant long-term changes in hydrology.

5.7.3 Spatial and Temporal Changes

Historical groundwater levels and production records indicate that no significant spatial or temporal changes in groundwater production or groundwater storage have occurred. The groundwater subunits have been managed to sustain groundwater levels in the various subunits.

5.8 Operational Yield

Luhdorff and Scalmanini (LSCE, 2012) recommend that the concept of "operational yield" be used for managing the subunits in the East Subbasin rather than the concept of perennial yield (or safe yield). Table 5-4 below, reproduced from Table 3-1 of the 2011 Santa Clarita Valley Water Report, tabulates the planned operational yield for both the Alluvial Aquifer and Saugus Formation. The operational yield provides proposed groundwater production while maintaining the health of both aquifer systems.

Table 5-4. Groundwater Operating Plan for the Santa Clarita Valley

Aquifer	Groundwater Production (AFY)			
	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
Alluvial	30,000 to 40,000	30,000 to 35,000	30,000 to 35,000	30,000 to 35,000
Saugus	7,500 to 15,000	15,000 to 25,000	21,000 to 25,000	21,000 to 35,000
Total	***37,500 to 55,000***	***45,000 to 60,000***	***51,000 to 60,000***	***51,000 to 70,000***

Source: Table 3-1 of the 2011 Santa Clarita Valley Water Report (LSCE, 2012)

5.9 Recharge and Discharge

The Alluvial Aquifer is recharged chiefly by infiltration of runoff waters in the Santa Clara River and its tributaries (DWR 2006c and 1968), with additional natural recharge from percolation of rainfall to the valley floor and subsurface inflow (RCS, 2002). Additional recharge is from percolation of excess irrigation water applied to urban landscaping and of reclaimed water discharged into the Santa Clara River channel (RCS, 2002). Recharge to the Saugus Formation is from infiltration of rainfall on the exposed formation and percolation of water from the Alluvial Aquifer (RCS, 2002). Discharge for both aquifers is through pumping for municipal and irrigation uses and consumption by phreatophytes. Additionally, The Saugus Formation discharges to the Alluvial Aquifer in the western part of the East Subbasin. In the same area, the Alluvial Aquifer discharges to the Santa Clara River (RCS, 2002).

5.9.1 Sources

Sources of groundwater recharge are natural surface flow from the Santa Clara River and local tributaries, deep percolation of rainfall, mountain front recharge from the adjacent highland areas, wastewater treatment plant effluent discharges, return flows from irrigation of both landscape and agricultural areas, nuisance flows collected in urban storm drains and discharged as surface flow into the Santa Clara River and tributaries, dam underflow from Castaic Lake, and subsurface underflow from Acton Subbasin. In addition, the alluvial groundwater basins also provide a source of the recharge to the underlying Saugus formation and likewise, rising groundwater in the Saugus formation can provide a source of recharge to the alluvium in the down gradient area of the basin

5.9.2 Infiltration of Surface Water

Infiltration of surface waters in the East Subbasin takes place in unlined tributary channels and in the Santa Clara River bed. It is estimated that for the period from 2001 to 2011, approximately 43,000 acre-ft/yr, on average, infiltrated the groundwater as streambed percolation. 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 a slight increase in stormwater capture in the watershed. Due to the high permeability of the Santa Clara River channel, surface flows percolate quickly into the groundwater system. Stormwater is also recharged naturally at unpaved areas (e.g., parks, golf courses, landscaped areas, dirt lots, residential lawns and gardens, etc.) where the geology promotes deep percolation. Therefore, it is unlikely that a significant increase in groundwater recharge would occur with the addition of new percolation basins.

5.9.3 Infiltration of Imported Water

Imported water is delivered to the East Subbasin area via the California Aqueduct where it flows into Castaic Lake. Infiltration of imported water occurs as a result of deep percolation from the application of the delivered water for landscape irrigation, streambed percolation in Castaic Creek from releases from Castaic Dam, as well as leakage that occurs beneath the dam. The sections below provide a brief discussion of current and future imported supplies that may contribute to groundwater recharge through the infiltration of applied water.

5.9.3.1 State Water Project Supplies

CLWA entered into a SWP Water Supply Contract with DWR in the early 1960s, which allows purveyors to purchase and distribute SWP water. The 2010 UWMP reports that CLWA's imported water supplies consist primarily of SWP supplies (Kennedy/Jenks and LSCE, 2011). The first deliveries to CLWA began in 1980. CLWA also has access to water from Flexible Storage Accounts in Castaic Lake – which are planned for dry-year use but are not strictly limited as such.

5.9.3.2 Other Imported Supplies

In addition to its SWP supplies, CLWA has an imported surface supply from the Buena Vista Water Storage District (BVWSD) and Rosedale Rio-Bravo Water Storage District (RRBWSD) in Kern County, which was first delivered to CLWA in 2007. CLWA wholesales both these imported supplies to each of the local retail water purveyors. Additionally, Newhall Land has acquired a water transfer supply from a source in Kern County referred to as Nickel Water.

The following supplies are now available to CLWA and the purveyors through transfers that have been executed since 2005. These supplies are now part of the imported supplies available to the service area.

5.9.3.2.1 Buena Vista – Rosedale

CLWA has executed a long-term transfer agreement for 11,000 acre-ft/yr with BVWSD and RRBWSD. These two districts, both located in Kern County, joined together to develop a program that provides both a firm water supply and a water banking component. Both districts are member agencies of the Kern County Water Agency (KCWA), a SWP contractor, and both districts have contracts with KCWA for SWP Table A Amounts. The supply is based on existing long-standing Kern River water rights held by BVWSD, and is delivered by exchange of the two districts' SWP Table A supplies. CLWA began taking delivery of this supply in 2007.

5.9.3.2.2 Nickel Water – Newhall Land

Newhall Land has acquired a water transfer from Kern County sources known as Nickel Water. This source of supply totals 1,607 acre-ft/yr and was acquired in anticipation of the Newhall Ranch Specific Plan development. The 2010 UWMP anticipates the water supply will be available to the VWC (Kennedy/Jenks and LSCE, 2011).

5.9.4 Infiltration of Recycled Water

All water produced at the Valencia and Saugus WRPs is referred to as "recycled water". The recycled water is either beneficially reused or discharged to the Santa Clara River. The following discussion of the history, current use and project growth of recycled water use in the East Subbasin is reproduced from the 2010 UWMP (Kennedy/Jenks and LSCE, 2011):

> *The Santa Clarita Valley Sanitation District (SCVSD) of Los Angeles County owns and operates two Water Reclamation Plants (WRPs), the Saugus WRP and the Valencia WRP, within the CLWA service area. According to the 2010 UWMP, the water is treated to tertiary levels and, with the exception of water used in Phase I of the Recycled Plan, is discharged to the Santa Clara River. The Newhall Ranch development is also planning to construct a WRP, and non-potable recycled water from this source may be incorporated into CLWA's recycled water system.*

The Valencia WRP is located on The Old Road near Magic Mountain Amusement Park and has a current treatment capacity of 21.6 million gallons per day (MGD), equivalent to 24,192 acre-ft/yr, developed over time in stages. In 2010, the Valencia WRP produced an average of 15.17 MGD (16,993 acre-ft/yr) of tertiary recycled water. Use of recycled water from the Valencia WRP is permitted under Los Angeles Regional Water Quality Control Board (RWQCB) Order Nos. 87-48 and 97-072.

The Saugus WRP is located southeast of the intersection of Bouquet Canyon Road and Soledad Canyon Road. The Saugus WRP has a current treatment capacity of 6.5 MGD (7,280 acre-ft/yr). No future expansions are possible at the plant due to space limitations at the site. In 2010, the Saugus WRP produced an average of 5.02 MGD (5,623 acre-ft/yr) of tertiary recycled water. Use of recycled water from this facility is permitted under Los Angeles RWQCB Order Nos. 87-49 and 97-072.

The Saugus and Valencia WRPs operated independently until 1980, at which time the two plants were linked by a bypass interceptor. The interceptor was installed to transfer a portion of flows received at the Saugus WRP to the Valencia WRP. Together, the Valencia and Saugus WRPs have a design capacity of 28.1 MGD (31,472 acre-ft/yr). In 2008 they produced an average of 20.9 MGD (23,422 acre-ft/yr). The primary sources of wastewater to the Saugus and Valencia WRPs are domestic. Both plants are tertiary treatment facilities and produce high quality effluent. Historically, the effluent from the two WRPs has been discharged to the Santa Clara River. The Saugus WRP effluent outfall is located approximately 400 feet downstream (west) of Bouquet Canyon Road. Effluent from the Valencia WRP is discharged to the Santa Clara River at a point approximately 2,000 feet downstream (west) of The Old Road Bridge. Phase 1 of the Recycled Plan has been constructed and begins with a 4,000 gpm pump station at the Valencia Water Reclamation Plant that connects to a 1.5 mg reservoir in the Westridge area with 15,600 linear feet of 24- and 20-inch pipeline. It serves landscape customers along The Old Road and the Tournament Players Club golf course, all of which are VWC customers. Phase 2C of the Recycled Plan (the South End project) would use this existing system and connect at The Old Road and Valencia Boulevard. From there it would cross the freeway and run south in Rockwell Canyon Road, ultimately reaching the intersection of Orchard Village Road and Lyons Avenue. The proposed Recycled Plan Phase 2A project would start at the Saugus WRP and cross the Santa Clara River through an existing pipeline. It would then serve customers on the north side of the river, generally along Newhall Ranch Road both west and east of Bouquet Canyon Road.

Draft Recycled Water Master Plans for the CLWA service area were completed in 1993 and 2002. These master plans considered significant developments affecting recycled water sources, supplies, users and demands so that CLWA could develop a cost-effective recycled water system *within its service area. In 2007, CLWA completed California Environmental Quality Act (CEQA) analysis of the 2002 Recycled Water Master Plan (Recycled Plan). This analysis consisted of a Program Environmental Impact Report (EIR) covering the various phases for a recycled water system as outlined in the Recycled Plan. The Program EIR was certified by the CLWA Board in March 2007. CLWA has constructed Phase I of the Recycled Plan, which can deliver 1,700 acre-ft/yr of water to the VWC service area. Deliveries of recycled water began in 2003 for irrigation water supply at a golf course and in roadway median strips. In 2009, recycled water deliveries were 328 AF.*

Overall, the Recycled Plan along with the Newhall Ranch development is expected to ultimately recycle up to 22,800 AF of treated (tertiary) wastewater suitable for reuse on golf courses, landscaping and other non-potable uses. CLWA completed a preliminary design report in 2009 on the second phase of the Recycled Plan (Phase 2A) that will take water from the Saugus Water Reclamation Plant (WRP) and distribute it to identified users to the north, across the Santa Clara River and then to the west and east.

Customers included in the Phase 2A expansion will be Santa Clarita Central Park and the Bridgeport and River Village developments. Large irrigation customers will be served with this expansion with a collective design that will increase recycled water deliveries by 500 acre-ft/yr. Recycled water will be further expanded with the South End Recycled Water project (Phase 2C). VWC has initiated project design expanding the existing recycled water transmission and distribution system southerly to supply recycled water to additional customers as well as to potentially supply a source of recycled water to customers of adjacent water agencies. Phase 2C of the Recycled Plan will result in the use of 910 acre-ft/yr of recycled water.

Infiltration of applied recycled water used for irrigation will increase with the areal and volumetric expansion of recycled water use. Recycled water will infiltrate and recharge the groundwater system in areas of landscape irrigation over a good portion of the East Subbasin. For purposes of this study, projections of salt and nutrient loading includes the expanded use and infiltration of recycled water in the East Subbasin.

5.10 Groundwater Storage

According to DWR, groundwater in storage in the Alluvial Aquifer during the historical high in 1945 is estimated to have been approximately 201,000 acre-ft (2006c). During Spring of 2000, it was approximately 161,000 acre-ft (RCS, 2002). Groundwater in storage in the Saugus Formation during Spring of 2000 is estimated to have been approximately 1,650,000 acre-ft. (RCS, 2002).

Historically, groundwater levels in both the Alluvial Aquifer and Saugus Formation indicate that groundwater in storage has remained the same within the seasonal and climatic fluctuations from at least 1990. Therefore, the estimation of groundwater in storage for this study is considered to be similar to that provided by RCS for Spring of 2000.

Regional changes in groundwater levels or groundwater in storage are not indicated by groundwater levels in the subunits. Groundwater levels in the subunits respond to climatic conditions such as increased rainfall and subsequent groundwater recharge as well as groundwater pumping from the aquifers. Groundwater management includes using groundwater storage during extended dry periods since, historically, the subunits recover during wet climatic periods.

6.0 WATER QUALITY

The Recycled Water Policy requires the SNMP to include an identification of salt and nutrient sources, calculation of assimilative capacity and loading estimates, and a description of the fate and transport of salt and nutrients in groundwater. The quality of groundwater, surface water, imported water, and treated recycled water are described below along with the methodologies used to determine existing groundwater quality and assimilative capacity.

The groundwater quality within each management zone is primarily the result of the quality of water recharged to the local groundwater aquifer. Therefore, the natural surface run-off, stormwater and dry weather flows from urban development, septic system leakage, return flow from agricultural practices, underflow from Castaic Dam, discharged treated wastewater into the Santa Clara River and applied recycled water as irrigation will contribute to the quality of groundwater in the Alluvial Aquifer and Saugus Formation. To an extent, the quality of groundwater flowing from outside the East Subbasin and the quality of groundwater from re-entrant canyon areas will also contribute to the quality of groundwater in the management zones within the East Subbasin.

6.1 Salts and Nutrient

The East Subbasin management zones (with the exception of Management Zone 6) have established WQOs for TDS, chloride, nitrate, and sulfate. Unless otherwise stated, “nitrate” is reported as NO_3 in this report. The water quality objectives for the Upper Santa Clara River East Subbasin Management Zones were established by the LARWQCB and outlined in Chapter 3 of the Basin Plan. These constituents are again listed in Table 3-2 of the “Regional Water Board Assistance in Guiding Salt and Nutrient Management Plan Development in Los Angeles Region” document. For the Upper Santa Clara Basin/Subbasin, Table 3-2 notes:

> *“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.”*

In addition, Table 4-2 of the guidance documents lists nitrate, salts, TDS, dichlorodiphenyltrichloroethane (DDT), and polychlorinated biphenlys (PCBs) as parameters of concern in the Los Angeles Region’s major basins. TDS, chloride, nitrate and sulfate were selected as the indicator salts and nutrients for this SNMP. DDT, PCBs, trichloroethylene (TCE), and perchlorate are monitored under other water quality monitoring programs and will therefore not be included in this SNMP.

6.1.1 Total Dissolved Solids (TDS)

Total salinity is commonly expressed in terms of TDS as milligrams per liter (mg/L). Since TDS monitoring data is generally available for groundwater and surface water in the management zones and 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 (DDW; formerly California Department of Public Health, CDPH), the recommended Secondary Maximum Contaminant Level (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 WQOs for TDS in the management zones range from 700 mg/L to 1,000 mg/L.

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 capability to use recycled water (MWD and USBR, 1999). 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, 1985). Current TDS concentrations (i.e., ambient groundwater) and WQOs for each management zone are discussed below.

6.1.2 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 are not typically present in natural freshwater. Elevated chloride concentrations in the management zones can be associated with anthropogenic activities such as the discharge of recycled water, therefore making it an appropriate indicator parameter for the SNMP.

The SWRCB DDW recommends a SMCL for chloride of 250 mg/L, with an upper limit of 500 mg/L and a short-term limit of 600 mg/L (SWRCB, 2010b). The WQOs for chloride in the management zones range from 100 mg/L to 150 mg/L. Chloride is currently detected below the SMCL of 500 mg/L and below the WQOs in wells present in all of the management zones (i.e., ambient groundwater).

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 USBR, 1999).

6.1.3 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, 2016b). High levels of nitrate in groundwater are associated with agricultural activities, septic systems, confined animal facilities, landscape fertilization, and wastewater treatment facilities. Nitrate is the primary form of nitrogen detected in groundwater. Concentrations of nitrate as NO_3 are presented throughout this report and referred to as “nitrate” concentrations.

The WQO for nitrate in all management zones is equivalent to the SWRCB’s Maximum Contaminant Level (MCL) of 45 mg/L. Natural nitrate levels in groundwater in each management zone are generally below the MCL and WQO.

6.1.4 Sulfate

Sulfate is a substance that occurs naturally in drinking water. Sulfate can occur as runoff and/or leaching from natural deposits and from industrial wastes. Health concerns regarding sulfate in drinking water have been raised because of reports that diarrhea may be associated with the ingestion of water containing high levels of sulfate. Of particular concern are groups within the general population that may be at greater risk from the laxative effects of sulfate when they experience an abrupt change from drinking water with low sulfate concentrations to drinking water with high sulfate concentrations.

Sulfate in drinking water currently has a SMCL of 250 mg/L, with an upper limit of 500 mg/L and a short-term limit of 600 mg/L, based on aesthetic effects (i.e., taste and odor). The WQOs for the management zones range from 150 mg/L to 350 mg/L. Groundwater in the management zones, with the exception of a portion of Management Zone 1, typically has sulfate levels below the SMCL and WQOs.

6.1.5 TDS, Chloride, Nitrate, and Sulfate 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. Salt and nutrients in source waters recharging the management zones may be increased through use as surface water percolates through the vadose zone into the aquifer. This can occur through fertilizer use, which adds nitrogen that is not completely removed by plant uptake. Salt and nutrients in irrigation return flows can also be concentrated by evapotranspiration (ET) as plants use the water and leave the salts in the percolating water. As precipitation and irrigation water infiltrates, salt and nutrients in the shallow soils can be picked up from the surface soils. Salt and nutrient subsurface materials can also be leached, dissolving in water, as water percolates through soils to the groundwater system.

TDS, chloride, and sulfate act conservatively 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.

As water moves through soil and rock formations that contain sulfate minerals, some of the sulfate dissolves into the groundwater. Minerals that contain sulfate include magnesium sulfate, sodium sulfate, and calcium sulfate (gypsum). A natural contribution of sulfate into the groundwater and surface water is from dissolution of gypsum in the Saugus Formation. However, it is important to note that no WQOs currently exist for the Saugus Formation.

Loading factors and movement of salt and nutrients within the hydrologic system are considered in the evaluation of historical salt and nutrient concentrations (see Section 7 – Basin Evaluation).

6.2 Groundwater Quality Data

To evaluate existing water quality conditions in the management zones, groundwater quality data was obtained from the following sources:

- CDPH
- The USGS Water Information System
- LARWQCB
- SCVSD
- LACFCD
- CLWA

- SCWD
- City of Santa Clarita Public Works Department
- NCWD
- VWC
- Newhall Land and Farming
- Groundwater Surface Water Interaction Model database
- Hydrodesktop – from the Consortium of Universities for the Advancement of Hydrologic Sciences (CUAHSI) Hydrologic Information System (HIS).

The data was compiled into a single Microsoft Excel database which is provided as Appendix B and will herein be referred to as the SNMP water quality database. The SNMP water quality database covers the period from 2001 through 2011. Using the SNMP water quality database, both historical and current groundwater quality and surface water quality conditions were evaluated for both salts (chloride, sulfate, and TDS) and nutrients (nitrate and ammonia for surface water), where data are available.

The evaluation of groundwater quality was analyzed and summarized for the five alluvial groundwater management zones that have LARWQCB Basin Plan water quality objectives, which include; Management Zone 1 (MZ-1) - Santa Clara-Mint Canyon, Management Zone 2 (MZ-2) – Placerita Canyon, Management Zone 3 (MZ-1) - South Fork, Management Zone 4 (MZ-4) - Santa Clara-Bouquet and San Francisquito Canyons, and Management Zone 5 (MZ-5) Castaic Valley. The LARWQCB Basin Plan objectives for these subunits are shown in the following Table 6-1.

In addition, water quality from Management Zone 6 (MZ-6) – Saugus Formation was evaluated at the request of the LARWQCB. Although Management Zone 6 has not been assigned WQOs, the LARWQCB recommended that the evaluation of existing and predicted future groundwater quality be completed by comparison to the most conservative (lowest) basin objectives from the alluvial management zones. Review of Table 6-1 indicates that water quality objectives for Management Zone 2 (Placerita Canyon) provide the most conservative basin objectives for TDS, chloride, nitrate, and sulfate and are shown in Table 6-1 as *italicized* values. The significant variability of water quality in the Saugus Formation needs to be further evaluated to establish meaningful WQOs.

Table 6-1. LARWQCB Basin Plan Water Quality Objectives for Groundwater

Management Zone	Subunit	Basin Objective (mg/L)			
		TDS	Chloride	Nitrate	Sulfate
1	Santa Clara-Mint Canyon	800	150	45	150
2	Placerita Canyon	700	100	45	150
3	South Fork	700	100	45	200
4	Santa Clara-Bouquet and San Francisquito Canyons	700	100	45	250
5	Castaic Valley	1,000	150	45	350
6	Saugus Formation	*700*	*100*	*45*	*NA*

Note: Management Zone 6 uses assumed WQOs for purposes of the analysis for this study.

6.3 Water Quality Analysis Methodologies

The methodologies used to calculate average groundwater quality and assimilative capacity are described in the following sections. An analysis of sulfate concentrations in the Saugus Formation is provided as Figure 10 and discussed in further detail in Section 6.5.6.1.

6.3.1 Average Salt and Nutrient Concentrations in Groundwater

Sampling results from wells in the management zones during the period 2001 through 2011 were used to calculate current groundwater quality. Much of the groundwater sampling data within the management zone was collected triennially (samples are collected and analyzed every three years). Initially, for this study, the methodology used by the USGS employing a minimum of three data sets for calculating ambient groundwater concentrations was used to assess the ambient groundwater concentrations. Therefore, the data set assembled ranges from 2001 through 2011 in order to have at least three data sets from wells in the management zones. However, initial calculation suggested that the values were not representative of the management zones because they did not consider variations in groundwater concentrations due to seasonal and climactic variations.

Therefore median[7] concentrations for TDS, chloride, nitrate, and sulfate concentrations from wells in each management zone were calculated. The tables below summarize the median and 90th percentile concentrations for TDS, chloride, nitrate, and sulfate for the historical period of 2001-2011. Water quality chemographs for each well are provided in Appendix C.

Table 6-2. Median and 90th Percentile Concentrations of TDS, Chloride, Nitrate, and Sulfate – 2001 through 2011 for Wells in Management Zone 1

Well Name	2001-2011 Median Concentration				2001-2011 90th Percentile			
	TDS	Chloride	Nitrate	Sulfate	TDS	Chloride	Nitrate	Sulfate
	mg/L				mg/L			
Honby	720	68	19	164	841	91	29	221
Lost Canyon 2	625	83	13	103	653	89	17	111
Lost Canyon 2A	790	100	16	129	795	123	19	146
Mitchell 5A	767	100	17	153	801	102	21	160
Mitchell 5B	680	84	16	116	733	105	20	134
North Oaks - Blended	-	-	27	-	-	-	30	-
North Oaks Central	800	110	31	146	816	116	39	149
North Oaks East	783	95	28	169	859	106	32	187
North Oaks West	811	100	31	142	842	114	36	156
Sand Canyon	808	93	20	175	867	106	25	193
Santa Clara	670	74	21	140	670	74	21	140
Sierra	764	82	24	190	838	100	38	208
Stadium	962	72	25	329	994	74	27	375
Valley Center	810	102	22	160	858	116	29	176
WELL 1 - PINETREE	722	98	15	108	792	130	23	121
WELL 3 - PINETREE	575	77	10	97	663	98	14	110
WELL 4 - PINETREE	740	107	17	114	859	133	29	143
WELL 5 - PINETREE	680	100	10	98	720	108	11	108
Well T4	-	65	23	116	-	95	27	118
Well T7	665	75	18	117	672	78	22	125
Well U3	-	66	28	267	-	78	30	267
Well U4	983	82	17	406	1,170	91	20	466
Well U6	762	55	19	273	986	93	22	379

7 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 non-detects) 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.

Table 6-3. Median and 90th Percentile Concentrations of TDS, Chloride, Nitrate, and Sulfate – 2001 through 2011 for Wells in Management Zone 4

Well Name	2001-2011 Median Concentration				2001-2011 90th Percentile			
	TDS	Chloride	Nitrate	Sulfate	TDS	Chloride	Nitrate	Sulfate
	mg/L				mg/L			
Well T2	-	86	22	102	-	92	25	115
Clark	767	98	22	176	831	109	24	200
Guida	703	64	19	178	770	66	23	195
Well K2	-	121	23	152	-	121	26	152
Well L2	-	82	20	131	-	82	27	131
Well N	672	86	22	155	755	93	31	170
Well N3	-	109	28	140	-	123	35	141
Well N4	-	96	18	153	-	96	20	153
Well N7	675	87	16	130	690	90	20	137
Well N8	630	63	21	138	704	86	26	148
Well Q2	659	59	17	159	756	69	26	214
Well S6	734	119	19	152	789	138	23	170
Well S7	776	121	21	165	877	134	26	175
Well S8	800	111	27	201	938	125	35	231
Well W10	659	50	12	185	670	54	18	195
Well W11	659	36	9	196	693	39	12	210
Well W9	610	35	13	174	637	40	16	198

Table 6-4. Median and 90th Percentile Concentrations of TDS, Chloride, Nitrate, and Sulfate – 2001 through 2011 for Wells in Management Zone 5

Well Name	2001-2011 Median Concentration				2001-2011 90th Percentile			
	TDS	Chloride	Nitrate	Sulfate	TDS	Chloride	Nitrate	Sulfate
	mg/L				mg/L			
NLF - C5	813	71	-	299	891	76	-	319
NLF-B14	864	69	-	301	886	75	-	321
NLF-C11	815	72	-	283	868	72	-	299
Well 01 - WHR	741	73	2	241	836	73	4	291
Well 02 - WHR	634	93	1	210	672	99	2	236
Well 04 - WHR[1]	1,202	64	7	648	1,202	64	7	648
Well 05 - WHR[1]	1,462	74	9	853	1,462	74	9	853
WELL 1 - CASTAIC	516	74	2	129	567	89	2	150
Well 10 - WHR	641	66	3	232	748	79	4	296
Well 15 - WHR	564	53	3	191	622	64	4	266
Well 17 - WHR	756	64	4	294	801	73	5	339
Well 18 - WHR	750	85	3	278	750	85	3	278
Well 18R - WHR	761	73	6	281	857	83	7	335
WELL 2 - CASTAIC	502	74	2	132	568	83	2	150
WELL 3 - CASTAIC	530	67	2	147	554	69	2	154
WELL 4 - CASTAIC	544	84	4	173	659	99	9	256
WELL 6 - CASTAIC	390	75	0	78	390	75	1	78
WELL 7 - CASTAIC	468	76	0	110	510	84	1	156
Well D	841	83	8	297	869	92	12	347
Well E-14[2]	-	-	75	280	-	-	75	280
Well E-15	917	96	16	310	1,008	102	21	316
Well E-17	-	74	-	340	-	74	-	340

[1]High TDS and sulfate concentrations considered outliers.

[2]High nitrate concentration considered an outlier. Well is missing chloride and TDS concentration data.

Table 6-5. Median and 90th Percentile Concentrations of TDS, Chloride, Nitrate, and Sulfate – 2001 through 2011 for Wells in Management Zone 6

Well Name	2001-2011 Median Concentration				2001-2011 90th Percentile			
	TDS	Chloride	Nitrate	Sulfate	TDS	Chloride	Nitrate	Sulfate
	mg/L				mg/L			
Los Valles L&G Well	250	14	11	57	250	14	11	57
WELL 11 - Newhall	690	29	19	304	768	29	20	308
WELL 12 - Newhall	533	37	15	148	599	43	17	189
WELL 13 - Newhall	678	41	30	207	702	44	34	220
Well 201	896	34	16	436	980	37	18	488
Well 205	666	27	9	253	701	29	11	287
Well 206	786	40	23	271	856	46	30	303
Well 207	-	27	7	190	-	27	7	190
Well W160	815	27	12	335	962	30	23	396

Figures 11a, 11b, 11c, and 11d show the median concentrations for TDS, chloride, nitrate, and sulfate for wells in each management zone, respectively.

6.3.2 Subdivision of Management Zone 1 for Calculation of Average Groundwater Quality

The median concentration plots indicated that an area of elevated TDS and sulfate concentrations is present in the vicinity of SCWD Valley Center and Stadium wells, and VWC Wells U3, U4 and U6. The elevated TDS and sulfate concentrations may be associated with a localized source of contamination located south of these wells since the elevated TDS and sulfate appears to be confined to a localized area – approximately 10% of the area of Management Zone 1.

In consultation with the LARWQCB, the area around the elevated TDS and sulfate levels has been delineated and is shown on Figures 11a through 11d. For discussion purposes, the elevated TDS and sulfate area is designated as Management Zone 1b and is shown and described in detail on Figure 11e. Previous analyses by the water purveyors have ruled out historical land use as a source of the elevated TDS and sulfate. The elevated TDS and sulfate is thought to be associated with groundwater flow in the native geologic materials. The area of Management Zone 1 outside of Management Zone 1b is designated as Management Zone 1a. Average groundwater concentrations and assimilative capacities have been calculated separately for Management Zone 1a and Management Zone 1b.

Table 6-6 below provides a comparison of median concentrations for the period 2001 through 2011 in Management Zone 1 versus median concentrations in Management Zone 1a and Management Zone 1b. Due to a localized area of elevated sulfate concentrations, Management Zone 1 would have a negative assimilative capacity for sulfate. By isolating the elevated sulfate area into a separate management zone (MZ-1b), the majority of Management Zone 1 designated as Management Zone 1a will have some assimilative capacity for future water planning. However, only projects that can increase assimilative capacity for TDS and sulfate can be considered for the limited area of Management Zone 1b.

Table 6-6. Median Concentration in MZ-1 vs. MZ-1a and MZ-1b

Description	TDS	Chloride	Nitrate	Sulfate
	[mg/L]			
Water Quality Objective	*800*	*150*	*45*	*150*
Management Zone 1	760	86	20	173
Management Zone 1a	728	89	20	138
Management Zone 1b	833	72	21	269

Table 6-7 below provides a comparison of ambient groundwater concentrations to WQOs for each management zone.

Table 6-7. Water Quality Objectives and Average (Ambient) Groundwater Concentrations by Management Zone

Management Zone	Groundwater Subunit	Water Quality Status Comparison	TDS [mg/L]	Chloride [mg/L]	Nitrate [mg/L]	Sulfate [mg/L]
1a	Santa Clara-Mint Canyon	Water Quality Objective	800	150	45	150
		Ambient Water Quality	***728***	***89***	***20***	***138***
1b	Santa Clara-Mint Canyon	Water Quality Objective	800	150	45	150
		Ambient Water Quality	***833***	***72***	***21***	***269***
2	Placerita Canyon[1]	Water Quality Objective	700	100	45	150
		Ambient Water Quality	***NA***	***NA***	***NA***	***NA***
3	South Fork[1]	Water Quality Objective	700	100	45	200
		Ambient Water Quality	***NA***	***NA***	***NA***	***NA***
4	Santa Clara-Bouquet and San Francisquito Canyons	Water Quality Objective	700	100	45	250
		Ambient Water Quality	***710***	***77***	***16***	***189***
5	Castaic Valley	Water Quality Objective	1,000	150	45	350
		Ambient Water Quality	***727***	***77***	***8***	***246***
6	Saugus Formation[2]	Water Quality Objective	700	100	45	NA
		Ambient Water Quality	***636***	***28***	***14***	***235***

[1] Insufficient data to establish trend.

[2] WQOs have not been established for the Saugus Formation. Therefore at the recommendation of the LARWQCB, with the exception of sulfate, the most conservative of the alluvial management zone basin objectives was used for comparison.

Note: Red values indicate exceedance of WQO.

The information in Table 6-7 shows that the average groundwater concentrations (ambient) are generally lower than the basin objectives. Only TDS in Management Zones 1b and 4 and sulfate in Management Zone 1b exceed the assigned basin objectives.

6.3.3 Water Quality of Management Zones 2001-2011

The chemographs provided in Appendix C show the calculated 25th, 75th, and 90th percentiles for the water quality data sets from each well in the East Subbasin. Data sets for the number of sampling events for each constituent were variable and ranged in number. Table 6-8 summarizes the range in the number of sampling events and average number of groundwater sampling events for each constituent by management zone. Generally, insufficient sampling events are available to provide an evaluation of groundwater quality trends in the management zones.

Table 6-8. Sampling Events for TDS, Chloride, Nitrate, and Sulfate by Management Zone

MZ/Constituent	Range of Events	Average	MZ/Constituent	Range of Events	Average
MZ-1	**1-91**	**10**	**MZ-5**	**1-28**	**7**
TDS	1-10	4	TDS	1-26	6
Chloride	1-10	4	Chloride	1-28	6
Nitrate	2-91	28	Nitrate	1-19	9
Sulfate	1-10	4	Sulfate	1-28	6
MZ-4	**1-45**	**10**	**MZ-6**	**1-42**	**9**
TDS	4-11	8	TDS	1-10	8
Chloride	1-11	5	Chloride	1-16	7
Nitrate	4-45	20	Nitrate	1-42	15
Sulfate	1-11	6	Sulfate	1-16	7

With few exceptions, a visual examination of the chemographs suggests that water quality is fairly stable and primarily responds to seasonal or climatic variations. Table 6-9 summarizes a Mann-Kendall analysis for all of the wells with 10 or more data sets for TDS, Chloride, and sulfate and a selected number of wells across the management zones with 10 or more data sets for nitrate. The locations of the wells are shown on Figure 8. The Mann-Kendall Trend Test is a non-parametric test that is used to detect trends in concentration time-series plot that contains the relative magnitudes of sample data. The Mann-Kendall test is applicable to groundwater quality evaluation because the test is statistically robust and can be effectively applied to data sets with non-detects.

Table 6-9. Mann-Kendall Analysis for Wells with Sufficient Data Sets

Well Name	Management Zone	Constituent	Trend
Honby	MZ-1	Nitrate	Stable/No Trend
Sierra	MZ-1	Nitrate	Stable/No Trend
1-Pinetree	MZ-1	Nitrate	Stable/No Trend
Well N	MZ-4	TDS	Stable/No Trend
Well N	MZ-4	Nitrate	Decreasing
Well N	MZ-4	Sulfate	Stable/No Trend
Well S6	MZ-4	Chloride	Stable/No Trend
Well C5	MZ-5	TDS	Stable/No Trend
Well C5	MZ-5	Chloride	Stable/No Trend
Well C5	MZ-5	Sulfate	Stable/No Trend
2-Castaic	MZ-5	Nitrate	Stable/No Trend
Well 201	MZ-6	Sulfate	Stable/No Trend
Well 205	MZ-6	Chloride	Stable/No Trend
Well 205	MZ-6	Nitrate	Stable/No Trend

The 25th, 75th, and 90th percentile concentration is calculated for each data set and is shown on the individual chemographs presented in Appendix C. For discussion, only median concentrations were also calculated and are shown for comparison along with the 90th percentile concentrations for wells in each management zone. The median and 90th percentile concentrations for TDS, chloride, nitrate, and sulfate concentrations from each well's data set are presented in Sections 6.5.1 through 6.5.6.

6.4 Salt and Nutrient Groundwater Quality Results

As discussed in the subsections below, the water quality assessment indicates that average TDS and chloride concentrations are below WQOs for the specific management zones with a few exceptions. Assimilative capacity is available for all constituents with the exception of TDS in Management Zone 4 and TDS and sulfate in Management Zone 1b. Using the proposed tentative WQO for sulfate in Management Zone 6, assimilative capacity exists for sulfate in Management Zone 6. Additional details regarding the historical groundwater quality will be discussed in Section 7. The following sections provide a review of historical groundwater quality by management zone.

6.5 Historical Groundwater Quality

The historical and current groundwater quality was evaluated by management zone. Available water quality data from wells within each management zone was obtained from water purveyors and from additional databases listed in Section 6.2. Groundwater quality for TDS, chloride, nitrate, and sulfate for wells within each management zone were plotted as chemographs and are provided for review in Appendix C. The chemographs provide a calculation of median, 25th, 75th, and 90th percentiles for the water quality data sets from each well in the East Subbasin. The median concentrations and 90th percentile concentration for each water quality constituent by well and for each management zone will be discussed below.

6.5.1 Santa Clara-Mint Canyon Subunit

6.5.1.1 Total Dissolved Solids (TDS), Chloride, Nitrate, and Sulfate

Water quality data from 22 wells in Management Zone 1 were evaluated. The wells are shown on Figure 8. Water quality plots for each constituent and for each of the wells are provided in Appendix C. Figures 11a, 11b, 11c, and 11d show the calculated median concentrations in Management Zone 1 for TDS, chloride, nitrate, and sulfate, respectively. Tables 6-10, 6-11, 6-12, and 6-13 report the median concentration and 90th percentile concentration for TDS, chloride, nitrate, and sulfate, respectively, by well in Management Zone 1 for the period 2001 through 2011.

Table 6-10. Median TDS Concentrations and 90th Percentile Concentrations for Wells in Management Zone 1

Well	Median TDS Concentration [mg/L]	90th Percentile [mg/L]	Well	Median TDS Concentration [mg/L]	90th Percentile [mg/L]
Honby	720	841	Stadium	962	994
Lost Canyon 2	625	653	Valley Center	810	858
Lost Canyon 2A	790	795	WELL 1 - PINETREE	722	792
Mitchell 5A	767	801	WELL 3 - PINETREE	575	663
Mitchell 5B	680	733	WELL 4 - PINETREE	740	859
North Oaks Central	800	816	WELL 5 - PINETREE	680	720
North Oaks East	783	859	Well T4	-	-
North Oaks West	811	842	Well T7	665	672
Sand Canyon	808	867	Well U3	-	-
Santa Clara	670	670	Well U4	983	1,170
Sierra	764	838	Well U6	762	986

Table 6-11. Median Chloride Concentrations and 90th Percentile Concentrations for Wells in Management Zone 1

Well I.D.	Median Chloride Concentration mg/L	90th Percentile mg/L	Well I.D.	Median Chloride Concentration mg/L	90th Percentile mg/L
Honby	68	91	Stadium	72	74
Lost Canyon 2	83	89	Valley Center	102	116
Lost Canyon 2A	100	123	WELL 1 - PINETREE	98	130
Mitchell 5A	100	102	WELL 3 - PINETREE	77	98
Mitchell 5B	84	105	WELL 4 - PINETREE	107	133
North Oaks Central	110	116	WELL 5 - PINETREE	100	108
North Oaks East	95	106	Well T4	65	95
North Oaks West	100	114	Well T7	75	78
Sand Canyon	93	106	Well U3	66	78
Santa Clara	74	74	Well U4	82	91
Sierra	82	100	Well U6	55	93

Table 6-12. Median Nitrate Concentrations and 90th Percentile Concentrations for Wells in Management Zone 1

Well I.D.	Median Nitrate Concentration (mg/L)	90th Percentile (mg/L)
Honby	19	29
Lost Canyon 2	13	17
Lost Canyon 2A	16	19
Mitchell 5A	17	21
Mitchell 5B	16	20
North Oaks Central	31	39
North Oaks East	28	32
North Oaks West	31	36
Sand Canyon	20	25
Santa Clara	21	21
Sierra	24	38

Well I.D.	Median Nitrate Concentration (mg/L)	90th Percentile (mg/L)
Stadium	25	27
Valley Center	22	29
WELL 1 - PINETREE	15	23
WELL 3 - PINETREE	10	14
WELL 4 - PINETREE	17	29
WELL 5 - PINETREE	10	11
Well T4	23	27
Well T7	18	22
Well U3	28	30
Well U4	17	20
Well U6	19	22

Table 6-13. Median Sulfate Concentrations and 90th Percentile Concentrations for Wells in Management Zone 1

Well I.D.	Median Sulfate Concentration (mg/L)	90th Percentile (mg/L)
Honby	164	221
Lost Canyon 2	103	111
Lost Canyon 2A	129	146
Mitchell 5A	153	160
Mitchell 5B	116	134
North Oaks Central	146	149
North Oaks East	169	187
North Oaks West	142	156
Sand Canyon	175	193
Santa Clara	140	140
Sierra	190	208

Well I.D.	Median Sulfate Concentration (mg/L)	90th Percentile (mg/L)
Stadium	329	375
Valley Center	160	176
WELL 1 - PINETREE	108	121
WELL 3 - PINETREE	97	110
WELL 4 - PINETREE	114	143
WELL 5 - PINETREE	98	108
Well T4	116	118
Well T7	117	125
Well U3	267	267
Well U4	406	466
Well U6	273	379

6.5.2 Placerita Subunit

Currently and historically, there are no municipal supply wells within the Placerita Subunit (see Figure 8). The Basin Plan WQOs for this subunit are shown in Table 6-7. Therefore, analysis of average groundwater concentrations and assimilative capacity will not be completed for the subunit in this SNMP.

6.5.3 South Fork Subunit

6.5.3.1 Total Dissolved Solids (TDS)

The only alluvial aquifer well in South Fork, VWC Well T2, was destroyed in 2005. TDS was not sampled in this well for the period 2000 through 2005 when the well was sampled for water quality. However, specific conductance was measured during this period and ranged from a high of 1,048 micromhos per centimeter (umhos/cm) in 2002 to a low of 745 umhos/cm in 2005 (last measurement). This range converts to TDS values of approximately 700 mg/L to 500 mg/L[8].

6.5.3.2 Chloride

Four historical chloride groundwater quality measurements were available for VWC Well T2 (2002 through 2005). Concentrations ranged from a high of 92 mg/L in February 2002 and July 2003 to a low of 43 mg/L in June 2005, which is below the WQO of 100 mg/L. Over this period, chloride concentrations decreased approximately 16 mg/L per year.

6.5.3.3 Nitrate as NO3

Historical nitrate (as NO3) groundwater quality data from VWC Well T2 (2001 through 2005), ranged from a high of approximately 24.9 mg/L in March 2001 to a low of 7.3 mg/L in August 2005, which is below the WQO of 45 mg/L. Nitrate concentrations decreased on average 3.5 mg/L per year during this period.

[8] The conversion of conductivity units to TDS units was accomplished using an approximation of 0.67 x umhos/cm = mg/L

6.5.3.4 Sulfate

Historical sulfate groundwater quality data from VWC Well T2 (2002 through 2005), ranged from approximately 76 mg/L in June 2005 to 116 mg/L in February 2002, which is below the WQO of 200 mg/L.

Due to limited data (a single well), concentration statistics are not calculated for this management zone and the calculation of an average groundwater concentration and an assimilative capacity will not be completed for this management zone in this SNMP.

6.5.4 Santa Clara-Bouquet and San Francisquito Canyons Subunit

6.5.4.1 Total Dissolved Solids (TDS), Chloride, Nitrate, and Sulfate

Water quality data from 17 wells in Management Zone 4 were evaluated. The wells are shown on Figure 8. Water quality plots for each constituent and for each of the wells are provided in Appendix C. Figures 11a, 11b, 11c, and 11d show the calculated median concentrations in Management Zone 4 for TDS, chloride, nitrate, and sulfate, respectively. Tables 6-14, 6-15, 6-16, and 6-17 report the median concentration and 90th percentile concentration for TDS, chloride, nitrate, and sulfate, respectively, by well in Management Zone 4 for the period 2001 through 2011.

Table 6-14. Median TDS Concentrations and 90th Percentile Concentrations for Wells in Management Zone 4

Well I.D.	Median TDS Concentration	90th Percentile	Well I.D.	Median TDS Concentration	90th Percentile
	mg/L			mg/L	
Well T2	-	-	Well N8	630	704
Clark	767	831	Well Q2	659	756
Guida	703	770	Well S6	734	789
Well K2	-	-	Well S7	776	877
Well L2	-	-	Well S8	800	938
Well N	672	755	Well W10	659	670
Well N3	-	-	Well W11	659	693
Well N4	-	-	Well W9	610	637
Well N7	675	690			

Table 6-15. Median Chloride Concentrations and 90th Percentile Concentrations for Wells in Management Zone 4

Well I.D.	Median Chloride Concentration	90th Percentile	Well I.D.	Median Chloride Concentration	90th Percentile
	mg/L			mg/L	
Well T2	86	92	Well N8	63	86
Clark	98	109	Well Q2	59	69
Guida	64	66	Well S6	119	138
Well K2	121	121	Well S7	121	134
Well L2	82	82	Well S8	111	125
Well N	86	93	Well W10	50	54
Well N3	109	123	Well W11	36	39
Well N4	96	96	Well W9	35	40
Well N7	87	90			

Table 6-16. Median Nitrate Concentrations and 90th Percentile Concentrations for Wells in Management Zone 4

Well I.D.	Median Nitrate Concentration	90th Percentile	Well I.D.	Median Nitrate Concentration	90th Percentile
	mg/L			mg/L	
Well T2	22	25	Well N8	21	26
Clark	22	24	Well Q2	17	26
Guida	19	23	Well S6	19	23
Well K2	23	26	Well S7	21	26
Well L2	20	27	Well S8	27	35
Well N	22	31	Well W10	12	18
Well N3	28	35	Well W11	9	12
Well N4	18	20	Well W9	13	16
Well N7	16	20			

Table 6-17. Median Sulfate Concentrations and 90th Percentile Concentrations for Wells in Management Zone 4

Well I.D.	Median Sulfate Concentration	90th Percentile	Well I.D.	Median Sulfate Concentration	90th Percentile
	mg/L			mg/L	
Well T2	102	115	Well N8	138	148
Clark	176	200	Well Q2	159	214
Guida	178	195	Well S6	152	170
Well K2	152	152	Well S7	165	175
Well L2	131	131	Well S8	201	231
Well N	155	170	Well W10	185	195
Well N3	140	141	Well W11	196	210
Well N4	153	153	Well W9	174	198
Well N7	130	137			

6.5.5 Castaic Valley Subunit

6.5.5.1 Total Dissolved Solids (TDS), Chloride, Nitrate, and Sulfate

Water quality data from 22 wells in Management Zone 5 were evaluated. The wells are shown on Figure 8. Water quality plots for each constituent and for each of the wells are provided in Appendix C. Figures 11a, 11b, 11c, and 11d show the calculated median concentrations in Management Zone 5 for TDS, chloride, nitrate, and sulfate, respectively. Tables 6-18, 6-19, 6-20, and 6-21 below tabulate the median concentration and 90th percentile for the data sets from each well in Management Zone 5 for TDS, chloride, nitrate, and sulfate, respectively. Anomalous high TDS and sulfate concentrations were considered outliers and were not included in the calculation of median concentration and 90th percentile.

Table 6-18. Median TDS Concentrations and 90th Percentile Concentrations for Wells in Management Zone 5

Well I.D.	Median TDS Concentration (mg/L)	90th Percentile (mg/L)
NLF - C5	813	891
NLF-B14	864	886
NLF-C11	815	868
Well 01 - WHR	741	836
Well 02 - WHR	634	672
Well 04 - WHR	-	-
Well 05 - WHR	-	-
WELL 1 - CASTAIC	516	567
Well 10 - WHR	641	748
Well 15 - WHR	564	622
Well 17 - WHR	756	801

Well I.D.	Median TDS Concentration (mg/L)	90th Percentile (mg/L)
Well 18 - WHR	750	750
Well 18R - WHR	761	857
WELL 2 - CASTAIC	502	568
WELL 3 - CASTAIC	530	554
WELL 4 - CASTAIC	544	659
WELL 6 - CASTAIC	390	390
WELL 7 - CASTAIC	468	510
Well D	841	869
Well E-14	-	-
Well E-15	917	1,008
Well E-17	-	-

Table 6-19. Median Chloride Concentrations and 90th Percentile Concentrations for Wells in Management Zone 5

Well I.D.	Median Chloride Concentration (mg/L)	90th Percentile (mg/L)
NLF - C5	71	76
NLF-B14	69	75
NLF-C11	72	72
Well 01 - WHR	73	73
Well 02 - WHR	93	99
Well 04 – WHR	64	64
Well 05 - WHR	74	74
WELL 1 - CASTAIC	74	89
Well 10 - WHR	66	79
Well 15 - WHR	53	64
Well 17 - WHR	64	73

Well I.D.	Median Chloride Concentration (mg/L)	90th Percentile (mg/L)
Well 18 - WHR	85	85
Well 18R - WHR	73	83
WELL 2 - CASTAIC	74	83
WELL 3 - CASTAIC	67	69
WELL 4 - CASTAIC	84	99
WELL 6 - CASTAIC	75	75
WELL 7 - CASTAIC	76	84
Well D	83	92
Well E-14	-	-
Well E-15	96	102
Well E-17	74	74

Table 6-20. Median Nitrate Concentrations and 90th Percentile Concentrations for Wells in Management Zone 5

Well I.D.	Median Nitrate Concentration	90th Percentile
	mg/L	
NLF - C5	-	-
NLF-B14	-	-
NLF-C11	-	-
Well 01 - WHR	2	4
Well 02 - WHR	1	2
Well 04 - WHR	7	7
Well 05 - WHR	9	9
WELL 1 - CASTAIC	2	2
Well 10 - WHR	3	4
Well 15 - WHR	3	4
Well 17 - WHR	4	5

Well I.D.	Median Nitrate Concentration	90th Percentile
	mg/L	
Well 18 - WHR	3	3
Well 18R - WHR	6	7
WELL 2 - CASTAIC	2	2
WELL 3 - CASTAIC	2	2
WELL 4 - CASTAIC	4	9
WELL 6 - CASTAIC	0	1
WELL 7 - CASTAIC	0	1
Well D	8	12
Well E-14	-	-
Well E-15	16	21
Well E-17	-	-

Table 6-21. Median Sulfate Concentrations and 90th Percentile Concentrations for Wells in Management Zone 5

Well I.D.	Median Sulfate Concentration	90th Percentile
	mg/L	
NLF - C5	299	319
NLF-B14	301	321
NLF-C11	283	299
Well 01 - WHR	241	291
Well 02 - WHR	210	236
Well 04 - WHR	-	-
Well 05 - WHR	-	-
WELL 1 - CASTAIC	129	150
Well 10 - WHR	232	296
Well 15 - WHR	191	266
Well 17 - WHR	294	339

Well I.D.	Median Sulfate Concentration	90th Percentile
	mg/L	
Well 18 - WHR	278	278
Well 18R - WHR	281	335
WELL 2 - CASTAIC	132	150
WELL 3 - CASTAIC	147	154
WELL 4 - CASTAIC	173	256
WELL 6 - CASTAIC	78	78
WELL 7 - CASTAIC	110	156
Well D	297	347
Well E-14	280	280
Well E-15	310	316
Well E-17	340	340

6.5.6 Saugus Formation Subunit

The Saugus Formation Subunit (Management Zone 6) underlies most of the alluvial aquifer area. Only the eastern one-half and the southern one-quarter of Management Zone 1 is not underlain by the Saugus Formation. According to DWR (2006c), "*the Saugus Formation is late Pliocene to early Pleistocene age consisting of as much as about 8,500 feet of poorly consolidated, weakly indurated, poorly sorted, sandstone, siltstone, and conglomerate…The upper member of the Saugus Formation contains lenses of conglomerate and sandstone interbedded with sandy mudstone deposited in a terrestrial environment (Slade 2002). Wells in the upper member have typically have higher yields, reaching more than 3,000 gpm.*" Further, DWR reports "*The lower portion of the Saugus Formation is termed the Sunshine Ranch Member, which consists of as much as 3,500 feet of sand and silt deposited in a brackish marine to terrestrial environment (Slade, 2002). Groundwater is not widely produced from this member for municipal and irrigation uses because well yield is typically low, about 100 gpm and the groundwater can be brackish (Slade, 2002). The maximum depth to the base of fresh water is about 1,500 feet northeast of the San Gabriel fault, 5,500 feet between the San Gabriel and Holser faults, and about 5,000 feet southwest of the Holser fault (Slade, 2002). Specific yield is estimated to range from about 5 to 8 percent (Slade, 2002).*" Figure 9 shows municipal supply wells that extract groundwater from the Saugus Formation.

6.5.6.1 Total Dissolved Solids (TDS), Chloride, Nitrate, and Sulfate

DWR (2006c) reports that "*groundwater in the Saugus Formation aquifer is of calcium bicarbonate character in the southeast, calcium sulfate in the central, and sodium bicarbonate in the western parts of the subbasin (Slade 2002). TDS content in the Saugus Formation aquifer ranges from about 500 to 900 mg/L (Slade 2002). Water sampled from 59 public supply wells show an average TDS content of 695 mg/L in the subbasin and a range from 300 to 1,662 mg/L.*"

Saugus Formation wells with some degree of available information are shown on Figure 9. Saugus wells with water quality data prior to the base period are shown on Figure 10. Nine Saugus wells were used to prepare a preliminary evaluation of native water quality for sulfate in the Saugus Formation. Water quality plots for each constituent and for each of the wells are provided in Appendix C. Figures 11a, 11b, 11c, and 11d show the calculated median concentrations in Management Zone 6 for TDS, chloride, nitrate, and sulfate respectively. Tables 6-22, 6-23, 6-24, and 6-25 below tabulate the median concentration and 90th percentile for the data sets from each well in Management Zone 6 for TDS, chloride, nitrate, and sulfate, respectively.

Currently, WQOs have not been assigned for Management Zone 6. For the purposes of this SNMP, the LARWQCB has recommended using the most conservative WQOs of the alluvial management zones for the calculation of assimilative capacity for TDS, chloride and nitrate. These WQOs will be referred to as "interim" throughout the remainder of the report. Due to the lack of sufficient supporting (historical) water quality data for sulfate, an interim WQO for sulfate in Management Zone 6, is not suggested in this study. As such, assimilative capacity for sulfate in Management Zone 6 cannot be calculated at this time.

Table 6-22. Median TDS Concentrations and 90th Percentile Concentrations for Wells in Management Zone 6

Well I.D.	Median TDS Concentration	90th Percentile	Well I.D.	Median TDS Concentration	90th Percentile
	mg/L			mg/L	
Los Valles L&G Well	250	250	Well 205	666	701
WELL 11 - Newhall	690	768	Well 206	786	856
WELL 12 - Newhall	533	599	Well 207	-	-
WELL 13 - Newhall	678	702	Well W160	815	962
Well 201	896	980			

Table 6-23. Median Chloride Concentrations and 90th Percentile Concentrations for Wells in Management Zone 6

Well I.D.	Median Chloride Concentration	90th Percentile	Well I.D.	Median Chloride Concentration	90th Percentile
	mg/L			mg/L	
Los Valles L&G Well	14	14	Well 205	27	29
WELL 11 - Newhall	29	29	Well 206	40	46
WELL 12 - Newhall	37	43	Well 207	27	27
WELL 13 - Newhall	41	44	Well W160	27	30
Well 201	34	37			

Table 6-24. Median Nitrate Concentrations and 90th Percentile Concentrations for Wells in Management Zone 6

Well I.D.	Median Nitrate Concentration	90th Percentile	Well I.D.	Median Nitrate Concentration	90th Percentile
	mg/L			mg/L	
Los Valles L&G Well	11	11	Well 205	9	11
WELL 11 - Newhall	19	20	Well 206	23	30
WELL 12 - Newhall	15	17	Well 207	7	7
WELL 13 - Newhall	30	34	Well W160	12	23
Well 201	16	18			

Table 6-25. Median Sulfate Concentrations and 90th Percentile Concentrations for Wells in Management Zone 6

Well I.D.	Median Sulfate Concentration	90th Percentile	Well I.D.	Median Sulfate Concentration	90th Percentile
	mg/L			mg/L	
Los Valles L&G Well	57	57	Well 205	253	287
WELL 11 - Newhall	304	308	Well 206	271	303
WELL 12 - Newhall	148	189	Well 207	190	190
WELL 13 - Newhall	207	220	Well W160	335	396
Well 201	436	488			

6.5.7 Calculation of Average (ambient) Groundwater Quality Concentration

The median concentrations in individual wells (as shown on Figures 11a through 11d) were used to develop concentration contours for each constituent for each management zone. Figures 12a, 12b, 12c, and 12d present the concentration contours for TDS, chloride, nitrate, and sulfate in the alluvial management zones, respectively. Figures 13a, 13b, 13c, and 13d present the concentration contours for TDS, chloride, nitrate, and sulfate in Management Zone 6, respectively. The average concentration of each constituent in each management zone was calculated based on the volume of water and the median concentration contours. The average concentration for the entire management zone was calculated as the average of the median concentrations in the management zone. The average concentration is shown in the black box over each management zone. Table 6-26 below provides a tabulation of the average groundwater concentration for each constituent in each management zone. The average concentration for each constituent is used as the ambient groundwater concentration for this study. The average groundwater concentration for each constituent, by management zone, is shown in relation to the WQOs in Table 6-27.

Table 6-26. Average (Ambient) Groundwater Concentrations by Management Zone

Management Zone	TDS	Chloride	Nitrate	Sulfate
	[mg/L]			
1a	728	89	20	138
1b	833	72	21	269
4	710	77	16	189
5	727	77	8	246
6	636	28	14	235

Since the Saugus Formation does not have designated WQOs, the average concentration is compared to the WQOs from Management Zone 2 (Placerita Canyon) in Table 6-27 below. The information in Table 6-27 shows that the average groundwater concentrations (ambient) are generally lower than the WQOs. Only TDS in MZ-4 and MZ-1b and Sulfate in MZ-1b exceed the assigned WQO. However, the average concentrations are still below the SMCL set forth by DDW of 1,000 mg/L for TDS.

Table 6-27. Basin Objectives and Average (Ambient) Groundwater Concentrations by Management Zone

Management Zone	Groundwater Subunit	Water Quality Status Comparison	TDS [mg/L]	Chloride [mg/L]	Nitrate [mg/L]	Sulfate [mg/L]
1a	Santa Clara-Mint Canyon	Water Quality Objective	800	150	45	150
		Ambient Water Quality	***728***	***89***	***20***	***138***
1b	Santa Clara-Mint Canyon	Water Quality Objective	800	150	45	150
		Ambient Water Quality	***833***	***72***	***21***	***269***
2	Placerita Canyon[1]	Water Quality Objective	700	100	45	150
		Ambient Water Quality	***NA***	***NA***	***NA***	***NA***
3	South Fork[1]	Water Quality Objective	700	100	45	200
		Ambient Water Quality	***NA***	***NA***	***NA***	***NA***
4	Santa Clara-Bouquet and San Francisquito Canyons	Water Quality Objective	700	100	45	250
		Ambient Water Quality	***710***	***77***	***16***	***189***
5	Castaic Valley	Water Quality Objective	1,000	150	45	350
		Ambient Water Quality	***727***	***77***	***8***	***246***
6	Saugus Formation[2]	Water Quality Objective	700	100	45	NA
		Ambient Water Quality	***636***	***28***	***14***	***235***

[1] Insufficient data to establish trend.

[2] WQOs have not been established for the Saugus Formation. Therefore, at the recommendation of the LARWQCB, the most conservative of the alluvial management zone WQOs for TDS, chloride and nitrate were used for comparison.

Note: Red values indicate exeedance of WQOs.

6.5.8 Assimilative Capacity

The average TDS, chloride, nitrate, and sulfate concentrations for each management zone were determined by preparing concentration contours of the median concentration values (see Figures 11a through 11d) from the wells in each management zone. Figures 12a through 12d show the concentration contours for the alluvial management zones and Figures 13a through 13d show the concentration contours for Management Zone 6. The average groundwater concentration value for each constituent in each management zone is considered to be the ambient groundwater concentration. The ambient concentration for each constituent was subtracted from the specific WQO for that constituent for each management zone (see Table 6-27). The resulting values are the assimilative capacities for each constituent and for each management zone, and are shown in Table 6-28 below.

Table 6-28. TDS, Chloride, Nitrate, and Sulfate Assimilative Capacities by Management Zone

Management Zone	Groundwater Subunit	Assimilative Capacity [mg/L]			
		TDS	Chloride	Nitrate	Sulfate
1a	Santa Clara-Mint Canyon	72	61	25	12
1b	Santa Clara-Mint Canyon	**-33**	78	24	**-119**
2	Placerita Canyon[1]	NA	NA	NA	NA
3	South Fork[1]	NA	NA	NA	NA
4	Santa Clara-Bouquet and San Francisquito Canyons	**-10**	23	29	61
5	Castaic Valley	273	73	37	104
6	Saugus Formation[2]	64	72	31	NA

[1] Insufficient data to establish trend.

[2] WQOs have not been established for the Saugus Formation. Therefore, at the recommendation of the LARWQCB, the most conservative of the alluvial management zone WQOs for TDS, chloride and nitrate were used for comparison.

Note: Red values indicate exeedance of WQOs.

The data indicates that assimilative capacity is available for all constituents for all management zones with the exception of TDS for Management Zones 1b and 4 and sulfate for Management Zone 1b. Assimilative capacity cannot be calculated for Management Zone 6 since there are no current WQOs. Management Zones 2 and 3 have no data set to validate the WQOs.

6.6 State Water Project Water

SWP water is an important part of water supply within the East Subbasin. Water placed in Castaic Lake ultimately provides groundwater recharge as a result of releases from Castaic Lake and indirectly as landscape irrigation water coming from the potable water system and recycled water recharge. Therefore, the quality of water coming from Castaic Lake via the water treatment plants and mixing with native groundwater contributes to the long-term groundwater quality in the groundwater subunits.

According to the 2010 UWMP, all imported water is delivered to Castaic Lake through SWP facilities (Kennedy/Jenks and LSCE, 2011). The West Branch of the California Aqueduct begins at a bifurcation of the Aqueduct south of Edmonston Pumping Plant, which pumps SWP water through and across the Tehachapi Mountains. From the point of bifurcation, the West Branch is an open canal through Quail Lake, a small flow regulation reservoir, to the Peace Valley Pipeline, which conveys water into Pyramid

Lake. From Pyramid Lake, water is released into the Angeles Tunnel, through Castaic Power Plant and into Elderberry Forebay above Castaic Lake, and then into Castaic Lake itself.

From Castaic Lake, which serves as the terminal reservoir of the SWP's West Branch, the water is treated at either CLWA's Earl Schmidt Filtration Plant or Rio Vista Water Treatment Plant and delivered to the retail water purveyors through transmission lines owned and operated by CLWA.

Influent SWP at the Rio Vista Water Treatment Plant ranged in TDS from 234 mg/L to 338 mg/L between 1995 through 2011. The average TDS concentration was 295 mg/L. The chloride concentrations between 1989 and 2011 ranged from 39 mg/L to 144 mg/L with an average concentration of 63 mg/L. Nitrate concentrations ranged from 0.9 mg/L to 4.4 mg/L with an average concentration of 2.3 mg/L. Sulfate concentrations ranged from 38 mg/L to 172 mg/L between 1989 and 2011 with an average concentration of 64 mg/L.

6.6.1 Total Dissolved Solids (TDS)

Historical water quality data from Castaic Lake (1988-2011), Earl Schmidt Filtration Plant effluent (1991-2011), and the Rio Vista Water Treatment Plant effluent (1997-2011) was reviewed. The data plots for Castaic Lake, which are representative of SWP water, are shown in Appendix C. The TDS data indicates that during the period of record, TDS concentrations ranged from 129 mg/L in May 2006 to 400 mg/L in April 1996. The latest water quality sample from Castaic Lake had a TDS concentration of 287 mg/L in September 2011.

The data plot for Earl Schmidt Filtration Plant effluent TDS is also shown in Appendix C. The data indicates that during the period of record, TDS concentrations ranged from 270 mg/L in March 2011 to 393 mg/L in August 2009. The latest water quality sample from the Earl Schmidt Filtration Plant had a TDS concentration of 296 mg/L in September 2011.

The data plot for the Rio Vista Water Treatment Plant effluent TDS shown in Appendix C indicates that during the period of record, TDS concentration ranged from 268 mg/L in June 2011 to 370 mg/L in July 2009. The latest water quality sample from the Rio Vista Water Treatment Plant had a TDS concentration of 292 mg/L in July 2011.

6.6.2 Chloride

The data plot for Castaic Lake chloride is shown in Appendix C. The data indicates that during the period of record (1988-2011) chloride concentration ranged from 40 mg/L in November 2006 to 120 mg/L in

April 1989. The latest water quality sample from Castaic Lake had a chloride concentration of 59 mg/L in September 2011.

The data plot for Earl Schmidt Filtration Plant effluent chloride is also shown in Appendix C. The data indicates that during the period of record (1991-2011) chloride concentration ranged from 47 mg/L in October 1997 to 110 mg/L in March 1991 and April 1992. The latest water quality sample from the Earl Schmidt Filtration Plant effluent had a chloride concentration of 64 mg/L in September 2011.

The data plot for the Rio Vista Water Treatment Plant effluent chloride is shown in Appendix C. The data indicates that during the period of record (1997-2011) chloride concentration ranged from 53 mg/L in October 1997 to 120 mg/L in April 1989. The latest water quality sample from the Rio Vista Water Treatment Plant effluent had a chloride concentration of 62 mg/L in September 2011.

6.6.3 Nitrate as NO3

The data plot for Castaic Lake nitrate (as NO3) is shown in Appendix C. The data indicates that during the period of record (1988-2011) nitrate concentrations ranged from 0 mg/L in April 1996 to 4.4 mg/L in December 2009. The latest water quality sample from Castaic Lake had a nitrate concentration of 1.7 mg/L in August 2011.

The data plot for Earl Schmidt Filtration Plant effluent nitrate is also shown in Appendix C. The data indicates that during the period of record (1991-2011) nitrate concentrations ranged from 0.9 mg/L in March 1991 to 4.6 mg/L in March 2010. The latest water quality sample from the Earl Schmidt Filtration Plant effluent had a nitrate concentration of 1.8 mg/L in August 2011.

The data plot for the Rio Vista Water Treatment Plant effluent nitrate is shown in Appendix C. The data indicates that during the period of record (1997-2011) nitrate concentrations ranged from 1.8 mg/L in May 2011 to 6.1 mg/L in March 2010. The latest water quality sample from the Rio Vista Water Treatment Plant effluent had a nitrate concentration of 1.9 mg/L in September 2011.

6.6.4 Sulfate

The data plot for Castaic Lake sulfate is shown in Appendix C. The data indicates that during the period of record (1988-2011) sulfate concentration ranged from 38 mg/L from January through February 2001 to 130 mg/L in April 1996. The latest water quality sample from Castaic Lake had a sulfate concentration of 54 mg/L in September 2011.

The data plot for Earl Schmidt Filtration Plant effluent sulfate is also shown in Appendix C. The data indicates that during the period of record (1991-2011) sulfate concentration ranged from 46 mg/L in December 2010 to 105 mg/L in April 1995. The latest water quality sample from the Earl Schmidt Filtration Plant effluent had a sulfate concentration of 54 mg/L in September 2011.

The data plot for the Rio Vista Water Treatment Plant effluent sulfate is shown in Appendix C. The data indicates that during the period of record (1997-2011) sulfate concentration ranged from 48 mg/L in April and May 2011 to 83 mg/L in October 1997. The latest water quality sample from the Rio Vista Water Treatment Plant effluent had a sulfate concentration of 54 mg/L in September 2011.

6.7 Surface Water Quality

This section will discuss surface water quality by river reach using the LARWQCB designations for river reaches beginning upstream at Reach 7 and moving downstream to Reach 5. Surface WQOs for the Upper Santa Clara River reaches as set forth in the LARWQCB 1994 Basin Plan and the LARWQCB 2002 TMDLs for Reach 5 and Reach 6 are shown in Table 6-29 below.

Table 6-29. LARWQCB Water Quality Objectives for Inland Surface Waters

Santa Clara River Reach	Description of River Reach	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Boron (mg/L	Nitrogen (mg/L)	Chloride 2002 TMDL[1]
5 (Bluecut)	Between West Pier Hwy 99 and Bluecut Gage	1,000	400	100	1.5	5	100
6 (Highway 99)	Between Bouquet Cyn Rd Bridge and West Pier Hwy 99	1,000	300	100	1.5	10	100
7 (Bouquet Cyn)	Between Lang Gage and Bouquet Cyn Bridge	800	150	100	1.0	5	NA
8 (above Lang Gage)	Above Lang Gaging Station	500	100	50	0.5	5	NA

[1]TMDL amended in 2014

6.7.1 Reach 7 Surface Water Quality

Although the Saugus WRP discharges in Reach 6, SCVSD maintains a monitoring station upstream in Reach 7. Monitoring station SA-RA is typically dry most of the time. Historical water quality data from sampling site SA-RA (2011) was reviewed. According to SCVSD (2005), the sampling site for SA-RA is located 300 ft upstream of the Saugus WRP discharge Point 001. Water quality from the sampling point represents surface water quality both upstream of, and without the influence of, the WRP.

6.7.1.1 Total Dissolved Solids (TDS)

The data plot for SA-RA TDS concentrations is shown in Appendix C. The data indicate that during the period of record, TDS concentration ranged from 440 mg/L in April 2011 to 526 mg/L in March 2011. The TDS concentration at SA-RA remained below the WQO of 800 mg/L in March-April, 2011.

6.7.1.2 Chloride

The data plot for SA-RA chloride is shown in Appendix C. The data indicate that during the period of record, chloride concentration ranged from 19.7 mg/L in March 2011 to 78.4 mg/L in October 2010. The latest water quality sample of SA-RA had a chloride concentration of 36.5 mg/L in April 2011. The chloride concentration at SA-RA has remained below the WQO of 100 mg/L during the recording period.

6.7.1.3 Nitrogen

The data plot for SA-RA total nitrogen is shown in Appendix C. The data indicate that during the period of record, nitrogen concentration ranged from 8.5 mg/L in October 2010 to 31.8 mg/L in December 2010. The latest water quality sample for SA-RA had a total nitrogen concentration of 31.3 mg/L in April 2011. The total nitrogen concentration for SA-RA has remained above the WQO of 5 mg/L for total nitrogen during the recording period.

6.7.1.4 Ammonia Nitrogen

The data plot for ammonia nitrogen from SA-RA, located immediately upstream of the Saugus WRP is shown on Figure 6-1. The SA-RA data, with values of 0.1 mg/L, represent surface water quality upstream of the influence of the WRP.

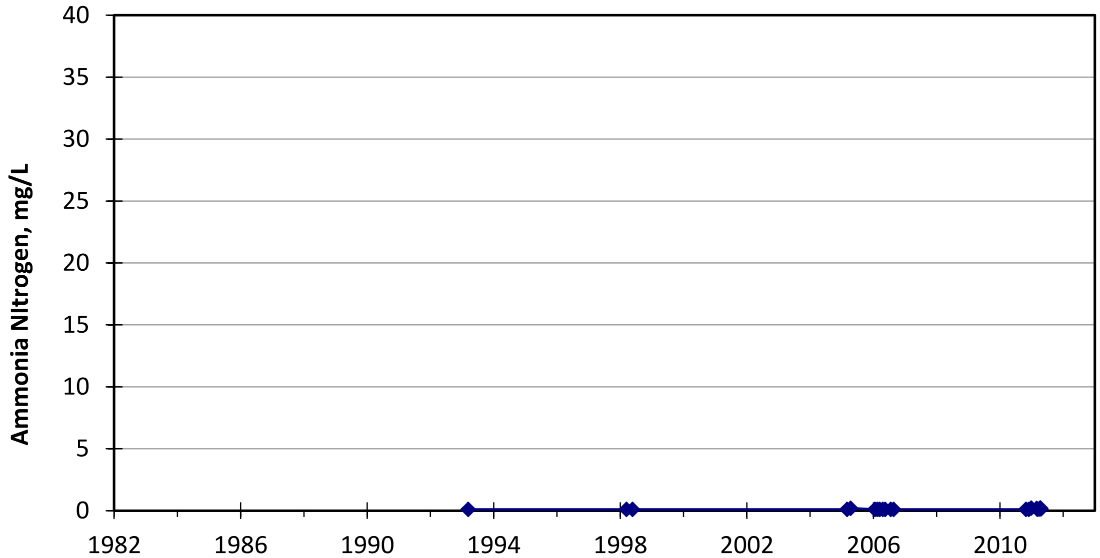


Figure 6-1. Ammonia Nitrogen in Surface Water – SA-RA

6.7.1.5 Sulfate

The data plot for SA-RA sulfate is shown in Appendix C. The data indicate that during the period of record, sulfate concentration ranged from 45 mg/L in April 2011 to 60 mg/L in March 2011. The sulfate concentration for SA-RA has remained below the WQO of 150 mg/L.

6.7.2 Reach 6 Los Angeles County Department of Public Works Surface Water Sampling Station S-29

Historical water quality data from the Saugus WRP effluent (1992-2011), and from the downstream sampling site, SA-RB (2010-2011) was reviewed. According to SCVSD (2005), the sampling site for SA-RB is located 100 ft downstream of Saugus WRP discharge Point 001. Therefore, water quality from SA-RB represents surface water quality downstream of the influence of the water reclamation plant.

6.7.2.1 Total Dissolved Solids (TDS)

The data plot for SA-RB TDS is shown in Appendix C. The data indicate that during the period of record, TDS concentrations ranged from 602 mg/L in August 2011 to 856 mg/L in March 2010. The latest water quality sample at SA-RB had a TDS concentration of 714 mg/L in October 2011. The TDS concentration at SA-RB exceeded the WQO of 800 mg/L at least three times during 2010-2011.

6.7.2.2 Chloride

The data plot for SA-RB chloride is shown in Appendix C. The data indicate that during the period of record, chloride concentration ranged from 106 mg/L in August 2011 to 145 mg/L in January 2011. The latest water quality sample at SA-RB had a chloride concentration of 116 mg/L in October 2011. The chloride concentration at SA-RB has remained above the WQO of 100 mg/L during the recording period.

6.7.2.3 Nitrogen

The data plot for SA-RB total nitrogen is shown in Appendix C. The data indicate that during the period of record, nitrogen concentration ranged from 5.1 mg/L in December 2010 to 8.3 mg/L in January 2011. The latest water quality sample for SA-RB had a total nitrogen concentration of 6.1 mg/L in October 2011. The total nitrogen concentration of the Saugus WRP effluent has remained at or above the WQO of 5 mg/L from 1992-2002 and in 2007. The total nitrogen concentration of the Saugus WRP effluent has remained above the WQO of 5 mg/L from 2009-2011.

6.7.2.4 Ammonia Nitrogen

The data plot for SA-RB ammonia is shown in Figure 6-2 below. The plot shows the impact to operational changes in the plant significantly reducing ammonia concentrations in the surface water in late 2003.

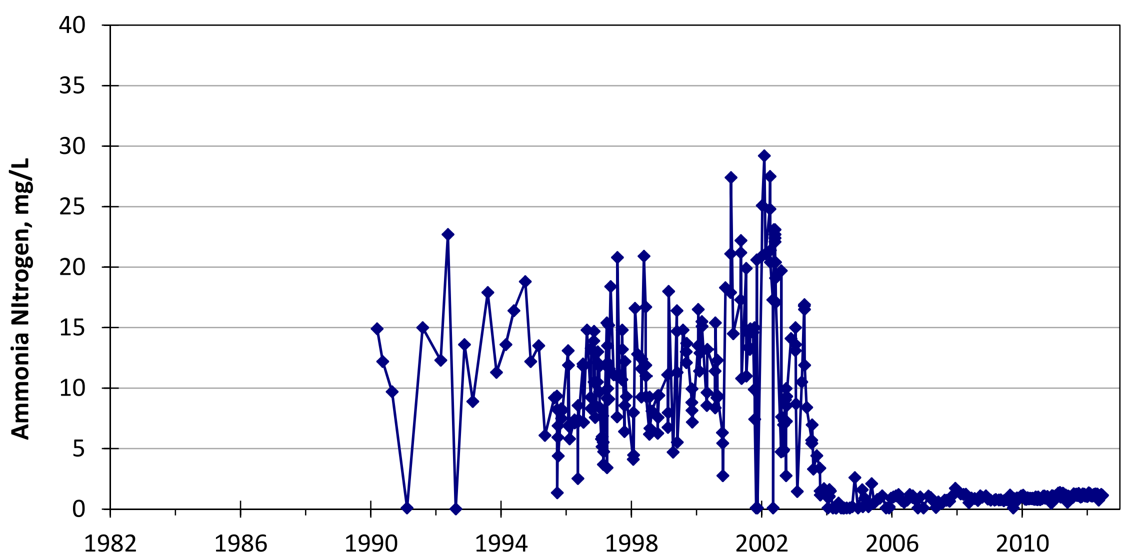


Figure 6-2. Ammonia Nitrogen in Surface Water – SA-RB

6.7.2.5 Sulfate

The data plots for SA-RB sulfate are shown in Appendix C. The data indicates that during the period of record, sulfate concentrations ranged from 122 mg/L in October 2010 to 193 mg/L in March 2010. The latest water quality sample for SA-RB had a sulfate concentration of 171 mg/L in October 2011. The sulfate concentration at SA-RB has exceeded the WQO of 150 mg/L in 2010-2011.

6.7.3 LACDPW Sampling Point S29

The LACDPW surface water sampling point S-29 is used to collect data as required by the County's MS4 permit. The sampling location is immediately west of the Old Road Bridge and east of the Valencia WRP. Surface water sample data for the period 2002 through 2012 was available for this study.

6.7.3.1 Total Dissolved Solids (TDS)

TDS concentrations ranged from 28 mg/L to 942 mg/L for the period of record, and are below the WQO of 1,000 mg/L for Santa Clara River Reach 5.

6.7.3.2 Chloride

Chloride concentrations ranged from 2.58 mg/L to 125 mg/L for the period of record, rising above the WQO of 100 mg/L during portions of each year.

6.7.3.3 Nitrogen

Total nitrogen concentrations ranged from non-detect to 8.38 mg/L for the period of record, rising above the WQO of 5 mg/L during portions of each year. The total nitrogen concentration trendline shown on the data plot provided in Appendix C indicates that the TDS concentrations show a slight increase of approximately 0.16 mg/L per year during the period of record.

6.7.3.4 Ammonia Nitrogen

The data plot for ammonia at sampling point S-29 is shown on Figure 6-3 below. Ammonia concentrations ranged from 0.13 mg/L to 1.35 mg/L for the period of record.

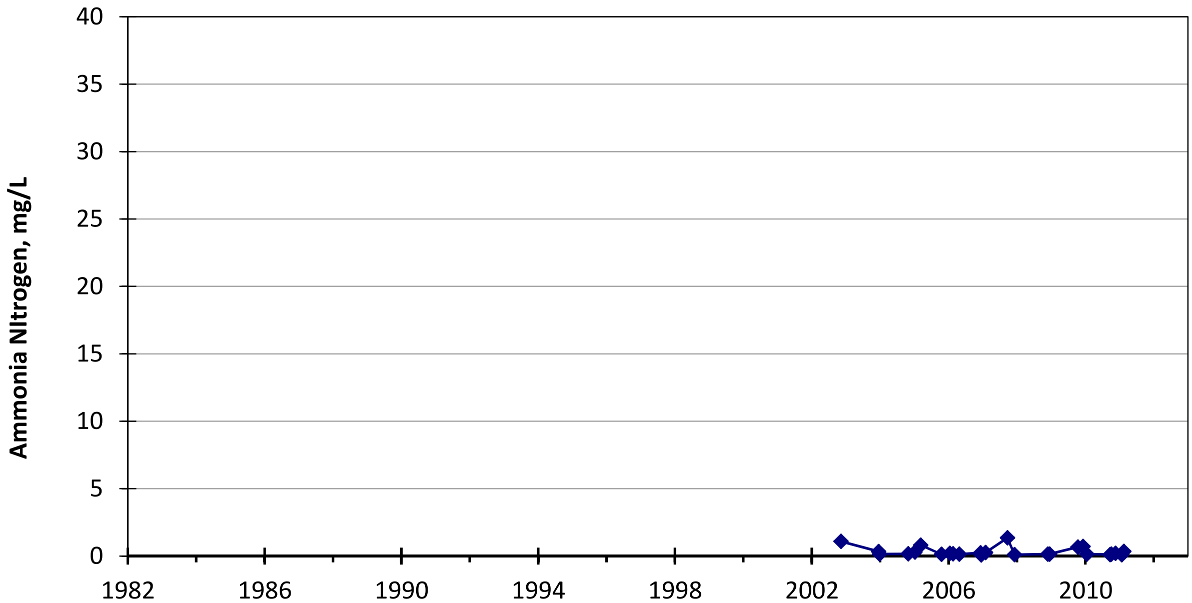


Figure 6-3. Ammonia Nitrogen in Surface Water – LACDPW Surface Water Sampling Site S-29

6.7.3.5 Sulfate

Sulfate concentrations ranged from 2.89 mg/L to 288 mg/L for the period of record, remaining below the WQO of 400 mg/L. The sulfate concentration trendline shown on the data plot provided in Appendix C indicates that the sulfate concentrations show an increase of approximately 1.3 mg/L per year during the period of record.

6.7.4 Reach 5 Surface Waters

Historical water quality data from Valencia WRP effluent (1990-2011), and influent/effluent sampling sites VA-RC (1990-2009), VA-RD (1990-2009), VA-RE (1995-2011) was reviewed. The data plots for Valencia WRP effluent are shown in Appendix C. According to SCVSD, sample Site VA-RC is located 300 ft upstream of Valencia WRP discharge point 001 and sample Site VA-RD is located 300 ft downstream of Valencia WRP discharge point 001. Sample Site VA-RE is located 1.6 miles upstream of Chiquita Canyon Road, which is approximately 2.8 miles downstream of Valencia WRP discharge point 001.

6.7.4.1 Total Dissolved Solids (TDS)

The data plot for Valencia WRP effluent TDS is shown in Appendix C. The data indicates that during the period of record, TDS concentrations ranged from 614 mg/L in February 2007 to 1,100 mg/L in February

2006. The latest water quality sample from the Valencia WRP had a TDS concentration of 706 mg/L in October 2011. The TDS concentration in the Valencia WRP effluent exceeded the WQO of 1,000 mg/L in 2006.

The data plot for VA-RC TDS is shown in Appendix C. The data indicate that during the period of record, TDS concentrations ranged from 604 mg/L in May 1990 to 1,850 mg/L in February 1991. The latest water quality sample at VA-RC had a TDS concentration of 834 mg/L in August 2009. The TDS concentration at VA-RC exceeded the WQO of 1,000 mg/L in 1991-1992, 1998, and 2004.

The data plot for VA-RD TDS is shown in Appendix C. The data indicate that during the period of record, TDS concentrations ranged from 544 mg/L in May 1990 to 1,980 mg/L in February 1991. The latest water quality sample at VA-RD had a TDS concentration of 756 mg/L in August 2009. The TDS concentration at VA-RD exceeded the WQO of 1,000 mg/L in 1991 and 1998.

The data plot for VA-RE TDS is shown in Appendix C. The data indicate that during the period of record, TDS concentration ranged from 338 mg/L in January 2006 to 1,496 mg/L in February 1991. The latest water quality sample from VA-RE had a TDS concentration of 786 mg/L in August 2009. The TDS concentration at VA-RE exceeded the WQO of 1,000 mg/L in 1991 and 2004.

6.7.4.2 Chloride

The data plot for the Valencia WRP effluent chloride is shown in Appendix C. The data indicate that during the period of record, chloride concentrations ranged from 99 mg/L in November 1994 to 231 mg/L in January 2003. The latest water quality sample of Valencia WRP effluent had a chloride concentration of 121 mg/L in September 2011. The chloride concentration in the Valencia WRP effluent has remained above the WQO of 100 mg/L during the recording period – except in November 1994.

The data plot for VA-RC chloride is shown in Appendix C. The data indicate that during the period of record, chloride concentrations ranged from 31 mg/L in March 2005 to 170 mg/L in January 2004. The latest water quality sample at VA-RC had a chloride concentration of 112 mg/L in September 2011. The chloride concentration at VA-RC has remained above the WQO of 100 mg/L during the recording period – except in November 1994.

The data plot for VA-RD chloride is shown in Appendix C. The data indicate that during the period of record, chloride concentration ranged from 0 mg/L in February 2001 to 225 mg/L in October 2002. The latest water quality sample at VA-RD had a chloride concentration of 118 mg/L in October 2011. The chloride concentration in the Valencia WRP effluent has remained above the WQO of 100 mg/L for the majority of the recording period.

The data plot for VA-RE chloride is shown in Appendix C. The sampling point is located furthest downstream from the Valencia WRP discharge. The data indicate that during the period of record, chloride concentrations ranged from 47 mg/L in February 1998 to 145 mg/L in January 2003. The latest water quality sample at VA-RE had a chloride concentration of 114 mg/L in October 2011. The chloride concentration at VA-RE has remained above the WQO of 100 mg/L for the majority of the recording period.

6.7.4.3 Nitrogen

The data plot for the Valencia WRP effluent total nitrogen is shown in Appendix C. The data indicate that during the period of record, total nitrogen concentrations ranged from 1.5 mg/L in July 2008 to 30.4 mg/L in September 1995. The latest water quality sample from the Valencia WRP had a total nitrogen concentration of 4 mg/L in October 2011. The total nitrogen concentration of the Valencia WRP effluent remained above the WQO of 5 mg/L from 1992-2006.

The data plot for VA-RC total nitrogen is shown in Appendix C. The data indicate that during the period of record, nitrogen concentrations ranged from 0.4 mg/L in September 2008 to 7.8 mg/L in February 2000. The latest water quality sample for VA-RC had a total nitrogen concentration of 2.4 mg/L in October 2011. The total nitrogen concentration for VA-RC exceeded the WQO of 5 mg/L for total nitrogen frequently during the period of 1995-2003 and in 2011.

The data plot for VA-RD total nitrogen is shown in Appendix C. The data indicate that during the period of record, nitrogen concentrations ranged from 1.4 mg/L in September 2008 to 25 mg/L in February 1997. The latest water quality sample for VA-RD had a total nitrogen concentration of 4.0 mg/L in October 2011. The total nitrogen concentration for VA-RD remained above the WQO of 5 mg/L for total nitrogen from 1995-2005, and in 2008 and 2010.

The data plot for VA-RE total nitrogen is shown in Appendix C. The data indicate that during the period of record, nitrogen concentrations ranged from 0.4 mg/L in January 2006 to 19.1 mg/L in May 2002. The latest water quality sample for VA-RE had a total nitrogen concentration of 3.5 mg/L in October 2011. The total nitrogen concentration for VA-RE frequently exceeded above the WQO of 5 mg/L for total nitrogen from 1995-2005.

6.7.4.4 Ammonia Nitrogen

The data plot for VA-RC, located immediately upstream of the Valencia WRP discharge point and representing surface water quality upstream of the influence of the Valencia WRP discharge and downstream of the LACDPW S29 sampling site, is shown below on Figure 6-4.

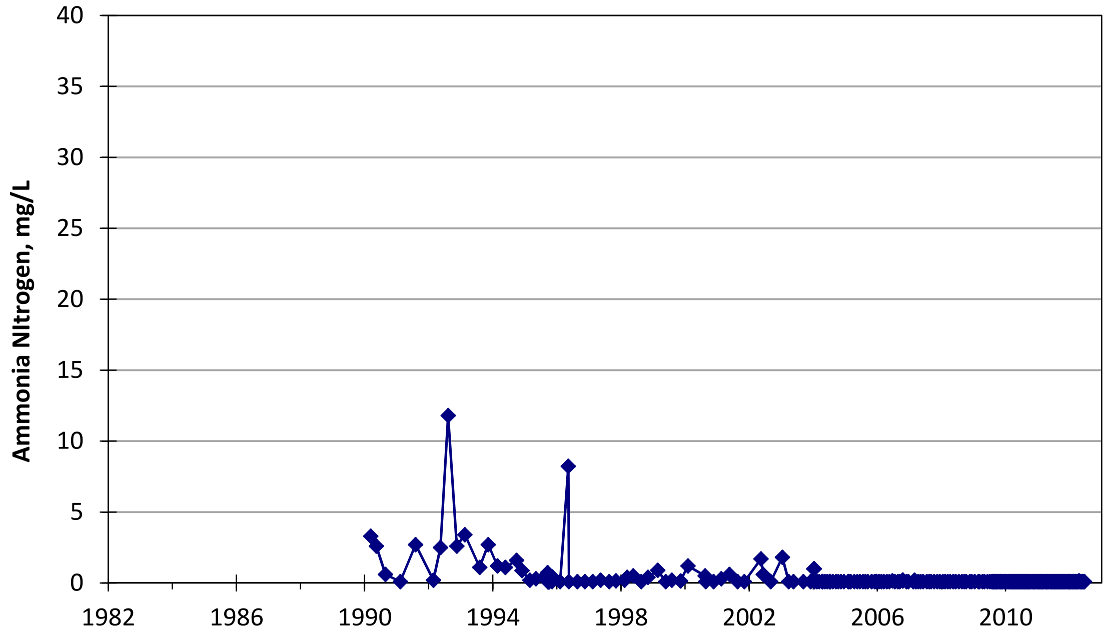


Figure 6-4. Ammonia Nitrogen in Surface Water – VA-RC

The plots below (Figures 6-5 and 6-6) of historical ammonia concentrations from VA-RD and VA-RE show the influence of the Valencia WRP. The impact of operational changes to reduce the ammonia concentrations in the discharge are indicated by the sharp downward trend of ammonia concentrations in late 2003 on both plots.

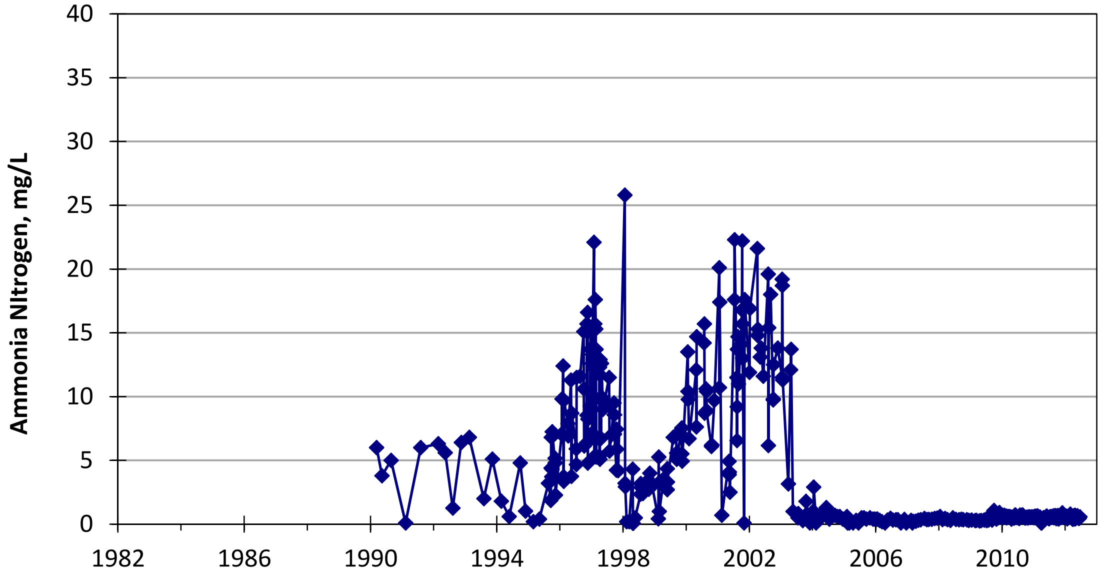


Figure 6-5. Ammonia Nitrogen in Surface Water – VA-RD

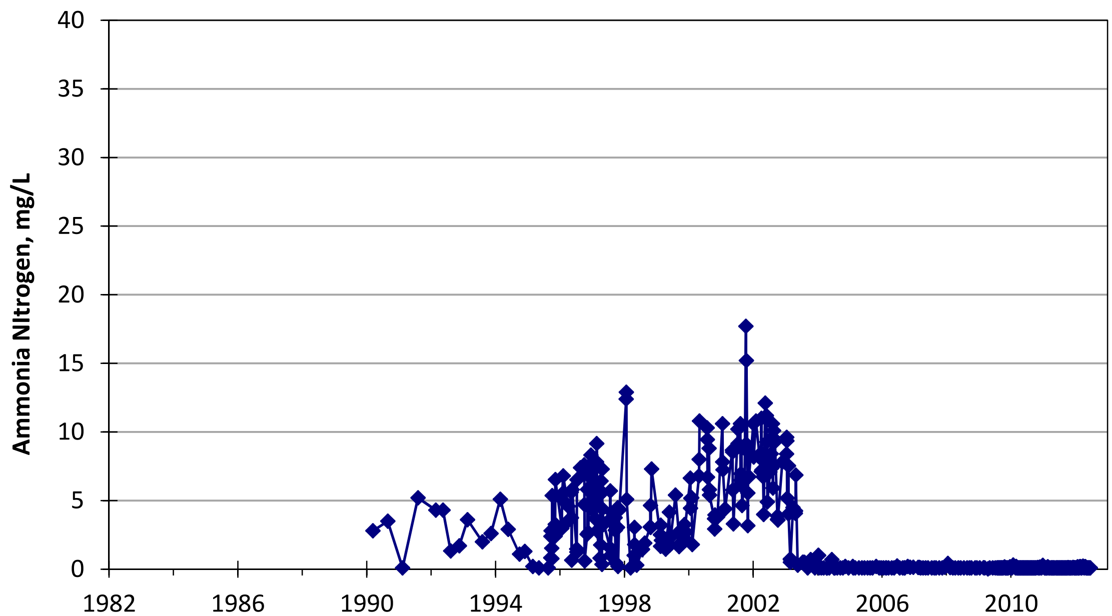


Figure 6-6. Ammonia Nitrogen in Surface Water – VA-RE

6.7.4.5 Sulfate

The data plot for Valencia WRP sulfate is shown in Appendix C. The data indicate that during the period of record, sulfate concentrations ranged from 104 mg/L in December 1999 to 273 mg/L in July 1996. The latest water quality sample from the Valencia WRP had a sulfate concentration of 179 mg/L in October 2011. The sulfate concentration in the Valencia WRP effluent has remained below the WQO of 300 mg/L during the recording period.

The data plot for VA-RC sulfate is shown in Appendix C. The data indicate that during the period of record, sulfate concentrations ranged from 187 mg/L in April 2011 to 455 mg/L in February 1998. The latest water quality sample for VA-RC had a sulfate concentration of 292 mg/L in October 2011. The sulfate concentration at VA-RC exceeded the WQO of 300 mg/L in February 1998, September 2002, February 2004, and from April to December, 2004.

The data plot for VA-RD sulfate is shown in Appendix C. The data indicate that during the period of record, sulfate concentrations ranged from 126 mg/L in January 2004 to 458 mg/L in February 1998. The latest water quality sample at VA-RD had a sulfate concentration of 227 mg/L in October 2011. The sulfate concentration at VA-RD exceeded the WQO of 300 mg/L in February 1998.

The data plot for VA-RE sulfate is shown in Appendix C. The data indicate that during the period of record, sulfate concentrations ranged from 102 mg/L in April 2006 to 342 mg/L in October 2001. The latest water quality sample from the VA-RE had a sulfate concentration of 255 mg/L in October 2011. The sulfate concentration VA-RE has exceeded the WQO of 300 mg/L in October 2001 and January 2010.

6.8 Recycled Water Volumes and Quality

6.8.1 Recycled Water Volumes

Recycled water quality for effluent flows to the Saugus and Valencia WRPs is maintained by SCVSD. Average monthly influent flows have steadily risen from 4.8 MGD to a maximum of 20.9 MGD in 2008. Discharges to the Santa Clara River have steadily increased from 4.8 MGD in 1987 to a maximum of 17 MGD in March 2005. The discharges to the Santa Clara River from the Valencia WRP have declined since 2005 to 14.5 MGD in November 2011.

Average monthly influent flows have steadily risen from a low of 4.5 MGD in 1987 to a maximum of 8.4 MGD at the beginning of 2002 for the Saugus WRP. Discharges to the Santa Clara River rose from 4.3 MGD in early 1987 to a maximum of 7.7 MGD in April 1995.

Approximately 400 acre-ft/yr of recycled water is used in the study area for landscape irrigation. The remaining volume of treated wastewater is discharged to Santa Clara River at either the Saugus or Valencia WRP.

6.8.2 Recycled Water Quality

Water quality concentrations of the effluent recycled water discharges to the Santa Clara River are discussed in the previous sections of Reach 6 Surface Water Quality (Section 6.7.2) and Reach 5 Surface Water Quality (Section 6.7.4) where the Saugus WRP and the Valencia WRP water quality are discussed. Additionally, water quality plots are shown in Appendix C.

7.0 BASIN EVALUATION – SANTA CLARA RIVER VALLEY EAST SUBBASIN

7.1 Background

This section describes the two primary components of the salt and nutrient balance within the East Subbasin – namely: 1) water balance terms, and 2) estimates of salt and nutrient loading for the water balance components. This section also describes historical changes in salt and nutrient loads and parameter concentrations. It also provides a predictive scenario for salt and nutrient loading and parameter concentrations projected into the future using water balance terms for a 23-year period which includes average, wet, and dry climatic cycles and approximates the average annual long-term precipitation for the study portion of the watershed. The future baseline scenario is used in Section 9 to compare with proposed future projects.

A groundwater model prepared by GSI was used to obtain water balance terms and their respective volumes. The GSI Technical Memorandum providing documentation of the development of the water balance terms is included as Appendix D. The Technical Memorandum published by GSI for this analysis is dated December 5, 2014. Subsequent to receiving the technical memorandum, GEOSCIENCE requested that GSI update the water balance tables to provide additional detail in water balance terms for use in the salt loading model. The updated tables used for this analysis are dated August 12, 2015, and are presented following the 2014 technical memorandum as Tables D-1a through D-2h. The spreadsheet model prepared by GEOSCIENCE for this study was used to calculate the historical and future salt loads in the management zones. A description of the water balance for each subunit of the East Subbasin, with the exception of Management Zone 6 (Saugus Formation) is provided below. However, a water balance for Management Zone 6 was provided for future project predictions, as described in Section 9. Groundwater quality in the Saugus Formation management zone from areas that provide most of the potable water is primarily influenced by (1) the water quality of water leaking downward from the alluvial aquifer, and (2) from the recharge of precipitation.

The sources of salts and nutrients to the subunits are described in this section, along with loading estimates for each parameter. The predicted mass balance change and the resultant concentration change for each parameter and for each subbasin under “Land Use Build-Out” conditions is calculated for the period 2012 through 2035. Section 9 of this report provides calculations and discussion of predicted concentration changes for salt and nutrient parameters under specific single “Project” conditions.

7.2 Water Balance

The equation of hydrologic equilibrium involves relating geohydrologic and operational factors in a quantitative form. In hydrologic terms, this is known as the equation of hydrologic equilibrium, water balance, or hydrologic budget. In simple terms it is written as:

Inflow = Outflow ± Change in Storage

The Basin Plan, adopted by the LARWQCB in 1994, was designed to preserve and enhance water quality as well as to protect the beneficial uses of water within the region. The Basin Plan defines major surface waters and groundwater basins into subcategories for planning purposes. These subcategories exhibit consistent hydrological, water quality or adjacent land use characteristics. The surface waters of the Upper Santa Clara River within the East Subbasin are identified as Reaches 7, 6 and 5 (see Figure 4). Surface water in the reaches contributes to groundwater storage in the Alluvial Aquifer/Saugus Formation within the management zones which the surface reach overlies. In turn, the reach receives rising water from the aquifers in the lower portion of the Upper Santa Clara River Valley. WQOs established by the LARWQCB vary within each of the three surface water reaches and six groundwater management zones. Therefore, groundwater budgets for the five alluvial management zones and the Saugus Formation (Management Zone 6) were developed to quantify the hydrologic variables within each subunit which contribute to the groundwater quality under regulation in the Basin Plan. The table below provides the groundwater subunit name, subunit management zone designation, and the surface water reach that interacts hydrologically with the subunit.

Table 7-1. Groundwater Subunit and Management Zones

Groundwater Subunit	Management Zone	Santa Clara River Surface Water Reach
Santa Clara-Mint Canyon	1	Reach 7
Placerita Canyon	2	Tributary
South Fork	3	Tributary
Santa Clara-Bouquet and San Francisquito Canyons	4	Reach 6
Castaic Valley	5	Reach 5
Saugus Formation	6	NA

The water balance takes into account all of the quantifiable hydrologic variables that affect the water resources within the East Subbasin.

Inflow terms include:

- Precipitation infiltration,
- Mountain front recharge,
- Surface water infiltration within streambeds,
- Treated wastewater releases within the Santa Clara River from the Saugus and Valencia WRPs,
- Permitted direct discharges to the Santa Clara River (NPDES),
- Underflow from upgradient subbasins and subunits,
- Return flow from agricultural use,
- Underflow from Castaic Dam leakage,
- Releases from Castaic Lake and Lagoon,
- Domestic use return flow,
- Return flow from recycled water application,
- Discharge from septic tanks and leachfields,
- Storm runoff,
- Rising groundwater from the Saugus Formation contributing to overlying alluvial aquifers, and
- Infiltration of urban runoff (nuisance flows).
- Downward leakage from alluvial basins to the Saugus Formation

Outflow terms include:

- Evapotranspiration,
- Groundwater extraction by purveyors and private wells,
- Rising water from alluvium becoming surface water flowing out of the subbasin,
- Subsurface outflow to adjacent subunits, and
- Downward leakage of alluvial groundwater to the underlying Saugus Formation.
- Upward leakage from Saugus Formation as rising water to alluvial basins

Not all of the terms listed above apply to all management zone water balances. Due to the evaluation of each management zone individually, some outflow terms for one management zone will be considered as inflow for another. For example, rising Saugus Formation water will be considered an outflow term for the Saugus Formation and an inflow term for the Castaic Valley Management Zone. However, the difference between the total inflow and total outflow in each management zone equals the total change in groundwater storage of the entire Alluvial Aquifer. A schematic of groundwater movement between the management zones is shown on Figure 14.

7.2.1 Alluvial Basin Water Balance – Inflows

Initially, water balance terms were prepared based on the hydrologic information available from various sources and the documentation from previously constructed groundwater models. The water balance terms were submitted to the IRWMG for review and comment. Comments were received by CLWA, NCWD, SCWD, and VWC, collectively referred to as the Upper Basin Water Purveyors (UBWP), via their consultant GSI of Santa Barbara, California. In 2004, CH2M Hill prepared a groundwater model for the Santa Clarita Valley and issued a report in April that same year entitled “Regional Groundwater Flow Model for the Santa Clarita Valley: Model Development and Calibration”. GSI has refined and updated the model, referred to in this document as the “Regional Model”, through 2011 and currently uses the model for water management, as directed by the UBWP. With the exception of two inflow terms, the GEOSCIENCE-calculated water balance terms were very close to the terms from the calibrated groundwater model. Based on the closeness of fit, and in consultation with the IRWMG, the model-generated inflow and outflow terms from the groundwater model are used for the water balance inflow and outflow terms and for the subsequent salt balance calculations with two essential modifications, which are discussed below.

The following inflow terms and their values obtained from the groundwater model were used both for the 2001 through 2011 water balance, and in preparing the salt balance:

- Stream leakage,
- Castaic Dam underflow,
- Subsurface inflow from the Acton subbasin and upstream tributaries,
- Upward leakage from the Saugus Formation, and
- Net lateral inflow from adjoining subunits.

A discussion of the calculation of the water balance terms in the model is presented in the report entitled “Calibrated Update of the Regional Groundwater Flow Model for the Santa Clara River Valley Groundwater Basin, East Subbasin” (GSI and LSCE, 2013).

Values for areal recharge and applied water were provided by the groundwater model. However, these terms were further refined to account for the contribution of inflow volumes (and salt loads) from return flow from agricultural, domestic, and septic uses. Since the groundwater model does not simulate terms for mountain front recharge, the model-generated output was further refined to calculate areal recharge from precipitation and mountain front recharge. For this study, GSI modified the model to include leakage from septic systems. A description of the calculation of inflow terms from return flow from agricultural, domestic, and septic uses, and areal recharge are provided in the following section. The rationale for modifications made to the model-generated water balance inflow terms are provided in Appendix E.

7.2.2 Return Flow from Agricultural Practices

Southern California Association of Governments (SCAG) 2008 land use was used to determine the types of land use practices in the East Subbasin. The volume of water applied for agriculture was based on data reported in Table 3-7 of the 2010 UWMP for agricultural users and others (14,500 acre-ft/yr). It was assumed that about 500 acre-ft/yr could be attributed to private wells (or approximately 20% of the residential users in the non-sewered areas); therefore, this amount was not included as applied water for agriculture. The water applied annually for agriculture is that volume applied over the agricultural area. Return flow from deep percolation of agricultural water was assumed to be 25% of the total applied water (Water Resources Engineers, 1970).

7.2.3 Return Flow from Domestic Outdoor Purposes

Domestic land use classification includes residential, commercial and industrial practices. Water use volumes were assumed to be similar to that reflected in the Aqua Terra Calleguas Model for medium density residential (Aqua-Terra, 2004). However, it is assumed that 50% of water used for domestic purposes will be applied outside the home or office building, typically for irrigation purposes. It is anticipated that approximately 20% of this water applied for outdoor purposes will infiltrate and return to groundwater in the form of return flow. Return flow from the application of water on agricultural or golf course land use areas was assumed to be 25%. The difference in return flow percentages reflects the difference in the type of application between residential/commercial and agriculture/golf course use; it is typically assumed that irrigation of landscapes in the residential/commercial setting is more efficient and therefore produces less return flow.

The volume of water from deep percolation of applied water for agricultural and domestic/commercial application was adjusted and distributed to each management zone based on the percentage of contribution from each management zone from the Regional Model. Likewise, the contribution of deep percolation from applied water for agricultural and domestic/commercial application was distributed annually based on the percentage of contribution noted from the model output.

Calculated return flow values from deep percolation of applied water are summarized by land use type in the following Table 7-2.

Table 7-2. Calculation of Return Flow Volume from Deep Percolation of Applied Water

Land Use Type	Acres	Total Applied Water (acre-ft/yr)	Applied Water becoming Return Flow	Return Flow (acre-ft/yr)
Agricultural/Golf Courses	2,132	14,000[1]	25%	3,500
Residential/Commercial	15,149	16,230[2]	20%	3,250
Total				**6,750**

[1] Pumping for Agricultural Uses and Others including Golf Courses: Table 3-7 2010 UWMP (14,500) and assuming that approximately 500 acre-ft/yr (or approximately 20% of residences in unsewered areas) may be private pumping not included in agricultural application.

[2] 50% of Average Annual Extractions for Domestic, Commercial, Industrial 2001-2011: Purveyor Records (32,460 acre-ft/yr; rounded up from 32,457 acre-ft/yr).

7.2.4 Return Flow from Septic Use

Areas where septic systems are in use were assumed to be commercial and residential land use areas as defined by 2008 SCAG Geographic Information System (GIS) data within the East Subbasin where sewered infrastructure was absent. Sewer infrastructure was provided by the City of Santa Clarita, LACSD, and the LADPW. Personal communication with the above mentioned agencies determined that areas beyond the sewered system were likely to be on a septic system. Figure 15 shows the approximate locations of unsewered areas in the study area.

Quantity of seepage from septic use areas was determined by the USGS Water Resource Investigation 03-4009 (USGS, 2003), which estimates that residential and commercial land use septic systems seep as much as 70 gallons per day (gpd) per person and 1,000 gpd per acre, respectively. In addition to the estimates of septic seepage prepared by the USGS, Systech (2002) and the 2010 UWMP (Kennedy/Jenks and LSCE, 2011) estimate household septic use at 75 gpd per capita and 77 gpd per capita, respectively. Based upon a population of approximately 29,343 living in unsewered areas (estimated from census data for areas outside sewer infrastructure), and an average 74 gpd per capita [the average of 70 gpd per person (USGS, 2003), 75 gpd per person (Systech, 2002), and 77 gpd per person (Kennedy/Jenks and LSCE, 2011)], the contribution of septage was estimated to be 2,432 acre-ft/yr.

Table 7-3 below summarizes daily septic seepage by land use type based on the three studies noted above.

Table 7-3. Potential Septic Seepage

USGS (2003)			
Land Use	Persons per House	Houses per Acre	Gallons per Day
Low Density Residential	3	2	70/person
Multi-Family Residential	2	16	70/person
Commercial			1,000/acre
Systech (2002)			
			Gallons per Day
			75/person
2010 UWMP			
			Gallons per Day
			77/person

The volume of recharge water from percolating septage was adjusted and distributed to each management zone based on the percentage of volume obtained from the Regional Model. The annual volume of septage for each management zone was kept constant for each year during the study period.

7.2.5 Landscape Irrigation using Recycled Water

Currently, recycled water for irrigation purposes is applied to the surface of the land underlain by the Saugus Formation subunit from the Valencia WRP. In 2010, approximately 350 acre-ft of recycled water was applied to the Tournament Players Club and nearby roadway medians near McBean and Magic Mountain Parkway. It is estimated that approximately 20% of applied recycled water for irrigation purposes will recharge the groundwater as return flow, or approximately 70 acre-ft/yr. It is anticipated in the future, following the completion of Phases 2b and 2c of the CLWA Recycled Water Master Plan, that additional volumes of recycled water will be applied annually for irrigation purposes. Future use of recycled water is discussed in Section 9 of this report. Figure 16 shows the location of the limited application of recycled water in the study area.

7.2.6 Areal Recharge

The volume of deep percolation from areal recharge was calculated by subtracting the sum of the volume of deep percolation from applied water (6,750 acre-ft/yr; see Section 7.2.3) and the volume of recharge from septage (2,432 acre-ft/yr; see Section 7.2.4) from the total model generated volume for deep percolation (19,644 acre-ft/yr):

$$\begin{pmatrix} Percolation\ from \\ Areal\ Recharge \end{pmatrix} = \begin{pmatrix} Combined\ Volume\ from \\ the\ Regional\ Model \end{pmatrix} - \begin{pmatrix} Deep\ Percolation\ of \\ Applied\ Water \end{pmatrix} - (Septage)$$

= (19,644 acre-ft/yr) – (5,780 acre-ft/yr) – (2,432 acre-ft/yr)

= ***11,432 acre-ft/yr***

The volume of deep percolation from areal recharge was adjusted and distributed to each management zone based on the percentage of contribution from each management zone. Likewise, the contribution of areal recharge was distributed annually based on the percentage of contribution noted from the model output. Water quality data in Castaic Valley (Management Zone 5) appear to be stable. To simulate this condition, the volume of recharge from precipitation was increased and the volume of applied water was decreased iteratively to allow a general match with observed water quality conditions in the management zone. An adjusted volume of 1,000 acre-ft/yr was added to areal recharge.

7.2.7 Alluvial Basin Water Balance – Outflows

The following outflow terms provided by the Regional Model are used for the 2001 through 2011 water balance and salt balance preparation:

- Pumping,
- Discharge to streams,
- Evapotranspiration,
- Subsurface outflow to downstream subunit,
- Downward leakage to Saugus Formation, and
- Net lateral outflow to adjoining subunits

A discussion of the calculation of the water balance outflow terms in the model is presented in the report entitled "Calibrated Update of the Regional Groundwater Flow Model for the Santa Clara River Valley Groundwater Basin, East Subbasin" (GSI and LSCE, 2013) and in the 2014 report presented as Appendix D.

The average annual water balance for each alluvial management zone and the entire Alluvial Aquifer for the period 2001 through 2011 are shown in Table 7-4 below and graphically on Figures 17a through 17e. The water balances for the alluvial basins by year for each management zone and the entire alluvial aquifer are provided in Appendix F, Tables F-1 through F-6

7.3 Saugus Formation Inflows and Outflows

The Saugus Formation is an important source of water in the Santa Clarita Valley. Inflow terms for the Saugus Formation include deep percolation of rainfall on the land surfaces where Saugus Formation is exposed, localized deep percolation of septic systems, applied water, and alluvial basin leakage. Outflows from the Saugus Formation include pumping from the aquifer, discharge to streams from rising water, and evapotranspiration. Table 7-4 tabulates the inflow and outflow terms derived from the regional groundwater model for 2012.

Table 7-4. Summary of Inflow and Outflow Terms for Saugus Formation

Deep Perc of Precip	Deep Perc from Septic Systems	Applied Water Recharge Outside West Side Villages	Applied Water Recharge Inside West Side Villages	Stream Leakage	Downward Leakage from Alluvium + Net Lateral Inflow from Adjoining Units	TOTAL INFLOW	Pumping	GW Discharge to Streams	Evapo-trans-piration	Subsurface Outflow at Blue Cut (County Line)	Upward Leakage to Alluvium	TOTAL OUTFLOW
[acre-ft]												
29,070	1,254	2,787	0	10	3,836	**36,956**	12,841	0	2,499	0	2,751	**18,090**

Table 7-5 provides a summary of water balance terms for all alluvial management zones and the Saugus Formation (Management Zone 6) derived from the Regional Model.

Table 7-5. Summary of Water Balances – East Subbasin Alluvial Aquifer Management Zones

Manage-ment Zone	Deep Perc of Precip	Deep Perc from Septic Systems	Deep Perc of Applied Water	Stream Leakage	Castaic Dam Underflow	Subsurface Inflow from Acton Basin and Upstream Tributaries	Inflow from Adjacent Management Zone	Upward Leakage from Saugus + Net Lateral Inflow from Adjoining Units	TOTAL INFLOW
	[acre-ft]								
1a	2,822	916	1,047	11,268	0	2,633	NA	4,662	**23,349**
1b	193	63	72	772	0	180	NA	320	**1,600**
2	291	560	157	776	0	0	NA	477	**2,261**
3	1,847	375	1,057	4,358	0	0	420	3,924	**11,981**
4	2,829	306	1,106	10,682	0	0	12,930	4,117	**31,970**
5	3,450	212	2,341	9,298	1,701	0	7,613	12,658	**37,273**
6*	29,070	1,254	2,787	10	0	0	3,836		**36,956**
								Total Inflows	**145,390**

Manage-ment Zone	Pumping	GW Discharge to Streams	Evapo-trans-piration	Subsurface Outflow at Bluecut	Downward Leakage to Saugus/upward leakage to alluvium	Outflow to Adjacent Management Zone			TOTAL OUTFLOW
	[acre-ft]								
1a	11,281	2,184	1,243	NA	27	8,655			**23,390**
1b	773	150	85	NA	2	593			**1,603**
2	0	0	785	NA	740	420			**1,945**
3	0	0	3,417	NA	4,671	3,681			**11,769**
4	11,026	10,527	1,882	NA	1,096	7,613			**32,144**
5	15,153	12,151	2,202	6,725	432	NA			**36,663**
6	12,841	0	2,499	0	2,751	0			**18,091**
								Total Outflows	**125,605**

*Saugus terms are those used for 2012 predictive scenarios

Inset Figure 7-1 shows the annual change in groundwater storage for each alluvial management zone for the historical study period. Figure 7-2 below shows the annual change in groundwater storage for the entire alluvial aquifer. Both figures indicate that, with exception of Management Zone 4, groundwater in storage has increased in the management zones. Change in storage was not calculated for Management Zone 6 but is estimated for the predictive scenarios discussed in Section 9. Groundwater storage in the Alluvial Aquifer, as a whole, has increased slightly during the period 2001 through 2011. It should also be noted that downstream surface flows through the Blue Cut gaging station have increased over the years as a result of the constant permitted discharges leaving the Valencia WRP – indicating that storage in the downstream portion of the alluvial aquifer is maintained.

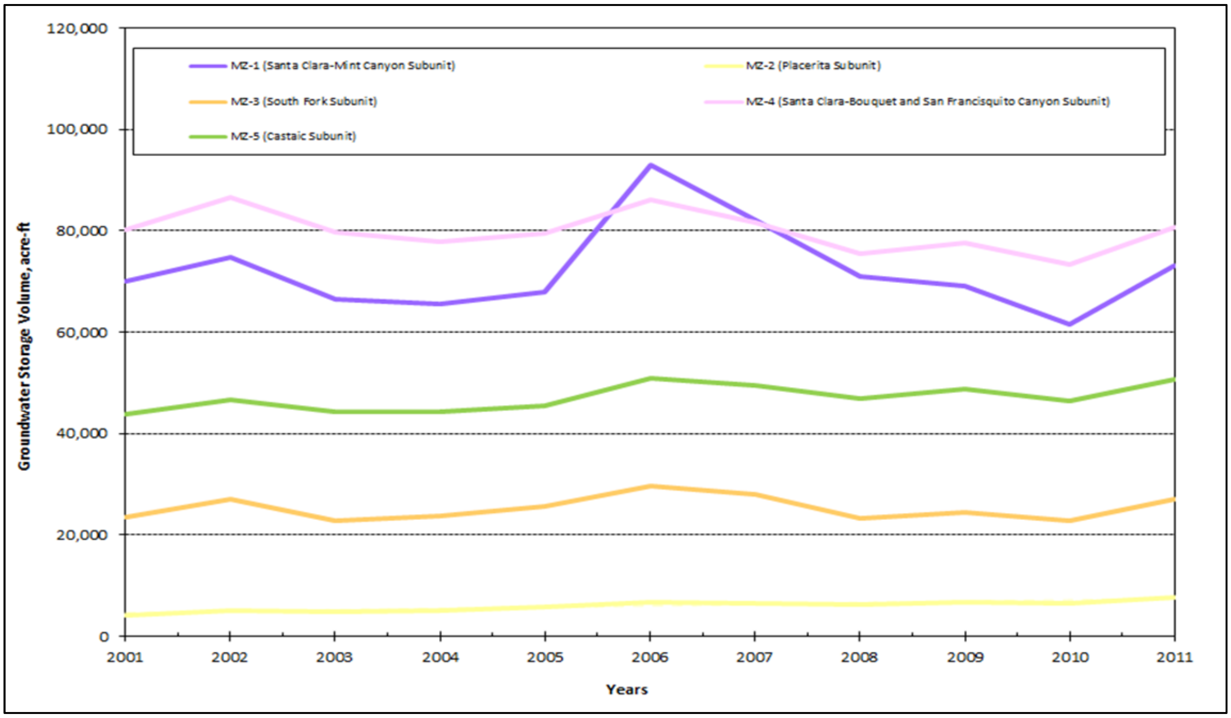


Figure 7-1. Groundwater in Storage – East Subbasin Alluvial Aquifer Management Zones (2001-2011)

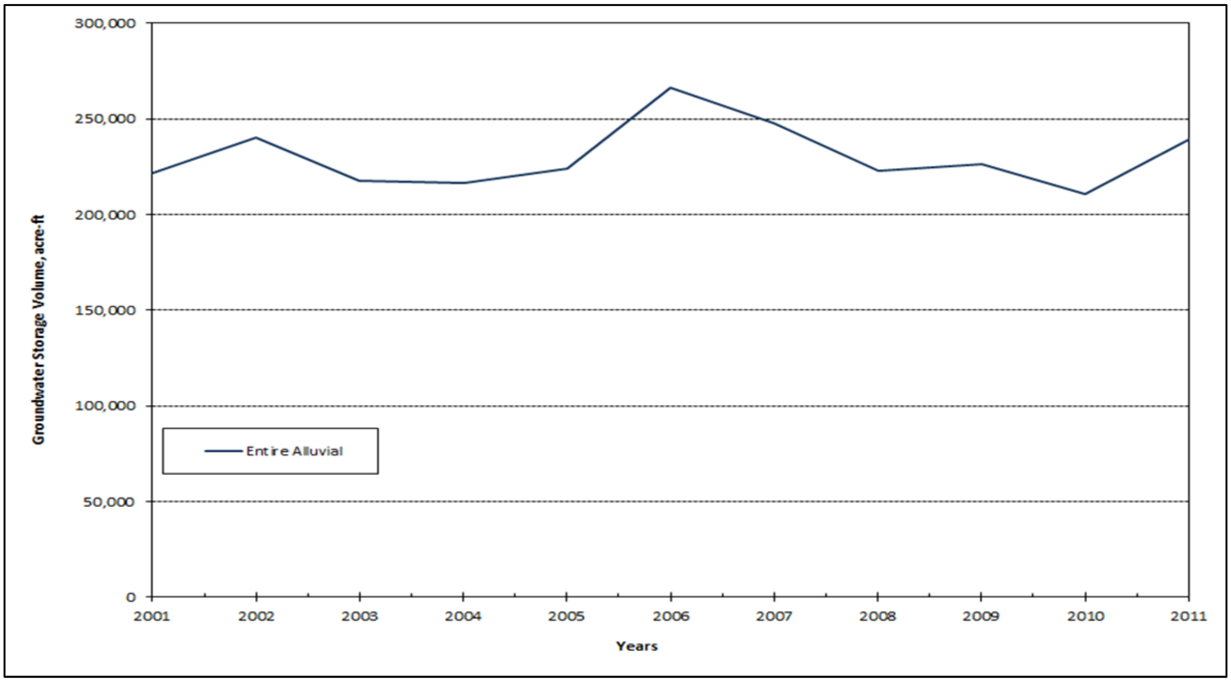


Figure 7-2. Groundwater in Storage – Entire Alluvial Aquifer (2001- 2011)

7.4 Salt and Nutrient Balance

This section describes the salt and nutrient balances for the East Subbasin management zones. A salt balance is defined as:

> *"…the difference (positive or negative) between the quantity of salt carried into a hydrologic system and the quantity of salt removed, plus or minus the change in quantity of salt in storage over a specific period of time" (USGS, 1975).*

Salt and nutrients refer to selected constituents of the TDS in surface water and groundwater. Preparation of the salt and nutrient balance was conducted using the following steps:

1. Determine the inflow and outflow parameters for each management zone (described above).
2. Determine the appropriate salt and nutrient load for each inflow and outflow parameter.
3. Calculate the annual salt and nutrient load for the inflow and outflow parameters and the resultant change in mass (either positive or negative).
4. Calculate the concentration changes in each management zone based upon the annual change in salt and nutrient mass in the management zone and change in groundwater in storage.

5. Calculate the trend in concentrations in each management zone for the period 2001 through 2011.
6. Using the average annual inflow and outflow volumes for the period 2001 through 2011 and calculated average mass loading and concentration of salt and nutrients in each management zone, calculate the mass change and concentration trends for the period 2012 through 2035.

7.4.1 Conceptual Model

Rainfall, surface runoff from rainfall, groundwater recharged from native surface waters and deep percolation of rainfall all contribute to the natural presence of salts and nutrients in hydrologic systems. Salt and nutrients with concentrations above natural system levels occur due to anthropogenic (i.e., man-made) changes in the hydrologic system. The advent of agricultural practices, building of septic systems, discharge of treated wastewater, and discharge of urban stormwater has added additional salt and nutrient loads into the hydrologic system that would not have occurred under natural conditions.

Salt and nutrients in the East Subbasin come from both natural and anthropogenic sources. Natural sources of salt and nutrient loads consist of:

- Rainfall occurring in the watershed tributaries and subunits;
- Natural surface flows in the Santa Clara River and tributary drainages; and
- Groundwater recharge from natural sources such as surface infiltration of natural runoff and deep percolation of rainfall in the watershed.

Anthropogenic sources of salt and nutrients in the East Subbasin consist of:

- Return flow from domestic, commercial, and industrial landscape application, including golf courses;
- Return flow from agricultural application;
- Recharge from septic tanks and leach fields;
- Infiltration of urban stormflows and nuisance flows;
- Discharge and infiltration of surface flows under municipal permits;
- Atmospheric deposition; and
- Discharge and infiltration of treated wastewater.

The identification and quantification of salt and nutrient loads from the various natural and anthropogenic sources is necessary to evaluate the quantity of salt nutrients that come into and leave the East Subbasin on an annual basis. Salt and nutrient loading is associated with various land uses (as shown on Figure 2). Figures 18a, 18b, 18c, and 18d show the location of storm drains and storm drain discharge points in the Santa Clara River. Storm drains collect surface flow from urban areas with subsequent discharge and infiltration in the Santa Clara River bed. The quantification of salt and nutrient loading was developed by determining the potential volume of water coming from each source and applying an appropriate loading factor based on water quality sampling data and the distribution of potential salt loads by land use.

7.4.2 Salt and Nutrient Source Identification

Salts occur naturally in surface water and groundwater from the dissolution of minerals in soils and geologic formations. Salts in the environment are concentrated as a result of agricultural and landscape irrigation, septic systems, infiltration ponds and natural surface water drainages that receive treated wastewater.

Nutrients (e.g., nitrate, phosphorus, potassium) occur in nature and are needed by plant life for growth. However, due to its effects on human beings, nitrate is of concern when elevated concentrations are present in groundwater. The sources of nitrate include the use of fertilizers in the past and present for agricultural activities (including golf courses), discharges from septic tanks, and treated wastewater.

7.4.3 Alluvial Basin Inflow and Outflow Parameter Concentrations

7.4.3.1 Alluvial Basin Inflow Parameter Concentrations

A summary of salt and nutrient loading factors for inflow and outflow parameters applied to each management zone and the assumptions used to generate the salt and nutrient loads are provided in Appendix F as Tables F-7 through F-12. The loading factors were reviewed by the LARWCB as a part of the document review process. Note that the calculation and application of the annual salt and nutrient loading to the groundwater subunits occurs once during each model annual time-step when using a spreadsheet model. The model does not account for the period of time required in the natural system for salt and nutrients to move through the unsaturated zone and into the groundwater system. However, since the alluvial system is relatively shallow and it (historically) responds rapidly to recharge from stormflows, the movement of salt and nutrients into the groundwater system and out of the groundwater system as rising water likely occurs rapidly. In addition, inflow from upgradient management zones was calibrated to match historical water quality for Management Zones 4 and 5 (i.e., inflow from Management Zone 3 and Management Zone 4, respectively). This is discussed further in Section 7.3.3.3.

7.4.3.2 Alluvial Basin Outflow Parameter Concentrations

Salt and nutrient outflow concentrations for each outflow term are calculated by the spreadsheet model based upon the loading factors shown in Appendix F, Tables F-1 through F-6. The calculation and application of the annual salt and nutrient loading to the groundwater management zones occurs once during each model annual time-step in the spreadsheet model. Tables F-13a through F-18d show the concentrations of each outflow term, by year, for 2001 through 2011.

7.4.3.3 Calibration of Spreadsheet Model for Historical Conditions

The spreadsheet model was calibrated to generally match historical water quality conditions. An iterative process was used to determine which parameters were sensitive to change and to determine the appropriate salt loads within a reasonable range that would result in a general match of the historical conditions. The process included using initial salt loading factors which were subsequently changed to result in a match of historical water quality. The spreadsheet model cannot directly simulate the physical condition of salts abandoned in the vadose zone which subsequently are flushed during high rainfall events, or from subsurface flow from geologic materials such as the Mint Canyon Formation which underlies the eastern portion of Management Zone 1. Therefore, salt concentrations in stream leakage were increased to match historical water quality. The salt loading factors which arrived as a result of the sensitivity and calibration processes, are reported in Appendix F, Tables F-7 through F-12. They are also used as the basis for the predictive scenarios discussed in Section 7.2.

7.4.3.4 Historical Salt and Nutrient Concentrations

After the calibration procedure, the salt and nutrient loads were applied to the annual water balances for each management zone to evaluate the annual and overall changes in salt and nutrient concentrations for the study period. Since land uses have not significantly changed from the period 2001 through 2011, salt and nutrient loading is assumed to remain the same during this period. Projected salt and nutrient loading, discussed in the following section, takes into consideration proposed land use changes in the East Subbasin and the associated change in annual water budgets.

Tables F-13a through F-18d show the average annual salt and nutrient loads for Management Zones MZ-1a, MZ-1b, MZ-2, MZ-3, MZ-4, and MZ-5 for 2001-2011. The tables provide the total mass of salt in the combined inflow parameters and the combined outflow parameters and tabulate the positive or negative change in mass for each year. The ending concentrations of groundwater in storage are used as beginning points for future projections. The model calculation for the average groundwater concentrations may be slightly lower or higher than those calculated from the groundwater data discussed in Section 6. This is due to a number of factors, including loading estimates applied over a wide range of terrane, uncertainties introduced due to gaps in water quality spatially and temporally, and the fact that the spreadsheet model format predicts concentrations once during each model annual time-step. However, the model provides an appropriate predictive tool since the range of concentrations and concentration changes are similar to those observed in the water quality data.

The salt balances for the historical period (2001-2011) for each management zone are illustrated on Figures 19a through 19f. The values provided on the figures are in tons. The mass of each constituent is shown by colors and explained in the legend in the top left had corner of the figure. A negative value indicates a decrease in mass in the management zone as a result of groundwater outflow. Positive values indicate an increase in mass in the management zone as a result of flow into the groundwater in the management zone.

7.4.4 Saugus Formation Inflow and Outflow Concentrations

7.4.4.1 Saugus Formation Inflow Concentrations

Salts moving into and out of the Saugus Aquifer (MZ-6) attributable to anthropogenic sources and groundwater management activities, are taken into account in the movement of groundwater between the alluvial basin and the upper portion of the Saugus Aquifer in the groundwater model.

The loading concentrations to the Saugus Formation were determined by inflow parameters concentration in alluvium (Management Zone 1a through Management Zone 5) multiplying the ratio of the area of alluvium in each Management zone overlying Saugus Formation and the total area of Saugus Formation. Table below summarized the area of alluvium within Saugus Formation and the ratio for each Management Zone.

For example, TDS concentration for Deep Percolation from Septic Systems is 777 mg/L, 777 mg/L, 808 mg/L, 833 mg/L, 783 mg/L, and 758 mg/L for Management Zone 1a, 1b, 2, 3, 4, and 5, respectively. TDS concentration for Deep Percolation from Septic Systems in Saugus Formation is calculated as following:

777*0.08 + 777*0.02 + 808*0.04 + 833*0.22 + 783*0.33 + 758*0.31 = 786 mg/LTable 7-5 below shows the calculated ratio from the specific area of Suagus Formarion underlying each management zone.

Table 7-6. Underlying Alluvial Management Zones and Ratio for Concentration Calculation

Management Zone	Area within Saugus Formation [Acres]	Ratio
1a	1,528	0.08
1b	491	0.02
2	716	0.04
3	4,338	0.22
4	6,493	0.33
5	6,215	0.31
Total	19,780	1.00

Note that the ratio of loading concentration for applied water recharge inside West Side Villages in the Saugus Formation only uses the area of Management Zone 4 and 5 due to the fact that this flux term (applied water recharge) only occurs in these two management zones. Table below summarizes ratio used to calculate applied water recharge inside West Side Villages in Saugus Formation. For example, TDS concentration for applied water recharge inside West Side Villages is 4,991 mg/L and 4,835 mg/L for Management Zone 4 and 5 respectively. TDS concentration for applied water recharge inside West Side Villages is calculated as following: 4991*0.51 + 4835*0.49 = 4,915 mg/L

Table 7-7. Alluvial Management Zones 4 and 5 and Ratio for Concentration Calculation for Westside Villages

Management Zone	Area within Saugus Formation [Acres]	Ratio
4	6,493	0.51
5	6,215	0.49
Total	12,708	1.00

Using the ratios shown in the tables above, initial salt and nutrient concentrations for Saugus Formation inflow terms were calculated for the first year of the predictive scenarios (2012). Table 7-7 below tabulates the initial concentrations for the water balance terms for the Saugus Formation inflow parameters.

Table 7-8. Salt and Nutrient Concentrations for Saugus Formation Inflow Water Balance Terms

Inflow Terms	TDS	Chloride	Nitrate	Sulfate
	mg/L			
Deep Percolation of Precipitation	100	40	9	40
Deep Percolation from Septic Systems	786	105	43	150
Applied Water Recharge Outside West Side Villages	2,267	302	16	433
Applied Water Recharge Inside West Side Villages	4,915	687	34	917
Stream Leakage	669	89	13	179
Downward Leakage from Alluvium + Net Lateral Inflow from Adjoining Units	816	93	18	218

7.4.4.2 Saugus Formation Outflow Concentrations

Salt and nutrient outflow concentrations for each outflow term are calculated by the spreadsheet model based upon the loading factors shown in Table 7-7. The calculation and application of the annual salt and nutrient loading to the groundwater management zones occurs once during each model annual time-step in the spreadsheet model.

7.4.5 Projected Groundwater Storage Change and Salt Balance: 2012-2035

7.4.5.1 Projected Groundwater Storage Change

For future projections, the amount of precipitation and projected variations in groundwater pumping was based on future hydrologic conditions simulated using the historically observed rainfall conditions that occurred in the Santa Clarita Valley from 1980 through 2003. This period included years of normal rainfall, above-normal rainfall, and multi-year drought periods. Average precipitation for this period is 18.13 inches, which is identical to the long-term average precipitation for the period of record (18.13 inches from 1931 through 2011).

Changes in land use, recharge from urban irrigation and septic systems, return flows from agricultural irrigation, stormflows, recharge to streams, and recharge from treated wastewater discharge to the Santa Clara River are considered in the future predicted water budgets. Appendix E describes the derivation of the pumping volumes used for the future period as well as an explanation of all of the terms used in the water balance for future predictions.

Currently, discharges from the Valencia WRP are assumed to flow out of the East Subbasin without mixing with the groundwater system in Management Zone 5. This assumption is based on the fact that for most of the year, natural rising water from the Saugus Formation to the alluvium precludes downward percolation of surface flows from the Santa Clara River. However, since discharge from the Saugus WRP is located further east (discharges to the river immediately above the mouth of the South Fork), the contribution of the Saugus WRP was estimated by determining the flows in the river during dry years when little or no flow would come from other sources. The estimated contribution to the groundwater system from Saugus WRP flows are included in the future water balance.

Figure 7-3 below shows the projected change in groundwater storage under "Land Use Build-Out" (i.e., no additional projects) for each Alluvial Aquifer management zone from 2012 through 2035. Figure 7-4 shows the projected change in groundwater storage for the entire Alluvial Aquifer from 2012 through 2035. Figure 7-5 shows the projected change in groundwater storage for Management Zone 6 for the period 2012 through 2035.

7.4.5.2 Projected Salt and Nutrient Balance

Projections of salt and nutrient loading for the period 2012 through 2035 were conducted by using the average annual water balance terms for both inflow and outflow terms from the GSI groundwater model (see Appendix D, Tables D-1a and D-2h). The model was modified to include projected land use changes from the City of Santa Clarita Planning document for areas within the City and from OVOV planning for areas within Los Angeles County but outside the City. Land use categories were modified to provide consistent designations of land uses both from the City document and from OVOV. Land use changes were assumed to be linear in the model. Therefore, annual water budgets progressively include the changes as a result of changes in land use. The change in mass within each management zone and concentration changes were calculated annually through 2035 in the spreadsheet model. The projections represent changing land use conditions and climate, with the resulting water balance volumes calculated annually from 2012 through 2035. Table F-19a through Table F-25d provide the projected water balances, mass loading changes, and calculated concentration changes for the period 2012 through 2035 for TDS, chloride, nitrate, and sulfate for each management zone. Land use changes and proposed projects will affect MZ-6 in the projected period 2012 through 2035; therefore a water balance and salt balances are included for Management Zone 6.

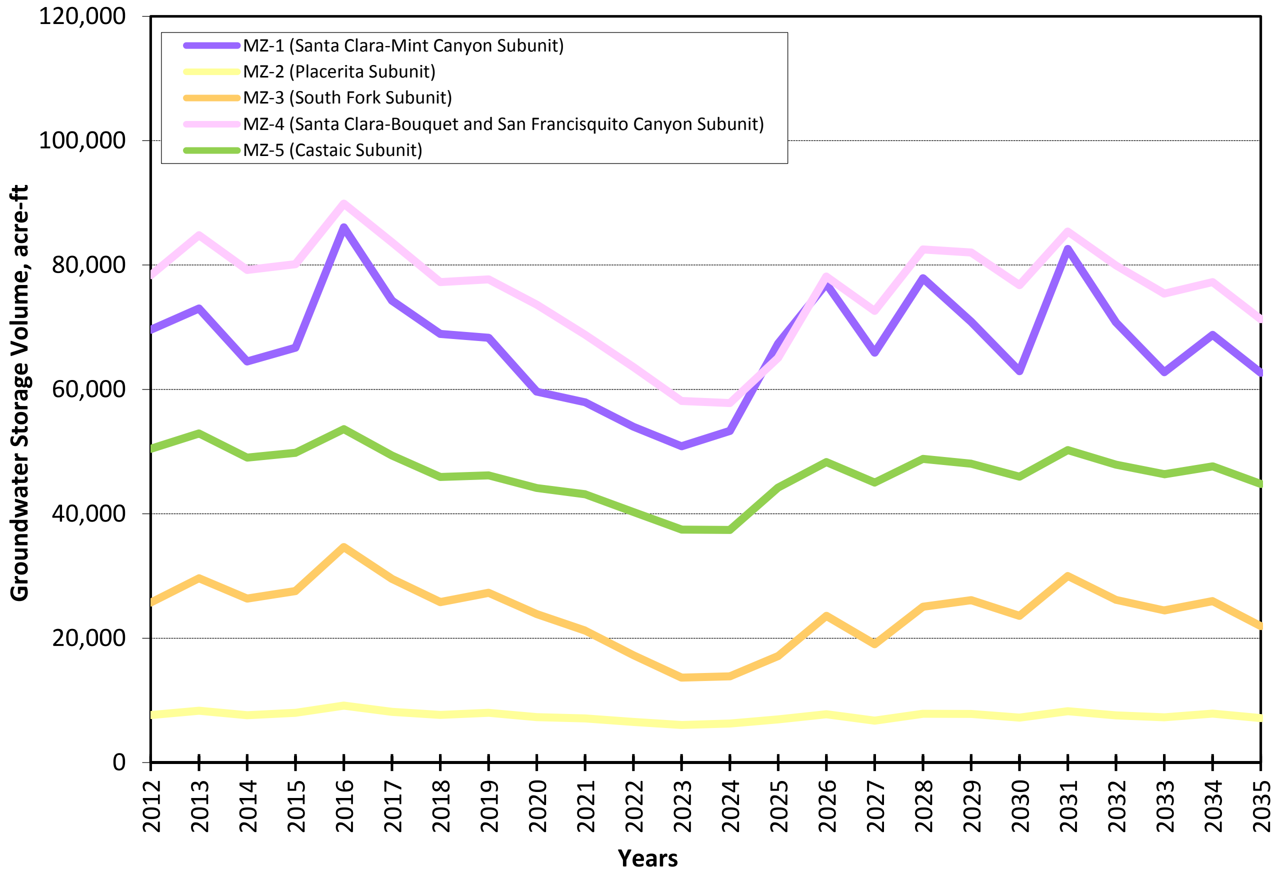


Figure 7-3. Groundwater in Storage – East Subbasin Alluvial Aquifer Management Zones (2012-2035)

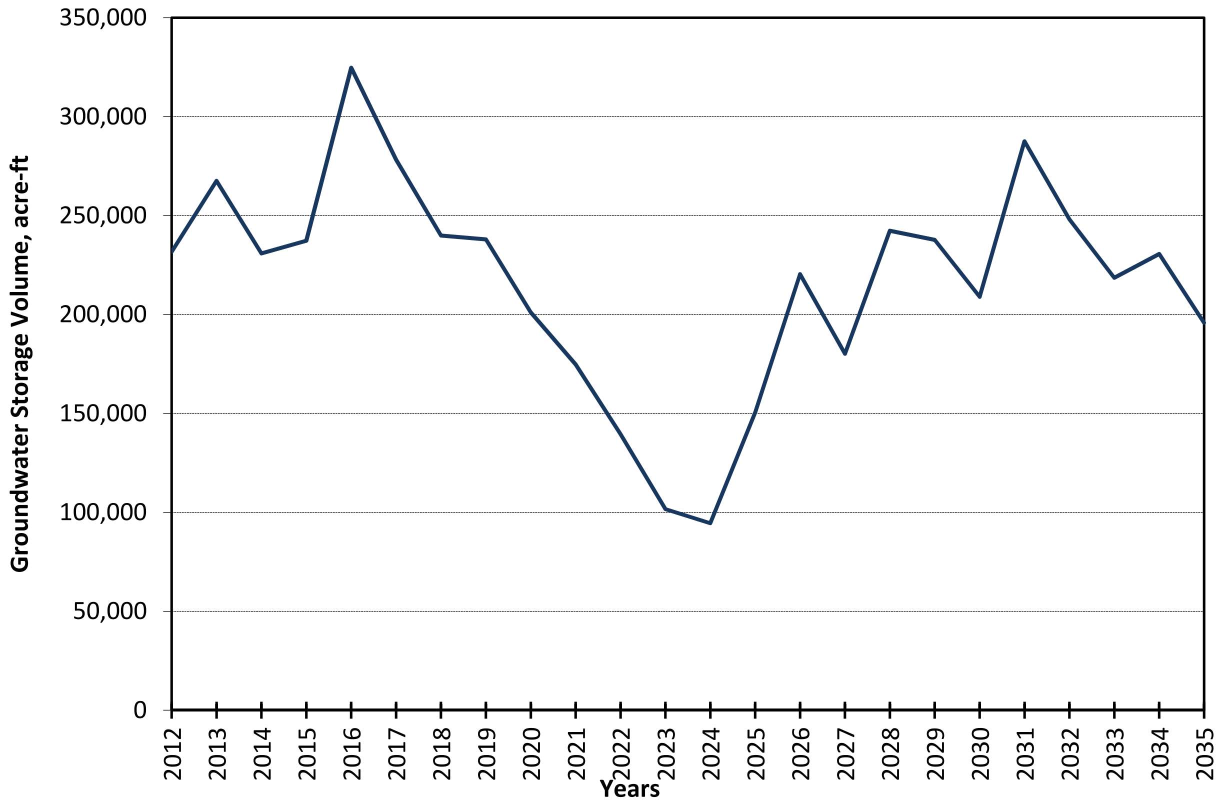


Figure 7-4. Annual Groundwater Storage Change – Entire Alluvial Aquifer East Subbasin (2012-2035)

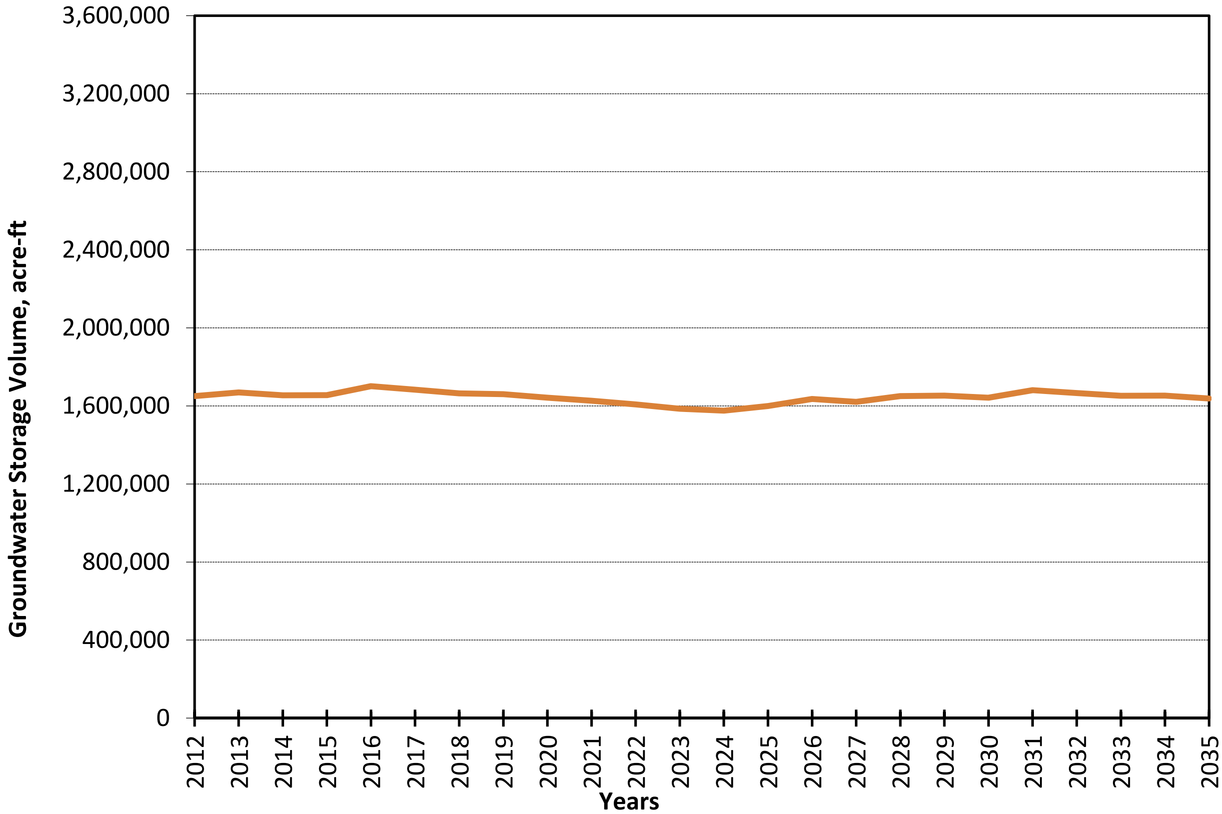


Figure 7-5. Groundwater in Storage – Saugus Formation (2012-2035)

The water and salt balances for each management zone under the continuance of existing conditions from 2012 through 2035 towards Land Use Build-Out are shown on Figures 20a through 20f and Figures 21a through 21g, respectively. These figures summarize the change in water storage and mass for each constituent for each management zone. The projected concentration changes for all management zones are shown on Figures 22.1.a through 22.1.g, Figures 22.2.a through 22.2.g, Figures 22.3.a through 22.3.g, and Figures 22.4.a through 22.4.g for TDS, chloride, nitrate and sulfate, respectively. The Land Use Build-Out predictive scenario includes changes in water use based on annual land use changes through the entire period without the addition of new water management projects. The concentration plots (and those provided in Section 9) include the following:

- Projected concentration changes as a solid colored line (colors are assigned by constituent),
- Average projected concentration as a horizontal line of the same color as the concentration plot,
- Average (ambient) groundwater quality,
- Average projected baseline concentration (under Land Use Build-Out conditions) for comparison,

- WQO (with the exception of sulfate for Management Zone 6),
- Current assimilative capacity (calculated in Section 6),
- 90^{th} percentile[9] of the projected concentrations (text box in plot shows 90^{th} percentile value), and
- Projected assimilative capacity for 2012 through 2035.

The summaries of Land Use Build-Out conditions results for all constituents are included in attached Tables 1a through 1d. The Table 7-5 below summarizes the average TDS, chloride, nitrate and sulfate concentrations as a result of Land Use Build-Out conditions (i.e., changes in land use in accordance with local and regional land use plans but without the addition of any new water conservation or recycled water projects for the period 2012 through 2035). The changes in salt and nutrient concentrations in each management zone are compared to the basin objective for the management zones in the table below.

Table 7-9. Salt and Nutrient Concentrations under Land Use Build-Out Conditions

Chemical (Units in mg/L)	**Management Zone 1a**		**Management Zone 1b**		**Management Zone 2**		**Management Zone 3**		**Management Zone 4**		**Management Zone 5**		**Management Zone 6[3]**	
	WQO[1]	**LUB[2]**	**WQO**	**LUB**	**WQO**	**LUB**	**WQO**	**LUB**	**WQO**	**LUB**	**WQO**	**LUB**	**WQO**	**LUB**
TDS	*800*	739	*800*	790	*700*	-	*700*	-	*700*	**1.0**	*1,000*	728	*700*	636
Chloride	*150*	89	*150*	72	*100*	-	*100*	-	*100*	93	*150*	79	*100*	46
Nitrate	*45*	19	*45*	23	*45*	-	*45*	-	*45*	19	*45*	11	*45*	19
Sulfate	*150*	150	*150*	**225**	*150*	-	*200*	-	*250*	166	*350*	248	-	251

[1] WQO = Water Quality Objective
[2] LUB = Land Use Build-Out
[3] WQOs have not been established for the Saugus Formation. Therefore, at the recommendation of the LARWQCB, the most conservative of the alluvial management zone WQOs for TDS, chloride and nitrate were used for comparison.

Review of the table above indicates that only sulfate in Management Zone 1b and TDS in MZ-4 will exceed the WQO under Land Use Build-Out conditions.

[9] The 90^{th} percentile represents the value for which 90% of the projected concentrations fall below, or 10% of the projected concentrations fall above.

7.4.5.3 Assimilative Capacity Change from Land Use-Build-Out: 2012-2035

The results of the spreadsheet model indicates that future groundwater concentrations under Land Use Build-Out conditions in some cases, use assimilative capacity at a rate greater than the thresholds established by the LARWQCB Recycled Water Policy for planned recycled water projects.

Table 7-6 shows the assimilative capacity used in the management zones as a result of Land Use Build-Out conditions. It was calculated as the difference between the current assimilative capacity (determined from ambient concentrations) and the projected assimilative capacity. A negative number indicates that no assimilative capacity was used and represents an increase in assimilative capacity (i.e., the projected water quality will be lower than the current ambient concentrations).

Table 7-10. Assimilative Capacity Used – Land Use Build-Out

Chemical	Management Zone 1a	Management Zone 1b	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5	Management Zone 6
TDS	-15%	129%	-	-	12%	0%	-1%
Chloride	0%	0%	-	-	-71%	-3%	-24%
Nitrate	3%	-9%	-	-	-10%	-8%	-17%
Sulfate	-102%	37%	-	-	39%	-2%	-

Note: negative (-) values denote a *decrease* in assimilative capacity

TDS assimilative capacity will decrease in Management Zone 1b and Management Zone 4, but increase in Management Zone 1a and Management Zone 6. TDS concentrations under the Land Use Build-Out conditions do not change in Management Zone 5. Chloride assimilative capacity will not change in Management Zones 1a and 1b, but will increase in Management Zones 4, 5, and 6. Nitrate assimilative capacity will increase for all management zones – except Management Zone 1a. Assimilative capacity cannot be calculated for sulfate in Management Zone 6 because there is no WQO for reference and comparison. Modeling indicates that sulfate concentrations in Management Zones 1a, 5, and 6 will increase 8.7%, 0.9%, and 6.9%, respectively, from Land Use Build-Out. Sulfate concentrations will decrease by 16% and 13% in Management Zone 1b and Management Zone 4, respectively, from ambient groundwater concentrations as a result of Land Use Build-Out.

The Recycled Water Policy thresholds apply to the use of assimilative capacity for future recycled water projects. Land Use Build-Out conditions do not include any proposed project, but nonetheless assimilative capacity in the management zones in some cases will decrease significantly. Where assimilative capacity is used, it is generally used at a greater rate (12% to 129%) than the thresholds established for recycled water projects by the Recycled Water Policy (10% for single projects and 20% for all projects combined). However, the proposed projects discussed in Section 9 will have a varying but generally beneficial effect, by decreasing the amount of assimilative capacity used, as compared to the projected Land Use Build-Out condition assimilative capacities. Therefore, implementation of the proposed projects in the East Subbasin will result in a "maximum benefit" to the people of the State by providing additional water supply and conservation activities while decreasing the total amount of assimilative capacity used as compared to the Land Use Build-Out conditions.

In summary, the spreadsheet model indicates that future groundwater concentrations under Land Use Build-Out conditions will, in some management zones and for some constituents, use assimilative capacity at a rate greater than the thresholds established by the LARWQCB Recycled Water Policy. The sources of mass which contributes to changes in assimilative capacity under the Land Use Build-Out only, is illustrated and discussed in Section 9.4.1. Section 9 will analyze the impacts of new projects on future salt and nutrient concentrations in the management zones.

7.4.6 Import/Export

Imported water is received through CLWA and introduced into the system primarily through the water purveyors, and to a much lesser extent, through underflow from Castaic Dam and releases from Castaic Dam in the Castaic Valley Subunit (Management Zone 5). The imported water after delivery or release becomes a part of the hydrologic system and is accounted for in the salt balance. Groundwater and surface water is not exported from the East Subbasin, but instead leaves as natural subsurface and surface outflow.

7.5 Constituents of Emerging Concern (CECs)

According to the USEPA, "*Chemicals are being discovered in water that previously had not been detected or are being detected at levels that may be significantly different than expected. These are often generally referred to as 'contaminants of emerging concern' (CECs) because the risk to human health and the environment associated with their presence, frequency of occurrence, or source may not be known. EPA is working to improve its understanding of a number of CECs, particularly pharmaceuticals and personal care products (PPCPs) and perfluorinated compounds among others*."

With regards to the SNMP, the Recycled Water Policy states that monitoring for CECs should be included when current or planned uses of recycled water include planned groundwater recharge reuse projects (Attachment A of Recycled Water Policy- "Requirements for Monitoring Constituents of Emerging Concern for Recycled Water"). Currently, only one groundwater recharge project using recycled water is planned for the East Subbasin. The project is identified as the Vista Canyon WRP and is planned for a location in Management Zone 1. Irrigation projects using recycled water are not required to conduct CEC monitoring.

A proposal for CEC monitoring has been prepared jointly by the Joint Outfall System and SCVSD to satisfy NPDES monitoring requirements, among others, for the Saugus and Valencia WRP discharges. This can be included in the SNMP Monitoring Plan discussed in Section 10.

In addition, the USEPA's Unregulated Contaminant Monitoring (UCM) program requires collection of data for suspected contaminants that may be present in drinking water and that do not have health-based standards set under the Safe Drinking Water Act (SDWA). Every five years, the EPA reviews the list of contaminants, largely based on the Contaminant Candidate List. The SDWA Amendments of 1996 provide for:

- Monitoring no more than 30 contaminants every five years;
- Monitoring only a representative sample of public water systems serving less than 10,000 people; and
- Storing analytical results in a National Contaminant Occurrence Database (NCOD).

Historically, the UCM program has progressed in several stages. Currently, USEPA manages the program directly as specified in the Unregulated Contaminant Monitoring Rule (UCMR). The history of the UCM program includes:

- UCM-State Rounds 1 & 2 (1988-1997) – State drinking water programs managed the original program and required public water systems (PWSs) serving more than 500 people to monitor contaminants.
- UCMR 1 (2001-2005) – The SDWA Amendments of 1996 redesigned the UCM program to incorporate a tiered monitoring approach and required monitoring for 25 contaminants (24 chemicals and one bacterial genus) during 2001-2003.
- UCMR 2 (2007-2011) – UCMR 2 monitoring was managed by EPA and established a new set of 25 chemical contaminants sampled during 2008-2010.
- UCMR 3 (2012-2016) – Current regulation monitoring for 30 contaminants (28 chemicals and 2 viruses) from 2012-2015.

The water purveyors in the East Subbasin are required to sample under the UCM program and are currently in the third cycle of sampling. The suite of required analytes is listed in the federal register and can be accessed at: https://www.federalregister.gov/articles/2012/05/02/2012-9978/revisions-to-the-unregulated-contaminant-monitoring-regulation-ucmr-3-for-public-water-systems#h-32.

In summary, CEC monitoring is and will be conducted in the East Subbasin in accordance with applicable permit and agency requirements.

7.6 Basin Management Plan Elements

This section describes the groundwater management goals developed cooperatively by basin stakeholders and the proposed monitoring features to characterize annual basin hydrology and track on-going salt and nutrient loadings and other constituents of concern in the East Subbasin. The proposed monitoring efforts and data analysis described in this section will provide the data needed to evaluate the effectiveness of the strategies to manage salt and nutrient loads and CECs, as described in Section 10 of this SNMP report.

7.6.1 Groundwater Management Goals

Groundwater management goals set forth in the "Groundwater Management Plan, Santa Clara River Valley Groundwater Basin, East Subbasin, Los Angeles County" (CLWA, 2003) included the development of a groundwater monitoring plan. The 2003 Groundwater Management Plan (GWMP) lays out four water supply management goals for the East Subbasin. The four groundwater management goals are reproduced below:

1. Development of an integrated surface water, groundwater, and recycled water supply to meet existing and projected demands for municipal, agricultural, and other water supply since pumpage for other uses is from the same aquifer system. This objective includes agricultural small community, non-agricultural irrigation, and individual domestic uses.

2. Assessment of groundwater basin conditions to determine a range of operational yield values that will make use of local groundwater conjunctively with SWP and recycled water to avoid groundwater overdraft and the undesirable effects associated with it. A corresponding basin objective is to manage groundwater levels associated with groundwater discharge to the Santa Clara River at the west end of the basin, and thus not adversely impact surface and groundwater discharges to the downstream basins(s).

3. Preservation of groundwater quality for beneficial use in the basin, and for beneficial use of surface water and groundwater discharges from the basin. Included in this management goal will be the active characterization and solution of any groundwater contamination problems, through cooperation with responsible parties or through independent action if timely action by

responsible parties is not forthcoming and the preceding management objectives are thereby impacted or constrained.

4. Preservation of interrelated surface water resources. Included in this management goal will be the maintenance of appropriate surface water flows and non-degradation of surface water quality as a result of managing groundwater conditions to meet the other management goals for the Basin.

The 2003 GWMP provides ten (10) primary elements of water management to be accomplished through implementation of the GWMP. The elements in the 2003 GWMP which are related to the proposed groundwater monitoring plan for Salt and Nutrient Management planning include the following:

- Monitoring of groundwater levels, quality, production and subsidence
- Monitoring and management of surface water flows and quality
- Continuation of conjunctive use operations
- Long-term salinity management
- Integration of recycled water
- Identification and management of recharge areas and wellhead protection areas
- Identification of well construction, abandonment and destruction policies

With reference to the 2003 GWMP, Section 3.2.1 of the 2010 UWMP (Kennedy/Jenks and LSCE, 2011) provides the following narrative:

> *"As part of legislation authorizing CLWA to provide retail water service to individual municipal customers, Assembly Bill (AB) 134 (2001) included a requirement that CLWA prepare a GWMP in accordance with the provisions of Water Code Section 10753, which was originally enacted by AB 3030. The general contents of CLWA's GWMP were outlined in 2002, and a detailed plan was adopted in 2003 to satisfy the requirements of AB 134. The plan both complements and formalizes a number of existing water supply and water resource planning and management activities in CLWA's service area, which effectively encompasses the East Subbasin of the Santa Clara River Valley Groundwater Basin. Notably, CLWA's GWMP also includes a basin-wide monitoring program."*

The 2010 UWMP further states that the existing groundwater monitoring program will be reflected in the upcoming groundwater reporting to DWR as part of SBX7-6 implementation (California Statewide Groundwater Elevation Monitoring, CASGEM).

The intent of this SNMP is to provide a tool to aid in managing the water quality of the East Subbasin so as to follow the SNMP guidelines and to accomplish the overall goals of the GWMP. Specifically, characterization of salt and nutrient load sources will provide additional insight in the development of conjunctive use scenarios and potential impacts. This SNMP includes a proposed groundwater and surface water monitoring plan (see Section 10).

7.7 Recycled Water and Storm Water – Recharge Use and Objectives

7.7.1 Recycled Water Use and Objectives

Regarding recycled water use and objectives, the following information is reported in the 2010 UWMP:

1. Draft Recycled Water System Master Plans for the CLWA service area were completed in 1993 and 2002. The Program EIR for the Recycled Water Plan was certified by the CLWA Board in March 2007. Table 4-1 of the 2010 UWMP reproduced below as Table 7-7 provides a listing of the eight agencies that will participate in the implementation of the Recycled Plan.

Table 7-11. Participating Agencies

Participating Agency	Role in Plan Development
Castaic Lake Water Agency	Wholesale water provider
Newhall County Water District	Retail water purveyor
Santa Clarita Water Division	Retail water purveyor
Valencia Water Company	Retail water purveyor
Los Angeles County Waterworks District No. 36	Retail water purveyor
Santa Clarita Valley Sanitation District	Recycled water provider
Berry Petroleum	Recycled water provider

Source: Table 4-1 of the 2010 UWMP (modified; Kennedy/Jenks and LSCE, 2011)

2. CLWA has constructed Phase I of the Recycled Plan, which can deliver 1,700 acre-ft/yr of water to the VWC service area. Deliveries of recycled water began in 2003 for irrigation water supply at a golf course and in roadway median strips; by 2009, recycled water deliveries were

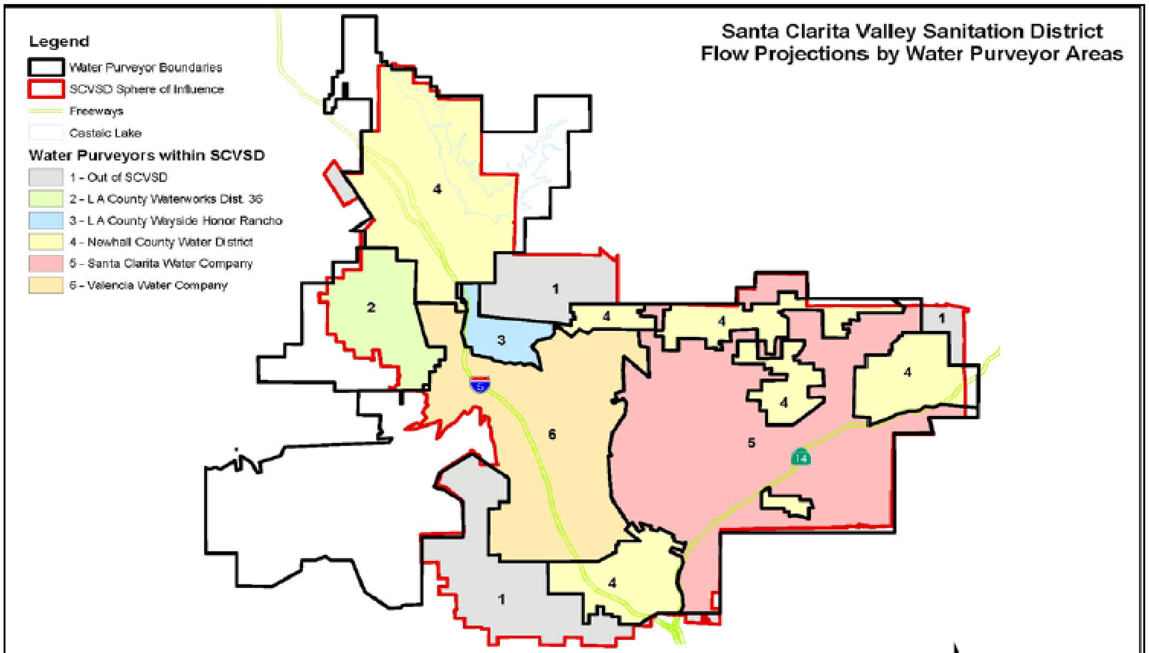
328 acre-ft. The current location of recycled water application along with proposed phases of distribution infrastructure for Phases 2A and 2C is shown on Figure 16.

3. According to the 2010 UWMP, the Recycled Water Plan, along with the Newhall Ranch development, is expected to ultimately recycle up to 22,800 acre-ft/year of treated (tertiary) wastewater suitable for reuse on golf courses, landscaping and other non-potable uses. However, during the planning period the impacts of using approximately 10,000 acre-ft/yr is evaluated (see Section 9). CLWA completed a preliminary design report in 2009 on the second phase of the Recycled Water Plan (Phase 2A) that will take water from the Saugus WRP and distribute it to identified users in the north, across the Santa Clara River, and then to the west and east. Customers included in the Phase 2A expansion will be Santa Clarita Central Park and the Bridgeport and River Village developments. Large irrigation customers will be served by this expansion with a collective design that will increase recycled water deliveries by approximately 500 acre-ft/yr.

4. Recycled water will be further expanded with the South End Recycled Water Project (Phase 2C). VWC has initiated project design expanding the existing recycled water transmission and distribution system southerly to supply recycled water to additional customers, as well as to potentially supply a source of recycled water to customers of adjacent water agencies. Phase 2C of the Recycled Water Plan will result in the use of approximately 910 acre-ft/yr of recycled water. The project also has a proposed west branch that will extend the existing recycled water system to serve customers along the western portions of Valencia Boulevard.

5. CLWA plans to update the Recycled Water Master Plan in the near future.

Inset Figure 7-6 below shows the projection of wastewater flows from each of the SCV water purveyors for the 2010 UWMP projection period of 2010 through 2035.



Map ID	Water Purveyor	Wastewater Flow Projection (MGD) 2010	2015	2020	2025	2030	2035
1	Out	0.3	1.2	1.5	1.7	1.9	2.4
2	L A County Waterworks Dist. 36	0.6	1.2	1.3	1.5	1.6	1.9
3	L A County Wayside Honor Rancho	0.0	0.0	0.0	0.1	0.1	0.1
4	Newhall County Water District	2.8	4.0	4.4	4.8	5.2	5.6
5	Santa Clarita Water Company	8.4	9.2	9.8	10.5	11.1	12.4
6	Valencia Water Company	9.3	9.7	10.5	11.2	12.0	12.7
	Total	**21.6**	**25.4**	**27.6**	**29.8**	**31.9**	**35.1**

Source: Figure 4-1 of the 2010 UWMP (Kennedy/Jenks and LSCE, 2011)

Figure 7-6. Santa Clarita Valley Sanitation District Flow Projections by Water Purveyor Service Area

7.7.2 Stormwater Use and Objectives

The 2010 UWMP does not address the potential for the capture and recharge of stormwater within the watershed. The 2012 IRWMP Update includes the objectives of meeting state permits and policies related to stormwater management and promoting low impact development, green streets, and other stormwater recharge projects.

For purposes of this planning document, it is assumed that approximately 1,000 acre-ft/yr of recharge, on average, will come from urban stormwater run-off while an average 4,000 acre-ft/yr[10] of recharge

[10] Represents the lower assumed value to increase water supply by capture and recharge of 5,000 to 10,000 acre-ft/yr of urban and stormwater runoff from the 2008 Integrated Regional Water Management Plan, Table ES-1 and Table 3.1 1; "Upper Santa Clara River IRWMP Objectives, Definitions, and Measurements" (Kennedy/Jenks, 2008).

will come from stormflows in the Santa Clara River and tributary drainages. The water balance for projected future conditions assumes that projects to capture and recharge urban run-off and stormflows will be in place by 2050.

8.0 CEQA ANALYSIS

As a part of the SNMP, Kennedy/Jenks Consultants (Kennedy/Jenks) prepared Substitute Environmental Documentation (SED). This SED analyzes environmental impacts that may occur from implementing the SNMP, very similar to a California Environmental Quality Act (CEQA) evaluation. The complete report is provided as Appendix G, and a summary is provided below.

The California Regional Water Quality Control Board, Los Angeles Region (Regional Board) is the lead agency for evaluating the environmental impacts of the SNMP. 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 SED and supported by substantial evidence in the administrative record. This SED is based on a proposed SNMP that will be considered by the Regional Board and, if approved by the Regional Board, will revise the implementation plan to the California Water Quality Control Plan, Los Angeles Region (Basin Plan) consistent with Water Code Section 13242. This SED analyzes foreseeable methods of compliance with the SNMP and provides the public information regarding environmental impacts, mitigation, and alternatives.

The SED will be considered by the Regional Board when the Regional Board considers adoption of the SNMP as a Basin Plan Amendment. Approval of the SED is separate from approval of a specific project alternative or a component of an alternative. The approval process for the SED includes (1) addressing public comments received during the 45-day comment period, (2) confirming that the Regional Board considered the information in the SED, and (3) affirming that the SED reflects independent judgment and analysis by the Regional Board (CEQA Guidelines Section 15090 (Title 14 of CCR), Division 6, Chapter 3).

The SNMP for the Upper Santa Clara River is intended to fulfill the requirements of the Statewide Recycled Water Policy and provide the framework for the management of water containing salts and nutrients in the Upper Santa Clara River groundwater basins in compliance with the Basin Plan.

This SED analyzes three Program Alternatives and both structural and non-structural Implementation Alternatives that encompass actions within the jurisdiction of the Regional Board and implementing municipalities and agencies. A No Project Alternative is analyzed to compare the impacts of approving a proposed alternative and its components compared with the impacts of not approving the proposed alternative. The SED analyzes the potential environmental impacts in accordance with significance criteria. CEQA requires the Regional Board to conduct a program level analysis of environmental impacts (Public Resources Code §21159(d)). This analysis fulfills that requirement. Public Resources Code Section 21159(c) requires that the environmental analysis take into account a reasonable range of:

1. Environmental, economic, and technical factors,
2. Population and geographic areas, and
3. 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 alternatives 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 are required to implement the requirements of the SNMP (Public Resources Code §21159.2). Notably, the Regional Board is prohibited from specifying the manner of compliance with its regulations (Water Code §13360), and accordingly, the actual environmental impacts will necessarily depend upon the compliance strategy selected by the local agencies and municipalities who intend to provide recycled water within the groundwater basin. Municipalities and agencies that will implement recycled water projects resulting in the need for management measures to address salt and nutrient loading in the Upper Santa Clara River groundwater basin may use this SED to help with the selection and approval of project alternatives.

Approval of projects (i.e., project alternatives or components of project alternatives) refers to the decision of either the implementing municipalities or agencies to select and carry out an alternative or a component of an alternative. In most cases the components assessed at a program-level do not have specific locations/designs at this time; the specific locations/designs will be determined by implementing municipalities and agencies. The project-level components will be subject to additional environmental review, including review by cities and municipalities implementing the management measures (Implementation Alternatives) identified in the SNMP.

Many of the specific projects and Best Management Practices (BMPs) analyzed in this SED will involve infrastructure projects that will reduce salt and nutrient loading in the groundwater basin. Construction and operation of infrastructure projects generate varying degrees of environmental impacts. The potential impacts can include, for example, noise associated with construction, air emissions associated with vehicles to deliver materials during construction, traffic associated with increased vehicle trips and where construction or attendant activities occur near or in thoroughfares, additional light and glare. Additionally, operation of infrastructure, such as water recycling or other water treatment facilities (e.g., desalination, regional water softening) would result in additional air and greenhouse gas emissions, primarily through an increase in energy use. Some of this gas emission impacts would be offset, in part, if recycled water is used in place of potable supplies due to the decreased need to transport and treat potable water.

To address the potential environmental impacts from construction and operation of the management measures identified in the SNMP, responsible parties can employ a variety of techniques, BMPs, and other mitigation measures to minimize potential impacts on the environment. Mitigation measures for construction projects include implementation of BMPs to reduce noise impacts, including sound barriers, developing detailed traffic plans in coordination with police or fire protection authorities, and using lower emission vehicles to reduce air pollutant emissions. Operational mitigation measures include use of renewable energy sources, noise reducing equipment and other BMPs.

Many of the mitigation measures identified in the SED are common practices currently employed to reduce impacts associated with construction and operation of infrastructure projects. Mitigation measures are suggested to minimize site specific impacts to less than significant levels. Mitigation of adverse environmental impacts is strictly within the discretion of the individual implementing agency. It is the obligation of responsible parties to mitigate adverse environmental impacts associated with reasonably foreseeable means of compliance when impacts are deemed significant (14CCR§15091(a)(2)).

This SED finds that foreseeable methods to implement the SNMP, including both nonstructural and structural management measures, would not cause significant impacts that cannot be mitigated through commonly used construction, design and operational practices. The SED identifies mitigation methods for impacts with potentially significant effects and finds that these methods can mitigate potentially significant impacts to levels that are less than significant. To the extent that there are significant adverse effects on the environment due to the implementation of this SNMP, there are feasible alternatives and/or feasible mitigation measures that would substantially lessen significant adverse impacts in most cases. The SED can be used by implementing municipalities and agencies to assist with any additional environmental analysis of specific projects required to comply with the SNMP.

9.0 ANTI-DEGRADATION ANALYSIS

The anti-degradation analysis described in this section follows the State Anti-Degradation Policy and evaluates whether changes in water quality resulting from implementation of proposed water management projects are consistent with the maximum benefit to the people of the State and will not unreasonably affect existing or potential beneficial uses. The analysis provides an evaluation of potential impacts on the salt and nutrient loading and water quality in the management zones of the East Subbasin from proposed future projects. The impacts from land use changes alone (i.e., implementation of no new projects) were evaluated under the Land Use Build-Out conditions discussed in Section 7.3. The Recycled Water Policy requirements are discussed for an anti-degradation analysis of future impacts to water quality from projects planned within the groundwater basin. Projects described herein were submitted by the IRWMG participants, who have been involved in water management planning, and developing this SNMP. The evaluation of future changes in the water quality of the East Subbasin considers the proposed additional use of recycled water and recycled water quality, but also considers the impacts of proposed long-term changes in land use, water use, conservation measures, and measures to decrease salt and nutrient loads through operational changes during the planning period.

9.1 State of California Anti-Degradation Policy

In accordance with the Statement of Policy with respect to Maintaining High Quality of Water in California (Resolution No. 68-16; SWRCB, 1968), an anti-degradation analysis must accompany the SNMP for the purpose of demonstrating that the projects included within the SNMP collectively satisfy Resolution No. 68-16 requirements, namely:

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 uses 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 water 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.*

An anti-degradation analysis is also required by the Recycled Water Policy to assess the impacts of proposed future projects on water quality in the groundwater basin. The intent of the Recycled Water Policy is to consider the impacts of proposed future recycled water projects as a part of long-planning SNMP process. If a project is considered in the SNMP, then potential project impacts will not have to be considered separately during the project planning process. Section 9 of the Recycled Water Policy is reproduced below:

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).

9.2 Summary of Projects Analyzed

The proposed projects to be analyzed as a part of the anti-degradation analysis were identified by the members of the IRWMG. A project description along with the area of operation and anticipated water quality was provided using "Upper Santa Clara River East Subbasin, Salt and Nutrient Management Plan, Anti-Degradation Analysis - Projects Questionnaire." The completed project questionnaires are provided in Appendix H. Since information for the Newhall Ranch WRP was submitted recently, a questionnaire form for that project is not in Appendix H. However, the pertinent information concerning the project is presented in Appendix H. The individual projects are:

- SCVSD Wastewater Treatment Plant Chloride Compliance Program,
- SCWD Water Use Efficiency Program,
- Vista Canyon Water Reclamation Plant,
- CLWA Recycled Water Master Plan,
- CLWA Santa Clarita Valley Water Use Efficiency Strategic Plan (SCV WUE SP), and
- Newhall Ranch Water Reclamation Plant and Recycled Water Use.

Table 9-1 summarizes the change in water use, change in source water quality, and management zones affected by each project.

Table 9-1. Proposed Future Projects – East Subbasin

Agency	Project	Change in Water Use	Change in Source Water Quality	Area of Change
SCVSD	Wastewater Treatment Plant Chloride Compliance Program	None	Water reclamation plants would reduce chloride concentrations discharged to the SCR to 100 mg/L as a three month average	MZ-4 and MZ-5
SCWD	Water Use Efficiency Programs (10 programs between 2014-2020)	Conserve 4,437 acre-ft/yr, reduction in residential and commercial run-off	No Change	All Management Zones
Vista Canyon	Vista Canyon Water Reclamation Plant (2014-2019)	Project will use 190 acre-ft/yr potable water, 137 acre-ft/yr recycled water and provide 302 acre-ft/yr of recycled water to others	Proposed chloride concentration of 117 mg/L (from 763 mg/L to 812 mg/L TDS)	MZ-1, MZ-4 and MZ-5
CLWA	Recycled Water Master Plan (Phases 2A, 2B and 2C)	Increased use of recycled water from 325 acre-ft/yr to 2,000 acre-ft/yr	No Change (recycled water will be at current effluent concentrations)	MZ-3, MZ-4 and MZ-5
CLWA	SCV WUE SP (5 programs between 2015-2026)	Conserve 3,287 acre-ft/yr, reduce SWP water by 380 acre-ft/yr, reduce residential run-off	No Change	All Management Zones
Newhall Ranch Sanitation District (NRSD)	Newhall Ranch Water Reclamation Plant	None	Applied water inside the nine West Side Communities will be at proposed effluent concentrations	MZ-4, MZ-5 and MZ-6

In addition to the projects listed above, baseline conditions under Land Use Build-Out conditions (baseline conditions with only anticipated land use changes) were considered for the projected period from 2012 through 2035, which was also discussed in Section 7.3.

9.3 Approach for Anti-Degradation Analysis

The existing groundwater quality and available assimilative capacity for each of the management zones in the East Subbasin was discussed in Section 6 of this SNMP. The ambient groundwater quality concentrations for TDS, chloride, nitrate, and sulfate calculated for the period 2001-2011 (see Section 6.5.7) along with the LARWQCB's WQO for each management zone are summarized in Table 9-2. Management Zone 6 (Saugus Formation) does not have established WQOs. The LARWQCB recommended the interim use of the most conservative of the alluvial management zone WQOs for the calculation of assimilative capacity for TDS, chloride and nitrate. However, due to the lack of supporting historical data for sulfate, no decision has been made in regards to the WQO for sulfate in Management Zone 6 (discussed in Section 6.5.6.1). The significant variability of water quality in the Saugus Formation needs to be further evaluated to establish meaningful WQOs.

Section 7 describes the historical changes in salt and nutrient loads and parameter concentrations, and presents the results of a predictive scenario for salt and nutrient loading and parameter concentrations under existing conditions (Land Use Build-Out conditions) projected into the future. This will be used as a comparison in the analysis of proposed projects considered in this section.

Table 9-2. Ambient Groundwater Concentrations and Water Quality Objectives

Management Zone	Groundwater Subunit	Water Quality Status Comparison	TDS [mg/L]	Chloride [mg/L]	Nitrate [mg/L]	Sulfate [mg/L]
1a	Santa Clara-Mint Canyon	Water Quality Objective	800	150	45	150
		Ambient Water Quality	***728***	***89***	***20***	***138***
1b	Santa Clara-Mint Canyon	Water Quality Objective	800	150	45	150
		Ambient Water Quality	***833***	***72***	***21***	***269***
2	South Fork[1]	Water Quality Objective	700	100	45	150
		Ambient Water Quality	***NA***	***NA***	***NA***	***NA***
3	Placerita Canyon[1]	Water Quality Objective	700	100	45	200
		Ambient Water Quality	***NA***	***NA***	***NA***	***NA***
4	Santa Clara-Bouquet and San Francisquito Canyons	Water Quality Objective	700	100	45	250
		Ambient Water Quality	***710***	***77***	***16***	***189***
5	Castaic Valley	Water Quality Objective	1,000	150	45	350
		Ambient Water Quality	***727***	***77***	***8***	***246***
6	Saugus Formation[2]	Water Quality Objective	700	100	45	-
		Ambient Water Quality	***636***	***28***	***14***	***235***

[1] Insufficient data to establish trend.

[2] WQOs have not been established for the Saugus Formation. Therefore, at the recommendation of the LARWQCB, the most conservative of the alluvial management zone WQOs was used in the interim for calculation of assimilative capacity for TDS, chloride and nitrate. No decision has been made in regards to the WQO for sulfate, as discussed in Section 6.5.6.1.

The data indicate that assimilative capacity is available for all constituents for all management zones – with the exception of TDS for Management Zones 1b and 4 and sulfate for Management Zone 1b. Management Zones 2 and 3 have no data set to validate the WQOs. The assimilative capacities for Management Zone 6 are artificial since the ambient concentrations were compared to the most conservative WQOs from Management Zone 2 (Placerita Canyon). Since the wells in Management Zone 6 (Saugus Formation) are primarily in the portion of the management zone which is overlain by Management Zone 3 and Management Zone 4, a comparison with the water quality objectives for TDS, chloride and nitrate from these management zones is more appropriate and appears reasonable. However, with regards to sulfate, historical water quality derived from the Saugus wells is significantly higher than from the overlying alluvial units. The historical water quality for the Saugus Formation is discussed in Section 6.5.6.1. Due to the lack of an interim WQO for sulfate, assimilative capacity was not calculated for sulfate in Management Zone 6.

The anti-degradation analysis consists of evaluating the water quality impacts from proposed recycled water and other projects in relation to the ambient water quality and the WQOs for each management zone. In accordance with the Recycled Water Policy, multiple projects utilizing less than 20% of the available assimilative capacity in a basin/subbasin or a single project using less than 10% of the available assimilative capacity, need only conduct an anti-degradation analysis to verify the use of the assimilative capacity.

In order to determine the impact of future use of recycled water in the management zones, water quality changes as a result of only land use changes (established in regional planning documents) were compared with water quality changes from single projects and from all projects combined. Work conducted by SCVSD provided an analysis of site-specific water quality changes at locations of recycled water application. The individual projects were evaluated using the spreadsheet model by incorporating the salt loading associated with the place of operation and operational parameters, as discussed in the following sections.

9.4 Assumptions for Predictive Scenarios

The spreadsheet model constructed to simulate historical conditions (refer to Section 7) was used to predict future groundwater quality and trends. It was also used to simulate the percentage of the assimilative capacity to be used by implementation of individual projects and all projects combined. The spreadsheet model tracks the existing volume of groundwater and the mass of TDS, chloride, nitrate, and sulfate in each management zone as project conditions are added.

Future water quality conditions for individual proposed projects and for all projects together were simulated for the period from 2012 through 2035 by modifying the salt and nutrient loads and water volumes in accordance with project descriptions. The Recycled Water Policy does not set forth a specific period of time for future analysis of the impacts of salt and nutrient impacts to groundwater quality – except that it must exceed ten years. The 24-year period (2012 through 2035) was selected by the IRWMG since it falls within the planning range incorporated by the 2010 UWMP and incorporates the time period in which planned projects described herein will be implemented or will be in the process of implementation.

9.4.1 Hydrologic Base Period

The future hydrologic conditions for the 24-year period from 2012 through 2035 were simulated using the hydrologic conditions from 1980 through 2003. This period includes normal, below normal, and a six year drought (Figure 3-21 and a portion of Table 3-21 from LSCE, 2009). Average precipitation for this period is 18.13 inches. The long-term average precipitation from 1931 through 2007 is 18.16 inches (Newhall-Soledad Rain Gage; Figure 3-21 LSCE, 2009).

9.4.2 Land Use

Changes in land use impact the salt and nutrient load application in the subbasin. SCAG (2008) land use distribution was used for calculating the existing salt and nutrient loads to the management zones. Changes in land use will change the distribution and mass loading in the management zones. Therefore, to simulate potential future salt and nutrient loads from changing land use, the input into the GSI groundwater model included future land use changes in the Santa Clarita Valley by the combined land use planning projected by the 2011 City of Santa Clarita General Plan and the 2012 Santa Clarita Valley Plan - OVOV (shown below on Figure 9-1).

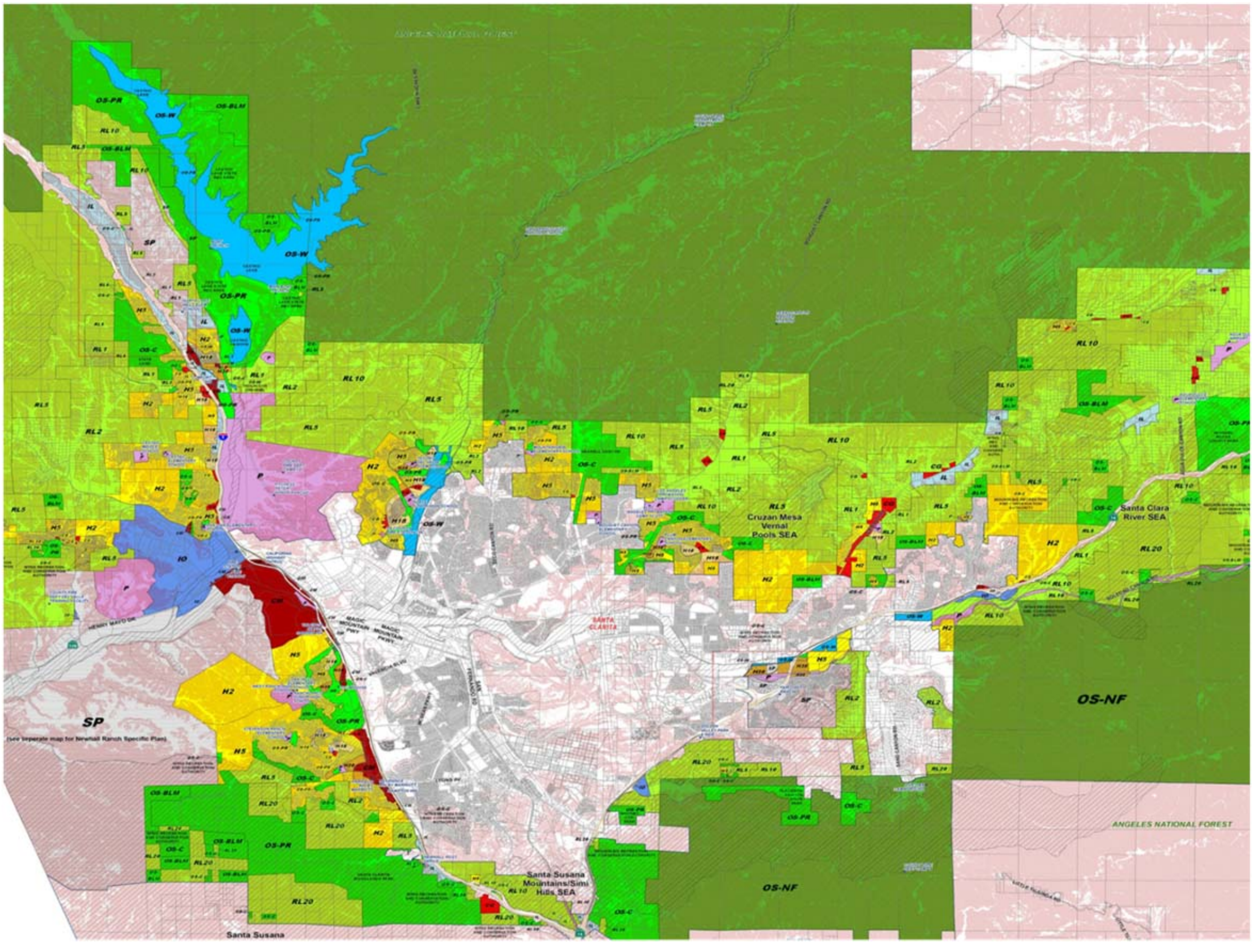


Figure 9-1. "One Valley One Vision" (OVOV) – Land Use Planning Map

The land use at "Build-Out" at year 2050 from the combined City of Santa Clarita General Plan and the OVOV Plan are tabulated in Table 9-3. Land use categories from the SCAG (2008) survey and the land use categories from OVOV Land Use Planning were compared. SCAG land use categories were combined to coincide with OVOV land use categories to allow tracking of land use changes from 2012 through 2035. Table 9-3 shows the modified SCAG land use categories in acres as well as OVOV land use categories at build-out. Annual changes in land use were assumed to be linear over the 24-year period within the 42-year period to build-out (2008-2050).

Table 9-3. Proposed Future Land Use at Build-Out by Management Zone

Land Use Type	Current Land Use: SCAG (2008) [acres]	Change in Land Use: OVOV [acres]	Combined Land Use at Build-Out (2050) [acres]
MZ-1: Santa Clara-Mint Canyon			
Agricultural and Park-Golf	476	0	476
Commercial-Industrial	799	1,335	2,133
Residential	5,269	5,588	10,857
Impervious Land Surface	1,789	115	1,904
Open Space	40,957	-7,066	33,890
MZ-2: Placerita Canyon			
Agricultural and Park-Golf	5	0	5
Commercial-Industrial	24	94	118
Residential	306	140	446
Impervious Land Surface	69	5	74
Open Space	2,956	-250	2,705
MZ-3: South Fork			
Agricultural and Park-Golf	269	0	269
Commercial-Industrial	782	263	1,045
Residential	1,724	492	2,217
Impervious Land Surface	1,061	8	1,069
Open Space	13,949	-1,108	12,840
MZ-4: Santa Clara-Bouquet and San Francisquito Canyons			
Agricultural and Park-Golf	542	0	542
Commercial-Industrial	1,401	695	2,096
Residential	2,125	1,093	3,218
Impervious Land Surface	1,170	63	1,233
Open Space	61,377	-2,194	59,182
MZ-5: Castaic Valley			
Agricultural and Park-Golf	776	0	776
Commercial-Industrial	415	2,318	2,733
Residential	1,045	11,051	12,097
Impervious Land Surface	1,360	28	1,388
Open Space	31,092	-13,825	17,267
MZ-6: Saugus Formation			
Agricultural and Park-Golf	521	0	521
Commercial-Industrial	1,419	4,357	5,776
Residential	5,211	12,424	17,635
Impervious Land Surface	1,945	138	2,083
Open Space	25,944	-15,542	10,402

Table 9-4 below provides an estimate of land use changes by type, year, and management zone. The annual change in land use within each management zone and by type was incorporated into the GSI Groundwater Model.

Table 9-4. Change in Land Use per Year to Build-Out by Management Zone

Management Zone	Agricultural/ Park/Golf Courses [acres]	Commercial/ Industrial [acres]	Domestic [acres]	Open Space [acres]	Impervious [acres]
1	0	32	133	-168	3
2	0	2	3	-6	1
3	0	6	12	-26	1
4	0	17	26	-52	2
5	0	55	263	-329	1
6	0	104	296	-370	3

In addition to the change in land use, the appropriate water use factors were also input into the Regional Model annually for each management zone to simulate the change in water use with change in land use. Salt and nutrient loading factors used for the salt and nutrient balance reported in Section 6 were applied to the appropriate land use areas on an annual basis for each management zone.

9.4.3 Groundwater Pumping

Proposed future pumping for the Alluvial Aquifer and Saugus Formation are tabulated in Table 3, Appendix D. The pumping values for the Saugus Formation are based on the operating plan prepared for the Basin, and consider existing available wells and capacities. These rates have been used for recent modeling analyses conducted for water management planning.

9.4.4 Salt and Nutrient Loading

The water balance terms by year from 2012 through 2035 were obtained from the groundwater model and input into the spreadsheet model along with corresponding salt loads. Loading assumptions used to evaluate changes in historical water quality and the change in water quality conditions under Land Use Build-Out conditions were used for the predictive scenarios without the addition of any projects. Changes in salt and nutrient concentrations required by the proposed new projects are shown on Table H-1. Loading assumptions not requiring change for implementation of the proposed new projects are tabulated in Tables F-7 through F-12 in Appendix F.

9.5 Evaluation of Water Quality Impacts

9.5.1 Water Quality Changes from Land Use Build-Out

The Land Use Build-Out Scenario was discussed in Section 7.3. This scenario assumes changes in land use in accordance with local and regional land use plans but without the addition of any new water conservation or recycled water projects for the period 2012 through 2035.

The simulated concentrations for salt and nutrients at the end of the planning period (2035) for each management zone are summarized in attached Tables 1a, 1b, 1c and 1d for TDS, chloride, nitrate and sulfate, respectively, and are shown on Figures 22.1.a through 22.4.g. Inset Figure 9-2 below shows the distribution of TDS mass by inflow source type for all management zones under Land Use Build-Out conditions.

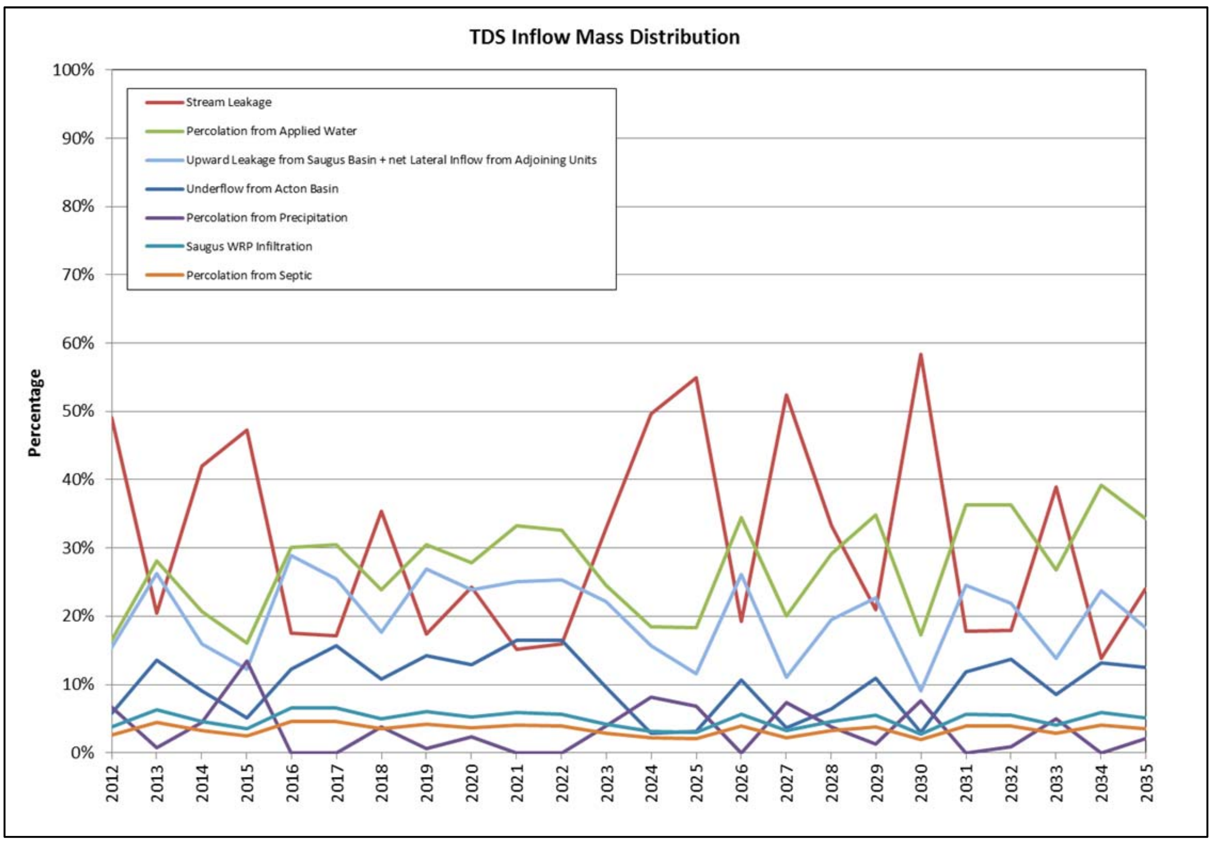


Figure 9-2. TDS Mass Distribution – Land Use Build-Out Conditions

The largest contributor of TDS mass under Land Use Build-Out conditions is from stream leakage followed by increased applied water and the contribution of upward leakage from the Saugus Formation.

Figure 9-3 shows the distribution of chloride mass by inflow source type for all management zones under Land Use Build-Out conditions.

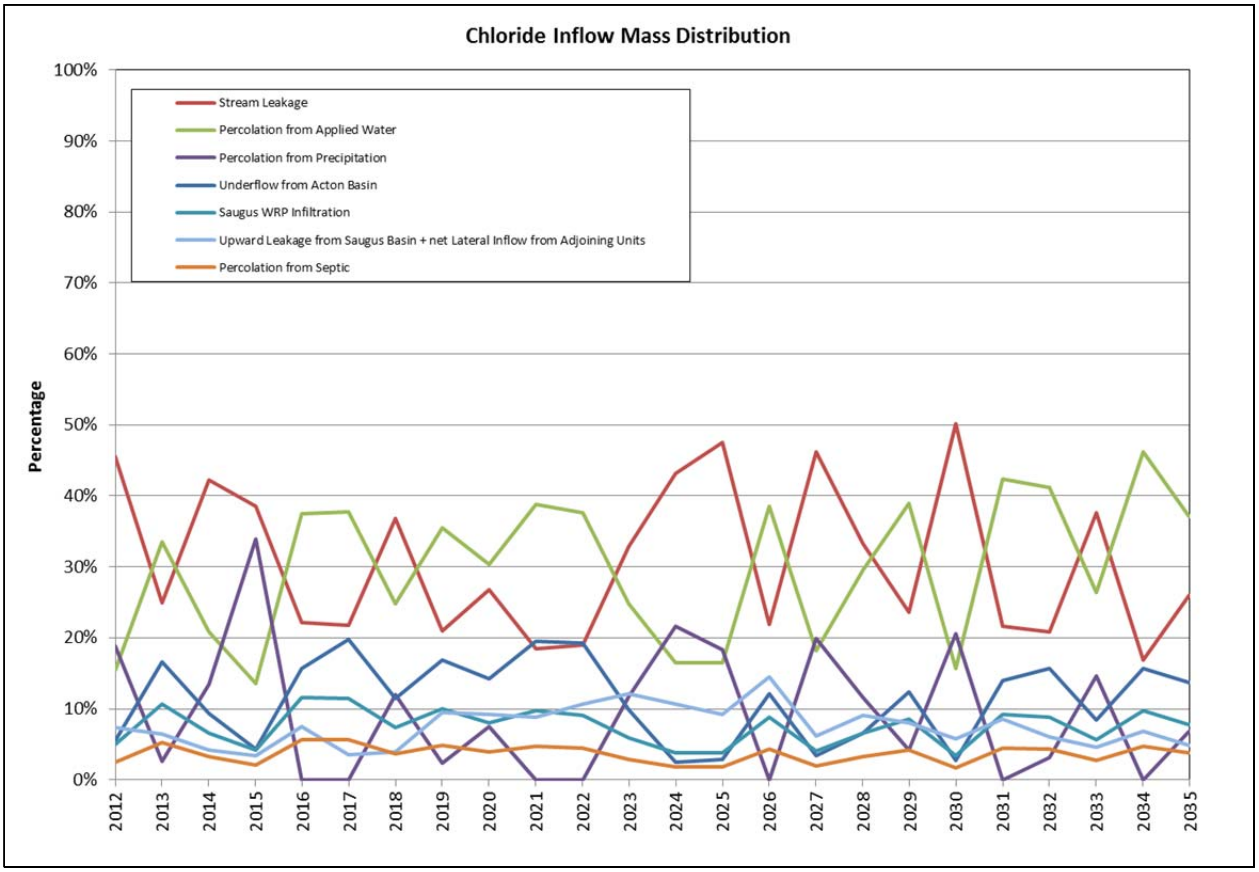


Figure 9-3. Chloride Mass Distribution – Land Use Build-Out Conditions

The largest contributor of chloride mass under Land Use Build-Out conditions is from stream leakage. The next is the contribution from increased applied water due to a decrease in open space and expansion of residential development.

Figure 9-4 shows the distribution of nitrate mass by inflow source type for all management zones under Land Use Build-Out conditions.

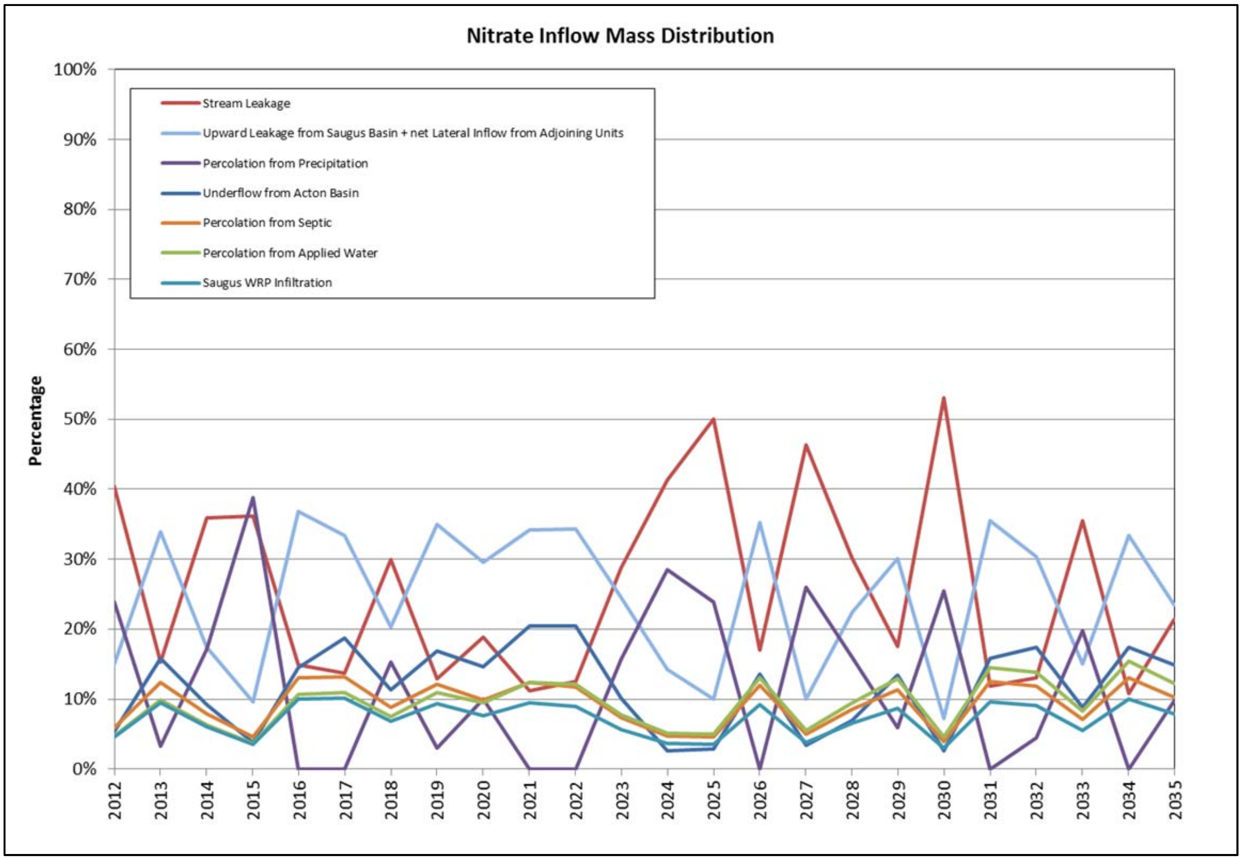


Figure 9-4. Nitrate Mass Distribution – Land Use Build-Out Conditions

The largest contributor of nitrate mass under Land Use Build-Out conditions is from stream leakage followed by upward leakage from the Saugus Formation.

Figure 9-5 shows the distribution of sulfate mass by inflow source type for all management zones under Land Use Build-Out conditions.

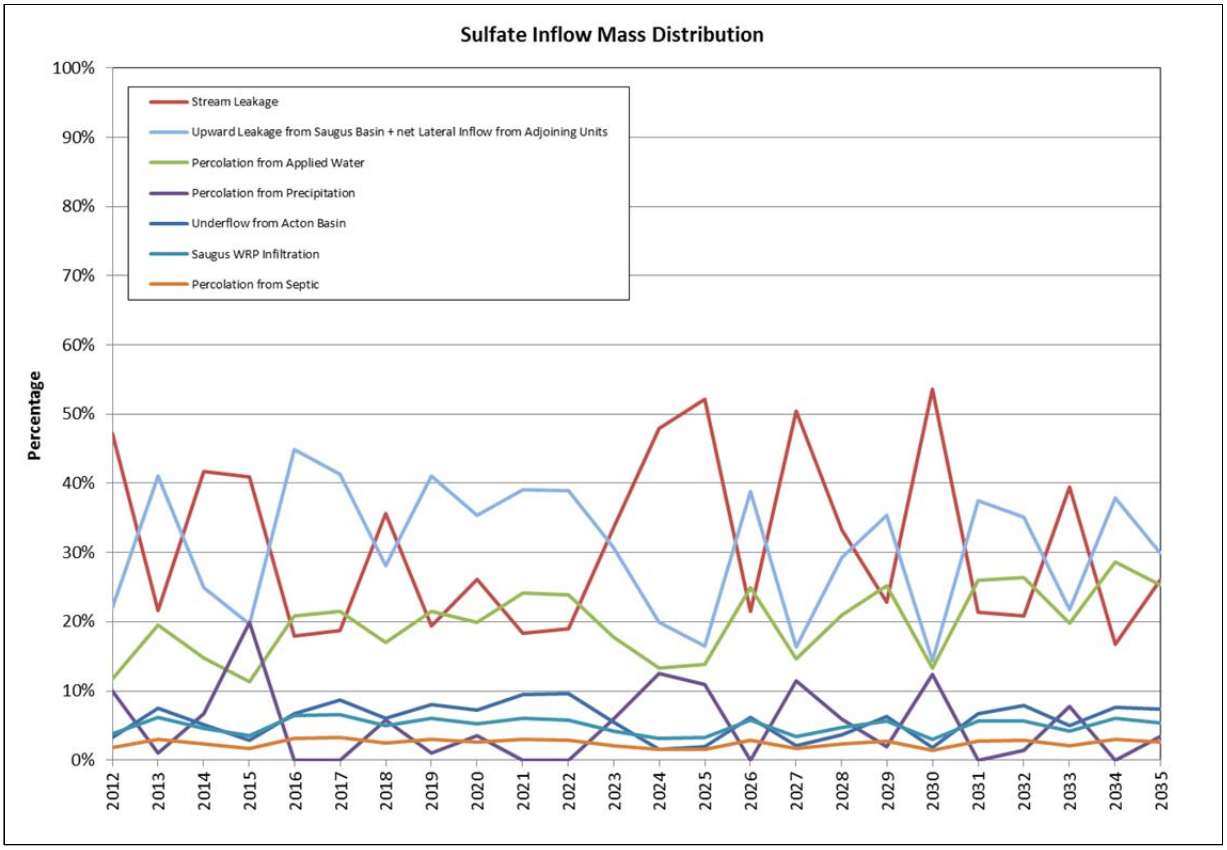


Figure 9-5. Sulfate Mass Distribution – Land Use Build-Out Conditions

The largest contributor of sulfate mass under Land Use Build-Out conditions is from upward leakage from the Saugus Formation, followed by stream leakage into the Alluvial Aquifer. Applied water provides the third largest contribution of sulfate to the groundwater system.

Tables 1a through 1d also include the average ambient concentrations and the WQOs for each management zone. Table 9-5 summarizes the average TDS, chloride, nitrate and sulfate concentrations as a result of Land Use Build-Out conditions.

Table 9-5. Salt and Nutrient Concentrations under Land Use Build-Out Conditions

Chemical (Units in mg/L)	Management Zone 1a		Management Zone 1b		Management Zone 2		Management Zone 3		Management Zone 4		Management Zone 5		Management Zone 6[3]	
	WQO[1]	LUB[2]	WQO	LUB	WQO	LUB	WQO	LUB	WQO	LUB	WQO	LUB	WQO	LUB
TDS	*800*	739	*800*	790	*700*	-	*700*	-	*700*	709	*1,000*	728	*700*	636
Chloride	*150*	89	*150*	72	*100*	-	*100*	-	*100*	93	*150*	79	*100*	46
Nitrate	*45*	19	*45*	23	*45*	-	*45*	-	*45*	19	*45*	11	*45*	19
Sulfate	*150*	150	*150*	225	*150*	-	*200*	-	*250*	166	*350*	248	-	251

[1] WQO = Water Quality Objective
[2] LUB = Land Use Build-Out
[3] Interim WQOs shown for Management Zone 6

Review of the table above indicates that only sulfate in Management Zone 1b and TDS in Management Zone 4 will exceed the WQO under Land Use Build-Out conditions. Water quality changes will occur as land use changes in the East Subbasin. Inset Figures 9-2 through 9-5 above indicate the source of mass (TDS, chloride, nitrate, and sulfate) entering the groundwater system as a result of the proposed land use changes.

Tables 1a through 1d show that TDS assimilative capacity will decrease in Management Zone 1a, increase in Management Zone 1b, increase by 12% in Management Zone 4, remain the same in Management Zone 5, and decrease by 1% in Management Zone 6. Chloride assimilative capacity will remain the same in Management Zone 1a and Management Zone 1b, and decrease by 71%, 3% and 24% in Management Zones 4, 5, and 6 respectively. Nitrate assimilative capacity will increase by 3% in Management Zone 1a, and decrease by 9%, 10%, 8%, and 17% in Management Zones 1b, 4, 5, and 6 respectively. The assimilative capacity for sulfate decreases by 102% in Management Zone 1a, increases by 37% in Management Zone 1b, increases by 39% in Management Zone 4, and decreases by 2% in Management Zone 5. Table 9-6 below summarizes the assimilative capacity used under Land Use Build-Out conditions.

Table 9-6. Assimilative Capacity Used – Land Use Build-Out

Chemical	Management Zone 1a	Management Zone 1b	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5	Management Zone 6
TDS	-15%	129%	-	-	12%	0%	-1%
Chloride	0%	0%	-	-	-71%	-3%	-24%
Nitrate	3%	-9%	-	-	-10%	-8%	-17%
Sulfate	-102%	37%	-	-	39%	-2%	-

Note: negative (-) values denote a *decrease* in assimilative capacity.

In summary, the spreadsheet model indicates that the assimilative capacity due to future groundwater concentrations under Land Use Build-Out conditions (i.e., without implementation of any new projects) will, in some cases, be used at a rate greater than the thresholds established by the LARWQCB Recycled Water Policy for the evaluation of new projects. As presented below, the proposed projects have varying effects, but a generally positive impact on the use of assimilative capacity – as compared to assimilative capacities of the projected Land Use Build-Out condition. Compared to the Land Use Build-Out conditions, implementation of projects in the East Subbasin will, in general, result in a "maximum benefit" to the people of the State by providing additional water supply and conservation activities while increasing assimilative capacity or decreasing the magnitude of assimilative capacity used from that of the Land Use Build-Out conditions.

9.5.2 Water Quality Changes from Additional Projects

The impacts of the proposed projects were evaluated by determining the water quality changes that will occur as a result of implementing the project for the management zone(s) in which the water quality change will occur. Table H-1 in Appendix H provides a summary of the anticipated water quality change for each project and how the anticipated water quality change was implemented in the spreadsheet model. Also in Appendix H, Tables H-1a through H-36d tabulate the annual change in mass and salt and nutrient concentrations occurring annually between 2012 through 2035 for All Projects, as well as for each individual project.

As discussed in Section 7, very limited data is currently available to evaluate groundwater quality in Management Zones 2 and 3. Therefore, the ability to project future concentrations in these management zones is limited. As such, the projected results for Management Zones 2 and 3 are not discussed in the following sections. In addition, due to the lack of an appropriate interim WQO for sulfate in Management Zone 6, the assimilative capacity for sulfate was unable to be calculated. On-going monitoring will allow for the evaluation of actual water quality trends for future comparison with the predictions provided from the spreadsheet model.

Table 9-7 provides a listing of figures which show projected salt balances and concentrations of each constituent under the individual project conditions.

Table 9-7. Figures List for Salt Balances and Concentration Plots for Single Project and All Projects

Proposed Project	Figure Number	
	Salt Balance (2012-2035)	Projected Concentrations (2012-2035)
SCVSD Chloride Compliance Program	23a through 23g	24.1.a through 24.4.g
SCWD Water Use Efficiency Programs (2014-2020)	25a through 25g	26.1.a through 26.4.g
Vista Canyon Water Reclamation Plant (2014-2019)	27a through 27g	28.1.a through 28.4.g
CLWA Recycled Water Master Plan (2014-2035)	29a through 29g	30.1.a through 30.4.g
CLWA SCV WUE SP (2012-2015)	31a through 31g	32.1.a through 32.4.g
Newhall Water Reclamation Plant (2023-2033)	33a through 33g	34.1.a through 34.4.g
All Projects (2012-2035)	35a through 35g	36.1.a through 36.4.g

The concentration plots include the following information on each plot:

- Projected concentration changes as a solid colored line (colors are assigned by constituent),
- Average projected concentration as a horizontal line of the same color as the concentration plot,
- Average (ambient) groundwater quality,
- Average projected baseline concentration (under Land Use Build-Out conditions) for comparison,
- WQO (with the exception of sulfate for Management Zone 6),
- Current assimilative capacity (calculated in Section 6),
- 90th percentile[11] of the projected concentrations (text box in plot shows 90th percentile value), and
- Projected assimilative capacity for 2012 through 2035.

[11] The 90th percentile represents the value for which 90% of the projected concentrations fall below, or 10% of the projected concentrations fall above.

9.5.2.1 SCVSD Wastewater Treatment Plant Chloride Compliance Program

SCVSD proposes to produce wastewater effluent that will meet a combined discharge of chloride from the Saugus and Valencia WRPs equal to 100 mg/L as a three-month average. The process will include further treatment and blending of recycled water with water treated using the reverse osmosis process. The Saugus WRP would discharge up to 150 mg/L chloride, while limiting discharges from the Valencia WRP to a concentration less than 100 mg/L, such that the combined discharge from the two plants would be 100 mg/L downstream of the Valencia WRP. Recycled water to be purchased by CLWA will increase to 10,275 acre-ft/yr by 2035. The CLWA-purchased recycled water will remain at current concentrations to be used for landscape irrigation. Therefore, the volume of effluent discharged to the SCR at 100 mg/L will be less than the volume purchased by CLWA. AMEC (2014) modeled flow weighted (FW) and non-flow weighted (NFW) operational options to compare their effects on surface water and groundwater of the Upper Santa Clara River watershed.

The results are briefly discussed below.

- There is little to no difference in the chloride concentrations simulated by the FW and NFW simulations downgradient of the Valencia WRP.
- The largest differences in surface water chloride concentrations downstream of the Saugus WRP occur around the peak drought time (Day 5,844) in the model simulation.
- The areas where the FW and NFW simulations predict differences in chloride concentrations in groundwater greater than 5.0 mg/L are limited in extent and lie between the Saugus and Valencia WRPs.
- The simulated groundwater chloride concentrations increase in wells located along the Santa Clara River in alluvium between the Saugus and Valencia WRPs during the drought period leading up to the peak drought time.
- Chloride concentrations for the FW and NFW simulations are very similar over time in surface water and groundwater downstream of the Valencia WRP. Chloride concentrations that increase in groundwater during the drought period are flushed out during the after-drought period in both the FW and NFW simulations.

The salt balances under SCVSD Chloride Compliance conditions from 2012 through 2035 are shown on Figures 23a through 23g. The projected concentration changes for all management zones under SCVSD Chloride Compliance conditions from 2012 through 2035 are shown on Figures 24.1.a through 24.1.g, Figures 24.2.a through 24.2.g, Figures 24.3.a through 24.3.g, and Figures 24.4.a through 24.4.g for TDS, chloride, nitrate and sulfate, respectively. The simulated concentrations for salt and nutrients at the end of the planning period (2035) for each management zone are also summarized in attached Tables 1a, 1b, 1c and 1d for TDS, chloride, nitrate and sulfate, respectively.

9.5.2.2 SCWD Water Use Efficiency Program (2014-2020)

The SCWD Water Use Efficiency Program consists of ten (10) programs designed to conserve 4,437 acre-ft/yr in water use by conserving approximately 634 acre-ft/yr from 2014 through 2020, thereby reducing residential and commercial urban water use and urban run-off. For this analysis, it is assumed that one-half of the water conservation will occur by a reduction of outside applied water and the other one half of the conservation volume will be indoor water use, reducing flows to the sewer.

The salt balances under SCWD Water Use Efficiency Program conditions from 2012 through 2035 are shown on Figures 25a through 25g. The projected concentration changes for all management zones from 2012 through 2035 are shown on Figures 26.1.a through 26.1.g, Figures 26.2.a through 26.2.g, Figures 26.3.a through 26.3.g, and Figures 26.4.a through 26.4.g for TDS, chloride, nitrate and sulfate, respectively. The simulated concentrations for salt and nutrients at the end of the planning period (2035) for each management zone are also summarized in attached Tables 1a, 1b, 1c and 1d for TDS, chloride, nitrate and sulfate, respectively.

Based on the analysis of historical and projected mass loading with the addition of the SCWD Water Use Efficiency Program, all projected salt and nutrient concentrations assessed herein will remain below the WQOs in Management Zones 1a, 4, 5 and 6. For Management Zone 2, the average projected TDS, chloride, and sulfate concentrations are above WQOs while the average nitrate concentration is below the WQO. For Management Zone 3, the average projected TDS and sulfate concentrations are above WQOs while the average chloride and nitrate concentrations are below the WQOs. In Management Zone 1b, TDS, chloride and nitrate will remain below the WQOs. The average projected sulfate concentration in Management Zone 1b is 75 mg/L above the WQO of 150 mg/L, while the 90th percentile is 92 mg/L over WQOs.

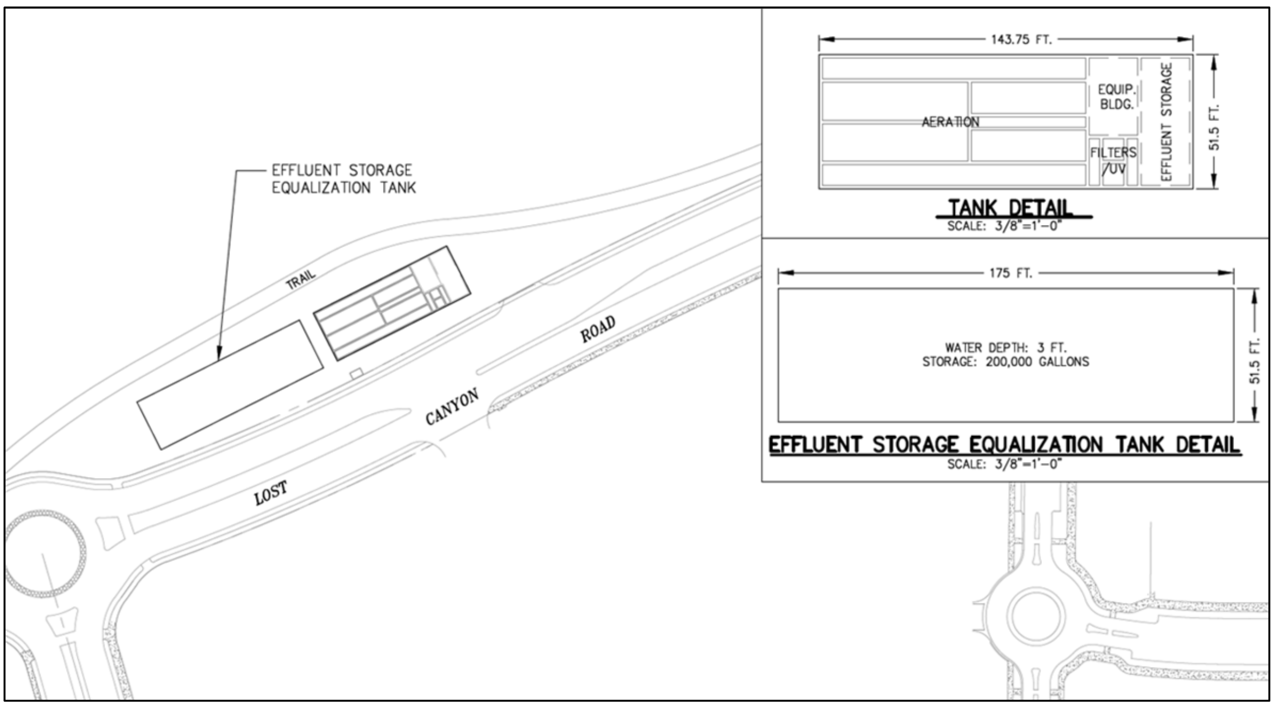
In general, the projected average salt and nutrient concentrations under SCWD Water Use Efficiency Program conditions are at or below those projected for Land Use Build-Out conditions – indicating that implementation of the project will reduce salt and nutrient concentrations. This is especially true for TDS and chloride concentrations in the Alluvial Aquifer management zones (Management Zones 1 through 5).

The projected results also show that the SCWD Water Use Efficiency Program utilizes greater than 10% of the available assimilative capacity for chloride in Management Zones 4 and 6, for nitrate in Management Zone 6, and for sulfate in Management Zone 1a. However, when compared to Land Use

Build-Out conditions, implementation of the SCWD Water Use Efficiency Program increases assimilative capacity by 2 mg/L for chloride in Management Zone 4 and sulfate in Management Zone 1a, and does not affect the remaining projected assimilative capacities.

9.5.2.3 Vista Canyon Water Reclamation Plant (2014-2019)

The Vista Canyon WRP will be constructed to serve Vista Canyon Development, located in Management Zone 1. The treatment plant will generate 439 AFY of treated wastewater. The plant would provide approximately 190 AFY of the treated wastewater to the Vista Canyon development area for landscape irrigation and the remainder will be placed into the existing sewer system and treated at downstream treatment plants. Figure 9-6 below shows the site layout of the Vista Canyon WRP.



Source: Dexter Wilson Engineering, 2016

Figure 9-6. Vista Canyon Site Layout

Please note that the Vista Canyon project modeled included placing recycled water in excess of irrigation needs in percolation ponds. The project description changed after the modeling was complete. The current Vista Canyon project described above is similar to the project as modeled and described below in that the same volume of recycled water (190 acre-ft/yr) will be used for landscape irrigation. The current project differs in the fact that no recycled water will be added directly to the underlying alluvial groundwater in MZ-1. The remaining 249 acre-ft/yr of recycled water discharged to the sewer will become part of the discharge that falls under SCVSD Wastewater Treatment Plant Chloride Compliance Program and will not result in a change to the assimilative capacity calculated for that project. Thus, the new project is more conservative in that less salt load will be added to Management Zone 1 and further treatment and addition of the chloride compliance program will result in less impact when all projects are considered. The analysis below uses the former project description for the anti-degradation analysis, since it is conservative in impact.

The impact of the proposed use of recycled water at the Vista Canyon Project is simulated in the spreadsheet model by return flows calculated at one fourth the volume (return flow percentage) and four times the concentrations for each constituent (addition of urban increment). The proposed volume to be placed in percolation ponds is simulated by adding the proposed volumes at the planned concentrations to stream leakage inflow term in the spreadsheet model for Management Zone 1.

The salt balances under Vista Canyon WRP conditions from 2012 through 2035 are shown on Figures 27a through 27g. The projected concentration changes for all management zones from 2012 through 2035 are shown on Figures 28.1.a through 28.1.g, Figures 28.2.a through 28.2.g, Figures 28.3.a through 28.3.g, and Figures 28.4.a through 28.4.g for TDS, chloride, nitrate and sulfate, respectively. The simulated concentrations for salt and nutrients at the end of the planning period (2035) for each management zone are also summarized in attached Tables 1a, 1b, 1c and 1d for TDS, chloride, nitrate and sulfate, respectively.

Based on the analysis of historical and projected mass loading with the addition of the Vista Canyon WRP, all projected salt and nutrient concentrations assessed herein will remain below the WQOs in Management Zones 5 and 6. While some annual concentrations are projected to range above WQOs at times, the average projected salt and nutrient concentrations remain below WQOs in Management Zone 1a for the predictive period. In addition, TDS, chloride and nitrate will remain below the WQOs in Management Zone 1a. The 90^{th} percentile of the projected sulfate concentrations, however, is 7 mg/L over the WQO of 150 mg/L. In Management Zone 1b, chloride and nitrate will remain below the WQOs. While some annual TDS concentrations range above the WQO at times, the average projected TDS concentration is below the WQO. The average projected sulfate concentration in Management Zone 1b is 75 mg/L above the WQO of 150 mg/L, while the 90^{th} percentile is 92 mg/L over WQOs. In Management Zone 2, projected average nitrate concentrations will remain below the WQO. The average projected TDS concentration is 278 mg/L over the WQO of 700 mg/L, while the average chloride concentration is 9 mg/L over the WQO of 100 mg/L and the average sulfate concentration is 97 mg/L over the WQO of 150 mg/L. In Management Zone 3, projected average chloride and nitrate concentrations will remain below the WQO. The average projected TDS concentration is 90 mg/L over the WQO of 700 mg/L, while the average sulfate concentration is 45 mg/L over the WQO of 200 mg/L. In Management Zone 4, chloride, nitrate and sulfate will remain below the WQOs. The average projected TDS concentration in Management Zone 4 is 10 mg/L above the WQO of 700, and the 90th percentile is 44 mg/L higher.

In general, the projected average salt and nutrient concentrations under Vista Canyon WRP conditions are the same as those projected for Land Use Build-Out conditions, indicating that implementation of the project will not have an effect on salt and nutrient concentrations.

The projected results also show that the Vista Canyon WRP utilizes greater than 10% of the available assimilative capacity for chloride in Management Zones 4 and 6, for nitrate in Management Zone 6, and for sulfate in Management Zone 1a. However, when compared to Land Use Build-Out conditions, implementation of the Vista Canyon WRP will have no effect on the projected assimilative capacities while providing the beneficial use of recycled water.

9.5.2.4 CLWA Recycled Water Master Plan (2014-2035)

The CLWA Recycled Water Master Plan proposes to incorporate additional recycled water for use in the Valley for landscape irrigation. Currently, 325 acre-ft/yr of recycled water is used for landscape irrigation. In accordance with the intent of the Recycled Water Policy, CLWA is planning to incrementally increase use of recycled water to about 2,000 acre-ft/yr for Phase 2A, 2B, and 2C planning areas by the year 2035. Approximately 1,000 acre-ft/yr will be used in areas upstream of the Saugus WRP and 1,000 acre-ft/yr will be used in the Phase 2C planning area.

The salt balances under CLWA Recycled Water Master Plan conditions from 2012 through 2035 are shown on Figures 29a through 29g. The projected concentration changes for all management zones from 2012 through 2035 are shown on Figures 30.1.a through 30.1.g, Figures 30.2.a through 30.2.g, Figures 30.3.a through 30.3.g, and Figures 30.4.a through 30.4.g for TDS, chloride, nitrate and sulfate, respectively. The simulated concentrations for salt and nutrients at the end of the planning period (2035) for each management zone are also summarized in attached Tables 1a, 1b, 1c and 1d for TDS, chloride, nitrate and sulfate, respectively.

Based on the analysis of historical and projected mass loading with the addition of the CLWA Recycled Water Master Plan, all projected salt and nutrient concentrations assessed herein will remain below the WQOs in Management Zones 5 and 6. While some annual concentrations are projected to range above WQOs at times, the average projected salt and nutrient concentrations remain below WQOs in Management Zone 1a. In Management Zone 1a, TDS, chloride and nitrate will remain below the WQOs, but the 90th percentile for the projected sulfate concentration is 7 mg/L over the WQO of 150 mg/L. In Management Zone 1b, chloride and nitrate will remain below the WQOs and, while some annual concentrations are projected to range above the WQO at times, the average projected TDS concentration is below the WQO of 800 mg/L. The average projected sulfate concentration in Management Zone 1b is 75 mg/L above the WQO of 150 mg/L, while the 90th percentile is 92 mg/L over WQOs. While there is insufficient information to make a robust determination, a cursory assessment shows that in Management Zone 2, nitrate concentrations remain below the WQO, while the average TDS, chloride and sulfate concentrations are over WQOs by 278 mg/L, 9 mg/L and 97 mg/L, respectively. Likewise, insufficient information in Management Zone 3 makes concentration determinations speculative. A cursory assessment shows that in Management Zone 3, average projected chloride and nitrate concentrations will remain below the WQOs. The average projected TDS and sulfate concentrations in Management Zone 3 are above the WQOs of 700 and 200 mg/L, respectively, by 110 mg/L and 49 mg/L. In Management Zone 4, TDS, nitrate and sulfate will remain below the WQOs. The average projected TDS concentration in Management Zone 4 is 9 mg/L over the WQO of 700 mg/L.

In general, the projected average salt and nutrient concentrations under CLWA Recycled Water Master Plan conditions are at or slightly above those projected for Land Use Build-Out conditions, indicating that implementation of the project may slightly increase salt and nutrient concentrations. This is especially true in Management Zones 3, 4 and 5.

The projected results also show that the CLWA Recycled Water Master Plan utilizes greater than 10% of the available assimilative capacity for chloride in Management Zones 4 and 6, for nitrate in Management Zone 6, and for sulfate in Management Zone 1a. However, when compared to Land Use Build-Out conditions, implementation of the CLWA Recycled Water Master Plan benefits the groundwater basin by increasing the assimilative capacity for chloride in Management Zone 4 by 2 mg/L. (40% increase of assimilative capacity as compared to Land Use Build-Out conditions) and has no effect on the remaining projected assimilative capacities.

9.5.2.4.1 CHLORIDE CONCENTRATIONS IN DISCHARGE – CHLORIDE CONCENTRATION SENSITIVITY ANALYSIS

Predictive modeling for the CLWA Recycled Water Master Plan assumed that chloride concentration in the recycled water for irrigation will be 125 mg/L. The 125 mg/L concentration was calculated as follows: The average chloride concentration for State Water Project water since 2000 is 70 mg/L with a median is 73 mg/L. The added increment varies significantly before it reaches the WRPs. Review of the data, indicates that an additional 45 mg/L is reasonable for assuming chloride concentration in the treated effluent discharge through 2013. However, the 45 mg/L increment is lower than that experienced since 2010 (mean=55 mg/L, median=54 mg/L). Taking the two averages results in an anticipated chloride concentration of about 125 mg/L for the anticipated recycled water.

In consideration of future chloride concentrations variations and peaks in State Water Project water specifically, during dry weather and dry hydrologic conditions, a sensitivity analysis using recycled water at a chloride concentration of 156 mg/L for irrigation application was conducted. The 156 mg/L concentration represents the average chloride concentration in the Valencia Treatment Wastewater Treatment Plant during the base period 2001-2011. The average Valencia Plant effluent chloride concentration is higher than the Saugus Plant effluent chloride concentration (average of over the base period. However, it should be noted that chloride concentrations may rise during some periods above those anticipated herein.

Table 9-8 compares the changes in assimilative capacity between current model and sensitivity run as a result of CLWA Recycled Water Master Plan. The concentrations shown in columns [1] and [2] are the resulting average concentrations for the initial model and sensitivity run respectively for Management Zone 3 and Management Zone 4. The assimilative capacity for the initial run and sensitivity run are reported in columns [3] and [4] respectively. Column [5] reports the change in assimilative capacity between the initial run and the sensitivity run for Management Zone 3 and Management Zone 4. As shown, a higher chloride concentration will result in a decline of assimilative capacity from 17.2 mg/L to 15.9 mg/L in Management Zone 3, while in Management Zone 4 results in a decline from 5.2 mg/L to 4.7 mg/L. The supporting tables for the sensitivity analysis are provided in Appendix J. Tables J-2 through J-4 provide a summary of the anticipated water quality change from the sensitivity analysis for the CLWA Recycled Water Master Plan for Management Zones 3, 4 and 6, respectively. Tables J-5 through J-7 provide a summary of the anticipated water quality change from the sensitivity analysis for the CLWA Recycled Water Master Plan along with "All Projects for Management Zones 3, 4 and 6, respectively. The anticipated water quality changes in the management zones as a result of the increased chloride concentration sensitivity analysis are shown in the spreadsheets. The sensitivity analysis indicates that the decline in assimilative capacity is insignificant at the higher chloride concentration used in the sensitivity analysis for both the single project and "All Projects" as shown in the table below.

Table 9-8. Summary of Sensitivity Analysis

Project	Management Zone	Average Chloride Concentration, mg/L		Assimilative Capacity, mg/L		Changes in Assimilative Capacity, mg/L
		[1]	[2]	[3]	[4]	[5]
		Current Model	Sensitivity Run	Current Model	Sensitivity Run	
CLWA Recycled Water Master Plan with Sensitivity Analysis	Management Zone 3	82.8	84.1	17.2	15.9	-1.3
	Management Zone 4	94.8	95.3	5.2	4.7	-0.5
All Projects with Sensitivity Analysis	Management Zone 3	80.7	82.0	19.3	18	-1.3
	Management Zone 4	88.3	88.8	11.7	11.2	-0.5

9.5.2.5 CLWA SCV WUE SP (2009-2013)

The SCV WUE SP plans to conserve 683 acre-ft/yr for a total planned reduction of 3,287 acre-ft over a five year span which will also result in a decreased need of 380 acre-ft/yr of imported water. The planned reductions will be achieved primarily through reduction in residential use and urban run-off. The full project benefits will be achieved between 2015 and 2026.

The salt balances under CLWA SCV WUE SP conditions from 2012 through 2035 are shown on Figures 31a through 31g. The projected concentration changes for all management zones under CLWA SCV WUE SP conditions from 2012 through 2035 are shown on Figures 32.1.a through 32.1.g, Figures 32.2.a through 32.2.g, Figures 32.3.a through 32.3.g, and Figures 32.4.a through 32.4.g for TDS, chloride, nitrate and sulfate, respectively. The simulated concentrations for salt and nutrients at the end of the planning period (2035) for each management zone are also summarized in attached Tables 1a, 1b, 1c and 1d for TDS, chloride, nitrate and sulfate, respectively.

Based on the analysis of historical and projected mass loading with the addition of the CLWA SCV WUE SP, all projected salt and nutrient concentrations assessed herein will remain below the WQOs in Management Zones 5 and 6. While some annual concentrations are projected to range above WQOs at times, the average projected salt and nutrient concentrations remain at or below WQOs in Management Zone 1a. In Management Zone 1a, TDS, chloride and nitrate will remain below the WQOs, but the 90th percentile for the projected sulfate concentration is 6 mg/L over the WQO of 150 mg/L. In Management Zone 1b, chloride and nitrate will remain below the WQOs and, while some annual concentrations are projected to range above the WQO at times, the average projected TDS concentration is below the WQO of 800 mg/L. The average projected sulfate concentration in Management Zone 1b is 75 mg/L above the WQO of 150 mg/L. While there is insufficient information to make a robust determination of water quality impacts in MZ-2 and MZ-3. However, a cursory assessment shows that in Management Zone 2, nitrate concentrations remain below the WQO, while the average TDS, chloride and sulfate concentrations are over WQOs by 265 mg/L, 7 mg/L and 95 mg/L, respectively. In Management Zone 3, chloride and nitrate concentrations will remain below the WQOs. The average projected TDS and sulfate concentrations in Management Zone 3 are above the WQOs of 700 and 200 mg/L, respectively, by 78 mg/L and 43 mg/L. In Management Zone 4, TDS, nitrate and sulfate will remain below the WQOs. The average projected TDS concentration in Management Zone 4 is 2 mg/L over the WQO of 700 mg/L.

In general, the projected average salt and nutrient concentrations under CLWA SCV WUE SP conditions are at or slightly below those projected for Land Use Build-Out conditions, indicating that implementation of the project will slightly decrease salt and nutrient concentrations. This is especially true for TDS, chloride and sulfate in the Alluvial Aquifer management zones (Management Zones 1 through 5).

The projected results also show that the CLWA SCV WUE SP utilizes greater than 10% of the available assimilative capacity for chloride in Management Zones 4 and 6, for nitrate in Management Zone 6, and for sulfate in Management Zone 1a. However, when compared to Land Use Build-Out conditions, implementation of the CLWA SCB WUE SP increases assimilative capacity by 1 mg/L for chloride in Management Zone 4 and sulfate in Management Zone 1a, and does not affect the remaining projected assimilative capacities.

9.5.2.6 Newhall Ranch Water Reclamation Plant and Recycled Water Use

The Newhall Ranch Water Reclamation Plant (Newhall WRP) will service development in the Newhall Ranch Specific Plan and may serve additional surrounding which are included in OVOV. The Newhall WRP is anticipated to come online in 2023 and will be constructed initially to treat a flow rate of 2.0 MGD with future expansions up to 5.3 MGD. At full buildout, the facility could accommodate the Newhall Ranch Specific Plan area (3.99 MGD) as well as the Val Verde area located north of the Specific Plan (1.31 MGD). Primarily, effluent from the Newhall WRP will be distributed as recycled water for landscape irrigation by VWC. However it is anticipated that some recycled water will be discharged to the Santa Clara River generally during the months of November through March during wet, dry, and average years through 2035. At complete build-out, recycled water demand will be near 7,164 acre-ft/y. At build-out of the Newhall Ranch Specific Plan (3.99 MGD) approximately 566 acre ft/yr of treated effluent discharged to the SCR. At build-out of the Newhall WRP (5.3 MGD) approximately 752 acre-ft/yr would be discharged to the Santa Clara River (566AFY*5.3 MGD/3.99MGD). Recycled water chloride concentration discharged to the river will be RO treated and will have a chloride concentration of 100 mg/L, while recycled water used for landscape irrigation is expected to have a chloride concentration of 125 mg/L. The specific discharge to stream volume will not impact the water quality in the groundwater basin.

The planned Newhall WRP will discharge to the river just east of the Los Angeles/Ventura County line for limited durations during the winter months. The discharge will continue to occur predominantly in reaches of the Santa Clara River that are perennial (i.e., are flowing year-round). Accordingly, little of this water recharges the aquifer.

The volume distribution and water types of 10,263 acre-ft/yr for outdoor use for the nine West Side communities to be developed by Newhall Land were provided by GSI (See Appendix D, Table D-3) and was used to evaluate the salt loads from land surface application. According to GSI Water (personal communication, 2015), the point of discharge occurs at a location of rising water and therefore water discharged to the surface of the stream will not mix groundwater but will continue as surface flow out of the basin, therefore only the volume of applied water was included in the for project analysis in the water budget terms provided by GSI. The salt balances under Newhall WRP conditions from 2012 through 2035 are shown on Figures 33a through 33g. The projected concentration changes for all management zones from 2012 through 2035 are shown on Figures 34.1.a through 34.1.g, Figures 34.2.a through 34.2.g, Figures 34.3.a through 34.3.g, and Figures 34.4.a through 34.4.g for TDS, chloride, nitrate and sulfate, respectively. The simulated concentrations for salt and nutrients at the end of the planning period (2035) for each management zone are also summarized in attached Tables 1a, 1b, 1c and 1d for TDS, chloride, nitrate and sulfate, respectively.

Based on the analysis of historical and projected mass loading with the addition of the Newhall WRP, all projected salt and nutrient concentrations assessed herein will remain below the WQOs in Management Zones 5 and 6. While some annual concentrations are projected to range above WQOs at times, the average projected salt and nutrient concentrations remain at or below WQOs in Management Zone 1a. In Management Zone 1a, TDS, chloride and nitrate will remain below the WQOs, but the 90^{th} percentile for the projected sulfate concentration is 7 mg/L over the WQO of 150 mg/L. In Management Zone 1b, chloride and nitrate will remain below the WQOs and, while some annual concentrations are projected to range above the WQO at times, the average projected TDS concentration is below the WQO of 800 mg/L. The average projected sulfate concentration in Management Zone 1b is 75 mg/L above the WQO of 150 mg/L. As stated before there is insufficient information to make a robust determination of water quality impacts for MZ-2 and MZ-3. However, a cursory assessment shows that in Management Zone 2, nitrate concentrations remain below the WQO, while the average TDS, chloride and sulfate concentrations are over WQOs by 278 mg/L, 9 mg/L and 97 mg/L, respectively. In Management Zone 3, chloride and nitrate concentrations will remain below the WQOs. The average projected TDS and sulfate concentrations in Management Zone 3 are above the WQOs of 700 and 200 mg/L, respectively, by 91 mg/L and 45 mg/L. In Management Zone 4, TDS, nitrate and sulfate will remain below the WQOs. The average projected TDS concentration in Management Zone 4 is 9 mg/L over the WQO of 700 mg/L.

In general, the projected average salt and nutrient concentrations under Newhall WRP conditions are at or slightly above those projected for Land Use Build-Out conditions, indicating that implementation of the project will slightly increase salt and nutrient concentrations. It should be noted that although changes in water quality due to the project are identified in Management Zone 1, 2, and 3, this is due to the fact that Management Zone 6 (Saugus Formation Aquifer) water quality is treated as a single unit. In fact, water quality changes in Management Zone 6 in the western part of the East Subbasin will not impact water quality changes in the eastern portion of the basin, since it is upgradient.

The projected results also show that the Newhall WRP utilizes greater than 10% of the available assimilative capacity for chloride in Management Zones 4 and 6, for nitrate in Management Zone 6, and for sulfate in Management Zone 1a. However, when compared to Land Use Build-Out conditions, implementation of the Newhall WRP decreases assimilative capacity for chloride in Management Zone 6 by 1 mg/L (2% of assimilative capacity under Land Use Build-Out conditions) and has no effect on the remaining projected assimilative capacities.

9.5.2.7 All Projects Combined

The predicted water quality changes were simulated for all projects proposed during the planning period of 2012 through 2035. The salt balances under All Projects conditions from 2012 through 2035 are shown on Figures 35a through 35g. The projected concentration changes for all management zones from 2012 through 2035 are shown on Figures 36.1.a through 36.1.g, Figures 36.2.a through 36.2.g, Figures 36.3.a through 36.3.g, and Figures 36.4.a through 36.4.g for TDS, chloride, nitrate and sulfate, respectively. The simulated concentrations for salt and nutrients at the end of the planning period (2035) for each management zone are also summarized in attached Tables 1a, 1b, 1c and 1d for TDS, chloride, nitrate and sulfate, respectively.

Based on the analysis of historical and projected mass loading with the addition of All Projects, all projected salt and nutrient concentrations assessed herein will remain below the WQOs in Management Zones 5 and 6. While some annual concentrations are projected to range above WQOs at times, the average projected salt and nutrient concentrations remain below WQOs in Management Zone 1a. In Management Zone 1a, TDS, chloride and nitrate will remain below the WQOs, but the 90th percentile for the projected sulfate concentration is 3 mg/L over the WQO of 150 mg/L. In Management Zone 1b, chloride and nitrate will remain below the WQOs and, while some annual concentrations are projected to range above the WQO at times, the average projected TDS concentration is below the WQO of 800 mg/L. The average projected sulfate concentration in Management Zone 1b is 75 mg/L above the WQO of 150 mg/L. As sated, there is currently insufficient information to make a robust determination of water quality impacts for MZ-2 and MZ-3. However, a cursory assessment shows that: in Management Zone 2, nitrate concentrations remain below the WQO, while the average TDS, chloride and sulfate concentrations are over WQOs by 248 mg/L, 6 mg/L and 92 mg/L, respectively. In Management Zone 3, chloride and nitrate concentrations will remain below the WQOs. The average projected TDS and sulfate concentrations in Management Zone 3 are above the WQOs of 700 and 200 mg/L, respectively, by 91 mg/L and 46 mg/L. In Management Zone 4, TDS, nitrate and sulfate will remain below the WQOs. The average projected TDS concentration in Management Zone 4 is 3 mg/L over the WQO of 700 mg/L.

The projected average salt and nutrient concentrations under All Projects conditions range below, above, or at those projected for Land Use Build-Out conditions. In general, however, the results indicate that the implementation of all of the proposed projects will have a net effect of reducing salt and nutrients in the management zones.

The projected results also show that the implementation of All Projects utilizes greater than 20% of the available assimilative capacity for chloride in Management Zones 4 and 6, and for sulfate in Management Zone 1a. Under All Projects conditions, greater than the allowable amount of assimilative capacity is utilized in the same management zones and for the same constituents as under Land Use Build-Out conditions, with a few exceptions. However, implementation of all projects has a net beneficial effect on groundwater in that the rate of the use of assimilative capacity is less than without the projects. Table 9-8 below provides a comparison of the change in assimilative capacity between Land Use Build-Out (i.e., no projects) conditions and the All Projects scenario.

Table 9-9. Comparison of Assimilative Capacity Used –Land Use Build-Out vs. All Projects

Chemical	Management Zone 1a		Management Zone 1b		Managemen t Zone 2		Management Zone 3		Management Zone 4		Management Zone 5		Management Zone 6	
	LUB[1]	AP[2]	LUB	AP	LUB	AP	LUB	AP	LUB	AP	LUB	AP	LUB	AP
TDS	-15%	14%	129%	143%	-	-	-	-	12%	70%	0%	3%	-1%	-1%
Chloride	0%	6%	0%	1%	-	-	-	-	-71%	-49%	-3%	3%	-24%	-25%
Nitrate	3%	2%	-9%	-9%	-	-	-	-	-10%	-11%	-8%	-8%	-17%	-17%
Sulfate	-102%	-76%	37%	37%	-	-	-	-	39%	41%	-2%	-2%	-	-

[1] LUB = Land Use Build-Out
[2] AP = All Projects
Notes: MZ-2, MZ-3 and sulfate in MZ-6 have insufficient data for preparation of analysis
Negative (-) values denote an *decrease* in assimilative capacity.

Tables 2a through 2d provide a comparison of assimilative capacity used by individual projects and all projects combined with the use of assimilative capacity under Land Use Build-Out conditions only. A review of Tables 2a through 2d indicates that generally, less assimilative capacity is used as a result of implementation of all the projects when compared to Land Use Build-Out conditions only. Water quality is moved closer to the WQOs as a result of implementation of the proposed projects.

Tables 3a through 3d provide a summary of the net increase or decrease in assimilative capacity use for each single project and all projects from water quality conditions that would result from Land Use Build-Out conditions only. Tables 9-9, 9-10, 9-11, and 9-12 below summarize the results of the net increase/decrease in TDS, chloride, nitrate, and sulfate assimilative capacity for the All Projects condition, respectively.

Table 9-10. Summary Net Increase/Decrease in TDS Assimilative Capacity for All Projects from Land Use Build-Out Conditions

Description		MZ-1a	MZ-1b	MZ-2	MZ-3	MZ-4	MZ-5	MZ-6
2001-2011 Conditions	Water Quality Objective (mg/L)	800	800	700	700	700	1,000	700
	Average (Ambient) Conc. (mg/L)	728	833	-	-	710	727	636
	Current Assimilative Capacity (mg/L)	72	-33	-	-	-10	273	64
No Project (2012-2035)	Average Concentration (mg/L)	739	790	-	-	709	728	636
	Assimilative Capacity (mg/L)	61	10	-	-	-9	272	64
	Assimilative Capacity Used	-15%	129%	-	-	12%	0%	-1%
All Projects (2012-2035)	Average Concentration (mg/L)	717	786	-	-	703	719	636
	Assimilative Capacity (mg/L)	83	14	-	-	-3	281	64
	Assimilative Capacity Used	14%	143%	-	-	70%	3%	-1%
	All Project AC[1] – LUB[2] AC (mg/L)	21.3	4.7	-	-	6.0	9.3	-0.4
	Net Increase/Decrease from LUB	**29%**	**14%**	**-**	**-**	**58%**	**3%**	**-1%**

[1] AC = Assimilative Capacity

[2] LUB = Land Use Build-Out

Table 9-11. Summary Net Increase/Decrease in Chloride Assimilative Capacity for All Projects from Land Use Build-Out Conditions

Description		MZ-1a	MZ-1b	MZ-2	MZ-3	MZ-4	MZ-5	MZ-6
2001-2011 Conditions	Water Quality Objective (mg/L)	150	150	100	100	100	150	100
	Average (Ambient) Conc. (mg/L)	89	72	-	-	77	77	28
	Current Assimilative Capacity (mg/L)	61	78	-	-	23	73	72
No Project (2012-2035)	Average Concentration (mg/L)	89	72	-	-	93	79	46
	Assimilative Capacity (mg/L)	61	78	-	-	7	71	54
	Assimilative Capacity Used	0%	0%	-	-	-71%	-3%	-24%
All Projects (2012-2035)	Average Concentration (mg/L)	85	71	-	-	88	75	46
	Assimilative Capacity (mg/L)	65	79	-	-	12	75	54
	Assimilative Capacity Used	6%	1%	-	-	-49%	3%	-25%
	All Project AC – LUB AC (mg/L)	3.4	0.8	-	-	5.0	4.0	-0.2
	Net Increase/Decrease from LUB	**6%**	**1%**	**-**	**-**	**21%**	**5%**	**0%**

Table 9-12. Summary Net Increase/Decrease in Nitrate Assimilative Capacity for All Projects from Land Use Build-Out Conditions

Description		MZ-1a	MZ-1b	MZ-2	MZ-3	MZ-4	MZ-5	MZ-6
2001-2011 Conditions	Water Quality Objective (mg/L)	45	45	45	45	45	45	45
	Average (Ambient) Conc. (mg/L)	20	21	-	-	16	8	14
	Current Assimilative Capacity (mg/L)	25	24	-	-	29	37	31
No Project (2012-2035)	Average Concentration (mg/L)	19	23	-	-	19	11	19
	Assimilative Capacity (mg/L)	26	22	-	-	26	34	26
	Assimilative Capacity Used	3%	-9%	-	-	-10%	-8%	-17%
All Projects (2012-2035)	Average Concentration (mg/L)	19	23	-	-	19	11	19
	Assimilative Capacity (mg/L)	26	22	-	-	26	34	26
	Assimilative Capacity Used	2%	-9%	-	-	-11%	-8%	-17%
	All Project AC – LUB AC (mg/L)	-0.1	0.0	-	-	-0.2	0.1	0.0
	Net Increase/Decrease from LUB	**0%**	**0%**	**-**	**-**	**-1%**	**0**	**0**

Table 9-13. Summary Net Increase/Decrease in Sulfate Assimilative Capacity for All Projects from Land Use Build-Out Conditions

Description		MZ-1a	MZ-1b	MZ-2	MZ-3	MZ-4	MZ-5	MZ-6
2001-2011 Conditions	Water Quality Objective (mg/L)	150	150	150	200	250	350	-
	Average (Ambient) Conc. (mg/L)	138	269	-	-	189	246	235
	Current Assimilative Capacity (mg/L)	12	-119	-	-	61	104	-
No Project (2012-2035)	Average Concentration (mg/L)	150	225	-	-	166	248	251
	Assimilative Capacity (mg/L)	0	-75	-	-	84	102	-
	Assimilative Capacity Used	-102%	37%	-	-	39%	-2%	-
All Projects (2012-2035)	Average Concentration (mg/L)	147	225	-	-	164	248	251
	Assimilative Capacity (mg/L)	3	-75	-	-	86	102	-
	Assimilative Capacity Used	-76%	37%	-	-	41%	-2%	-
	All Project AC – LUB AC (mg/L)	3.0	0.5	-	-	1.3	0.3	-
	Net Increase/Decrease from LUB	**26%**	**0%**	**-**	**-**	**2%**	**0%**	**-**

Table 9-14. Summary of Increase/Decrease in Assimilative Capacity for All Constituents for All Projects from Land Use Build-Out Conditions

Constituent	Management Zone 1a	Management Zone 1b	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5	Management Zone 6
TDS	29%	14%	-	-	58%	3%	-1%
Chloride	6%	1%	-	-	21%	5%	0%
Nitrate	0%	0%	-	-	-1%	0%	0%
Sulfate	26%	0%	-	-	2%	0%	-

Note: A positive value indicates an increase in assimilative capacity; a negative (-) value indicates a decrease in assimilative capacity.

Table 9-13 indicates that in comparison to the Land-Use Build-Out conditions, the implementation of the proposed projects in the East Subbasin will have a significant beneficial impact to assimilative capacity of all constituents, including Management Zone 1b. Assimilative capacity for TDS will decrease by 1% in Management Zone 6 and 1% for nitrate in Management Zone 4. These decreases are significantly less than the 20% threshold allowed for all-projects in the Recycled Water Policy. The implementation of the proposed projects is necessary to mitigate groundwater quality and will perform as an implementation measure when operated as part of the on-going management of groundwater resources and protection of groundwater quality in the East Subbasin.

9.6 Evaluation of Protection of Beneficial Uses

The LARWQCB Assistance in Guiding Salt and Nutrient Management Plan Development in the Los Angeles Region (Draft) summarizes the existing and potential beneficial uses of groundwater in the basins within the LARWQCB oversight. Table 9-14 below summarizes a portion of Table 2-1 of that document.

Four beneficial uses are designated for the management zone, which include municipal (MUN), industrial service supply (IND), industrial process supply (PROC), and agricultural supply (AGR).

Table 9-15. Existing Beneficial Uses – East Subbasin Management Zones

Management Zone	Subunit	MUN	IND	PROC	AGR
MZ-1	Mint Canyon	X	X	X	X
MZ-2	South Fork	X	X	X	X
MZ-3	Placerita	X	X	X	X
MZ-4	Bouquet and San Francisquito Canyons	X	X	X	X
MZ-5	Castaic Valley	X	X	X	X
MZ-6	Saugus Formation	X			

Source: Table 2-1 of the 1994 Basin Plan (LARWQCB, 1994)
Note: municipal (MUN), industrial service supply (IND), industrial process supply (PROC), and agricultural supply (AGR).

9.6.1 Agricultural Supply Beneficial Use

Pumping for agricultural uses occurs primarily in the Castaic Valley (Management Zone 5). The SWRCB published "A Compilation of Water Quality Goals," 17th Edition (2016a) points to a publication by Food and Agriculture Organization of the United Nations (FAO, 1976) entitled "Water Quality for Agriculture". The FAO document was reviewed to evaluate the impacts to agriculture. Of the constituents addressed in this SNMP, TDS, chloride, and nitrate are addressed in the FAO document.

With regard to TDS, the model indicates that TDS concentrations will show a slight increase from the ambient concentration (727 mg/L to 728 mg/L) under Land-Use Build-Out conditions, or decrease under the conditions for each single project, or for all projects combined. FAO (1976) reports a slight to moderate restriction on irrigation use of water containing 450-2,000 mg/L TDS. Therefore, with regards to TDS, agricultural uses will show no additional impacts from proposed projects.

With regards to chloride, the WQO is 150 mg/L. The current ambient concentration is 77 mg/L. Although slight, in MZ-5, the chloride concentration would be most impacted by the implementation of the Newhall WRP. However, under the Newhall WRP, chloride concentration increases to 80 mg/L. The maximum permissible concentration of chloride in irrigation water to avoid leaf injury ranges from 3.3 milliequivalents per liter (me/L) to 27 me/L depending on the crop (FAO, 1976). These threshold concentrations convert to 11 mg/L to 958 mg/L. A slight to moderate restriction on irrigation use of water containing 4-10 me/L (142-355 mg/L). Therefore, with regards to chloride agricultural uses will show no additional impacts from proposed projects.

Nitrate will increase to a maximum of 11 mg/L from an ambient concentration of 8 mg/L, remaining well below the WQO of 45 mg/L. A slight to moderate restriction on irrigation use of water containing 5-30 mg/L nitrate. Therefore, with regards to nitrate, agricultural uses will show no additional impacts from proposed projects.

9.6.2 Municipal Drinking Water Supply (MUN)

With regards to TDS, constituents will remain below the WQOs for single projects and all projects with the exception of Management Zone 4. The ambient concentration of TDS in Management Zone 4 is above the WQO by 10 mg/L. Implementation of the CLWA Masterplan will increase the TDS concentrations above the ambient concentration by 7 mg/L. The implementation of all the proposed projects will decrease the concentration 7 mg/L below the ambient concentration. All predicted concentrations remain well below the secondary MCL for TDS of 1,000 mg/L. Therefore, the implementation of all projects will have a beneficial impact on municipal water quality.

9.6.3 Industrial Water Supply (IND)

According to the San Francisco RWQCB (2015), uses of water for industrial activities that do not depend primarily on water quality, include, but are not limited to: mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization. Most industrial service supplies have essentially no water quality limitations except for gross constraints, such as freedom from unusual debris. It is anticipated that, since the groundwater under current and predicted concentrations can be used for municipal supply, industrial uses will not be impacted by the implementation of the proposed projects.

9.6.4 Industrial Process Supply (PROC)

According to the San Francisco RWQCB (2015), "*water quality requirements differ widely for the many industrial processes in use today. So many specific industrial processes exist with differing water quality requirements that no meaningful criteria can be established generally for quality of raw water supplies*." It is anticipated that, since the groundwater under current and predicted concentrations can be used for municipal supply, industrial process supply uses will not be impacted by the implementation of the proposed projects.

9.6.5 Protection of Beneficial Use Summary

Implementation of the proposed projects will not result in water quality changes that will impact the existing beneficial uses assigned to the groundwater of the East Subbasin.

9.7 Summary of Findings

The anti-degradation analysis shows that in the absence of projects, water quality changes will occur with the resulting concentrations above the ambient plus 10% assimilative capacity concentration threshold at 2035. The implementation of single projects and the combined projects in general will decrease salt and nutrient concentrations from Land Use Build-Out only concentrations; but also generally, will result in concentrations that are above the ambient plus 10% assimilative capacity concentration for single projects and the ambient plus 20% assimilative capacity concentration for the combined projects. Therefore, although single projects and all projects can results in an increase in assimilative capacity as compared to current ambient water quality, if No Projects are implemented, assimilative capacity will cross thresholds established in the Recycled Water Policy set forth to evaluate recycled water projects.

Implementation of the proposed projects represent a “maximum benefit” to the people of the State by providing beneficial uses for recycled water in conjunction with conservation projects within the to the East Subbasin. The proposed projects represent a maximum benefit for the following reasons:

- The Proposed SNMP projects will reduce residential and commercial urban water use and run-off and conserve 7,724 acre-ft during the planning period, thereby reducing dependency on imported water by 380-acre-ft.

- Currently 350 acre-ft per year of recycled water is used for landscape irrigation. Proposed SNMP projects will increase the amount of landscape irrigation incrementally to 9,164 irrigation and thus conserve precious potable water resources in the basin. An additional 815 acre-ft/yr will be available for potential aquifer recharge.

- The projected average salt and nutrient concentrations under Land Use Build-Out conditions (i.e. no project conditions) range below, above, or at those projected for All Projects conditions. Therefore, in general, the results indicate that the implementation of all of the proposed projects will have a net effect of reducing salt and nutrients in the management zones.

In addition to the minimal negative, and in many cases positive, water quality impacts associated with the proposed recycled water and water conservation projects in the groundwater basin, the Recycled Water Policy and the Governor’s recent drought proclamations[12] recognize the tremendous need for

[12] Proclamations made by Governor Jerry Brown On January 17, 2014 (Proclamation No. 1-17-2014) and on April 25, 2014

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, 2013)

Clearly, the benefits in terms of sustainability and reliability of recycled water use in conjunction with conservation projects cannot be overstated. The SNMP analysis finds that recycled water will be one of the highest quality source waters available (higher quality than imported water in terms of TDS and chloride) and that use of recycled water is an important component for future water supply sustainability.

In summary, this analysis indicates that several approaches to future assessment of assimilative capacity should be considered:

1. Less assimilative capacity is used as a result of implementation of all the projects when compared to Land Use Build-Out conditions only.
2. Water quality in Management Zone 1b will experience a beneficial impact from implementation of all projects as compared to Land Use Build-Out conditions only.
3. Water quality is moved closer to the WQOs as a result of implementation of the proposed projects.
4. Calculated assimilative capacity should be based on comparison of Land Use Build-Out changes with single project and All Projects conditions, since changes from Land Use Build-Out represents actual baseline conditions (i.e., predicted ambient increases from year to year) going forward in the Subbasin.

(Proclamation No. 4-25-14)

5. WQOs should be reevaluated to determine whether existing WQOs are appropriate for current water quality conditions and proposed groundwater management strategies. WQOs for Management Zone 6 should be prepared by the LARWQCB for future assessments.
6. The assimilative capacity, and thus the ambient plus 10% or 20% assimilative capacity concentrations, should be re-calculated when new data sets are collected from the proposed monitoring program (Section 12). New data sets should be used to update and refine the spreadsheet model and confirm the current anti-degradation analysis.
7. Implementation of the proposed projects represents a “maximum benefit” to the people of the State by providing beneficial uses for recycled water by increasing the assimilative capacity for each constituent from that will result under Land Use Build-Out conditions.

10.0 CHANGING CONDITIONS

Sections 10.1 through 10.4 below are taken from Chapter 2 of "The Los Angeles Region Framework for Climate Change Adaptation and Mitigation" (LARFCCAM) published by the LARWQCB in July 2015.

10.1 Temperature

"Models agree that climate change will bring a number of changes that will impact our lives. In general, ambient temperatures will rise, and we will see more extreme conditions, such as an increase in extreme heat days, and an increase in extreme precipitation events leading to more frequent and more severe flood events. In the Los Angeles area, by 2050, annual average temperatures are predicted to rise by 4-5 °F, and the occurrence of "extreme heat days" is expected to increase by two to six times even with efforts to reduce greenhouse gas emissions. These changes, together with reductions in snowpack, will make drought periods, which are a natural occurrence in the region, increasingly harmful. A likely consequence of this warmer climate will be an increase in the amount and intensity of fires. In southern California, the fire season is expected to last about three weeks longer, and the annual acreage burned could increase by 20 to 30 percent by 2050. Increases in burned areas add to impacts from erosion, increases in pollutant runoff, and increase the loss of wildlife habitat."

10.2 Precipitation and Snowpack

"Concurrently, Los Angeles area mountains will lose at a minimum 31% of snowfall. This decrease in snowfall, combined with warmer temperatures, will induce a decrease in the amount and duration of snowpack, with seasonal melting occurring on average 16 days earlier than usual in the spring. This is especially concerning since the Sierra Nevada snowpack is an essential source of freshwater to the region. While snowfall (which releases precipitation to streams more slowly) is projected to decline, throughout California, changes to mean precipitation are expected to be small. However, the increasing occurrence of extreme precipitations events will amplify the risk of flood, and overall extremely wet years are expected to increase by a factor of three by the end of the century."

10.3 Water Supplies

"Climate change will likely impact both water demand and water supply through various pathways, as illustrated in Figure 1 [of the LARFCCAM; reproduced below as Figure 10-1]*. Drought periods and a lower snowpack could trigger a drop in groundwater levels and a decrease in the amount of imported water available to the region, which would have major*

impacts on the water supply. In addition, higher temperatures will likely increase water demand. In order to cope with these added stresses on water supply and water demand, augmented pumping of local aquifers would exacerbate the decrease in groundwater levels."

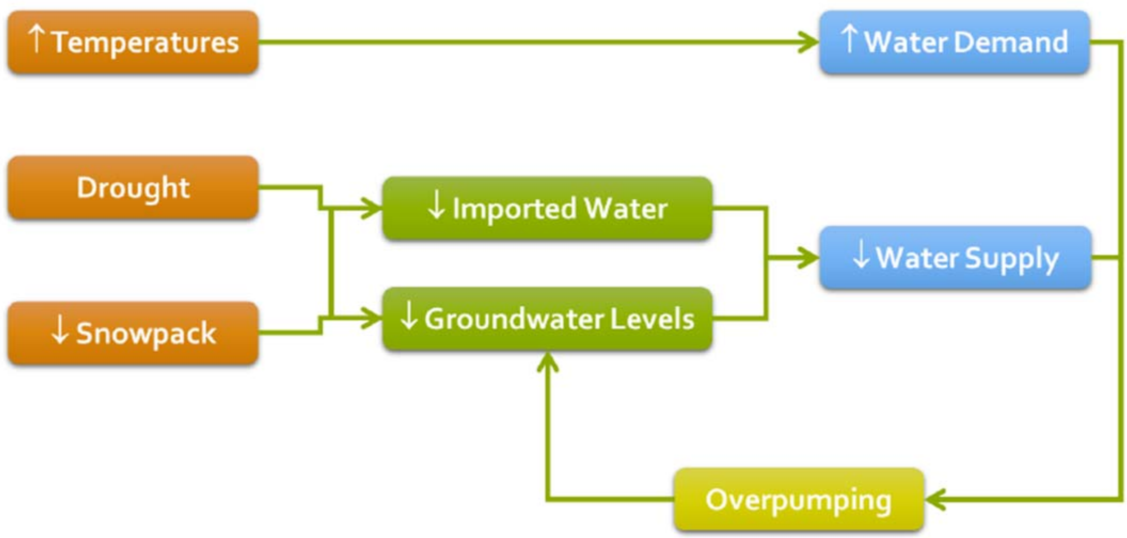


Figure 10-1. Simplified Schematic of the Impacts of Climate Change on Water Supplies

10.4 Water Quality

"Each of these changes has the potential to drastically alter hydrological and ecosystem processes in the region. As a whole, they could have major impacts not only on water supplies, but also on water quality. Those impacts could manifest in multiple ways, such as a decrease in stream flow, a reduction of aquatic habitats, a rise in surface water temperature, an increase in pollutant levels and sedimentation, an intensification of algae growth, or changes in salinity levels and acidification in coastal areas."

10.5 Water Supply Modeling to Evaluate Impact of Climate Change on Groundwater Supply

Water purveyors in the East Subbasin rely on local groundwater pumping and imported water as the principal water supply sources for the Santa Clarita Valley. Because of recent events that are expected to affect the long-term future reliability of imported water supplies, the Purveyors wanted to conduct a quantitative study of the ability of the local groundwater system to support current pumping operations and possible future increases in pumping on a long-term basis. GSI, using the "Purveyor's Groundwater Model" conducted an analysis of the potential impacts of climate change on groundwater levels and thus groundwater supply in the East Subbasin. A summary of the work is provided in "Climate Change and Water Supplies" (GSI, 2013).

According to GSI, as part of this planning process, the Purveyors wanted to consider the degree to which the viability of the various pumping plans might be affected by potential changes in climate. In particular, the Purveyors wanted to consider changes in the timing and magnitude of rainfall and subsequent natural recharge to the local groundwater basin.

10.6 Results of Climate Change Modeling

To prepare the analysis, several time-series projections of rainfall generated by research climatologists were translated to the local rainfall gauge that has a long historical record. The analysis proceeded with conducting a detailed statistical evaluation of those projections. GSI (2013) reports:

> "*For the groundwater model runs, GSI selected three sets of rainfall projections that reflected a reasonable range in climate possibilities as predicted by the variety of climate models that have been developed to date. Some of the selected projections were markedly wetter or drier through the end of the 21st century than the actual climatic conditions observed during the 20th century. GSI then translated the rainfall projections into monthly time-series estimates of groundwater recharge (via both direct rainfall and stormwater runoff), using rainfall runoff- recharge relationships that GSI personnel established during the process of calibrating the groundwater model to historic conditions.*
>
> *For the Purveyors' current basin-wide groundwater pumping plan, the time-series plot…shows the model-predicted groundwater elevation fluctuations (hydrographs) at one particular production well in the basin."*

According to GSI, based on the detailed technical analysis from the modeling effort, groundwater modeling shows that the current operating plan for the basin is sustainable during the next few decades. Additionally, while late 21st century rainfall trends cannot be reliably predicted at this time, the Purveyors recognize that current groundwater pumping rates might not remain sustainable if drier conditions prevail in the long term. This could result in a smaller local groundwater supply over time.

11.0 IMPLEMENTATION MEASURES

Implementation measures are projects or programs established to control, reduce, or manage (mitigate) salt and nutrient loading on a sustainable basis. “Sustainable” in this context means using a resource such that the resource is not depleted or permanently damaged.

11.1 Assessment and Need for Implementation Measures

The region has long been concerned about salinity and nutrient discharges in order to, among other things, allow for the use of recycled water. In the Santa Clarita Valley, the principal sources of chloride to the sewage system include potable water supply, SRWSs, treatment plant disinfection using chlorine, and other miscellaneous residential, commercial and industrial sources. Due to the importance of the East Subbasin as a water supply source, projects have been implemented over the years to manage salt and nutrient concentrations in the groundwater. Historic aggressive activities conducted to reduce salt and nutrient loads in the East Subbasin have included restrictions on brine discharges from water softeners into sewage systems, prohibition of installation of new residential SRWSs, water softener removal rebate programs, chlorine discharge limits, implementation of TMDLs for nitrogen compounds in the Santa Clara River, WRP upgrades, and a pilot water softening treatment for drinking water in the VWC service area. These efforts were discussed in greater detail in Section 2.4.

The Recycled Water Policy states that within one year of the receipt of a proposed SNMP, the LARWQCB shall consider for adoption revised implementation plans, consistent with Water Code Section 13242, for those groundwater basins where WQOs for salt and nutrients 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 the WQOs for TDS, chloride, nitrate, and sulfate. Existing (ambient) concentrations and assimilative capacities are presented in Section 6.5 of this SNMP. Projected future groundwater quality is summarized in Sections 7.3.4 and 9.4.1. Ambient groundwater exceeds the WQOs for TDS and sulfate in Management Zone 1b and TDS in Management Zone 4. Under Land Use Build-Out conditions (2012-2035), TDS will decrease to reach the WQO in Management Zone 1b. The decrease in concentrations and resulting increase in assimilative capacity is a result of existing implementation measures and groundwater management strategies. Nevertheless, future predictions described in Section 9.0 of this SNMP indicate that under Land Use Build-Out conditions, the assimilative capacity for some constituents will be used in greater percentages than the set thresholds set forth in the Recycled Water Policy for recycled water projects. Therefore, the projects simulated in Section 9.0 of this SNMP represent additional implementation measures to decrease salt and nutrient loading in the future and increase the assimilative capacity in the management zones, as compared to Land Use Build-Out conditions.

11.2 Types of Impacts

Implementation measures can impact the groundwater basins in two ways: 1) they can decrease the salt and nutrient loading, and/or 2) they can decrease the concentration of salt and nutrients in groundwater. This distinction is important in understanding the different types of benefits of implementation measures in the context of salt and nutrient management. The impacts are differentiated by the source water quality and whether one source water replaces another of different water quality. As reported in Section 9.0, all of the projects proposed in this SNMP will have a beneficial impact on the Basin, as compared to conditions that will result from on-going and approved changes in land use (Land Use Build-Out conditions). Therefore, all of the projects are considered implementation measures.

11.3 Types of Implementation Measures

Implementation measures are classified as existing, planned, or conceptual. Each implementation measure is listed on attached Table 4 and addresses stormwater/runoff management, groundwater recharge, wastewater salinity/nutrient source control, source water salinity control, public education/outreach, institutional measures, regulatory/non-regulatory requirements, land use regulation, conservation and/or TMDLs. Each measure is described in the following sections.

11.3.1 Existing Implementation Measures

Since existing implementation measures are projects/programs that have already been put into place, they are considered part of the baseline conditions. A brief description of the existing implementation measures is provided below.

Stormwater/Runoff Management:

- **Municipal Storm Water Permitting Program**: Regulates storm water discharges from municipal separate storm sewer systems (MS4s) through permits issued by the LARWQCB. NPDES stormwater permits have been adopted for medium (serving between 100,000 and 250,000 people) and large (serving 250,000 people) municipalities that require the discharger to develop and implement a Storm Water Management Plan/Program with the goal of reducing the discharge of pollutants to the maximum extent practicable (MEP). In addition, compliance with stormwater permitting requires the treatment/infiltration of the first 0.85 inches of any storm.

Wastewater Salinity/Nutrient Source Control:

- **Treatment Process Upgrade at the Valencia and Saugus WRPs**: Upgrades include nitrification/denitrification. As a result, nutrient concentrations in the effluent have decreased.

- **Industrial Wastewater Source Control Programs**: Ongoing source control programs that allow WRPs to achieve NPDES permit compliance.
- **SCVSD Automatic Water Softener Rebate Program**: Also a Public Education/Outreach program that provides reimbursement to SRWS owners for their removal. Phase I of the program commenced in November, 2005 and resulted in the removal of 431 units. Phase II commenced in May, 2007.

Source Water Salinity Control:

- **LACDPW Stormwater "First Flush" Policy**: Low Impact Development Guide that lists requirements for infiltration and other stormwater quality.

Institutional:

- **1999 SCVSD Ordinance Prohibiting Installation of New Residential SRWSs**: Ordinance that took effect in March 2003 and prohibits the installation of new SRWSs.
- **SCVSD Measure S**: Measure on the November, 2008 ballot that requires the removal and disposal of all remaining active SRWSs connected to SCVSD's sewage system. Responsible for the removal of approximately 8,000 SRWSs.
- **SCVSD Commercial and Industrial Sector Regulations**: Program added to the source control program for NPDES permit compliance. Enforces the SRWS ban and implementation of chloride discharge limits of 100 mg/L, or performance-based chloride limits that reflect the implementation of chloride reduction practices.

Regulatory/Non-Regulatory:

- **Wastewater, Recycled Water, Surface Water/Stormwater, Imported Water and Groundwater Monitoring:** Compliance with requirements of SB7x-6 and the Sustainable Groundwater Management Act.
- **State Regulations for Groundwater Replenishment Using Recycled Water**: Facilitation of artificial recharge for purposes of groundwater recovery to supplement Eastside wells.
- **LARWQCB Permits for Groundwater Recharge**: Facilitation of artificial recharge for purposes of groundwater recovery.
- **Recycled Water Non-Potable Reuse Regulations, Guidelines and Permits:** Facilitation of non-potable reuse by defining limits of human contact and streamlining permitting for projects.

- **CASGEM Monitoring**: Enhanced monitoring and reporting ensures compliance with requirements of SB7x-6 and coordinates groundwater level monitoring among all of the users in the subbasin.

Land Use Regulation:

- **City/County Model Water Efficient Landscape Ordinance**: Ordinances requiring new development to minimize exterior water use are required to be implemented by land use planning agencies and local water retailers.

Conservation:

- **Water Conservation Act of 2009 (Senate Bill X7-7)**: Requires all water providers above a minimum size to increase water use efficiency by demonstrating a 10% reduction in potable water demand by 2015 and 20% reduction by 2020. The bill also requires, among other things, that DWR, in consultation with other state agencies, develop a single standardized water use reporting form, which would be used by both urban and agricultural water agencies.
- **Emergency Drought Mandates**: Emergency measures to reduce water use and minimize drought impacts on customers while conforming to statewide drought mandates. Includes a list of prohibited activities.

TMDLs:

- **TMDLs for Chloride, Bacteria and Nitrogen**: Requires the management of all sources of pollutants in a watershed to attain applicable water quality standards.

11.3.2 Planned Implementation Measures

In addition to those discussed in Section 9.0 of this SNMP, the following implementation measures are planned to be implemented in the near future:

Stormwater/Runoff Management:

- **SWRCB Statewide NPDES for CWS**: DDW regulation of small potable water suppliers.
- **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. On April 7, 2015 the City of Santa Clarita adopted RESOLUTION NO. P15-02, approving the Unified Development Code Amendment 15-001 the Low Impact Development Ordinance. LID projects/practices decrease salt and nutrient loading and concentrations in groundwater.

Groundwater Recharge:

- **Projects from Recon Study:** Includes possible rubber dams and moving up to 10,000 acre-ft/yr of SWRP and VWRP water to discharge points in the eastern part of the subbasin for groundwater recharge.
- **Vista Canyon WRP:** Project will generate 439 acre-ft/yr of treated wastewater that will be used for landscape irrigation or placed into percolation ponds near the Santa Clara River (refer to Section 9.4.2.3).
- **City/County MS4 Stormwater Infiltration Basins**: In December 2012, the LARWQCB adopted a new MS4 Permit (Order No. R4-2012-0175), replacing the initial 2001 MS4 Permit issued by the LARWQCB. The 2012 MS4 Permit differs significantly from the 2001 MS4 Permit in several respects, including new requirements for hydromodification[13], an LID that applies 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. MS4 permits will decrease salt and nutrient loading and concentrations in groundwater.
- **Enhanced Watershed Protection Program:** The Upper Santa Clara Watershed Management Group commissioned the preparation of an Enhanced Watershed Management Plan (EWMP). The EWMP approach allows for Permittees to comprehensively evaluate opportunities, within

[13] 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.

the participating Permittees' collective jurisdictional area, for collaboration among Permittees and other partners on multi-benefit regional EWMP projects that, wherever feasible, retain (i) all non-storm water runoff and (ii) all storm water runoff from the 85th percentile, 24-hour storm event for the drainage areas tributary to the projects, while also achieving other benefits including flood control and water supply. This EWMP Work Plan applies to the Permittees within the IRWMG, and describes how the IRWMG intends to develop an EWMP that will address water quality issues within the geographical scope of their EWMP area.

Wastewater Salinity/Nutrient Source Control:

- **Newhall Ranch WRP:** WRP to service development in the Newhall Ranch Specific Plan and Westside communities, thereby also serving as a Wastewater Salinity/Nutrient Source Control program. It will also provide water for landscape irrigation (refer to Section 9.4.2.6).
- **SCVSD Wastewater Treatment Plant Chloride Compliance Program:** Reverse Osmosis treatment and blending of treated wastewater to produce a combined discharge of chloride from the Saugus and Valencia WRPs equal to 100 mg/L as a three-month average (refer to Section 9.4.2.1).

Source Water Salinity Control (and Conservation):

- **SCV Water Use Efficiency Programs:** Suite of water conservation programs/projects to be implemented from the updated Santa Clarita Valley Water Use Efficiency Plan (2015; refer to Section 9.4.2.5 for the SCV WUE SP).
- **SCWD Water Use Efficiency Programs:** Ten (10) programs designed to conserve water and reduce residential and urban use, run-off and sewage flows (refer to Section 9.4.2.2).

Conservation:

- **CLWA Recycled Water Master Plan:** Plans to incorporate additional recycled water for use in landscape irrigation (refer to Section 9.4.2.4).

Regulatory/Non-Regulatory:

- **SNMP Monitoring:** Increased groundwater level and water quality monitoring as recommended in Section 11.0 of this SNMP. The monitoring program data will allow preparation of updated ambient water quality for the management zones every three years.
- **Sustainable Groundwater Management Act Plan/Programs:** Long term planning and monitoring to ensure sustainable yield of the subbasin by all of the groundwater stakeholders.

11.3.3 Conceptual Implementation Measures

If, after 2035, the concentration of salts continues to increase and the assimilative capacity is reduced, then the incentive to implement the measures below is greater. Although the amount of salt reduction from these measures is unknown, the conceptual implementation measures would have an overall positive effect (decrease) of salt concentrations in the basin. At this time, it is uncertain which of the measures would be implemented either before or after 2035.

Groundwater Recharge:

- **ASR in Saugus Formation:** Recharge in the Saugus Formation using SWP water during wet years with recovery during dry years. Maximum input and recovery would be 5,000 acre-ft/yr.

Wastewater Salinity/Nutrient Source Control:

- **Brine Line to Ventura County**: Proposed Brine Line in the lower sections of the Santa Clara River Valley that could be extended to Los Angeles County.

Regulatory/Non-Regulatory:

- **State Regulations for Potable Reuse**: SWRCB and DDW are required to publish recommended regulations for potable reuse of recycled water by no later than 2017.

11.4 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
- Spreading ground capacities

Regulatory Challenges:

- DDW requirements
- LARWQCB requirements
- SWRCB requirements
- USEPA requirements
- California Water Code Section 1211 for changes in point of use 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

12.0 BASIN MONITORING PROGRAM

The proposed Salt and Nutrient Groundwater Monitoring Program must take into consideration the existing and planned land uses and facilities that can potentially impact long-term groundwater quality in the East Subbasin. Basin monitoring will consider point discharges such as stormwater outfalls, NPDES discharge points (both wastewater treatment plants and single point outfalls), areas of unsewered waste discharges, land areas with planned long-term application of recycled water, and the contributions of groundwater from adjacent subbasins.

Basinwide baseline groundwater quality will be established to use as a point of reference for the single SNMP monitoring program dataset. The current availability of groundwater quality data indicates that several gaps exist, primarily in the western end of the basins, which results in an incomplete characterization of the groundwater quality of the East Subbasin. As an example, the South Fork and Placerita Management Zones (Management Zone 2 and 3, respectively), have very little groundwater quality for the alluvial deposits. In addition, a significant data gap for quality in the alluvial aquifer water quality is present west of the confluence of Castaic Valley groundwater subunit (Management Zone 5) and the Santa Clara-Bouquet-San Francisquito Canyons groundwater subunit (Management Zone 4). Further investigation may show that wells for groundwater sampling may exist in the area.

12.1 Identify Stakeholders Implementing the Monitoring

Groundwater monitoring points have been used by the various agencies for both the Alluvial Aquifer and Saugus Formation. Specifically groundwater level monitoring and groundwater sampling analysis is conducted by the LACFCD, NCWD, NLF, SCWD, VWC, and WHR. The LACSD conducts a surface water sampling and groundwater monitoring program in accordance with permits issued by the LARWQCB. The USGS periodically monitors wells in the East Subbasin as part of their on-going Groundwater Ambient Monitoring and Assessment (GAMA) program. The locations of wells sampled as part of the GAMA program are shown on Figure 37. The CDPH maintains a database of groundwater quality information derived from the various sources listed above.

12.2 Groundwater Monitoring Plans

Historically, there has been no unified monitoring system for groundwater levels and groundwater quality in the East Subbasin. Groundwater levels and groundwater quality sampling and analysis have been conducted by various agencies. There is a need for a groundwater monitoring system for the East Subbasin, to not only address current water quality regulations such as the groundwater basin objectives and drinking water standards, but also to have the facility to evaluate potentially new constituents in groundwater such as CECs.

As stated previously, the 2003 GWMP presented a proposed monitoring program as a part of the effort to provide on-going data for groundwater management planning. Further discussion of the 2003 GWMP and USGS GAMA Program is provided in the following sections.

12.2.1 2003 Groundwater Management Plan

According to the 2003 GWMP, long term development and use of groundwater in the area has resulted in a fairly substantial amount of historical groundwater level data, and a useful amount of groundwater quality and pumping data that has been collected in the basin. During preparation of this SNMP, GEOSCIENCE has confirmed the extent of the available data and have also identified data gaps which will be discussed. The 2003 GWMP reports that "all the available historical groundwater level, quality, and pumping data have been organized into a computerized database for the Upper Santa Clara River Area." The database was updated and augmented with additional data for use in this study.

The network of wells reported in the 2003 GWMP are a combination of active production wells, inactive production wells, and dedicated monitoring wells located throughout the East Subbasin. According to the GWMP, the historical data collection efforts cannot be classified as an organized area-wide program of groundwater data collection. However, there is generally sufficient data available on which to interpret basin conditions (see page 2 of Appendix I in the 2003 GWMP). The GWMP noted that monitoring of existing wells, and expansion of the network of both production and monitoring wells, will be key to accomplishing all the goals for the basin. A regular and unified system of monitoring groundwater levels, quality, and pumping will provide the basis for ongoing assessment of basin conditions for salt and nutrient management as well as to accomplish the GWMP goal of "developing operational protocols that allow conjunctive use to support ongoing groundwater supply while avoiding undesirable conditions such as chronically depressed groundwater levels or degraded groundwater quality.

Appendix A of the GWMP reports dates of water level measurements for 140 alluvial wells and 14 wells in the Saugus Formation, as well as water quality measurement dates for 53 alluvial wells and 12 Saugus wells. The GWMP notes that the monitoring network can consist of the current network of wells, but could possibly be expanded to include some dedicated monitoring wells in addition to some potential new production wells.

The frequencies and types of groundwater data collection have varied by agency as a function of specific monitoring objectives in various parts of the basin. The 2003 GWMP notes that the lack of historical subsidence and the low potential for it to occur has resulted in no formal subsidence monitoring (i.e., no extensometers, fixed-point ground surveys, or remote sensing). The 2003 GWMP further notes "if the analysis of planned additional dry-year pumping indicates the potential for subsidence attributable to lower groundwater levels, monitoring or other appropriate action (e.g., redistributed or reduced pumping) will be undertaken." It is the intent of this SNMP to use this assessment and approach and to build on it to meet requirements of the SWRCB recycled water policy.

12.2.2 USGS – GAMA Program

The USGS GAMA Program website provides a description of the development of the GAMA monitoring program:

> *In October 2001, The California Assembly passed a bill, AB 599, establishing the Ground-Water-Quality Monitoring Act of 2001. The goal of AB 599 is to improve statewide comprehensive ground-water monitoring and increase availability of information about ground-water quality to the public. AB 599 requires the State Water Resources Control Board (SWRCB), in collaboration with an interagency task force (ITF) and a public advisory committee (PAC), to develop a plan for a comprehensive ground-water monitoring program. AB 599 specifies that the comprehensive program should be capable of assessing each ground-water basin in the State through direct and other statistically reliable sampling approaches, and that the program should integrate existing monitoring programs and design new program elements, as necessary. AB 599 also stresses the importance of prioritizing ground-water basins that provide drinking water.*
>
> *The USGS, in cooperation with the SWRCB, and in coordination with the ITF and PAC, has developed a framework for a comprehensive ground-water-quality monitoring and assessment program for California. The proposed framework relies extensively on previous work conducted by the USGS through its National Water-Quality Assessment (NAWQA) program. In particular, the NAWQA program defines three types of ground-water assessment: (1) status, the assessment of the current quality of the ground-water resource; (2) trends, the detection of changes in water quality, and (3) understanding, assessing the human and natural factors that affect ground-water quality.*
>
> *The GAMA program includes participants which include representatives from California Water Boards (SWRCB/RWQCB), Department of Water Resources (DWR), Department of Health Services (DHS), USGS, Lawrence Livermore National Laboratory (LLNL), regional water management entities, and county and local water agencies. A key aspect of the GAMA program is interagency collaboration and cooperation with local water agencies and well owners. These assessment integrates existing water-quality data (such as DHS public supply well water-quality data), with data collected specifically as part of the study. In addition, the GAMA program monitors a broader suite of constituents, at much lower detection limits, than required by DHS.*

> *Samples are analyzed for chemical constituents that include major ions, trace elements, nutrients, volatile organic compounds, pesticides, and pharmaceuticals, to define the quality of water in the ground-water basins. Naturally occurring isotopes (tritium, carbon-14, and helium-4) also were measured in samples to help identify the source and age of the sampled groundwater. A tiered analytical approach is used to balance spatial coverage and analytical intensity (number of constituents analyzed).*

The Santa Clara River Valley study included sampling between April, 2, 2007 and June 7, 2007; 54 wells were sampled. The study unit consisted of the portion of the Santa Clara River Valley which includes the Ojai Valley, Upper Ojai Valley, Ventura River Valley, Pleasant Valley, Arroyo Santa Rosa Valley, Las Posas Valley and Simi Valley groundwater basins (all of these are located outside the area addressed by this SNMP), and Santa Clara River Valley which is the focus of this SNMP. The results and analysis from the sampling were reported in USGS Scientific Investigations Report 2011-5052. Of the 54 wells sampled for the Santa Clara River Valley study, eleven (11) wells were located in the East Subbasin. The location of the GAMA sampling points are shown on Figure 37. The GAMA sampling and analysis did not include the constituents identified as CECs in the LARWQCB Salt and Nutrient Plan Guidance document.

The SNMP monitoring plan described herein includes the proposed use of 30 existing wells and installation of six (6) new wells, three each in Management Zone 2 and Management Zone 3. The wells will be used to collect both groundwater level and groundwater quality data.

12.2.3 California Statewide Groundwater Elevation Monitoring Plan (CASGEM)

A groundwater monitoring plan was prepared in compliance with the DWR CASGEM program, established in 2009 by the California State Legislature via SBx7-6. The Updated CASGEM monitoring plan was prepared by Richard C. Slade and Associates (RCS) and is dated August 2014. The document provides a description of the CASGEM-compliant water level monitoring program that has been established for the East Subbasin of the Santa Clara River Valley Groundwater Basin (DWR Basin No. 4-4.07).

At a minimum, water level data collection for CASGEM is to occur at least twice per year. Ideally, these two water level data collection points would be once during the late winter or spring (the seasonally high water level period when water demand is lower and rainfall recharge is occurring) and once during the late summer or early fall (the seasonally low water level period when groundwater demand is highest and very little recharge from rainfall is occurring). For this monitoring program, the goal for the collection of bi-annual water level measurements will be April and October of each year.

CASGEM monitoring is for groundwater levels only. The CASGEM monitoring network includes 60 wells, including LAWCD monitoring wells, municipal wells, and environmental monitoring wells associated with the Whittaker Bermite monitoring. Approximately ten (10) wells in the proposed CASGEM monitoring system are included in the proposed SNMP monitoring program described below. Wherever possible, eliminating a duplication of effort can be assured by the project stakeholder coordination and oversight.

12.2.4 Monitoring Program Goals

The goals of the SNMP monitoring program should be consistent with the Recycled Water Policy and with GWMP goals. The SNMP monitoring goals are a subset of the overall GWMP goals and should provide a tool for on-going tracking of salt and nutrient concentration trends, including selected CECs, as appropriate, which contribute to the quality of the groundwater. Section 6 provides a description of historical and current salt and nutrient concentrations in groundwater. Using the salt balance method, future salt and nutrient concentrations in groundwater were predicted based on projected water use and land use changes through the year 2035 (see Sections 7 and 9). According to the Recycled Water Policy, salt and nutrient monitoring programs "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.” The plan should allow consistent on-going collection of data to monitor the actual effects of land use changes and groundwater management policies on groundwater quality in the East Subbasin. Data collected from subsequent monitoring events will be used to re-calibrate the spreadsheet model.

12.3 SNMP Monitoring Plan

12.3.1 Sampling Locations

Proposed wells for the SNMP monitoring wells are shown on Figures 38 and 39 for the Alluvial Aquifer and Saugus Formation, respectively, and are listed on Table 3. The wells were selected to:

1. Provide a sampling location downgradient of potential salt and nutrient contributors such as treated effluent discharge locations, stormwater outfalls, septic tank areas, and land use areas with planned long-term application of recycled water, and

2. Allow evaluation of the contribution to groundwater quality from individual subunits downgradient of the confluence of the subbasins moving to the western end of the East Subbasin.

The proposed number of sampling locations should be reviewed after sufficient data is collected to allow evaluation of water quality trends to determine whether a fewer number of selected key wells could provide the necessary on-going data to evaluate salt and nutrient loading.

12.3.2 Water Quality Parameters

Various agencies collect groundwater quality data in accordance with specific reporting needs. The selected suite of analytes for the SNMP monitoring program will consist of TDS, chloride, nitrate, and sulfate. Monitoring of select CECs will be included in baseline data collection consistent with the SWQCB Recycled Water Policy requirements. However, since CEC data is currently being collected within the East Subbasin, the data will be added to the SNMP database and discussed in triennial updates.

12.3.3 Sampling Frequency

The recommended sampling frequency should coincide and be collaborative with current sampling programs. Data collection currently ranges from monthly to every three years. Data from the current sampling program should be collected annually, when available, to allow for long-term seasonal wet weather and dry weather effects on groundwater quality. The proposed sampling frequency should be reviewed after sufficient data is collected to evaluate potential long-term trends.

12.3.4 Quality Assurance/Quality Control

For purposes of this plan, quality assurance (QA) is defined as the integrated program designed to assure reliability of monitoring and measurement data. Quality control (QC) is defined as the routine application of specified procedures to obtain prescribed standards of performance in the monitoring and measurement process (ASTM D-18). The responsible parties, their assigned staff, and consultants tasked with collecting and submitting data, will be responsible for assuring that the precision, accuracy, and completeness of data collected as part of this monitoring program are known and documented, including the calibration and maintenance of all field equipment.

12.3.5 Database Management Plan

The purpose of this data management plan is to establish guidance for data filing, storage, and selected or alternate management point security during the implementation of the monitoring program. All data will be submitted, filed and stored in a Project File, entered into a comprehensive computer database (East Subbasin SNMP Database), and presented in a GIS format. Detailed procedures for the management of data follow.

12.3.5.1 Project Files

A Project File that stores all technical documents related to the SNMP should be established. Technical documents include, but are not limited to, the following:

- All correspondence to/from regulatory agencies
- Memoranda containing technical information or documentation of technical decisions
- Reports
- Legal documents

Information regarding each document will be entered into a computer database and the document filed in the Project File.

12.3.5.2 Storage and Security

Active monitoring program files will be maintained. Records will be entered into the project reference database. The database will include the following items of information for each document to assist in retrieval:

- Document number,
- Date document was generated or received,
- Type of document,
- Author and corporation,
- Addressee,
- Subject (description of document contents), and
- Source of document.

12.3.5.3 File Access

Immediate access will be limited to assigned personnel and designated representatives of the SNMP team, their assigned technical consultants, and their legal representatives. Entities outside of the above referenced groups can obtain the records with the permission of the IRWMG.

12.3.5.4 Project Database

Data will also be stored, organized, and secured in the East Subbasin SNMP Database created specifically for this study. The database will be hosted at the CLWA and can also be available on a secure file transfer protocol (ftp) site. All data entry will be made to the main SNMP database and copied to a project specific ftp site if desired by IRWMG.

Types of data stored in the computer database may include, but are not limited to: technical information such as groundwater levels, groundwater production volumes, groundwater and surface water quality analytical data, and treated effluent discharges and application. If programs designed for other operating systems are used for data compilation etc., the data files will be transferable to an IBM-compatible format. Specific technical programs used for data analysis will be selected based on the specific technical question to be answered.

12.3.5.5 Maintenance

The database will be maintained by a Database Manager. This individual will be responsible for the implementation, testing, documentation, and security of the database. The Database Manager will ensure that data entered into the database is complete and correct.

12.3.5.6 Documentation

Documentation should be prepared regarding the database files and file structure. The documentation should outline the protocol for QC, data entry, data analysis, and manipulation of the data. The objective of documentation is to provide enough information for individuals unfamiliar with the data to work efficiently within the database. It also provides a clear work history to simplify data reconstruction, if necessary.

12.3.5.7 Security

Proper back-up and security measures will be taken to prevent accidental loss of data and tampering with the database. Exact duplicates of working files will be made at least once each work session. The backup files will be stored in a separate physical location from the working files. Both the backup and working files will be kept in a locked storage area.

Data protection through the use of passwords will be employed whenever possible for working and backup files. The password protection will be removed when files are submitted for permanent storage.

12.3.6 Data Analysis and Reporting

The Recycled Water Policy requires the SNMP to identify who will collect/submit data and requires submittal at least every three (3) years (Section 6.b.(3)(a)(iii)). Therefore, a monitoring report summarizing monitoring data shall be prepared by CLWA and/or a member of the Task Force and submitted to the LARWQCB at least every three years. The report could also be included as a technical memorandum as part of the annual Santa Clara Valley Water report. An assessment of salt and nutrient conditions with regard to projected groundwater quality trends provided in the SNMP should be prepared and provided in the SNMP monitoring report. In addition, all SNMP monitoring data will be uploaded to the SWRCB's GeoTracker website.

12.4 Groundwater Level Monitoring

12.4.1 Groundwater Level Monitoring Locations and Frequency

Groundwater level monitoring will be carried out by the owner of each well. The monitoring protocol should be consistent for all wells selected for the SNMP monitoring program. The locations of monitoring wells to be used for water level monitoring are shown on Figures 38 and 39 for the Alluvial Aquifer and Saugus Formation, respectively. Groundwater levels and frequency will be measured in the wells as listed on Table 4. Measurements should be made on a monthly basis to enable evaluation of water level trends for individual wells, as well as the groundwater flow patterns and hydraulic gradients for the East Subbasin.

The majority of the wells selected for this monitoring program are active wells. The wells should be fully recovered before water level measurements are made in the wells. For inactive wells or LACDPW monitoring wells, if they are in the vicinity of an active pumping well, the amount of groundwater recovery time required to reach static conditions should be documented and implemented by field personnel prior to each monthly monitoring event.

The procedure used by well owners for the use of groundwater level measurement instruments may vary slightly, but the basic scientific methods are the same. Measurements obtained using a calibrated electric water level sounder or sonic meter should be made to the nearest 0.1 ft relative to an established reference point (RP) at the top of each well casing or sounding tube. Groundwater level measurements should be compared in the field to previous measurements and re-measured if significantly different. Measurements should be recorded in the field with a permanent ink pen on an appropriate form and will be converted to groundwater elevations by subtracting the depth to water from the RP elevation.

12.5 Monitoring Well Locations

The following detailed well information should be compiled in order for the well information to be submitted into the CASGEM Online Submittal System, as suggested by the 2010 UWMP.

- Basin name / number,
- Local well ID,
- State Well Number,
- Reference Point Elevation (ft NAVD88),
- Reference Point description,
- Ground Surface Elevation (ft amsl),
- Method of Determining Elevation,
- Accuracy of Elevation Method,
- Well coordinates (latitude/longitude in decimal degrees),
- Method of Determining Coordinates,
- Accuracy of Coordinate Method,
- Well Completion Type (single or multi-completion),
- Total Depth (ft),
- Top and Bottom of Screened Interval,
- Aquifer Monitored, and
- Written Description of Well Location.

12.6 Groundwater

Groundwater elevations for each monitoring network should be compiled in order to allow input into the CASGEM Online Submittal System. The data should include the following:

- Well identification number,
- Measurement date,
- Reference point elevation of the well (ft),
- Elevation of land surface datum at the well (ft),

- Depth to water below reference point (ft),
- Method of measuring water depth,
- Measurement Quality Codes,
- Measuring agency identification,
- Measurement time (PST/PDT with military time/24 hour format), and
- Comments about measurement, if applicable.

12.7 Basin Water Quality Monitoring

Determining the ongoing salt and nutrient loads to the watershed will be accomplished through semi-annual monitoring of surface water and groundwater quality. The data will be used to calculate the salt and nutrient load to the watershed and ultimately to the groundwater. The compiled data will be used to periodically refine the salt and nutrient long-term projections provided in Section 9 of this report. The subsections below provide a brief description of the water quality monitoring program.

12.7.1 Groundwater Quality Monitoring

Groundwater quality monitoring will be accomplished using selected Alluvial Aquifer and Saugus Formation wells. The selected wells will provide water quality data which is spatially representative of the aquifers in the specific subbasins within the overall East Subbasin. The location of the wells selected to monitor the Alluvial Aquifer are shown on Figure 38, while those for the Saugus Aquifer are shown on Figure 39. Wells within the Saugus Formation are limited in number and are located in the western portion of the East Subbasin (South Fork Subunit). Future wells drilled in the Saugus Formation should be considered for the monitoring program if they can provide data that represents areas of the Saugus Formation not represented by the existing wells. Groundwater monitoring points were selected to allow characterization of the groundwater in the Alluvial Aquifer underlying the Santa Clara River throughout the East Subbasin in order to determine the impacts of surface water quality on groundwater quality within the specific subbasins.

12.7.1.1 Areas of Large Recycled Water Projects

There are currently no large recycled water projects in the East Subbasin, although proposed projects from the Recon Study would include the addition of rubber dams to move up to 10,000 acre-ft/yr of SWRP and VWRP water to discharge points in the eastern part of the subbasin for groundwater recharge (see Section 10.3.2). The 2002 Recycled Water Master Plan prepared for CLWA projects that future recycled water projects will likely be concentrated in the western portion of the East Subbasin in proximity to the WRPs (see Figure 40) due to the need to limit the expense of future infrastructure needed to transport recycled water to potential users. The selected monitoring wells will provide sampling points to evaluate the impact of existing and future recycled water projects.

12.7.1.2 Recycled Water Recharge Areas

Treated effluent is currently discharged from the Saugus and Valencia WRPs directly into the Santa Clara River in accordance with permit requirements issued by the LARWQC. Discharges from both the Valencia and Saugus WRPs occur year-round. The 2010 UWMP reports that the combined production of both WRPs in 2010 was 19.5 MGD (Kennedy/Jenks and LSCE, 2011). The combined plant capacity is 28.1 MGD, or 31,472 acre-ft/yr. It is anticipated that treated effluent will continue to be discharged into the Santa Clara River and discharges will increase in the future as a result of growth in the community (see individual recycled water projects in Section 9). Treated effluent discharge may also decrease as recycled water use is expanded and due to water efficiency improvements in homes.

Surface water sampling and groundwater monitoring in accordance with permit requirements from the LARWQCB, currently conducted by the Sanitation District and conducted by others should be included in the SNMP Monitoring program database. An analysis of long-term trends of water quality parameters will be conducted by CLWA to evaluate the impacts of both long-term dry and wet conditions on groundwater conditions.

12.7.2 Previous Surface Water Quality Monitoring

The following subsections provide a brief description of existing and proposed surface water quality monitoring programs.

12.7.2.1 Comprehensive Water Quality Monitoring Plan for the Santa Clara River Watershed (2006)

The development of the 2006 Comprehensive Water Quality Monitoring Plan for the Santa Clara River Watershed was initiated in November 2003 by the Ventura County Watershed Protection District (VCWPD), under the direction of the SWRCB. The monitoring plan provides the basis for a proposed monitoring system for the entire Santa Clara River Watershed. AMEC (2006) was retained by VCWPD to compile and review existing water quality data, determine data gaps, and develop a Comprehensive Monitoring Plan (CMP) for the Santa Clara River.

The goals of this plan were to:

1. Develop baseline conditions for the watershed;

2. Have a mechanism to measure improvements or degradations in the water quality; and
3. Provide sufficient information to assist the Project Steering Committee (PSC) in making important management decisions regarding the watershed.

The objectives of the CMP, therefore, were to gather existing monitoring data for the Santa Clara River, assemble a comprehensive database, identify data gaps, evaluate the constituents monitored, and make recommendations regarding modifications to existing monitoring protocol and procedures necessary to ensure development of a comprehensive water quality monitoring program. The main purpose of the CMP was to develop baseline conditions for the entire Santa Clara River watershed and have a mechanism to measure improvements or degradations in the watershed. A slightly modified systematic sampling strategy, which typically selects locations that are separated by regular intervals along a water body, was considered to be the most effective sampling design for the CMP baseline study.

The monitoring point selection strategy, therefore, was based on: 1) selected downstream points of Santa Clara subbasins; 2) system morphology; and 3) historical data availability. Although considered important, land use was not considered in the selection of monitoring locations because it was determined that the systematic approach to monitoring would capture the impacts of a variety of land uses. The monitoring network set forth in the AMEC (2006) report is reproduced as Figure 41.

Also, considering that TMDLs are a primary concern with regard to the allocation and use of future data, the CMP concluded that siting and/or location of monitoring stations should include locations at or slightly downstream of real-time USGS gaging stations. With this proposed approach, the CMP determined that pollutant loads from different sub-watersheds or tributaries could be evaluated and flow measurements could be accessed at will through the USGS National Water Information System (NWIS).

Section 5.1.1 of the CMP entitled "Spatial Sampling: Selection of Preliminary Sampling Locations," states that preliminary sampling locations for the CMP were selected using the following strategy:

1. For major tributaries to the Santa Clara River (e.g., Mint Canyon), select a downstream [historical] monitoring location nearest to the junction with the Santa Clara River.
2. For the Santa Clara River, select a historical station that is slightly downstream of the tributary/Santa Clara River fork (beyond the mixing zone).
3. Select any additional locations along the Santa Clara River from historical or active stations that will provide information identified as a data gap in the Data Gap Analysis.

The proposed monitoring stations within the East Subbasin area (stream Reach 5, Reach 6, and Reach 7), as shown on Figure 46 of the CMP, are reproduced on Figure 42 of this report. In accordance with the sampling approach outlined above, the CMP recommended to use nine (9) existing USGS gaging stations, two (2) Surface Water Management Ambient Monitoring Program (SWAMP) monitoring stations, and proposes the development of a new surface water monitoring station for San Francisquito Creek, immediately north of its confluence with the Santa Clara River.

12.7.2.2 Santa Clara River Watershed Monitoring Program Friends of the Santa Clara River (2007)

This document is dated October 27, 2007 and provides the results of a short-term surface water monitoring program conducted on the Santa Clara River. The executive summary of the document states the following:

> *This Final Report presents the results of a volunteer citizen monitoring water quality program (Santa Clara River Monitoring Program) conducted from November 2004 to October 2007 by Friends of the Santa Clara River (FSCR) under State Water Resources Control Board Agreement Number 04-128-554-1 in support of the 2004 Santa Clara River Nutrient TMDL. The program consisted of monthly monitoring of the river's mainstem at six sites distributed from Soledad Canyon to just above the Victoria Avenue bridge near the City of Oxnard. Monitoring took place during 22 consecutive months with a completeness rate of over 95% for all parameters measured except for stream discharge (77%) due to high flows or extensive aquatic plant growth blanketing the stream channel. The following parameters were measured in the field: flow, temperature, dissolved oxygen, pH, conductivity, total dissolved solids, and turbidity. Grab samples were taken for dissolved inorganic nutrients that were analyzed by the Schimel Laboratory at the University of California at Santa Barbara. Nutrient analytes included ammonia-nitrogen, nitrate-nitrogen, total dissolved nitrogen, ortho-phosphate, and total dissolved phosphorus.*

Sampling Location SC-13 is located east and outside the East Subbasin while sampling location SC-10 is located approximately one-mile east of the intersection of the Santa Clara River and Interstate 5. The document concludes that the wide distribution of sampling sites does not allow for monitoring of specific land use types, and that only broad generalizations of sources can be inferred. The data from the report can be used to augment other historical surface water sampling data for the specific time period. According to Mr. Ron Bottorff of the Friends of the Santa Clara River (FSCR), the sampling program was terminated after publication of the 2007 report.

12.7.2.3 Santa Clarita Valley Sanitation District of Los Angeles County – Santa Clara River Watershed-Wide Monitoring Program and Implementation Plan (2011)

The Santa Clara River Watershed-Wide Monitoring Program and Implementation Plan (SCRWMP) monitoring plan was prepared by a stakeholder group led by the consultant retained by the LARWQCB. The executive summary of the document states:

> *This report presents a design for an integrated regional monitoring program for the Santa Clara River watershed, the Santa Clara River Watershed Monitoring Program (SCRWMP). This report also constitutes the response of the Santa Clarita Valley Sanitation District of Los Angeles County (Sanitation District) to requirements IX.A and I.N of Monitoring and Reporting Programs (MRPs) Board Order No. R4 2009-0075 and Board Order No. R4-2009-0074, adopted by the California Regional Water Quality Control Board, Los Angeles Region (LARWQCB) for the Saugus (CA0054313) and Valencia (CA0054216) Water Reclamation Plants, respectively. The SCRWMP fulfills the fundamental purpose of providing a framework for monitoring at the watershed scale in three ways:*
>
> - *Expanding the monitoring of ambient conditions related to key beneficial uses to the entire watershed*
> - *Improving the coordination and cost-effectiveness of disparate monitoring efforts*
> - *Providing a framework for periodic and comprehensive assessments of watershed condition*

The monitoring plan states that the program design was developed by a multi-stakeholder workgroup and was modeled on analogous efforts in the nearby San Gabriel River and Los Angeles River watersheds, the San Gabriel River Regional Monitoring Program (SGRRMP) and the Los Angeles River Watershed Monitoring Program (LARWMP). The SCRWMP addresses five key management questions:

1. What is the condition of streams in the watershed?
2. Are resources at areas of unique interest being protected and getting better or worse?
3. Are receiving waters near discharges meeting water quality objectives?
4. Is it safe to swim?
5. Are locally caught fish safe to eat?

Monitoring conducted as part of the SCRWMP proposed sampling approaches to address Questions 1, 2, and 3 above will include sampling and development of data. A subset of this data can be incorporated into the SNMP Monitoring Program database and used for salt and nutrient load analysis.

12.7.3 Proposed SNMP Surface Water Quality Monitoring

The proposed surface water monitoring in the East Subbasin watershed is outlined in Table 3 and the locations are shown on Figure 42. In addition, ongoing data collection activities that should be added to the SNMP database are discussed in the sections below.

12.7.3.1 Stormwater Quality Monitoring

Currently, stormwater quality monitoring for the Santa Clara River is conducted by LACDPW for their MS4 Storm Sewer Permit at sampling location S29 located near Interstate 5 and the Santa Clara River. Sampling at this location provides data to characterize the overall surface water quality of the Santa Clara River as a result of all contributions. Sampling at this location does not provide data to characterize the water quality contribution from specific potential contributors, such as upstream areas outside the East Subbasin or water quality from both residential and commercial storm drains. Existing surface water quality sampling for potential salt and nutrients should be incorporated into the surface water quality monitoring program.

12.7.3.2 Treated Effluent Discharge Quality Monitoring

Treated Effluent Discharge Quality Monitoring is conducted by SCVSD, who is responsible for the discharges. Monitoring is carried out in accordance with the existing permits issued by the LARWQCB for the Saugus and Valencia facilities. On-going water quality data collection for the wastewater discharges will be incorporated in the SNMP monitoring program data set for tracking salt and nutrient loads in the watershed from that source.

12.7.3.3 Other Constituents of Concern

The Recycled Water Policy includes a provision for annual monitoring of CECs (e.g., endocrine disrupters, personal care products or pharmaceuticals) for planned recycled water recharge projects. This is consistent with CEC monitoring related to the Saugus and Valencia WRP discharges that will be included in respective NPDES permits issued by the LARWQCB. The SWRCB “Suggested Elements” for salt and nutrient management plans includes identifying CECs and their respective sources.

The Final Blue Ribbon Panel report entitled “Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water” (SWRCB, 2010c) provides a list of recommended health based, performance based, and surrogate indicator parameters for groundwater recharge project monitoring. There are currently no groundwater recharge projects using treated effluent. Currently, only approximately 300 acre-ft/yr is being used for non-potable landscape irrigation. In the future, approximately 17,000 acre-ft/yr could be available for landscape irrigation within the watershed. CEC monitoring is already planned for the East Subbasin (see Section 7.4). The CEC data should be incorporated into periodic SNMP updates when the data is available.

12.7.4 Climatological Monitoring

12.7.4.1 Precipitation Stations

The precipitation stations listed below are the two primary weather stations located within and near the East Subbasin (see Figure 4). Data from these precipitation stations will be collected annually and included in the project database.

- Piru 2 ESE, with data from 1959.
- Newhall SFC32CE, with data from 1968.

12.7.4.2 Evapotranspiration Data

Reference evapotranspiration values will be collected from CIMIS station No. 204, which began recording in 2007.

12.7.5 Surface Water Flow Monitoring

12.7.5.1 Stream Gages

Stream flow gages maintained and operated by the USGS and LACDPW are located throughout the East Subbasin. The gages are listed below by USGS gage number or LACDPW identification numbers. The locations of gages are shown on Figure 4.

- USGS Gaging Station 11108500 – Blue Cut – Gage - SANTA CLARA RIVER AT L.A.-VENTURA CO. LINE CA
- USGS Gaging Station 11109000 – Las Brisas Bridge Gage - SANTA CLARA R NR PIRU CA
- USGS Gaging Station 11108134 – Castaic Lake
- LACDPW Gage F377-R - BOUQUET CANYON CREEK AT URBANDALE AVENUE

- LACDPW Gage F328-R - MINT CANYON CREEK AT FITCH AVENUE (Also, identified as USGS – Gaging Station 11107770- MINT CYN CA SIERRA HWY NR SAUGUS CA)
- LACDPW Gage F93 - SANTA CLARA RIVER AT LANG RAILROAD BRIDGE (Also identified as USGS Gaging Station 11107745 - SANTA CLARA R AB RR STATION NR LANG CA).
- LACDPW Gage F92C-R - SANTA CLARA RIVER AT OLD ROAD BRIDGE

The data collected from the gages should be collected annually and included as part of the East Subbasin SNMP monitoring program database. Additionally, recorded release data from Castaic Lake and Castaic Lagoon collected by the DWR should be obtained annually and incorporated in the project database.

12.7.5.2 Wastewater Discharge to Santa Clara River

Treated effluent volumes discharged into the Santa Clara River are monitored by SCVSD and reported annually to the LARWQCB. The data reported by SCVSD should be obtained annually and included as part of the East Subbasin SNMP monitoring program database.

12.8 Groundwater Production Monitoring

Groundwater production data is recorded by the water purveyors within the subbasin. The annual production data should be collected annually from each water purveyor to be included as part of the East Subbasin SNMP monitoring program database.

12.9 Calculation of Salt and Nutrient Loads

The Recycled Water Policy requires that "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." Therefore, monitoring data collected will be used to calculate salt and nutrient loads every three years.

12.9.1 Calculation of Subunit Water Balance

The water balance for each groundwater subunit should be calculated on an annual basis and provided as a part of the SNMP annual technical memorandum. The calculation of the water balance for each subunit will be used to calculate annual salt load entering and leaving the East Subbasin on a triennial basis.

12.9.2 Calculation of Salt and Nutrient Source Loading

The salt and nutrient loading balance sheets reported in Section 7 can be updated periodically using the data set from the monitoring program. The salt and nutrient balance can be conducted to track and confirm the salt and nutrient loads projected in Section 9. The results of the annual salt and nutrient balance should be incorporated into a technical memorandum to be included in the annual SCV Water Report, and should provide an analysis of salt and nutrient loading and water quality conditions in the East Subbasin by subsidiary subbasin and stream reaches over the previous three years.

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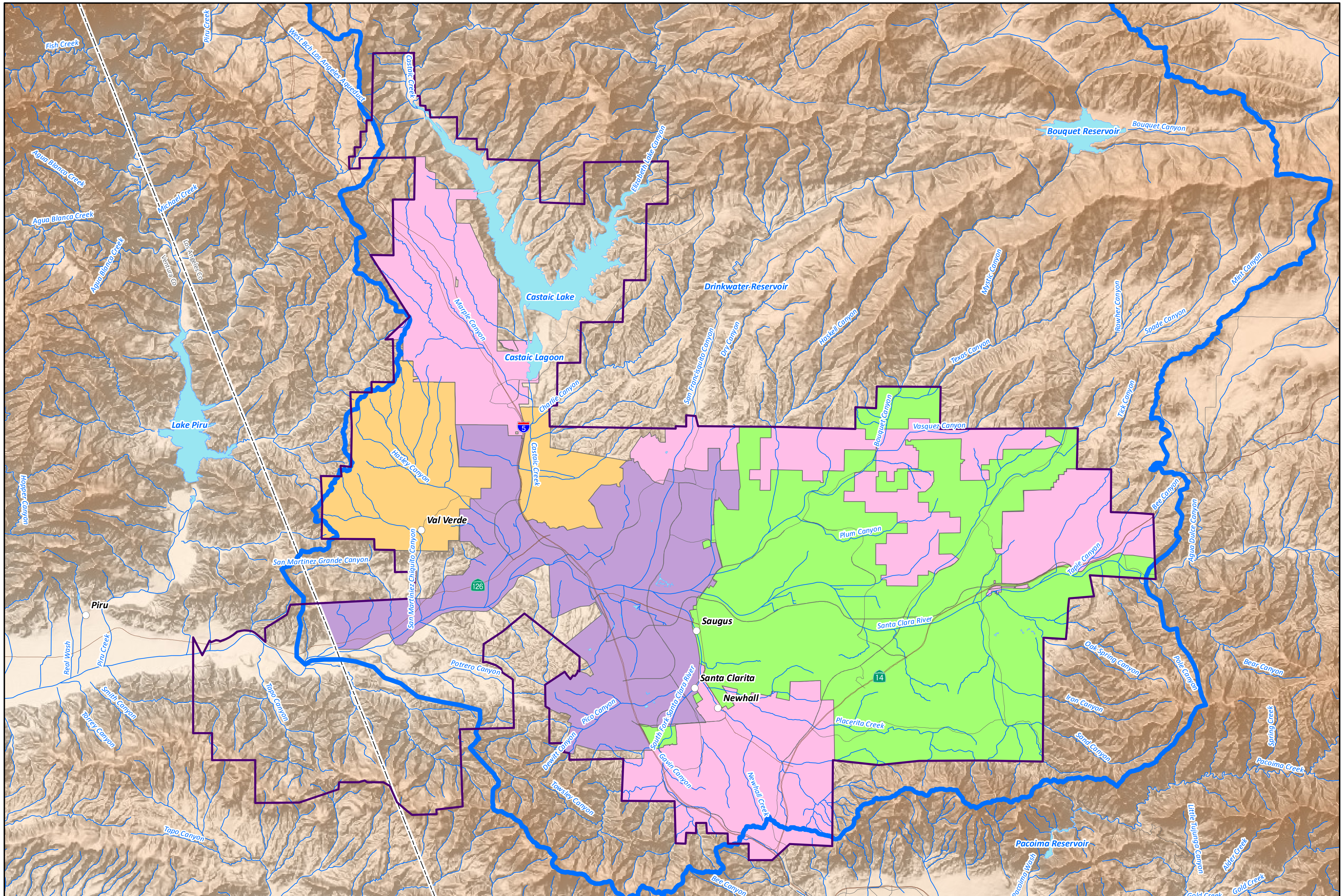
FIGURES

GEOSCIENCE

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN



CASTAIC LAKE WATER AGENCY SERVICE AREA AND OTHER WATER PURVEYORS

EXPLANATION

- Castaic Lake Water Agency Boundary
- Santa Clara River East Subbasin Watershed
- LA County Waterworks District No. 36 - Val Verde Boundary
- Newhall County Water District Boundary
- Santa Clarita Water Division Boundary
- Valencia Water Company Boundary

California County Inset

8-Dec-16

Prepared by: DB. Map Projection: State Plane 1983, Zone V.

NORTH

0 1.5 3 6 Miles

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Figure 1

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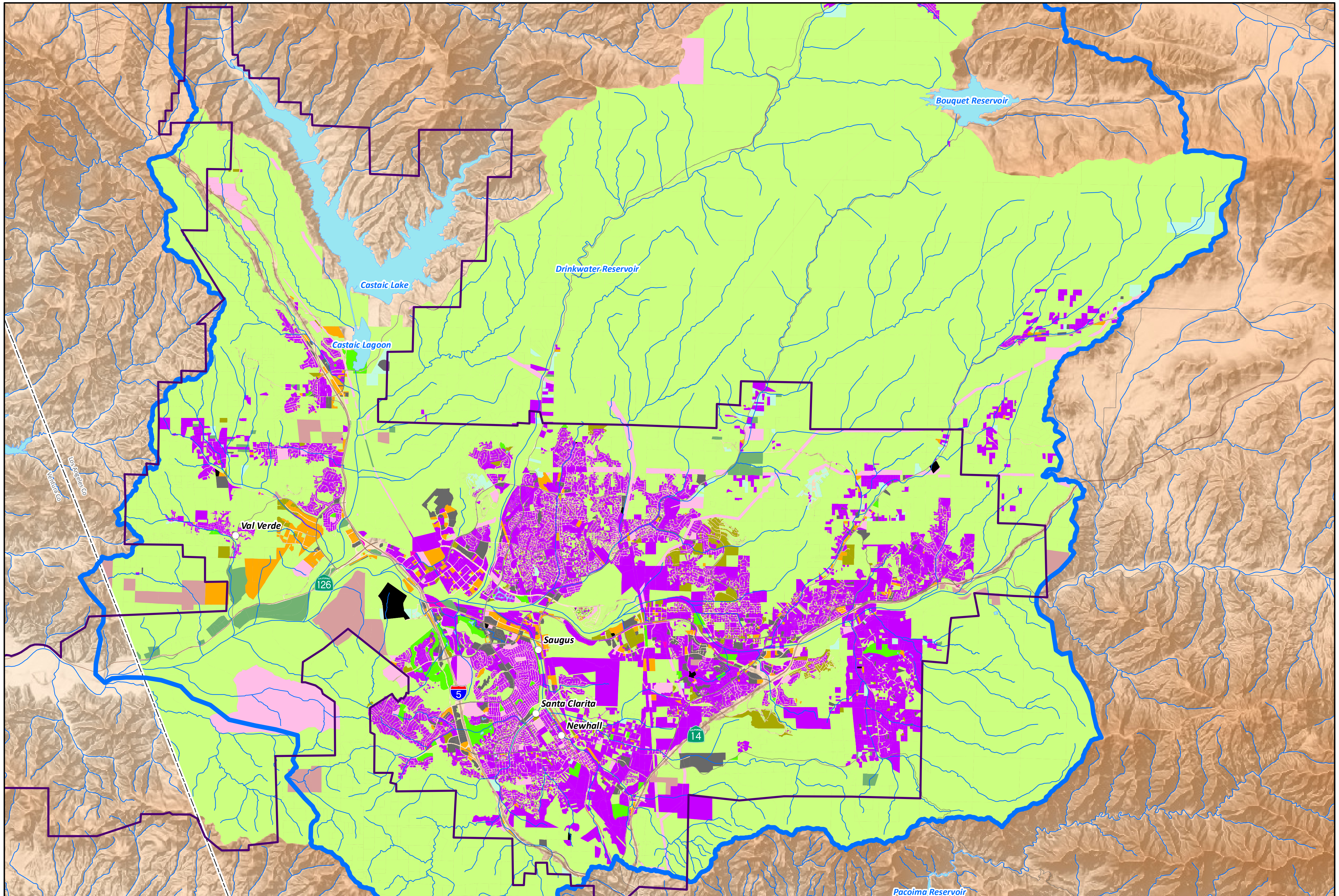
CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

2008 SCAG LAND USE



EXPLANATION

Castaic Lake Water Agency Boundary

Santa Clara River East Subbasin Watershed

2008 SCAG (Southern California Association of Governments) Land Use

- Agriculture
- Commercial
- Commercial Recreation
- Impervious
- Industrial
- Industrial - Open Space
- Non-Irrigated Agriculture
- Open Space
- Parks/ Golf Courses
- Public Facilities
- Residential
- Unclassified

NORTH

0 1 2 4 Miles

8-Dec-16

Prepared by: DB. Map Projection: State Plane 1983, Zone V.

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Figure 2

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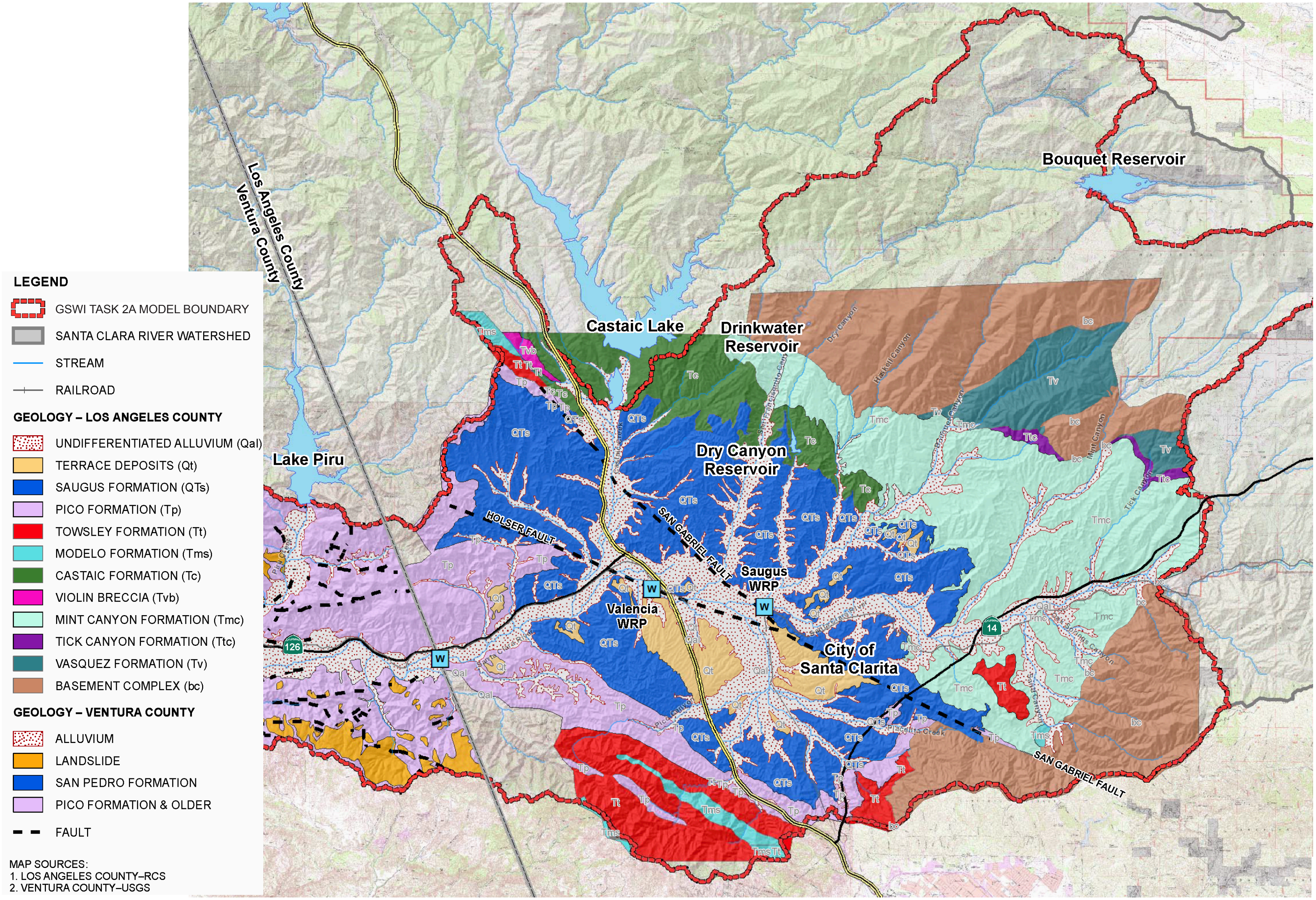

Source: GWSI, Task 2a - Conceptual Model Development, CH2MHill, Oct. 2006. Figure 4-1

Figure 3	Drawn: LB	CASTAIC LAKE WATER AGENCY	GEOSCIENCE
	Checked: JK	SALT AND NUTRIENT MANAGEMENT PLAN	GEOSCIENCE Support Services, Incorporated
	Approved:	SANTA CLARA RIVER VALLEY EAST SUBBASIN	P.O. Box 220, Claremont, CA 91711
	Date: 8-Dec-16	GEOLOGIC MAP	Tel: (909) 451-6650 Fax: (909) 451-6638 www.gssiwater.com

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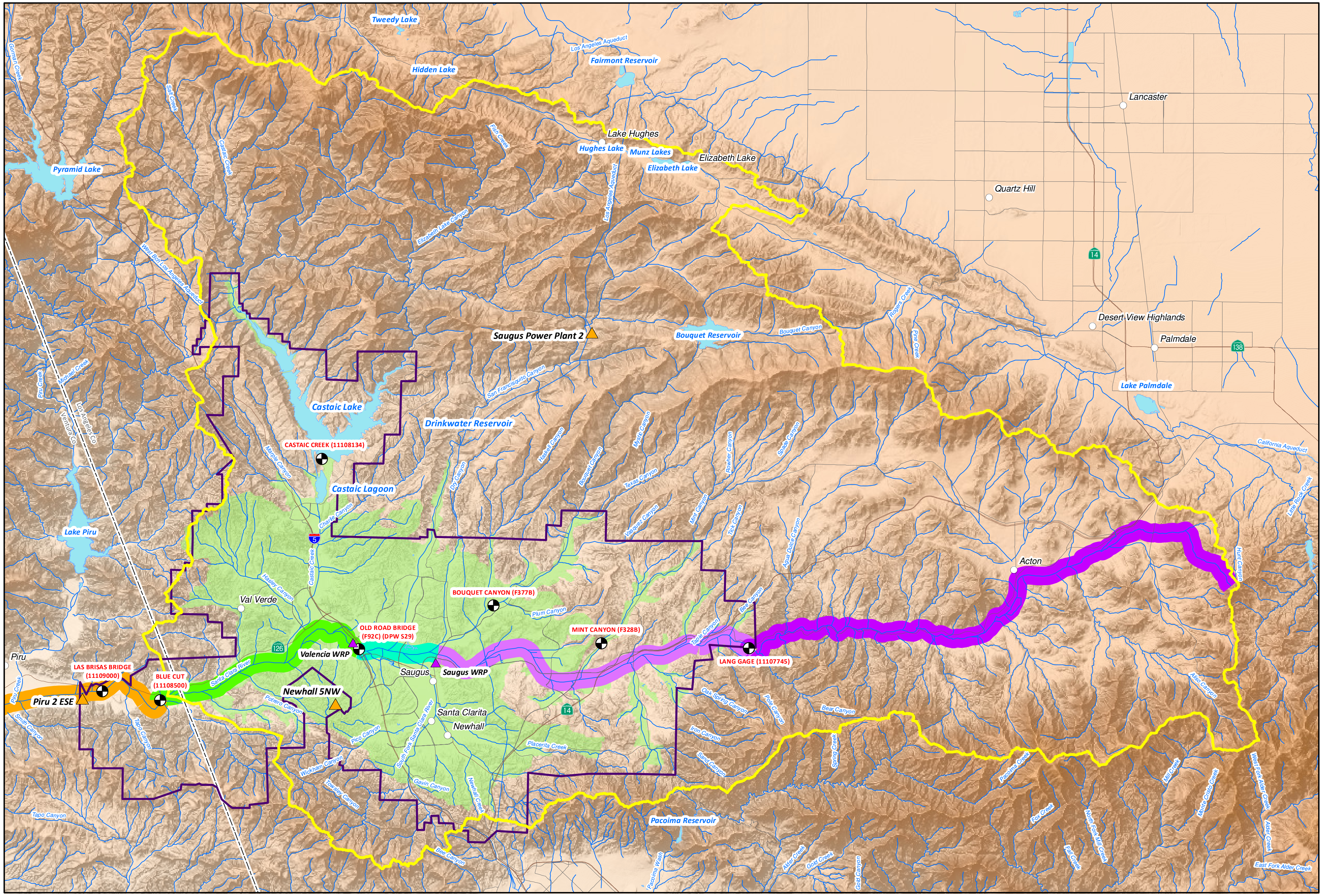
CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN



HYDROLOGIC SUBUNITS, PRECIPITATION AND STREAM GAGING STATIONS

EXPLANATION

- Castaic Lake Water Agency Boundary
- Upper Santa Clara River Watershed
- Santa Clara River Valley East Groundwater Subbasin

Santa Clara River Reaches (Number, Name)

- Reach 4b - Between Blue Cut Gaging Station and the Confluence Between Piru Creek
- Reach 5 - Upstream of the USGS Blue Cut Gaging Station to the West Pier Highway 99 (Now Old Road Bridge)
- Reach 6 - Upstream of Highway 99 (Now Old Road Bridge) to Bouquet Canyon Dridge
- Reach 7 - Upstream of Bouquet Canyon to Lang Gaging Station
- Reach 8 - Above Lang Gaging Station

MINT CANYON (F377-R) — DPW or USGS Stream Gage Site Identification / Site Number

Newhall 5NW — Precipitation Station

Water Reclamation Plant

NORTH

0 2 4 8 Miles

8-Dec-16

Prepared by: DB. Map Projection: State Plane 1983, Zone V.

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Figure 4

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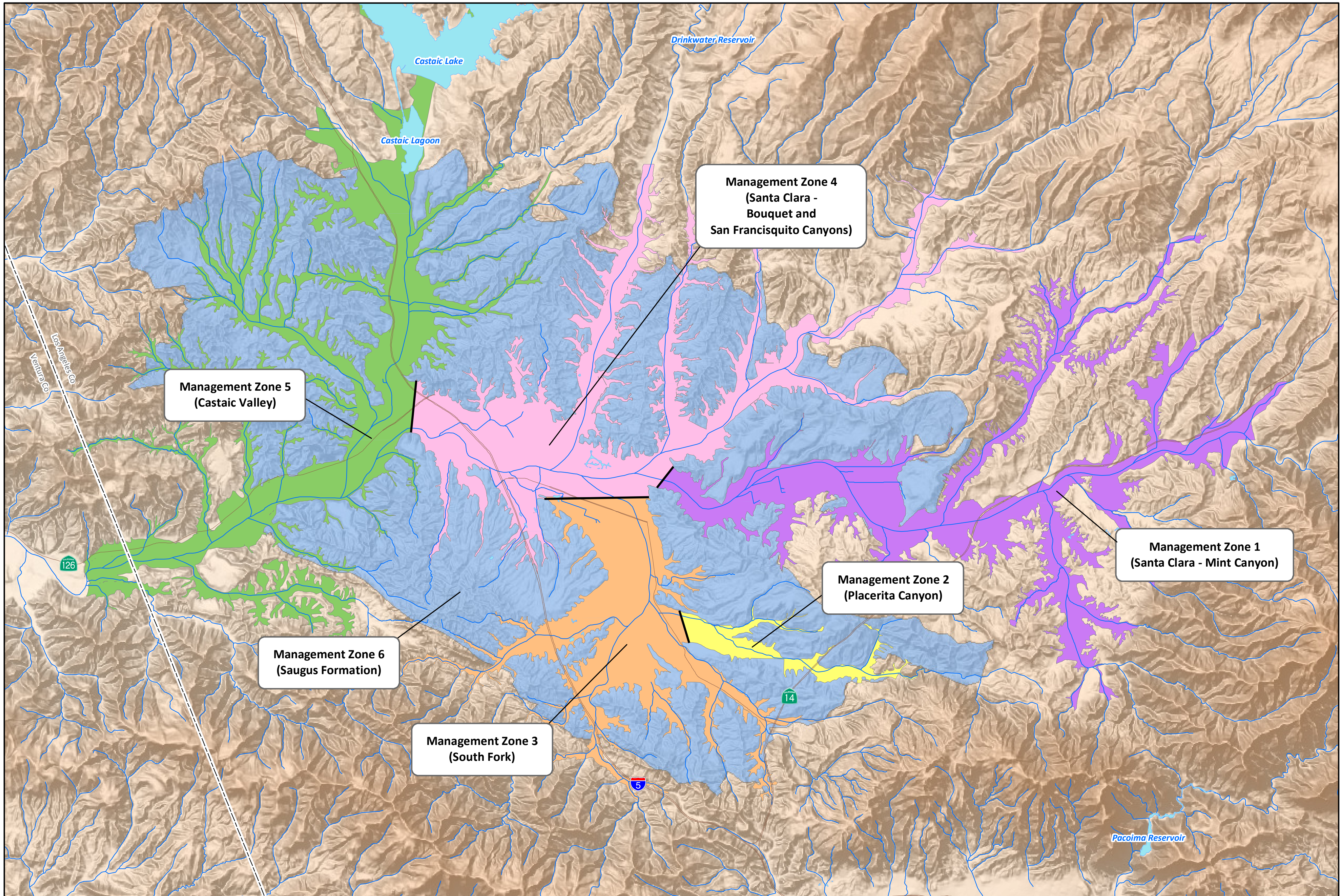
CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

EAST SUBBASIN GROUNDWATER MANAGEMENT ZONES ALLUVIAL AQUIFER AND SAUGUS FORMATION



EXPLANATION

LARWQCB Groundwater Subunit

- Management Zone 1 (Santa Clara - Mint Canyon)
- Management Zone 2 (Placerita Canyon)
- Management Zone 3 (South Fork)
- Management Zone 4 (Santa Clara-Bouquet and San Francisquito Canyons)
- Management Zone 5 (Castaic Valley)
- Management Zone 6 (Saugus Formation)
- Boundary Between Adjacent Management Zones

NORTH

0 1 2 4 Miles

8-Dec-16

Prepared by: DB. Map Projection: State Plane 1983, Zone V.

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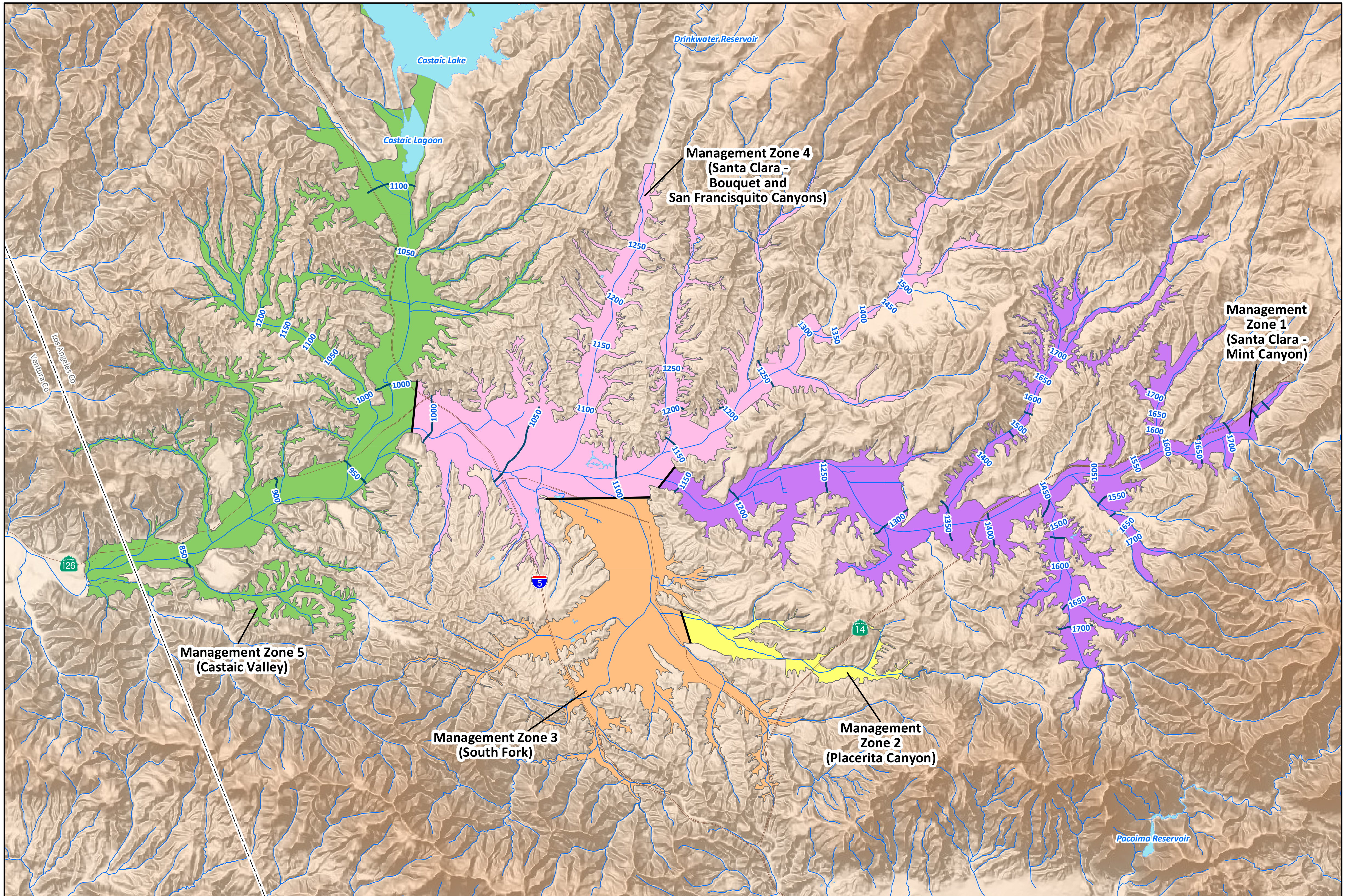
Figure 5

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_5_Subunits_12-16.mxd

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN



ALLUVIAL AQUIFER AVERAGE GROUNDWATER ELEVATIONS (2001 - 2011)

EXPLANATION

1700 — Average Groundwater Elevation (2001 - 2011) (ft amsl)

LARWQCB Groundwater Subunit

- Management Zone 1 (Santa Clara - Mint Canyon)
- Management Zone 2 (Placerita Canyon)
- Management Zone 3 (South Fork)
- Management Zone 4 (Santa Clara-Bouquet and San Francisquito Canyons)
- Management Zone 5 (Castaic Valley)

Boundary Between Adjacent Management Zones

8-Dec-16

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NORTH

0 1 2 4 Miles

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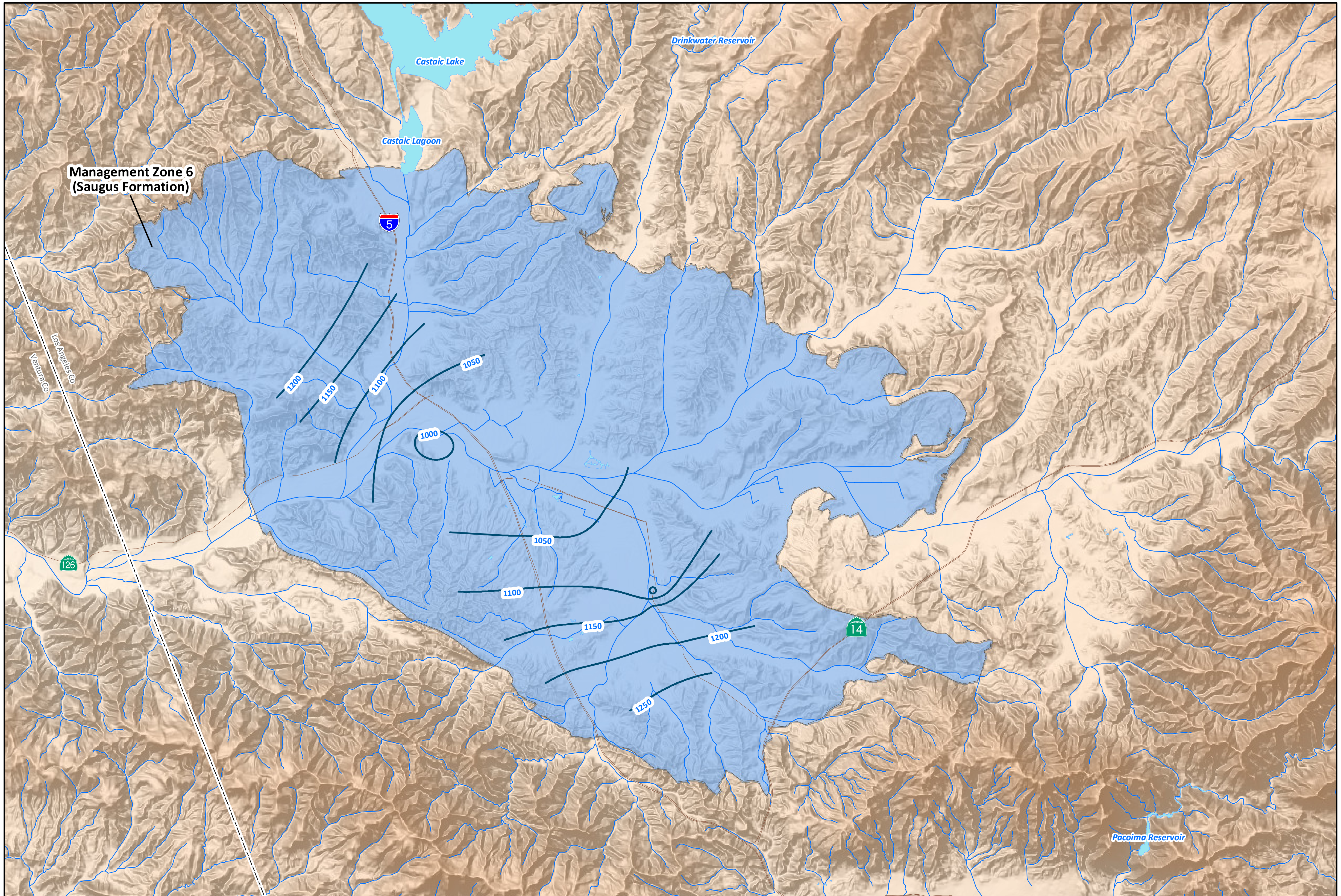
Figure 6

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SAUGUS FORMATION AVERAGE GROUNDWATER ELEVATIONS (2001 - 2011)

EXPLANATION

1700 — Average Groundwater Elevation (2001 - 2011) (ft amsl)

8-Dec-16

Prepared by: DB. Map Projection: State Plane 1983, Zone V.

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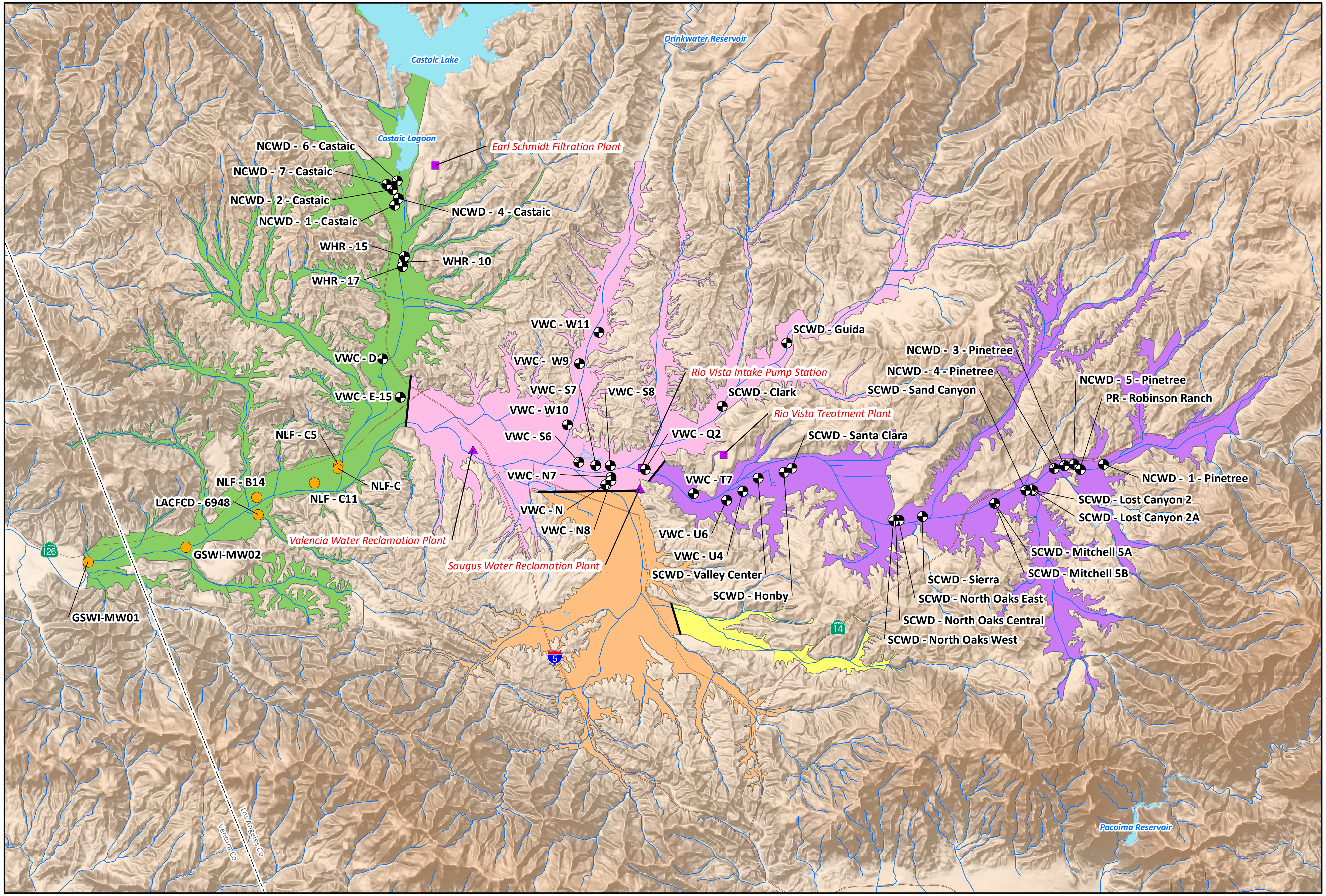
Figure 7

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_7_gw_elev_2001-2011_saugus_12-16.mxd

ALLUVIAL AQUIFER WELLS



EXPLANATION

Alluvial Aquifer Wells by Owner

- Active Municipal Well
- Active Monitoring Well

LACFCD = LA County Flood Control District
NCWD = Newhall County Water District
NLF = Newhall Land and Farming
(GSWI = Groundwater / Surface Water Interaction)
Private
SCWD = Santa Clarita Water Division
VWC = Valencia Water Company
WHR - Wayside Honor Ranch

LARWQCB Groundwater Subunit

- Management Zone 1 (Santa Clara - Mint Canyon)
- Management Zone 2 (Placerita Canyon)
- Management Zone 3 (South Fork)
- Management Zone 4 (Santa Clara-Bouquet and San Francisquito Canyons)
- Management Zone 5 (Castaic Valley)
- Boundary Between Adjacent Management Zones
- Water Treatment Facility
- Water Reclamation Plant

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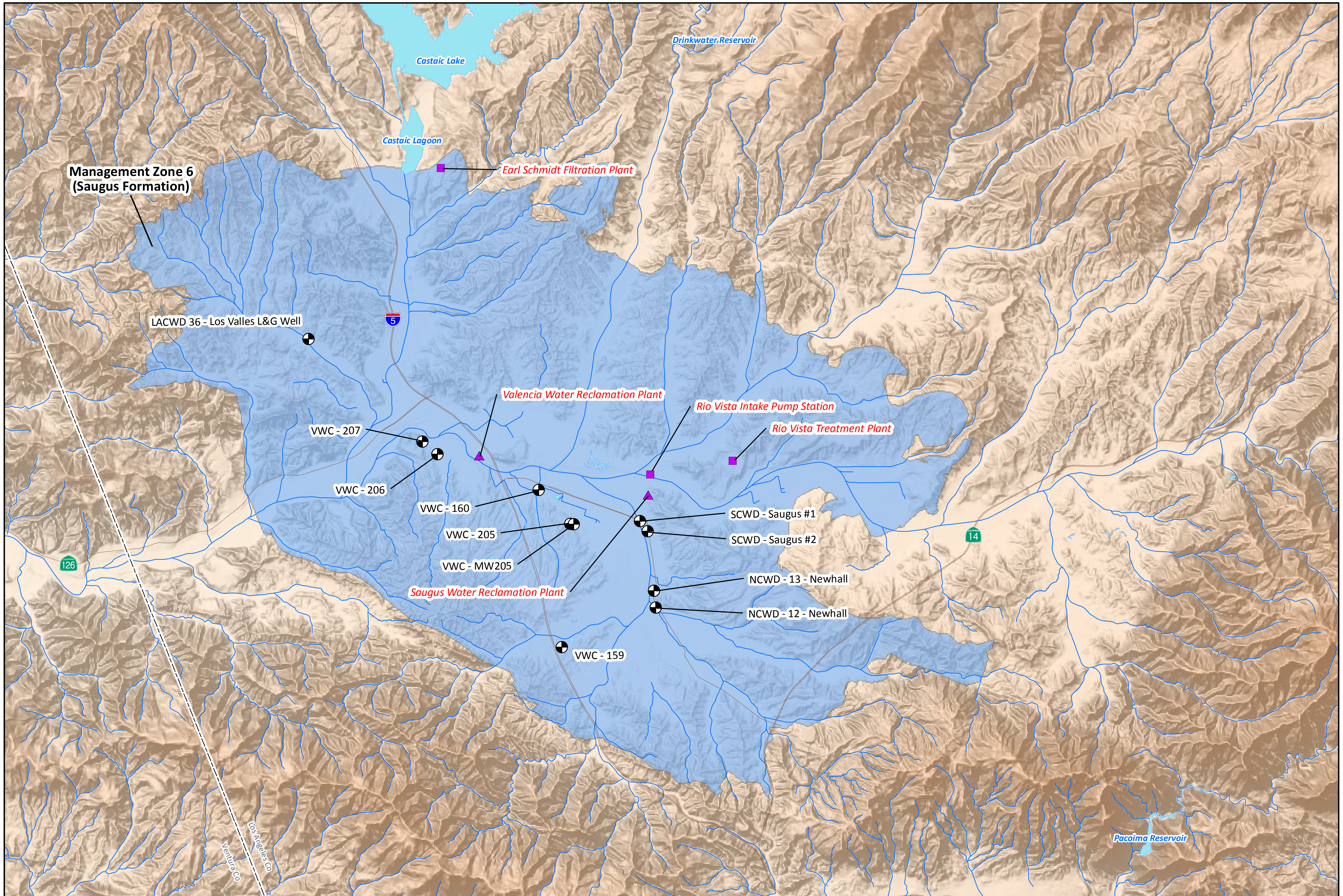
Figure 8

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

SAUGUS FORMATION WELLS



EXPLANATION

Saugus Formation Wells by Owner

Active

LACWD	LA County Waterworks District No. 36 - Val Verde
NCWD	Newhall County Water District
SCWD	Santa Clarita Water Division
VWC	Valencia Water Company

Water Treatment Facility

Water Reclamation Plant

NORTH

0 1 2 4 Miles

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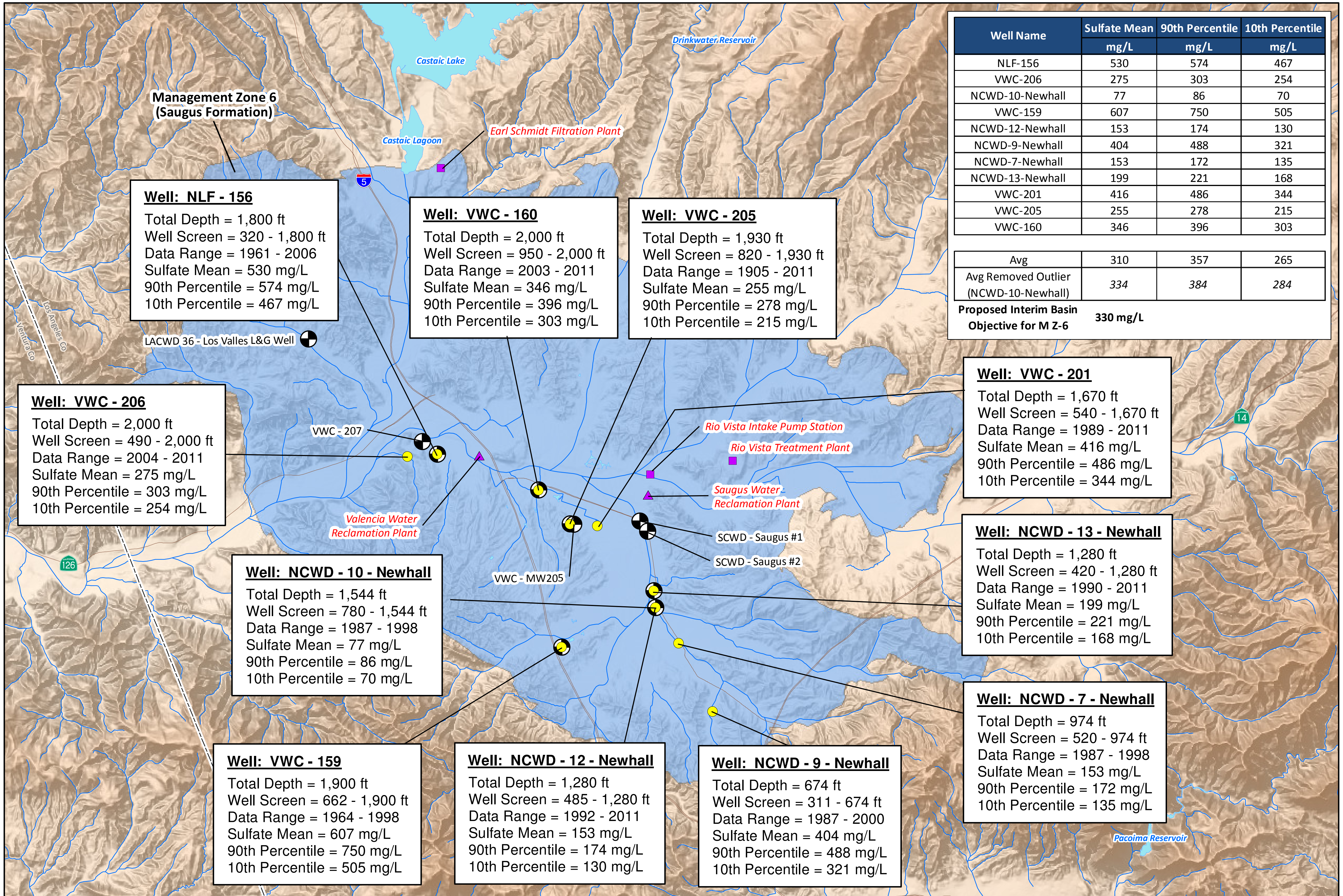
Figure 9

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_9_saugus_formation_wells_12-16.mxd

SULFATE CONCENTRATIONS IN SAUGUS FORMATION (MANAGEMENT ZONE 6)



Well Name	Sulfate Mean mg/L	90th Percentile mg/L	10th Percentile mg/L
NLF-156	530	574	467
VWC-206	275	303	254
NCWD-10-Newhall	77	86	70
VWC-159	607	750	505
NCWD-12-Newhall	153	174	130
NCWD-9-Newhall	404	488	321
NCWD-7-Newhall	153	172	135
NCWD-13-Newhall	199	221	168
VWC-201	416	486	344
VWC-205	255	278	215
VWC-160	346	396	303
Avg	310	357	265
Avg Removed Outlier (NCWD-10-Newhall)	*334*	*384*	*284*
Proposed Interim Basin Objective for M Z-6	330 mg/L		

EXPLANATION

Saugus Formation Wells by Owner

- Active
- Wells Used for Saugus Aquifer Water Quality Analysis

NCWD Newhall County Water District

NLF Newhall Land and Farming

VWC Valencia Water Company

- Water Treatment Facility
- Water Reclamation Plant

8-Dec-16

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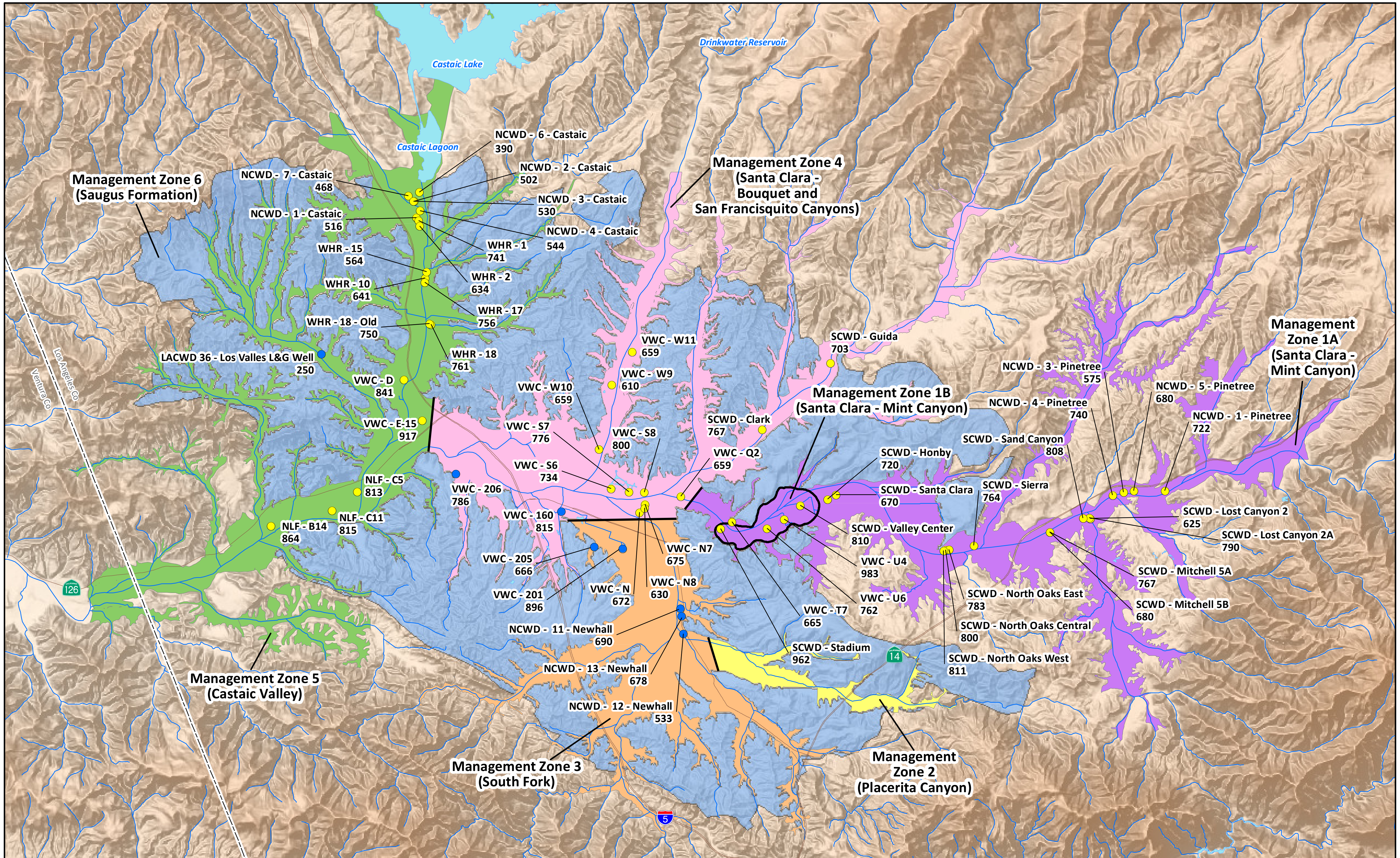
Figure 10

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_10_SulfateinSaugus_12-16.mxd

MEDIAN TDS CONCENTRATIONS ALLUVIAL AQUIFER AND SAUGUS FORMATION 2001 - 2011



TDS Concentration	Management Zone 1 (1A & 1B)	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5
Basin Objective	**800 (mg/L)**	**700 (mg/L)**	**700 (mg/L)**	**700 (mg/L)**	**1,000 (mg/L)**

EXPLANATION

Alluvial Aquifer Well

SCWD - North Oaks West Well Owner
811 TDS Concentration (mg/L)

Saugus Formation Well

VWC - 205 Well Owner
666 TDS Concentration (mg/L)

NOTE: No Data was available in Management Zones 2 and 3 for the time period 2001 - 2011.

Boundary Between Adjacent Management Zones

NORTH

0 1 2 4 Miles

8-Dec-16

Prepared by: DB. Map Projection: State Plane 1983, Zone V.

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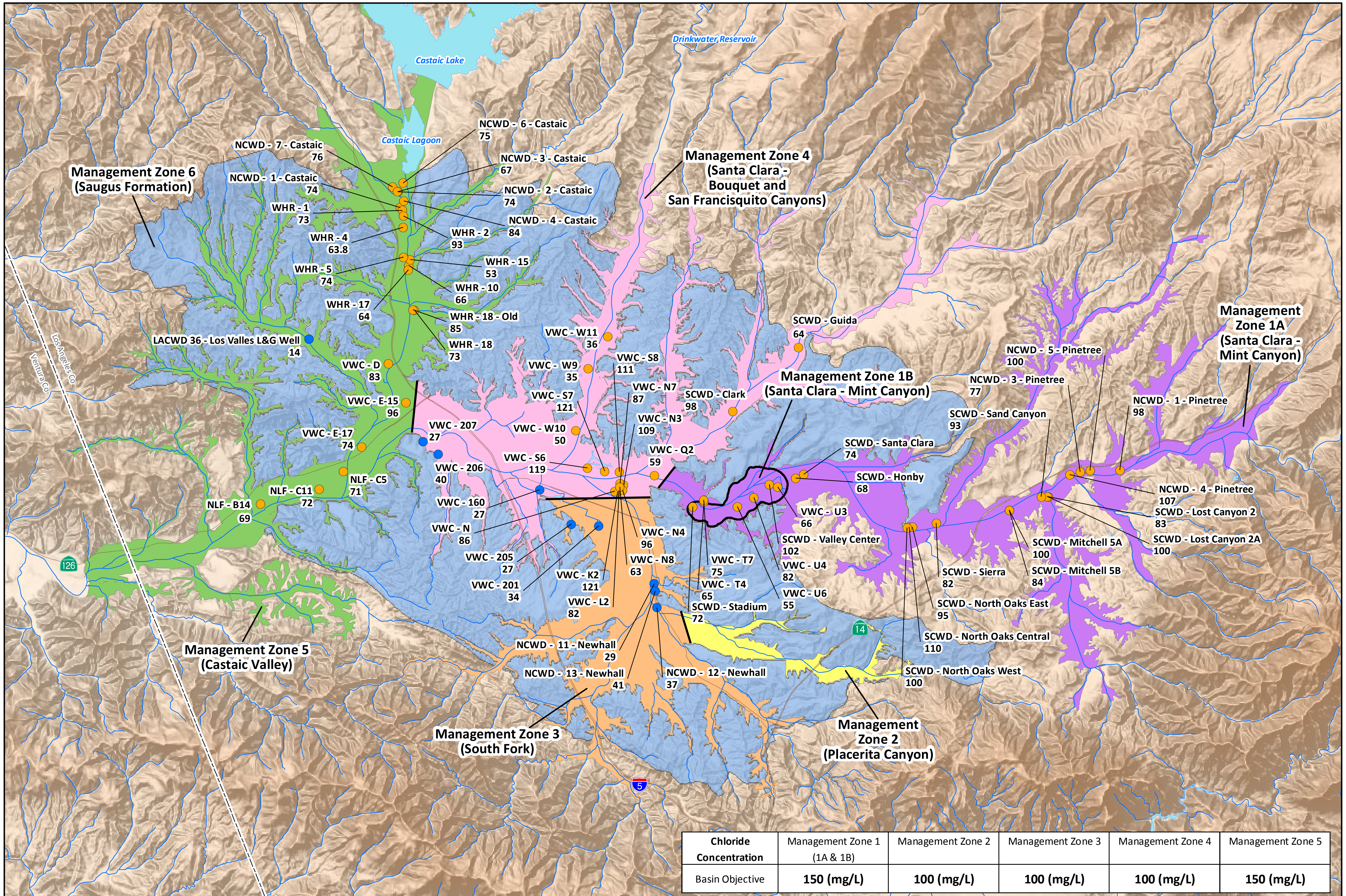
Figure 11a



Chloride Concentration	Management Zone 1 (1A & 1B)	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5
Basin Objective	**150 (mg/L)**	**100 (mg/L)**	**100 (mg/L)**	**100 (mg/L)**	**150 (mg/L)**

MEDIAN CHLORIDE CONCENTRATIONS ALLUVIAL AQUIFER AND SAUGUS FORMATION 2001 - 2011

EXPLANATION

Alluvial Aquifer Well

NLF - C11 Well Owner
72 Chloride Concentration (mg/L)

Saugus Formation Well

VWC - N Well Owner
86 Chloride Concentration (mg/L)

NOTE: No Data was available in Management Zones 2 and 3 for the time period 2001 - 2011.

Boundary Between Adjacent Management Zones

8-Dec-16

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NORTH

0 1 2 4 Miles

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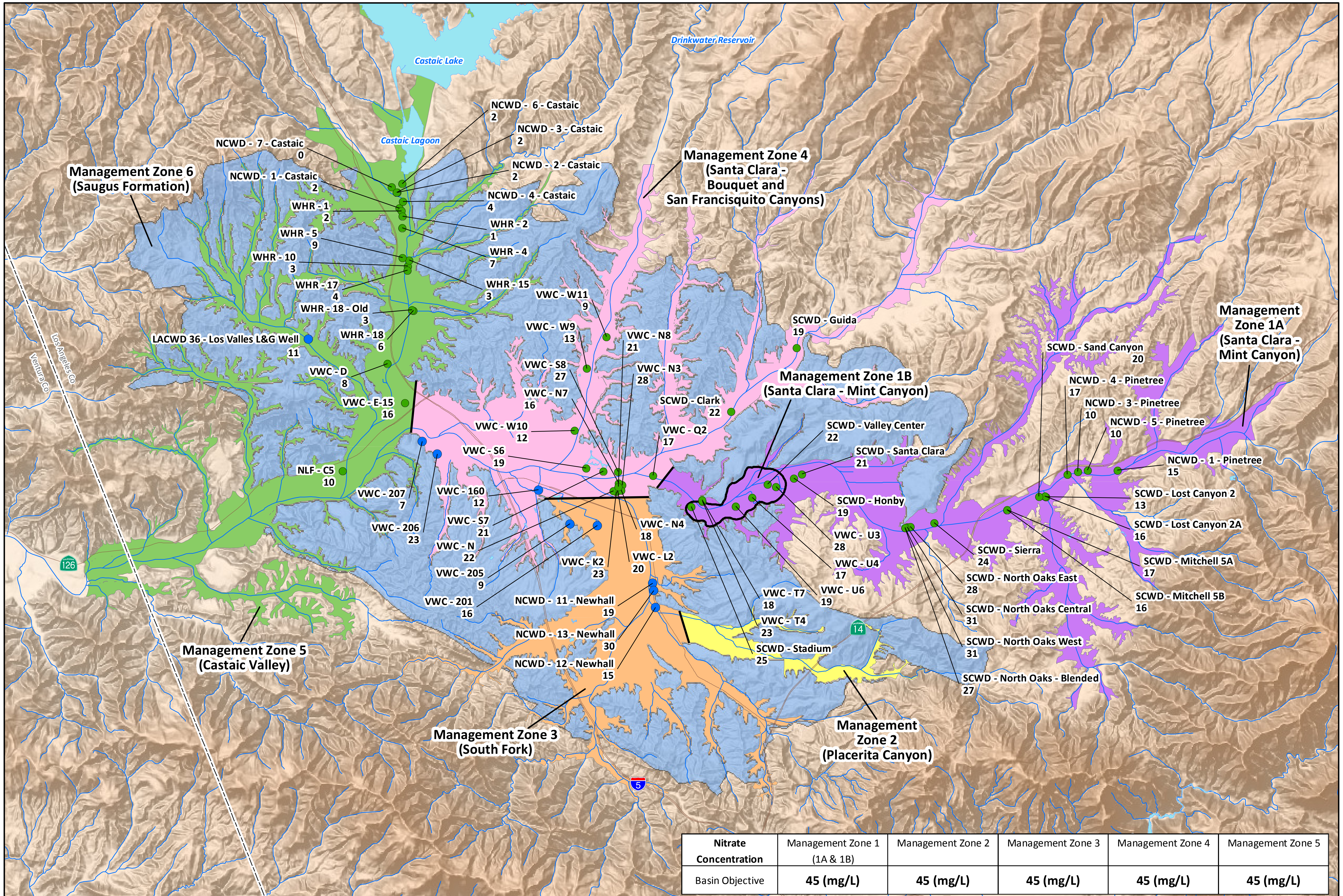
Figure 11b

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

MEDIAN NITRATE (AS NO3) CONCENTRATIONS ALLUVIAL AQUIFER AND SAUGUS FORMATION 2001 - 2011



Nitrate Concentration	Management Zone 1 (1A & 1B)	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5
Basin Objective	45 (mg/L)	45 (mg/L)	45 (mg/L)	45 (mg/L)	45 (mg/L)

EXPLANATION

Alluvial Aquifer Well

NLF - C5 / 10 — Well Owner; Nitrate (as NO3) Concentration (mg/L)

Saugus Formation Well

VWC - N / 22 — Well Owner; Nitrate Concentration (mg/L)

NOTE: No Data was available in Management Zones 2 and 3 for the time period 2001 - 2011.

Boundary Between Adjacent Management Zones

NORTH

0 1 2 4 Miles

8-Dec-16

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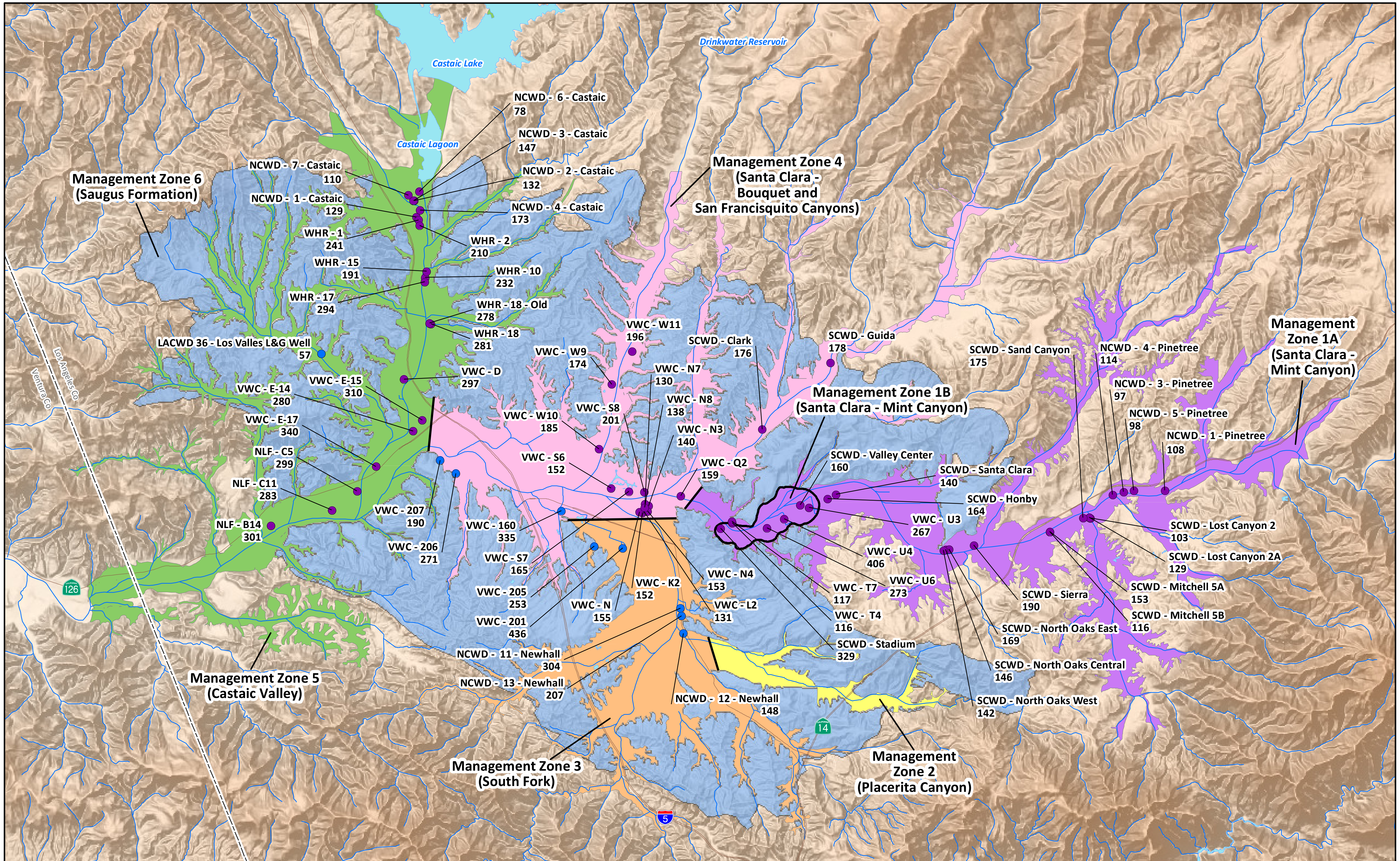
Figure 11c

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_11c_Nitrate_values_12-16.mxd

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

MEDIAN SULFATE CONCENTRATIONS ALLUVIAL AQUIFER AND SAUGUS FORMATION 2001 - 2011



Sulfate Concentration	Management Zone 1 (1A & 1B)	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5
Basin Objective	150 (mg/L)	150 (mg/L)	200 (mg/L)	250 (mg/L)	350 (mg/L)

EXPLANATION

Alluvial Aquifer Well

NLF - C5 / 299 — Well Owner / Sulfate Concentration (mg/L)

Saugus Formation Well

VWC - N / 155 — Well Owner / Sulfate Concentration (mg/L)

NOTE: No Data was available in Management Zones 2 and 3 for the time period 2001 - 2011.

Boundary Between Adjacent Management Zones

NORTH

0 1 2 4 Miles

8-Dec-16

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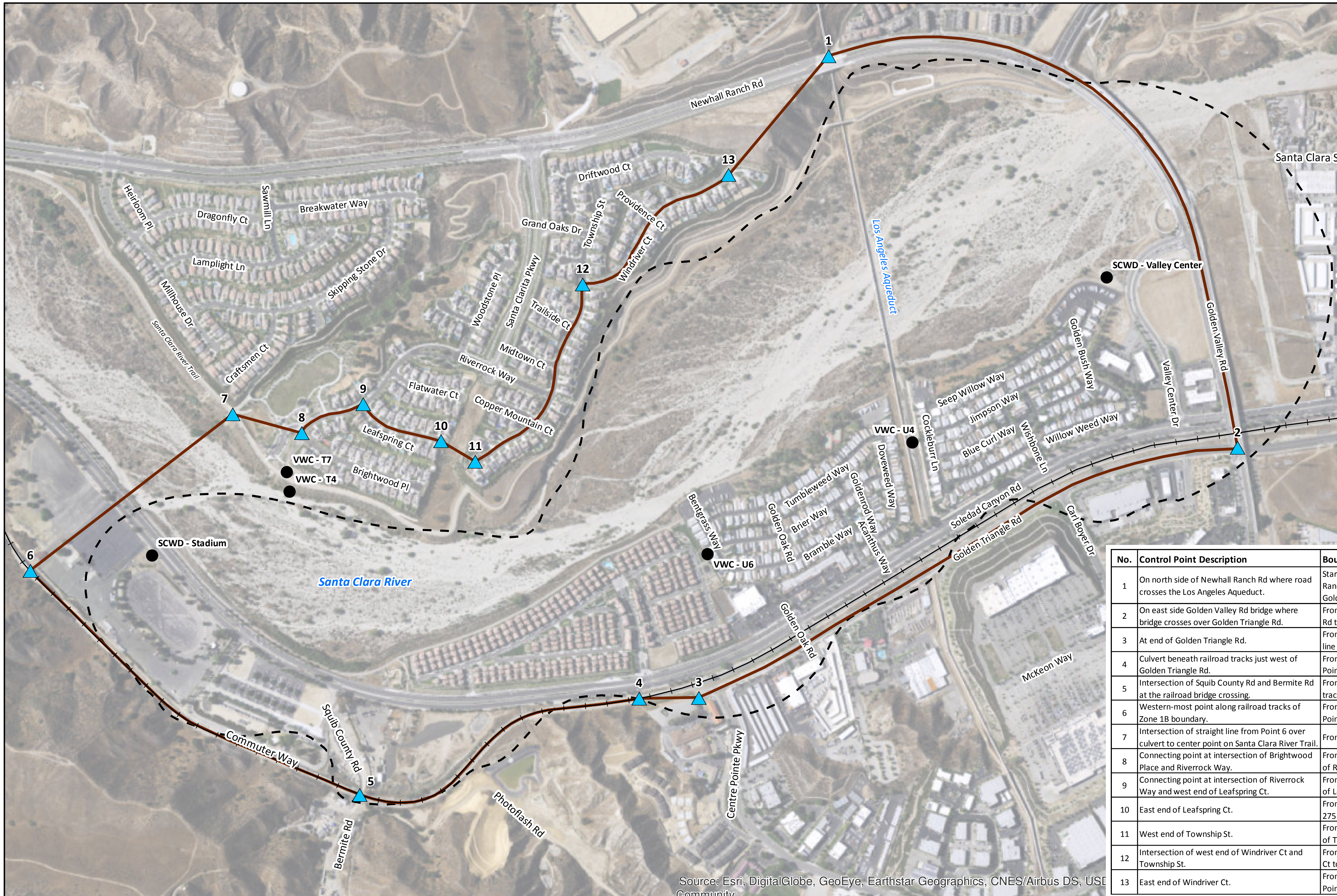
Figure 11d

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_11d_Sulfate_values_12-16.mxd

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

DETAILED DESCRIPTION OF MANAGEMENT ZONE 1b BOUNDARY



No.	Control Point Description	Boundary Description	x_sp83v	y_sp83v
1	On north side of Newhall Ranch Rd where road crosses the Los Angeles Aqueduct.	Starting at Point 1 on northbound lane of Newhall Ranch Rd, boundary heads southeast along Golden Valley Rd, to Point 2.	6407145.48	1978222.07
2	On east side Golden Valley Rd bridge where bridge crosses over Golden Triangle Rd.	From Point 2 extends west along Golden Triangle Rd to Point 3.	6410022.91	1975469.40
3	At end of Golden Triangle Rd.	From Point 3, extends 420 ft northwest in straight line to Point 4.	6406232.62	1973714.27
4	Culvert beneath railroad tracks just west of Golden Triangle Rd.	From Point 4, extends west along train tracks to Point 5.	6405814.57	1973709.41
5	Intersection of Squib County Rd and Bermite Rd at the railroad bridge crossing.	From Point 5, extends 2,850 ft west along train tracks to Point 6.	6403845.12	1973033.02
6	Western-most point along railroad tracks of Zone 1B boundary.	From Point 6, extends 1,800 ft northeast to Point 7.	6401526.72	1974606.35
7	Intersection of straight line from Point 6 over culvert to center point on Santa Clara River Trail.	From Point 7, extends 500 ft southeast to Point 8.	6402952.07	1975705.31
8	Connecting point at intersection of Brightwood Place and Riverrock Way.	From Point 8, extends northeast along centerline of Riverrock Way to Point 9.	6403436.44	1975573.02
9	Connecting point at intersection of Riverrock Way and west end of Leafspring Ct.	From Point 9, extends southeast along centerline of Leafspring Ct. to end of street, Point 10.	6403868.73	1975776.15
10	East end of Leafspring Ct.	From Point 10, extends southeast in straight line 275 ft to Point 11.	6404419.78	1975515.73
11	West end of Township St.	From Point 11, extends northeast along centerline of Township St to Point 12.	6404659.36	1975373.02
12	Intersection of west end of Windriver Ct and Township St.	From Point 12, extends northeast along Windriver Ct to Point 13.	6405414.57	1976618.85
13	East end of Windriver Ct.	From Point 13, extends 1,095 ft northeast to Point 1.	6406441.65	1977385.52

EXPLANATION

- - - Preliminary Management Zone 1b Boundary (491 acres)

— Revised Proposed Management Zone 1b Boundary (507 acres)

1 ▲ Control Point for Revised Proposed Management Zone 1b Boundary

● Wells Within Management Zone 1b

NORTH

0 500 1,000 2,000 Feet

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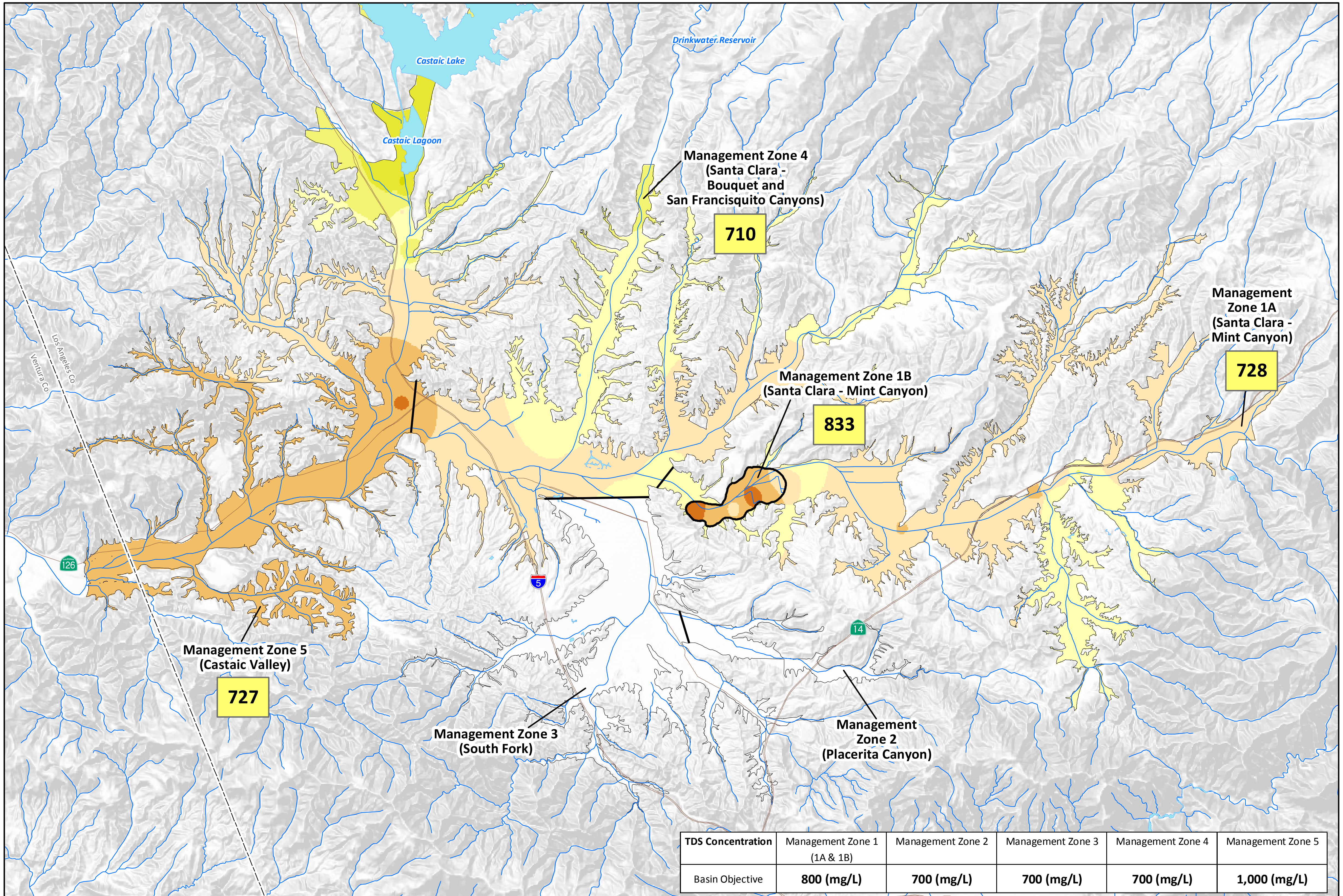
Figure 11e

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_11e_Mgmt_Zone_1b_12-16.mxd

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

AVERAGE TDS CONCENTRATION ALLUVIAL AQUIFER 2001 - 2011



TDS Concentration	Management Zone 1 (1A & 1B)	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5
Basin Objective	**800 (mg/L)**	**700 (mg/L)**	**700 (mg/L)**	**700 (mg/L)**	**1,000 (mg/L)**

EXPLANATION

TDS Concentration (mg/L)

- <400
- 400 - 500
- 500 - 600
- 600 - 700
- 700 - 800
- 800 - 900
- 900 - 1,000

727 Management Zone Average TDS Concentration (mg/L)

NOTE: No Data was available in Management Zones 2 and 3 for the time period 2001 - 2011.

Boundary Between Adjacent Management Zones

NORTH

0 1 2 4 Miles

8-Dec-16

Prepared by: DB. Map Projection: State Plane 1983, Zone V.

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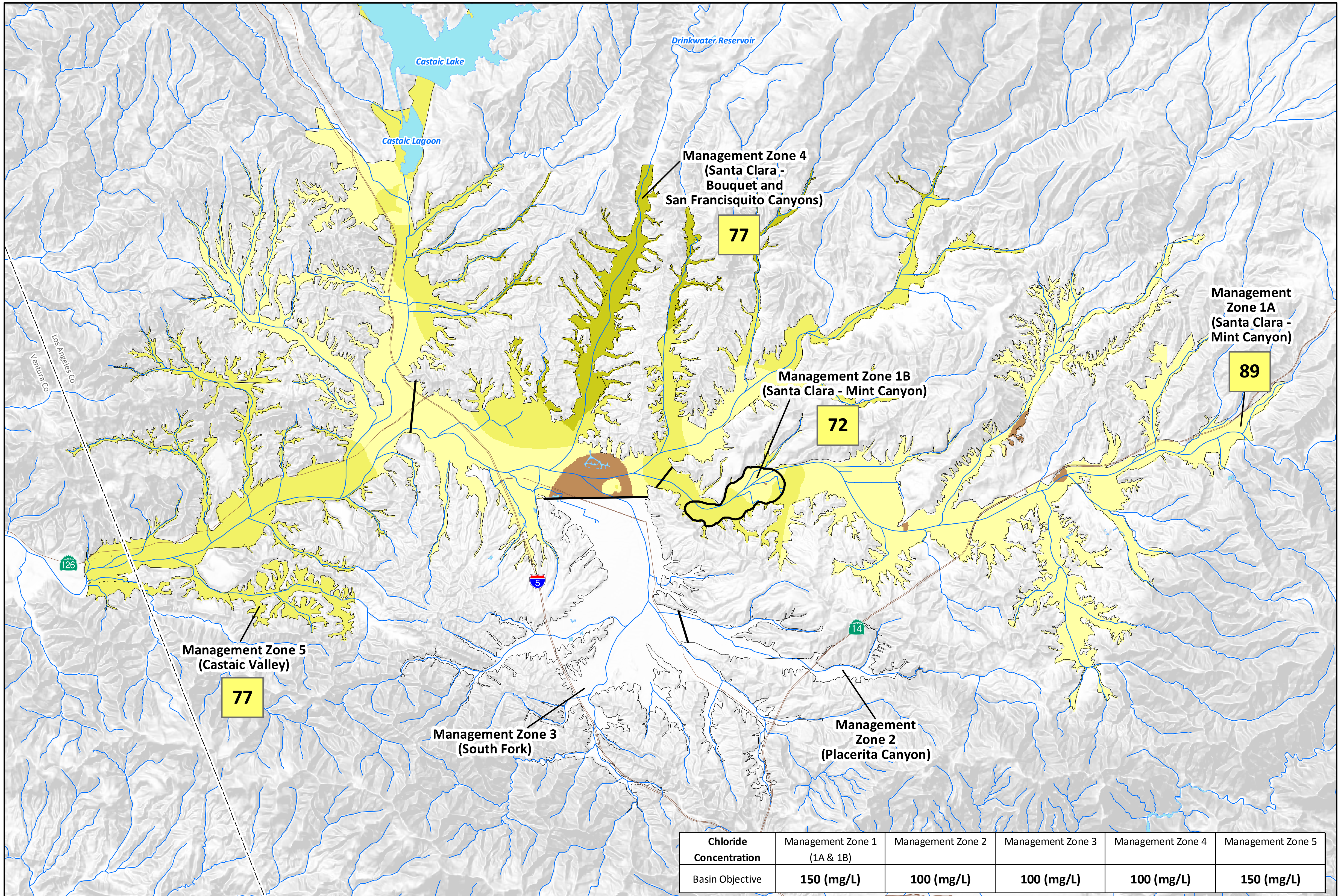
Figure 12a

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_12a_TDS_alluvial_12-16.mxd

AVERAGE CHLORIDE CONCENTRATION CONTOURS ALLUVIAL AQUIFER 2001 - 2011



Chloride Concentration	Management Zone 1 (1A & 1B)	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5
Basin Objective	**150 (mg/L)**	**100 (mg/L)**	**100 (mg/L)**	**100 (mg/L)**	**150 (mg/L)**

EXPLANATION

Chloride Concentration (mg/L)

- 25 - 50
- 50 - 75
- 75 - 100
- 100 - 125

77 — Management Zone Average Chloride Concentration (mg/L)

NOTE: No Data was available in Management Zones 2 and 3 for the time period 2001 - 2011.

Boundary Between Adjacent Management Zones

NORTH

0 1 2 4 Miles

8-Dec-16

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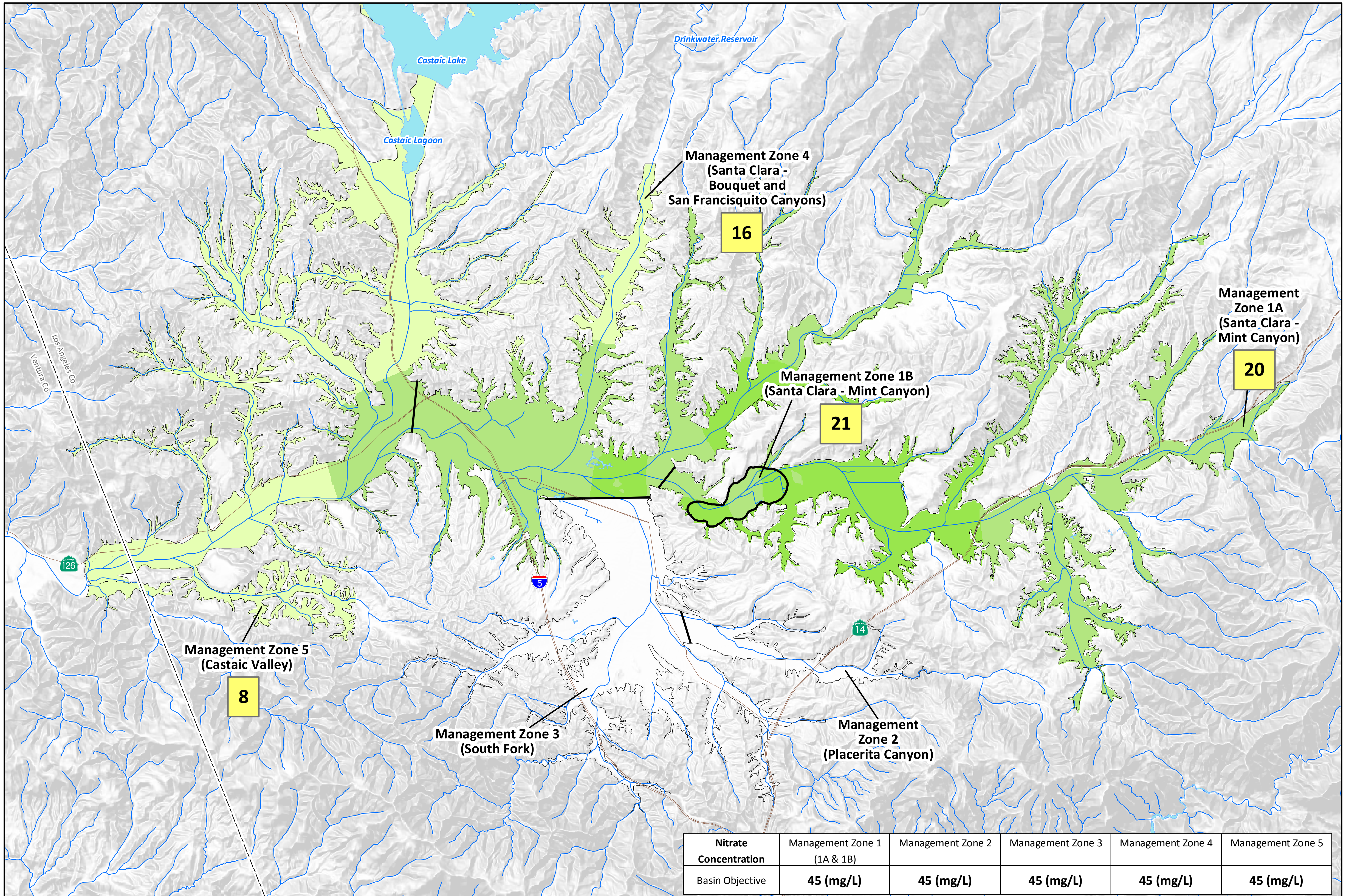
Figure 12b

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_12b_Chloride_alluvial_12-16.mxd

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

AVERAGE NITRATE (AS NO3) CONCENTRATION CONTOURS ALLUVIAL AQUIFER 2001 - 2011



Nitrate Concentration	Management Zone 1 (1A & 1B)	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5
Basin Objective	45 (mg/L)	45 (mg/L)	45 (mg/L)	45 (mg/L)	45 (mg/L)

EXPLANATION

Nitrate (as NO3) Concentration (mg/L)

- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 35

8 — Management Zone Average Nitrate (as NO3) Concentration (mg/L)

NOTE: No Data was available in Management Zones 2 and 3 for the time period 2001 - 2011.

Boundary Between Adjacent Management Zones

8-Dec-16

Prepared by: DB. Map Projection: State Plane 1983, Zone V.

NORTH

0 1 2 4 Miles

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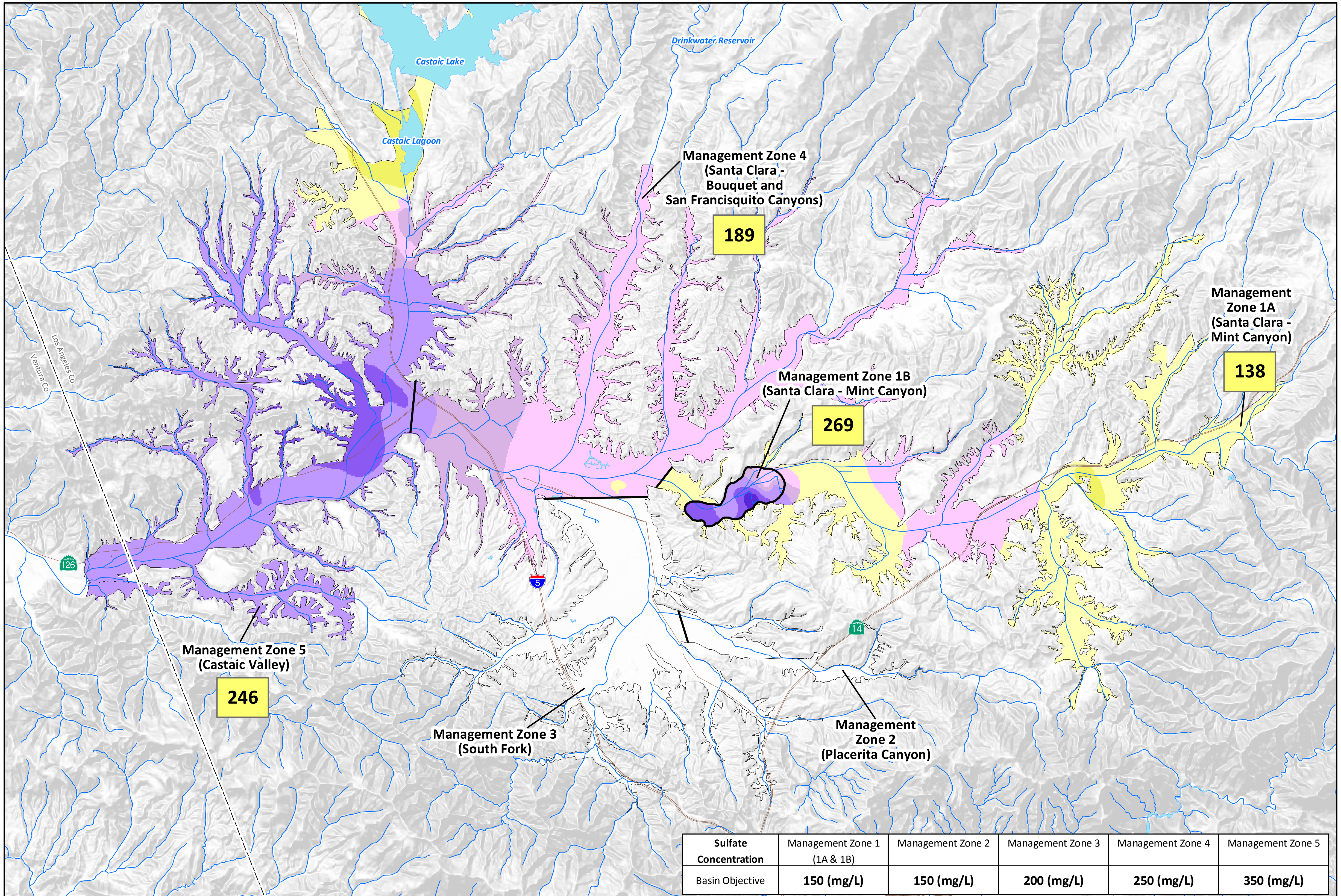
Figure 12c

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_12c_Nitrate_alluvial_12-16.mxd

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

AVERAGE SULFATE CONCENTRATION ALLUVIAL AQUIFER 2001 - 2011



Sulfate Concentration	Management Zone 1 (1A & 1B)	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5
Basin Objective	150 (mg/L)	150 (mg/L)	200 (mg/L)	250 (mg/L)	350 (mg/L)

EXPLANATION

Sulfate Concentration (mg/L)

- <50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- 250 - 300
- 300 - 350
- >350

246 Management Zone Average Sulfate Concentration (mg/L)

NOTE: No Data was available in Management Zones 2 and 3 for the time period 2001 - 2011.

Boundary Between Adjacent Management Zones

NORTH

0 1 2 4 Miles

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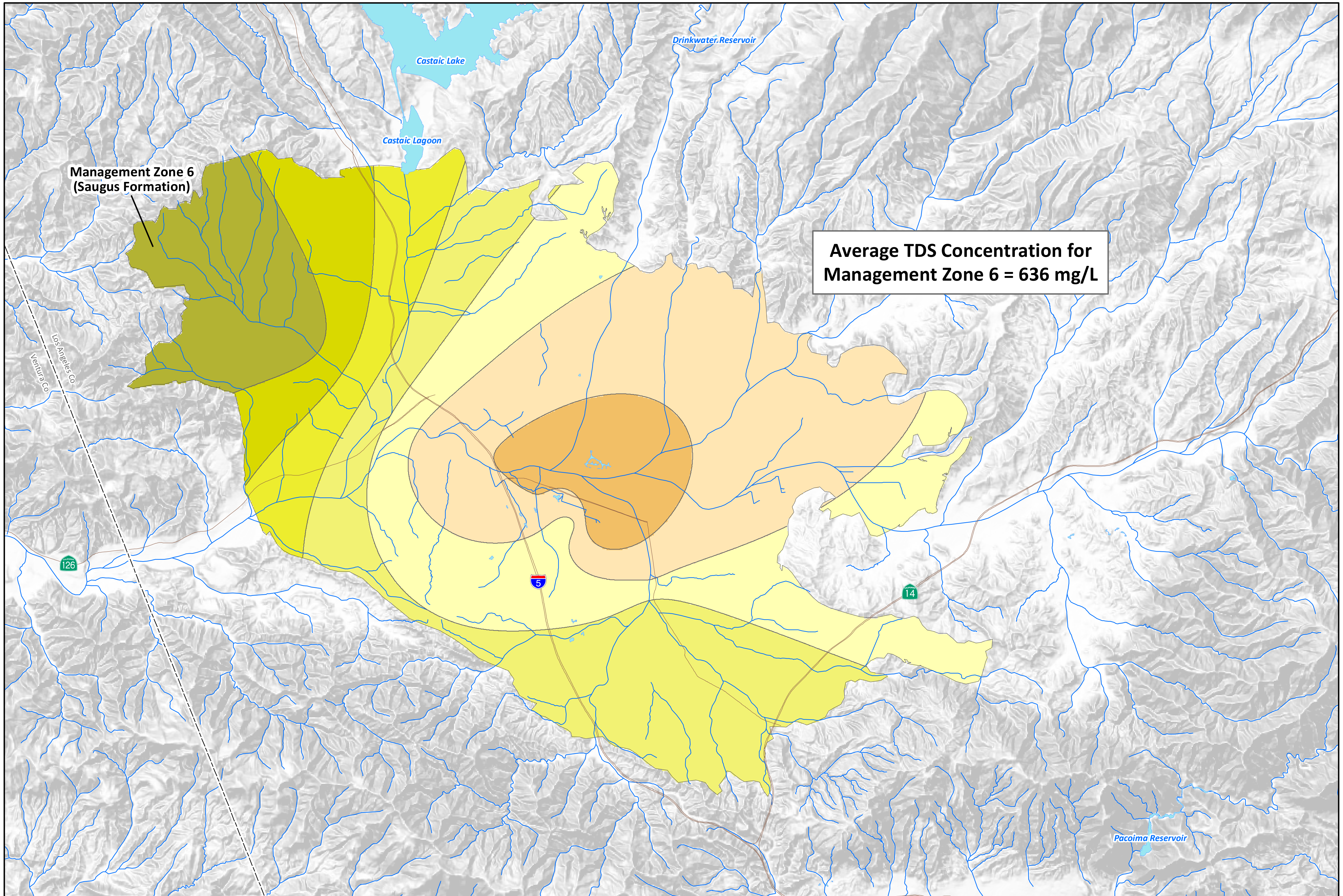
Figure 12d

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_12d_Sulfate_alluvial_12-16.mxd

AVERAGE TDS CONCENTRATION MANAGEMENT ZONE 6 (SAUGUS FORMATION) 2001 - 2011



EXPLANATION

TDS Concentration (mg/L)

- <300
- 300 - 400
- 400 - 500
- 500 - 600
- 600 - 700
- 700 - 800
- 800 - 900

NORTH

0 1 2 4 Miles

8-Dec-16

Prepared by: DB. Map Projection: State Plane 1983, Zone V.

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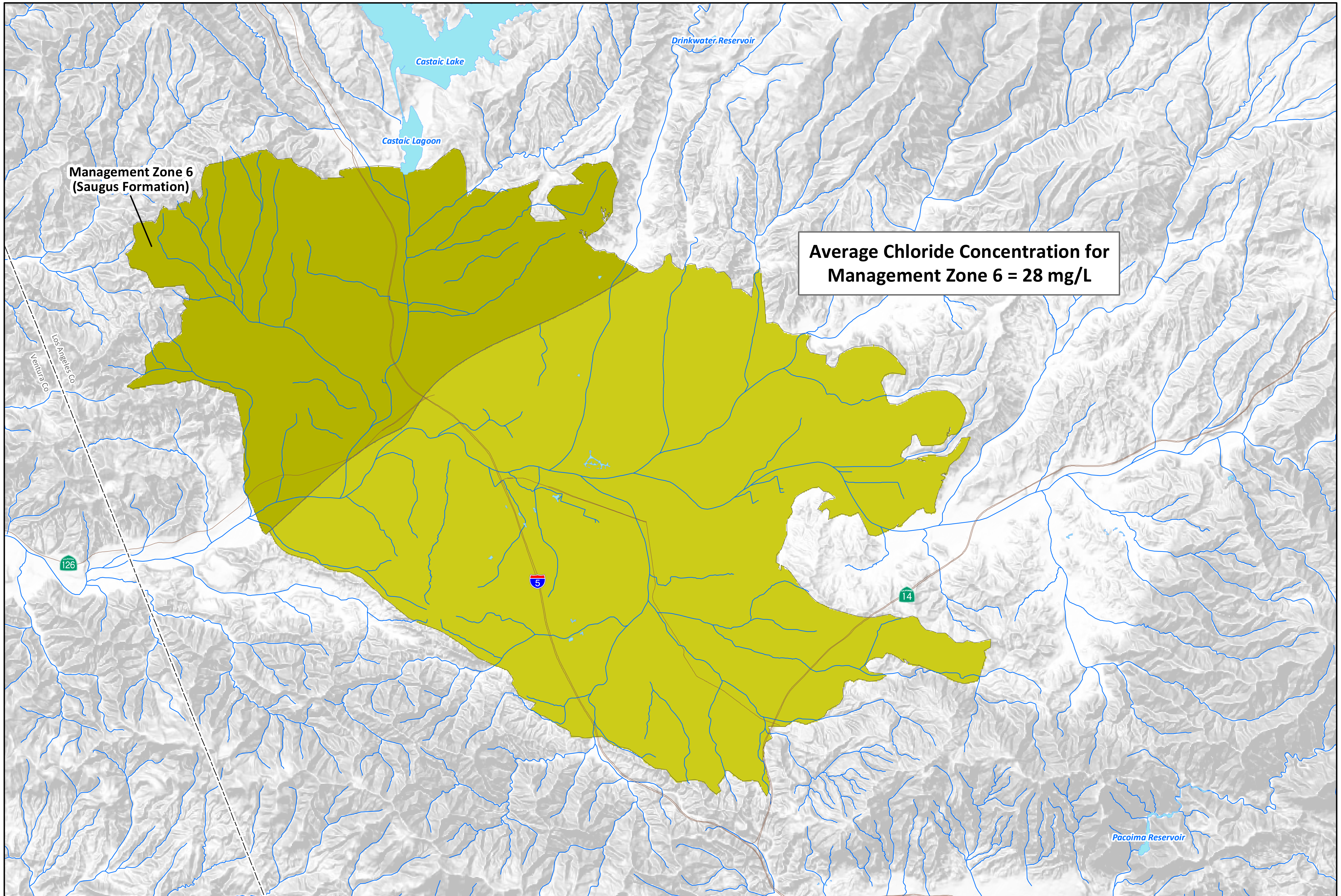
Figure 13a

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

AVERAGE CHLORIDE CONCENTRATION MANAGEMENT ZONE 6 (SAUGUS FORMATION) 2001 - 2011



EXPLANATION

Chloride Concentration (mg/L)

- <25
- 25 - 50

8-Dec-16

Prepared by: DB.   Map Projection: State Plane 1983, Zone V.

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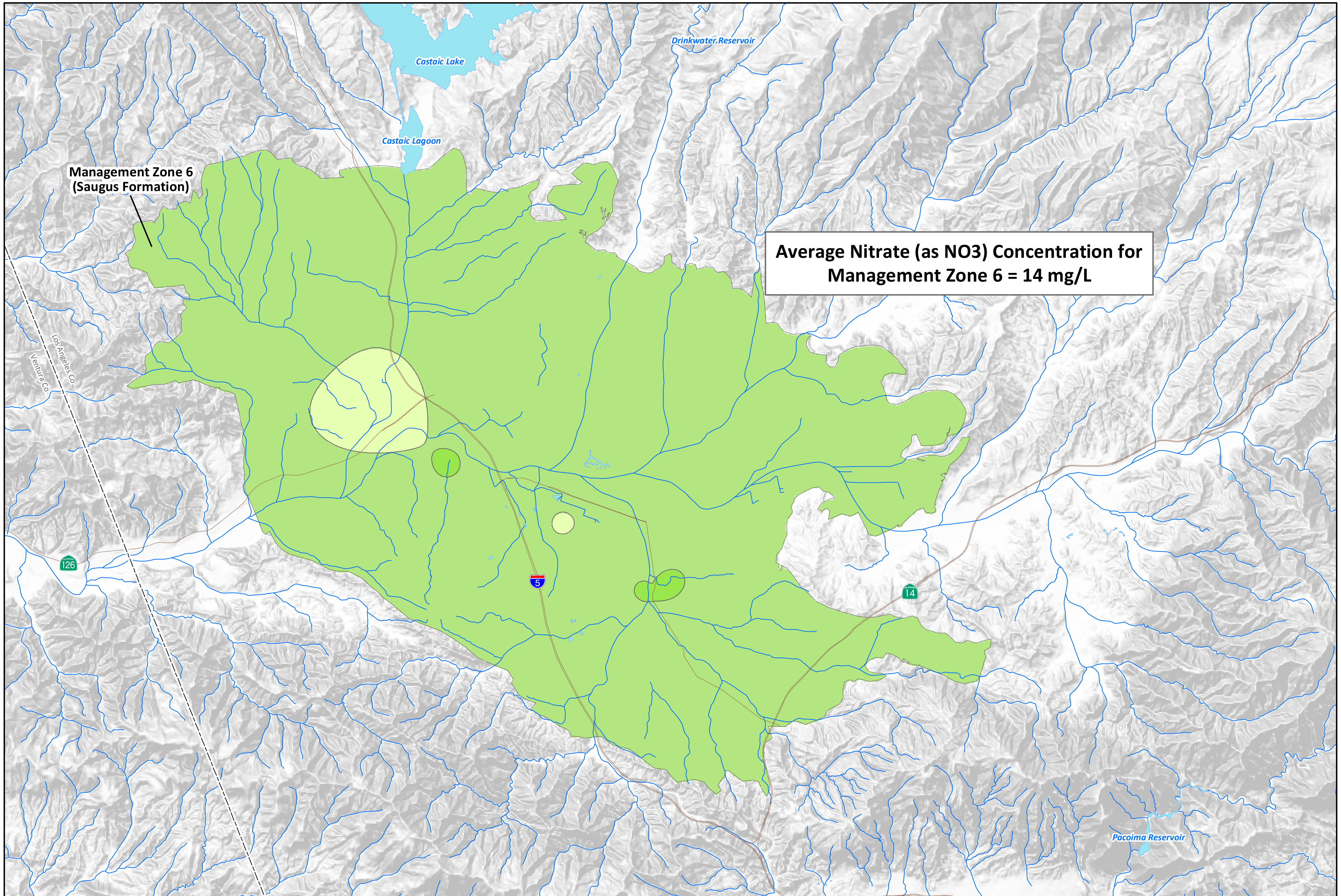
Figure 13b

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_13b_Chloride_saugus_12-16.mxd

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

AVERAGE NITRATE (AS NO3) CONCENTRATION MANAGEMENT ZONE 6 (SAUGUS FORMATION) 2001 - 2011



EXPLANATION

Nitrate (as NO3) Concentration (mg/L)

- 0 - 10
- 10 - 20
- 20 - 30

8-Dec-16

Prepared by: DB. Map Projection: State Plane 1983, Zone V.

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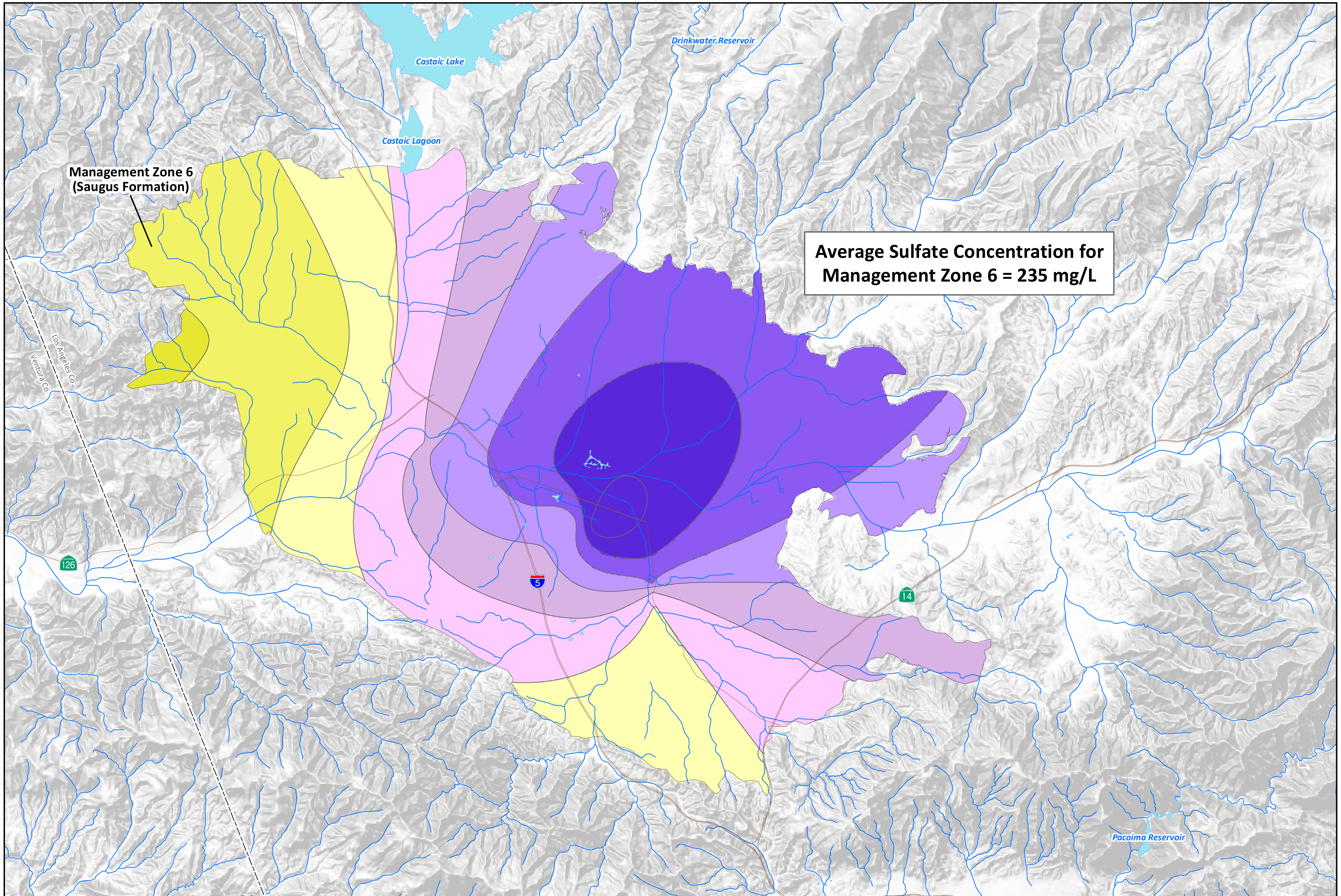
Figure 13c

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_13c_Nitrate_saugus_12-16.mxd

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

AVERAGE SULFATE CONCENTRATION MANAGEMENT ZONE 6 (SAUGUS FORMATION) 2001 - 2011



EXPLANATION

Sulfate Concentration (mg/L)

<50
50 - 100
100 - 150
150 - 200
200 - 250
250 - 300
300 - 350
>350

NORTH

0 1 2 4 Miles

8-Dec-16

Prepared by: DB. Map Projection: State Plane 1983, Zone V.

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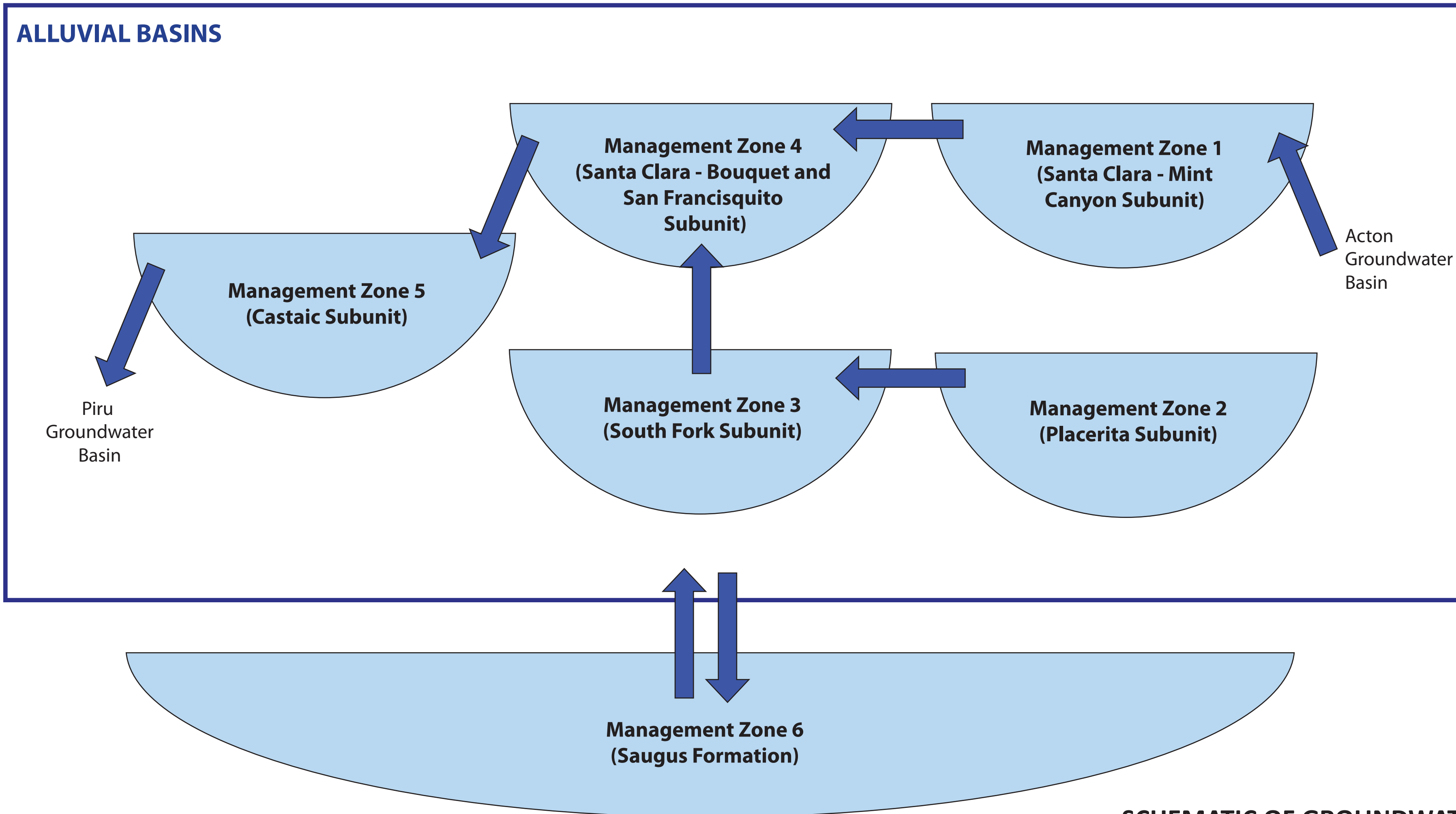
Figure 13d

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_13d_Sulfate_saugus_12-16.mxd

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SCHEMATIC OF GROUNDWATER FLOW BETWEEN MANAGEMENT ZONES

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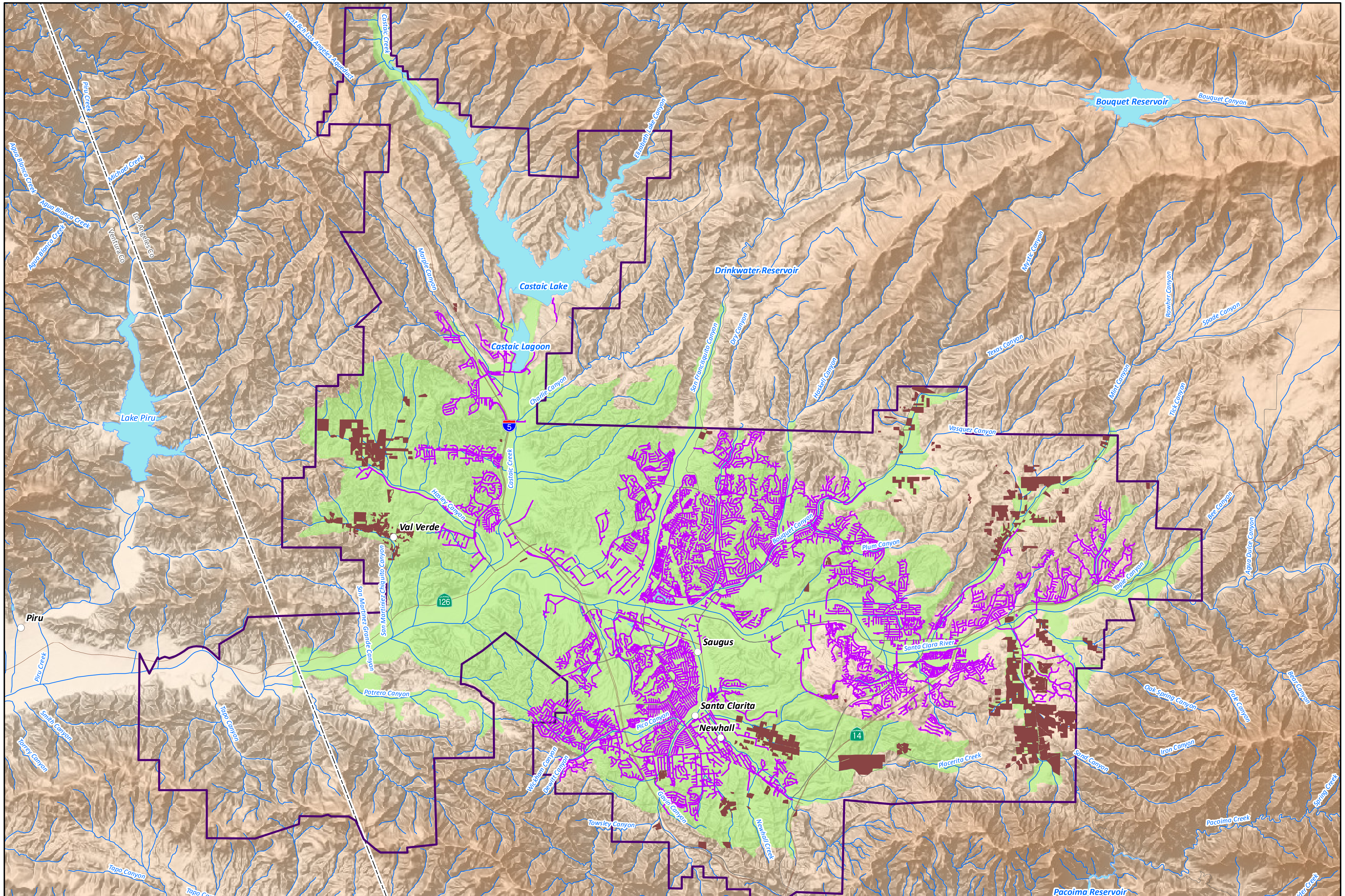
Figure 14

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SEWER LINES AND AREAS OF ASSUMED SEPTIC TANK USE

EXPLANATION

- Castaic Lake Water Agency Boundary
- Santa Clara River Valley East Groundwater Subbasin
- Sewer Line
- Area of Assumed Septic Tank Use

NOTE: Derived from 2008 SCAG Residential and Commercial Land Use

NORTH

0 1 2 4 Miles

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Prepared by: DB. Map Projection: State Plane 1983, Zone V.

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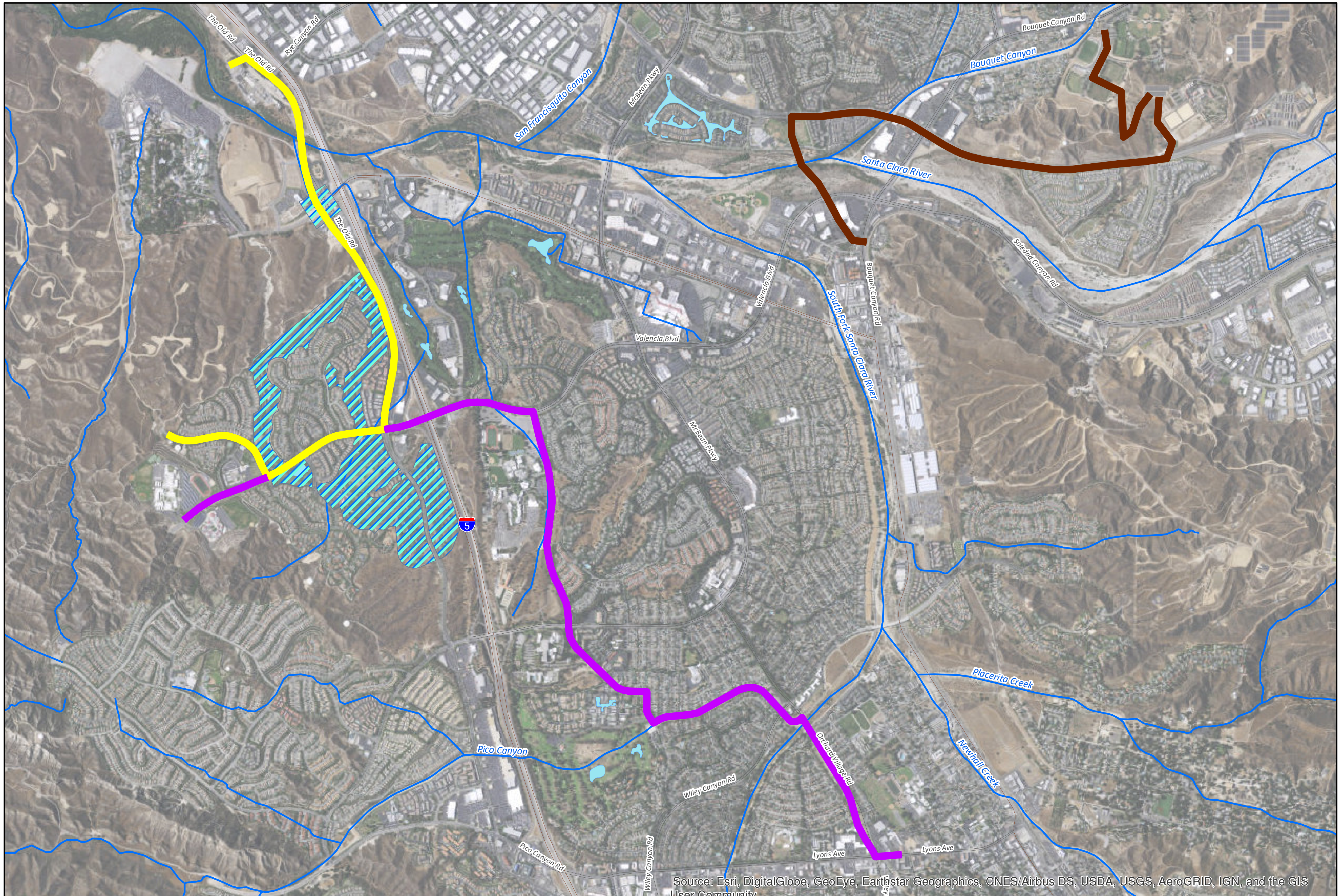
Figure 15

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_15_sewers_12-16.mxd

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

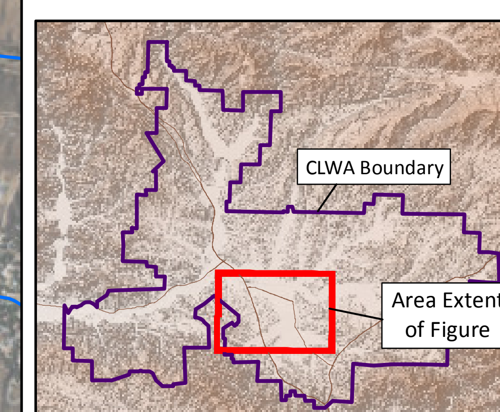
RECYCLED WATER USE: AREA AND PROPOSED RECYCLED WATER INFRASTRUCTURE



EXPLANATION

- Existing Recycled Water Infrastructure
- Proposed Phase 2A - Recycled Water Infrastructure
- Proposed Phase 2C - Recycled Water Infrastructure
- Current Areas of Recycled Water Use

Source: Figure 4-2, 2010 UWMP.



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NORTH

0 2,500 5,000 Feet

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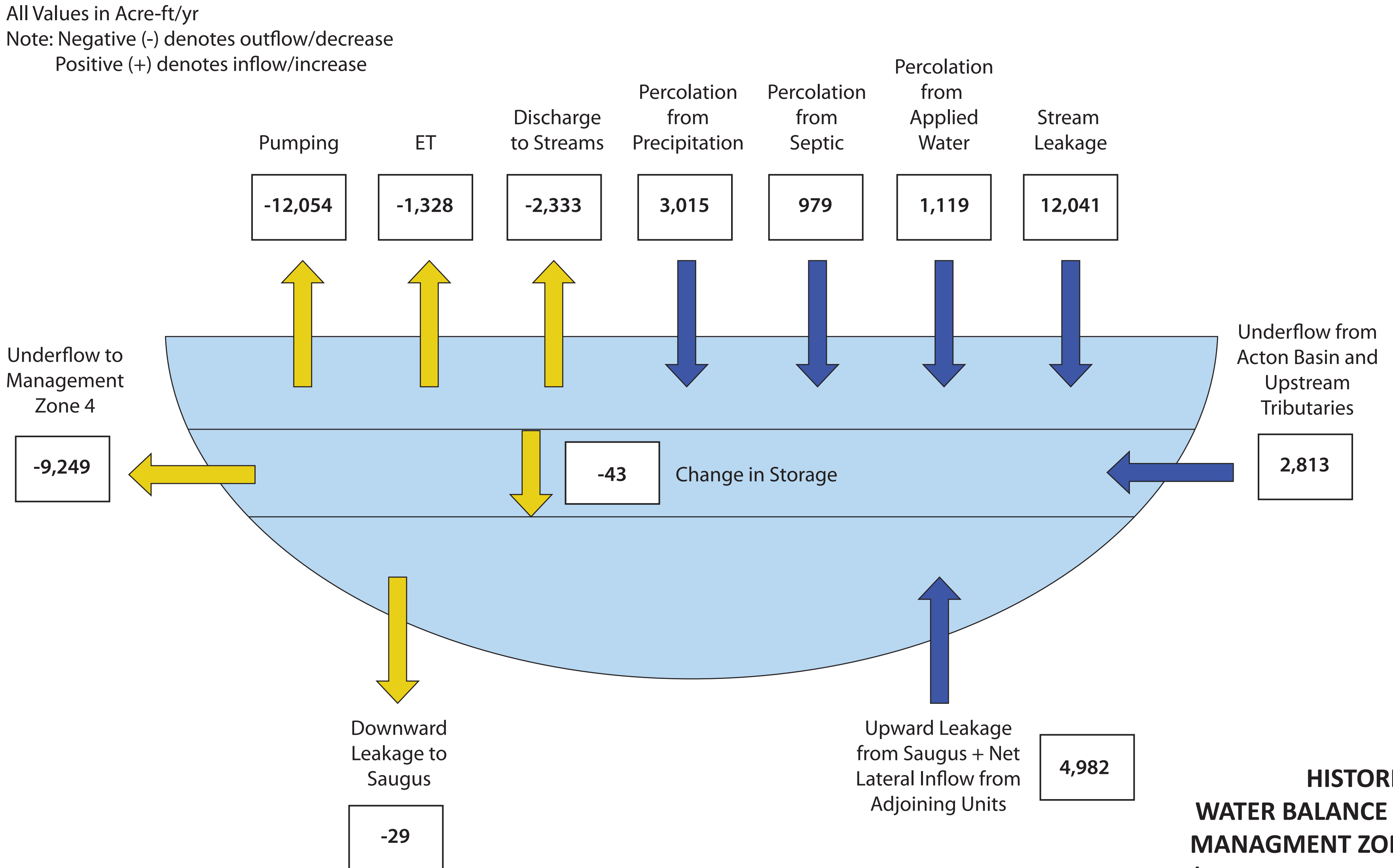
Figure 16

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_16_recycled_water_infrastructure_12-16.mxd



HISTORICAL WATER BALANCE FOR MANAGMENT ZONE 1 (SANTA CLARA - MINT CANYON SUBUNIT) 2001-2011

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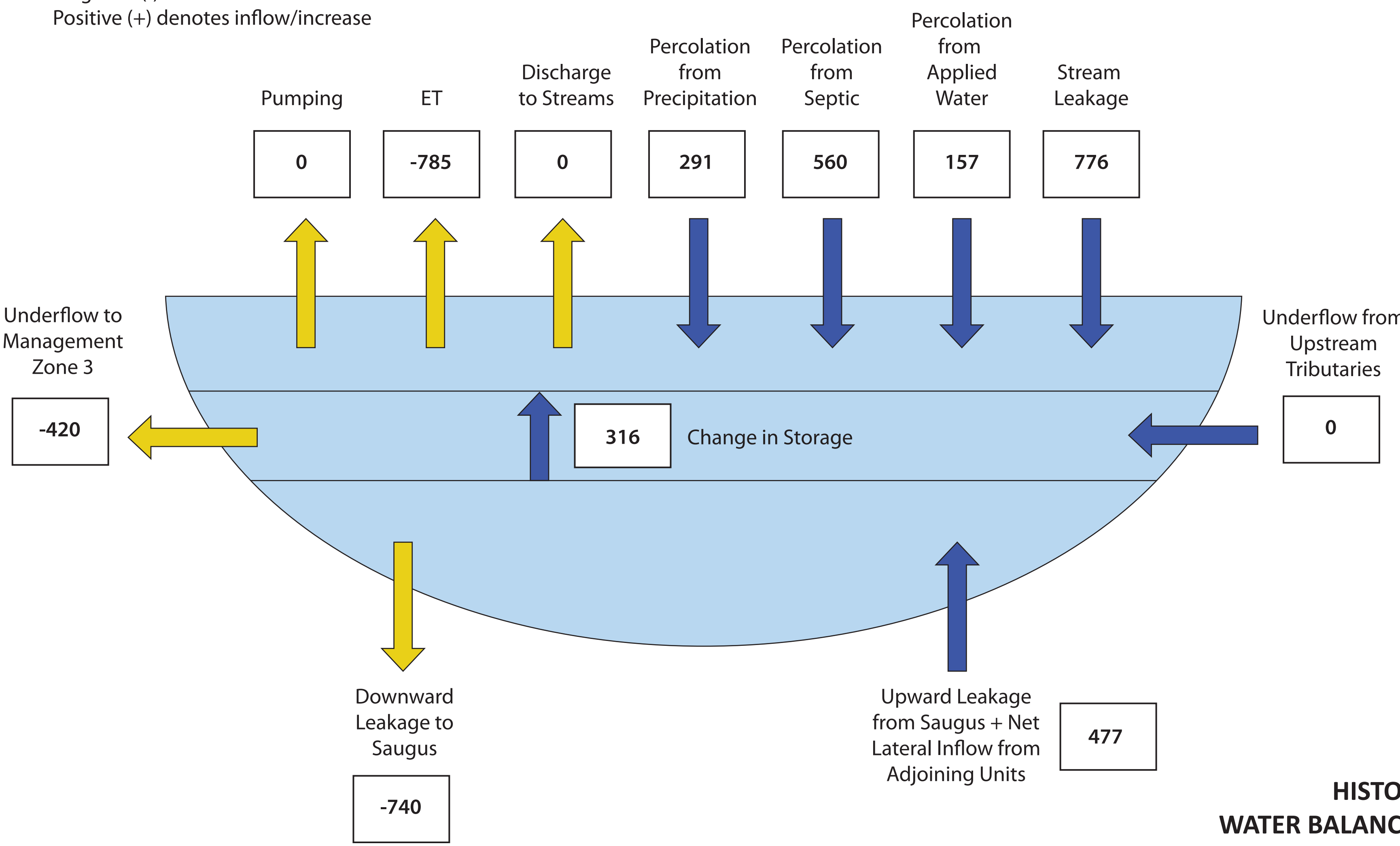
Figure 17a

All Values in Acre-ft/yr
Note: Negative (-) denotes outflow/decrease
Positive (+) denotes inflow/increase



HISTORICAL WATER BALANCE FOR MANAGMENT ZONE 2 (PLACERITA SUBUNIT) 2001-2011

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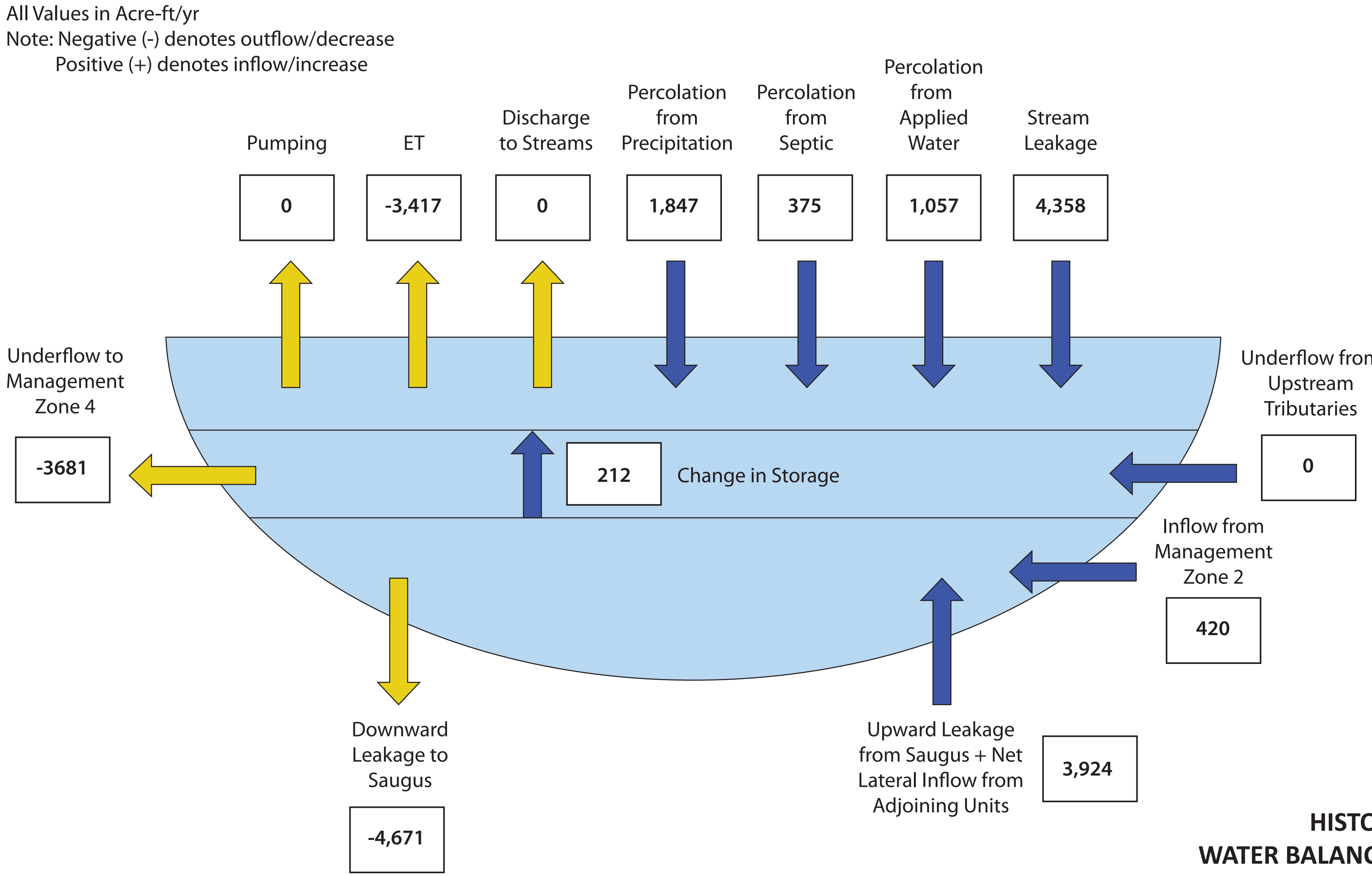
Figure 17b



HISTORICAL WATER BALANCE FOR MANAGMENT ZONE 3 (SOUTH FORK SUBUNIT) 2001-2011

Figure 17c

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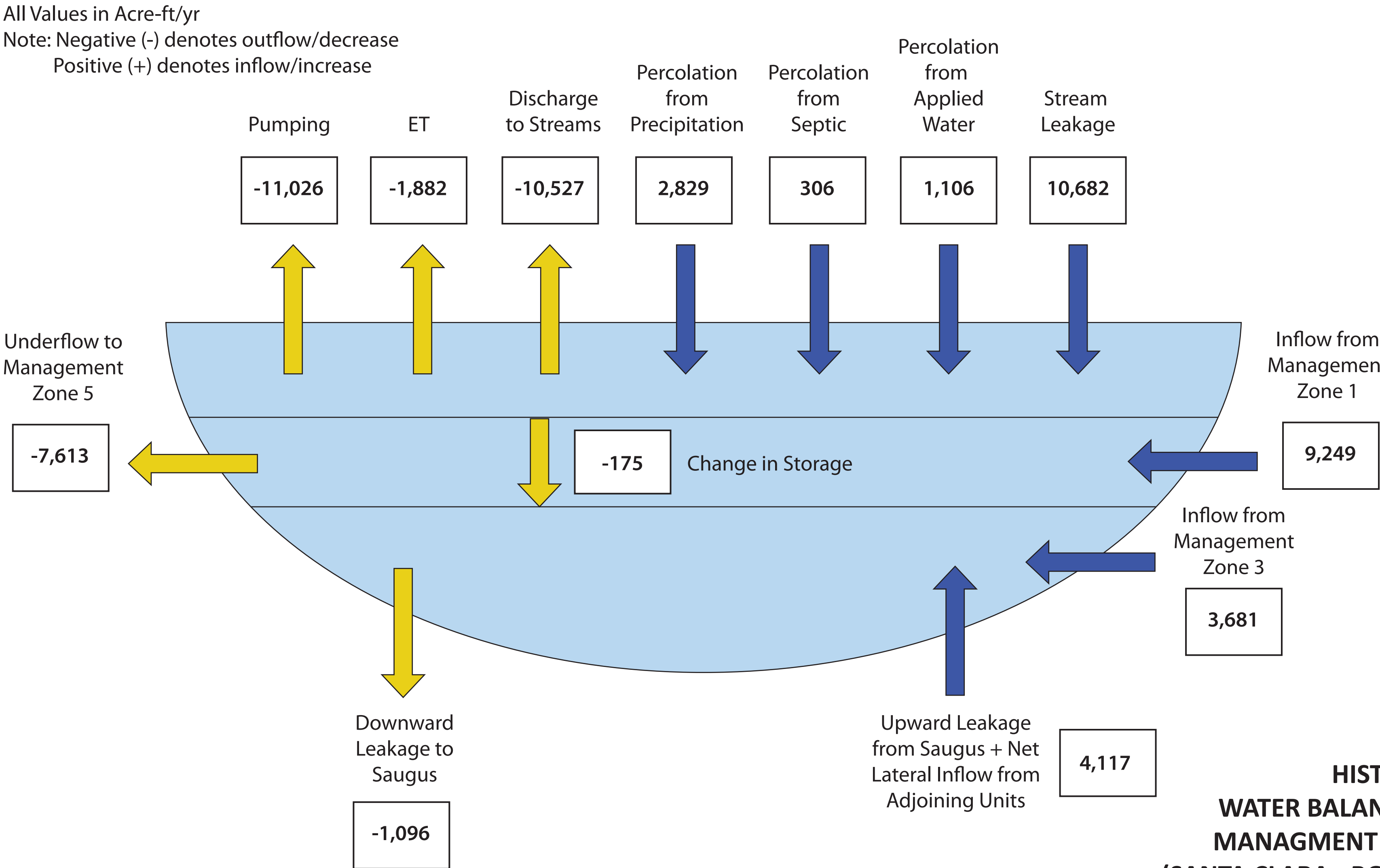

HISTORICAL WATER BALANCE FOR MANAGMENT ZONE 4 (SANTA CLARA - BOUQUET AND SAN FRANCISQUITO CANYON SUBUNIT) 2001-2011

Figure 17d

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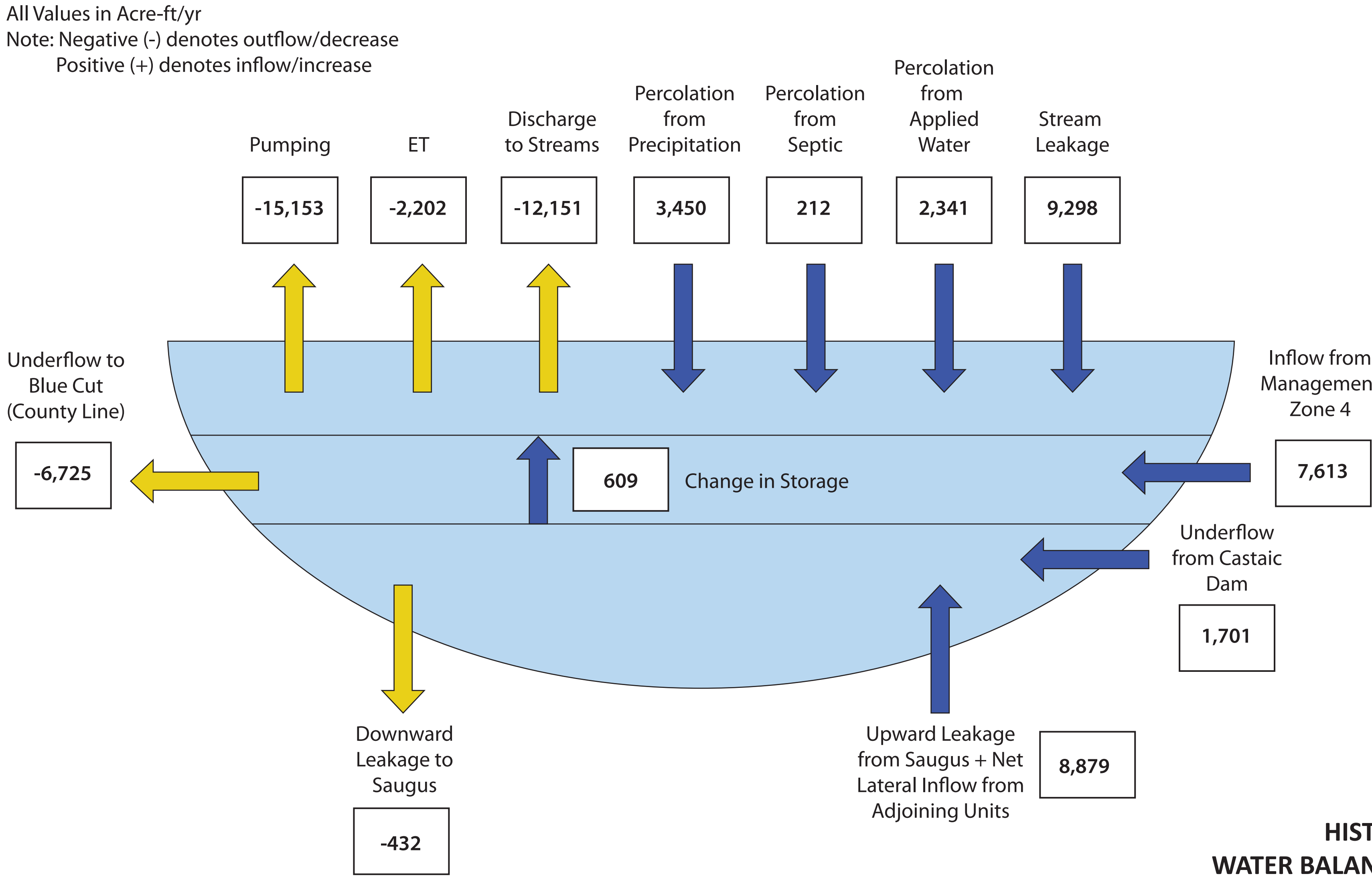

HISTORICAL WATER BALANCE FOR MANAGMENT ZONE 5 (CASTAIC SUBUNIT) 2001-2011

Figure 17e

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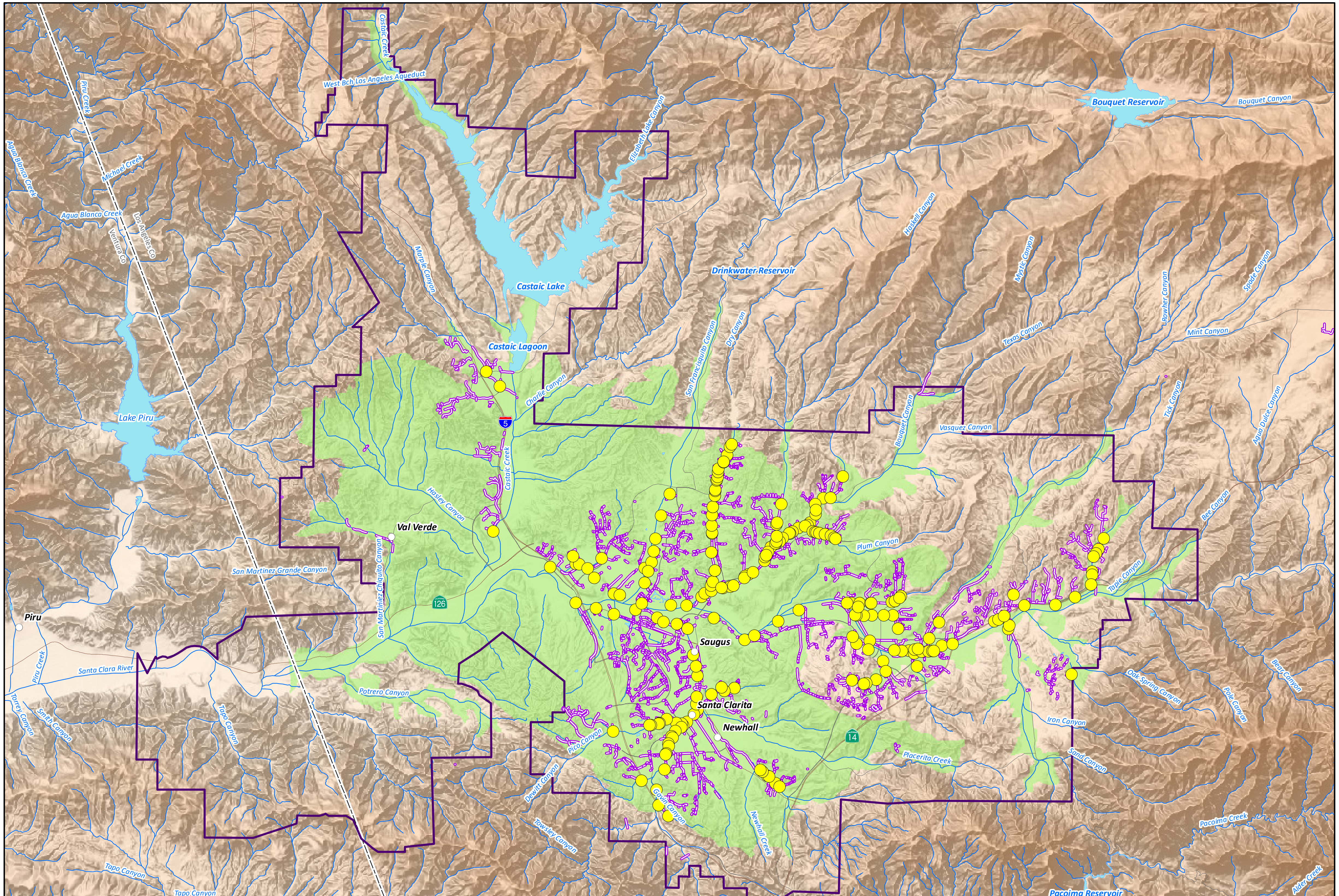
CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN



STORMWATER INFRASTRUCTURE SCR VALLEY EAST SUBBASIN

EXPLANATION

- Castaic Lake Water Agency Boundary
- Santa Clara River Valley East Groundwater Subbasin
- Storm Drain
- Stormwater Outfall Location

NORTH

0 1 2 4 Miles

8-Dec-16

Prepared by: DB. Map Projection: State Plane 1983, Zone V.

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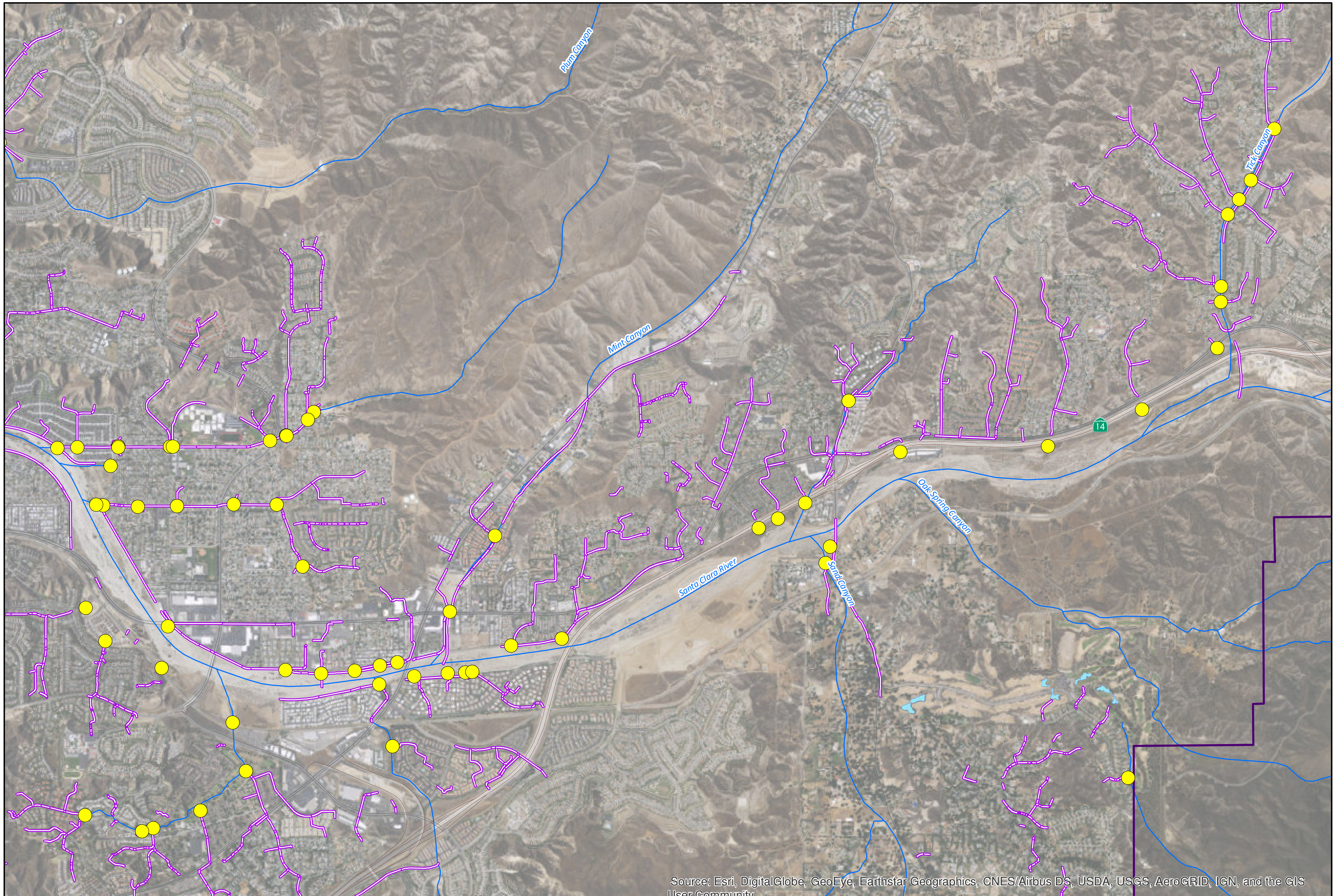
Figure 18a

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_18a_stormwater_12-16.mxd

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

STORMWATER INFRASTRUCTURE EASTERN PORTION OF SCR VALLEY EAST SUBBASIN

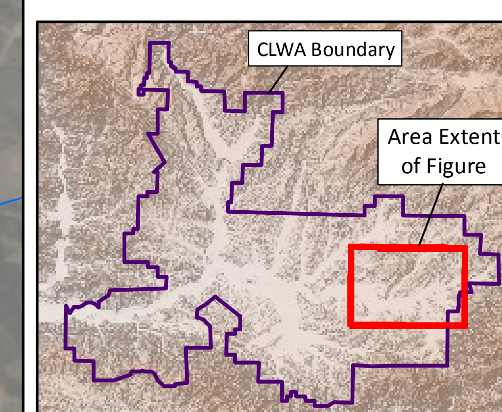


EXPLANATION

Castaic Lake Water Agency Boundary

Storm Drain

Stormwater Outfall Location



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NORTH

0 2,500 5,000 Feet

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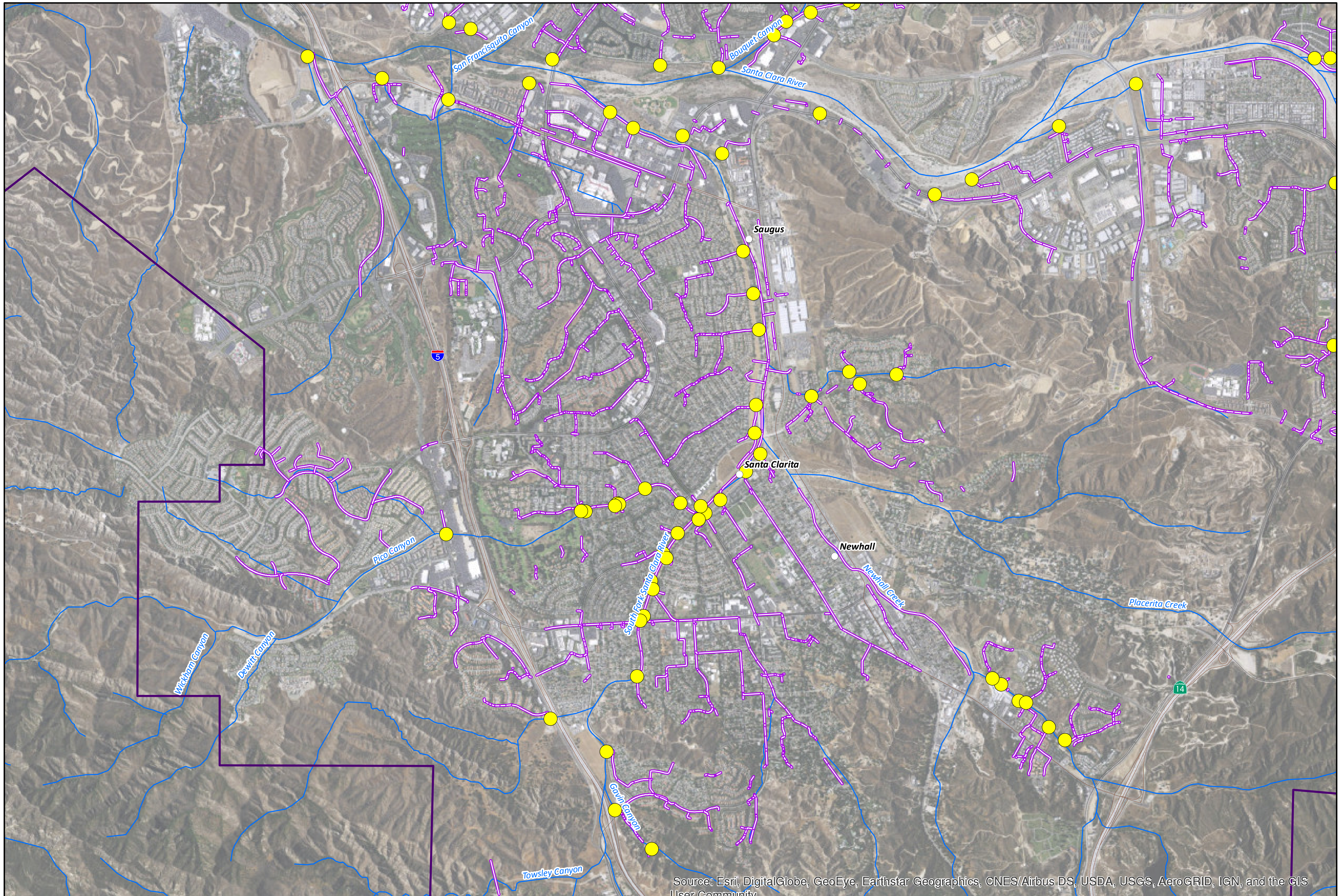
Figure 18b

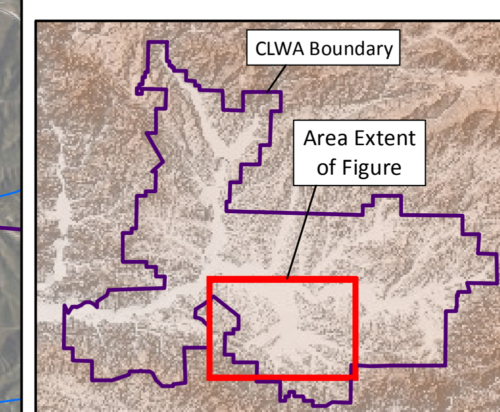
GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_18b_east_stormwater_12-16.mxd

STORMWATER INFRASTRUCTURE SOUTHERN PORTION OF SCR VALLEY EAST SUBBASIN



EXPLANATION

- Castaic Lake Water Agency Boundary
- Storm Drain
- Stormwater Outfall Location



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NORTH

0 3,200 6,400 Feet

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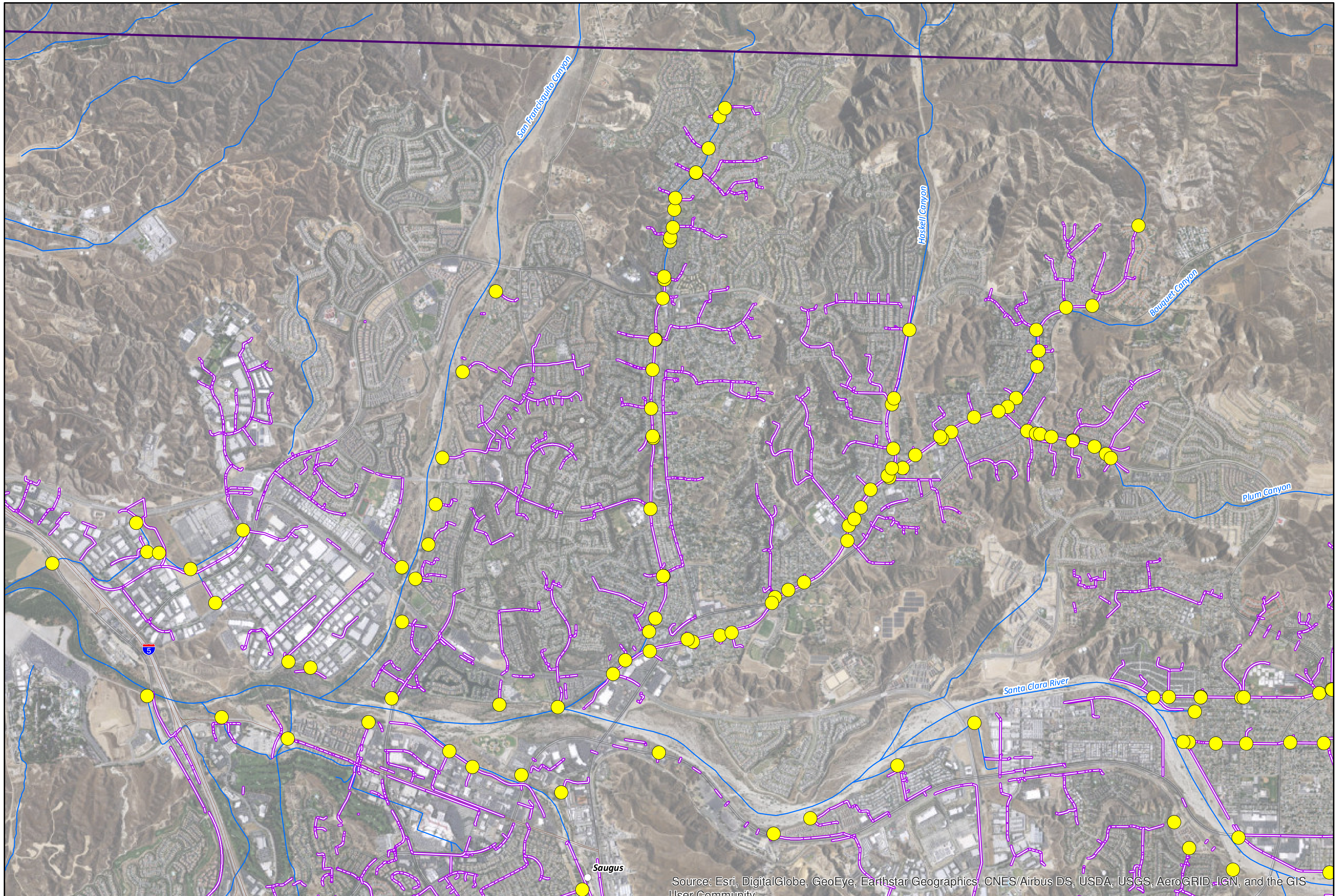
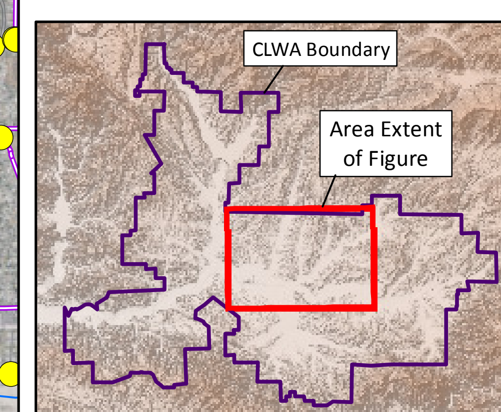
Figure 18c

STORMWATER INFRASTRUCTURE CENTRAL PORTION OF SCR VALLEY EAST SUBBASIN



EXPLANATION

- Castaic Lake Water Agency Boundary
- Storm Drain
- Stormwater Outfall Location



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NORTH

0 3,200 6,400 Feet

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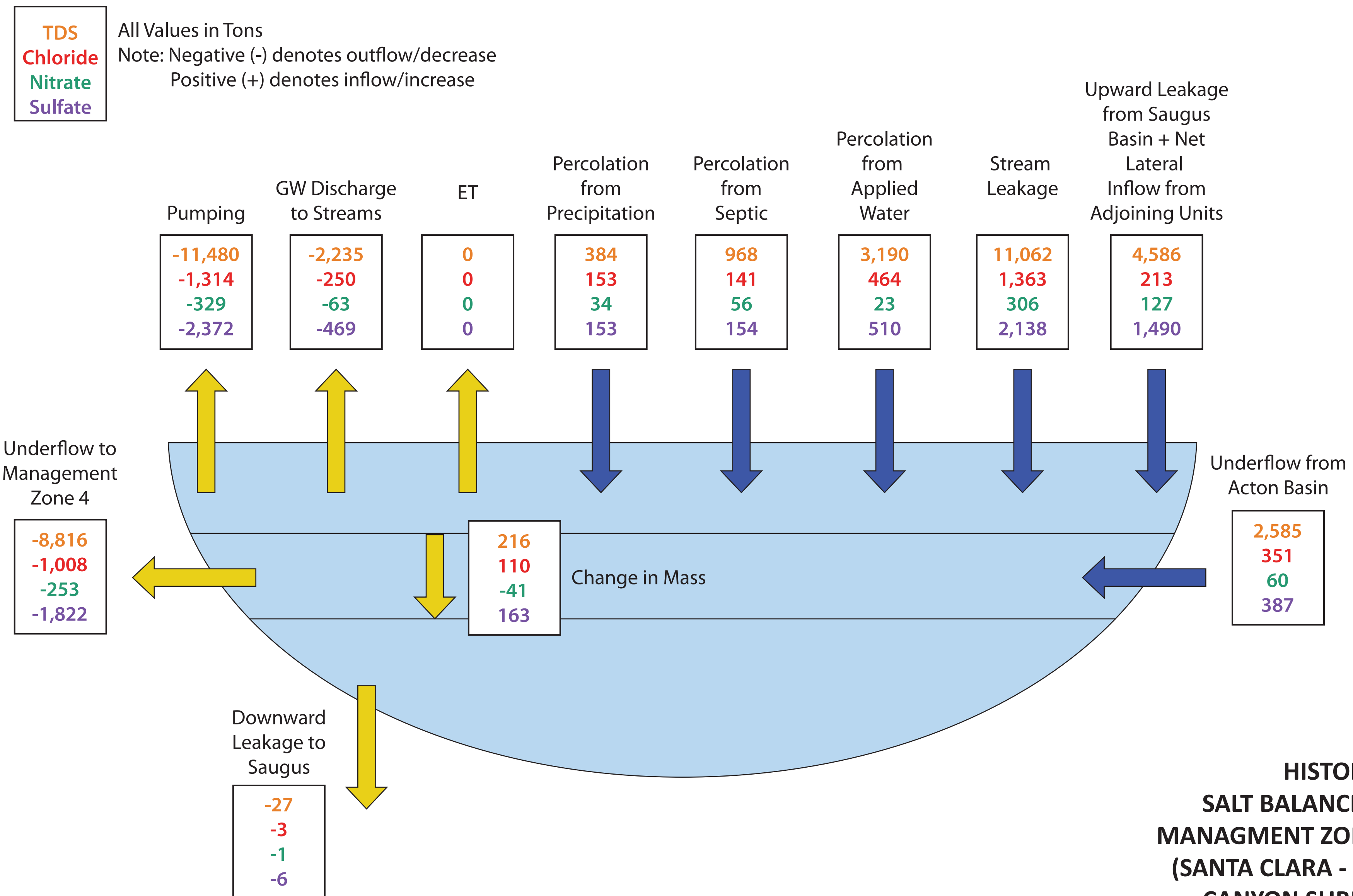
Figure 18d

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN - SANTA CLARA RIVER VALLEY EAST SUBBASIN



HISTORICAL SALT BALANCE FOR MANAGMENT ZONE 1a (SANTA CLARA - MINT CANYON SUBUNIT) 2001-2011

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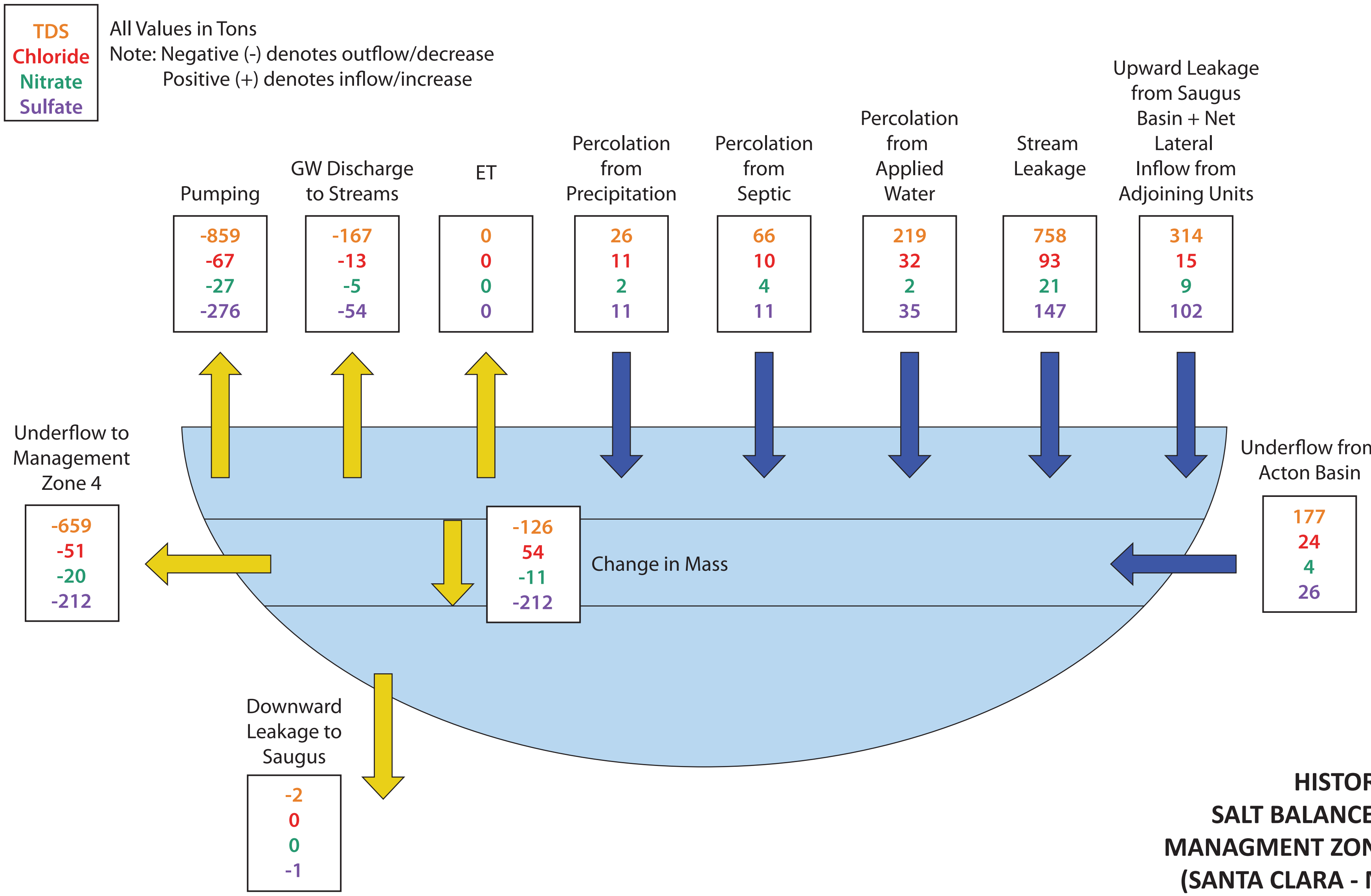
Figure 19a



HISTORICAL SALT BALANCE FOR MANAGMENT ZONE 1b (SANTA CLARA - MINT CANYON SUBUNIT) 2001-2011

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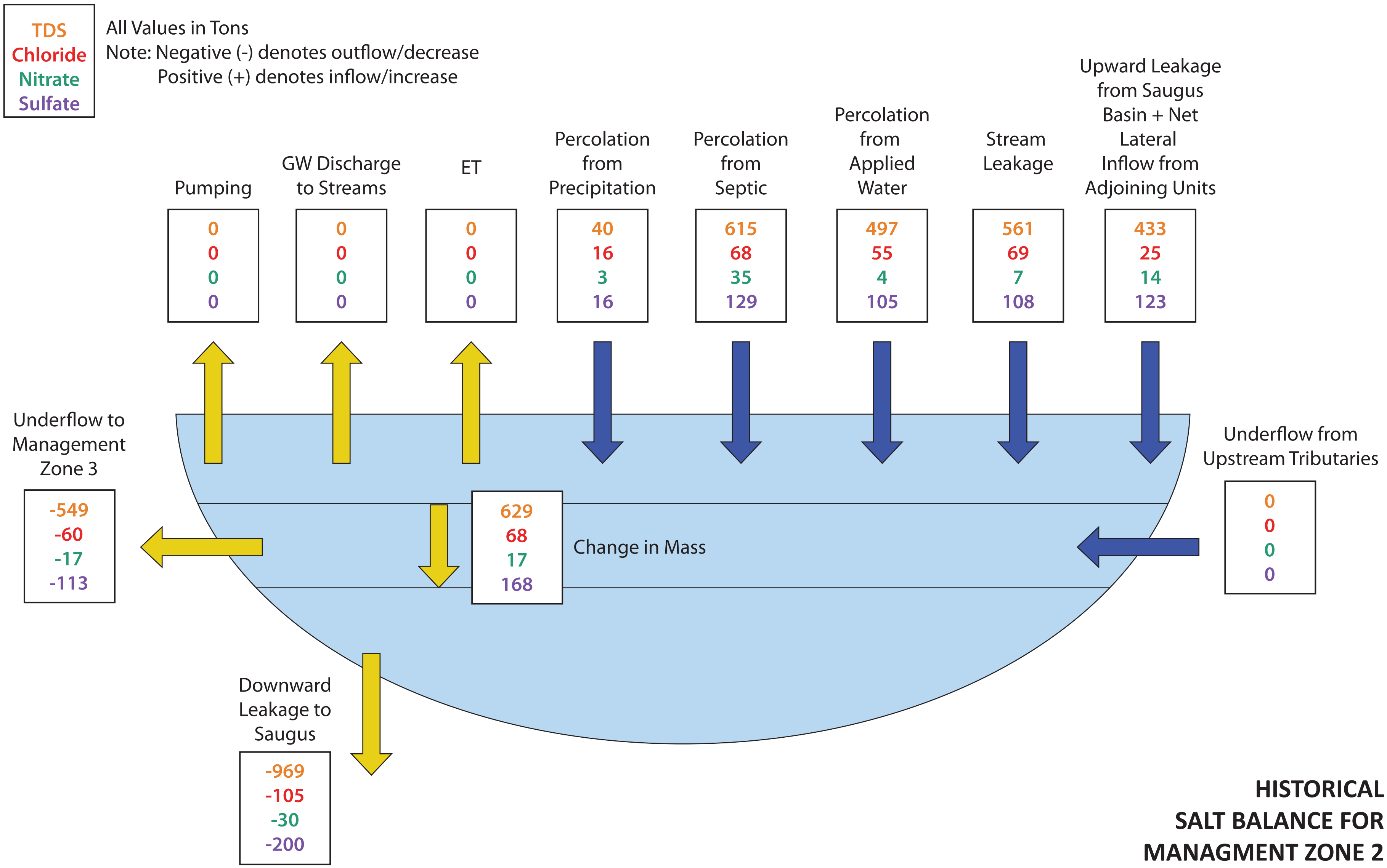
Figure 19b



HISTORICAL SALT BALANCE FOR MANAGMENT ZONE 2 (PLACERITA SUBUNIT) 2001-2011

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Figure 19c

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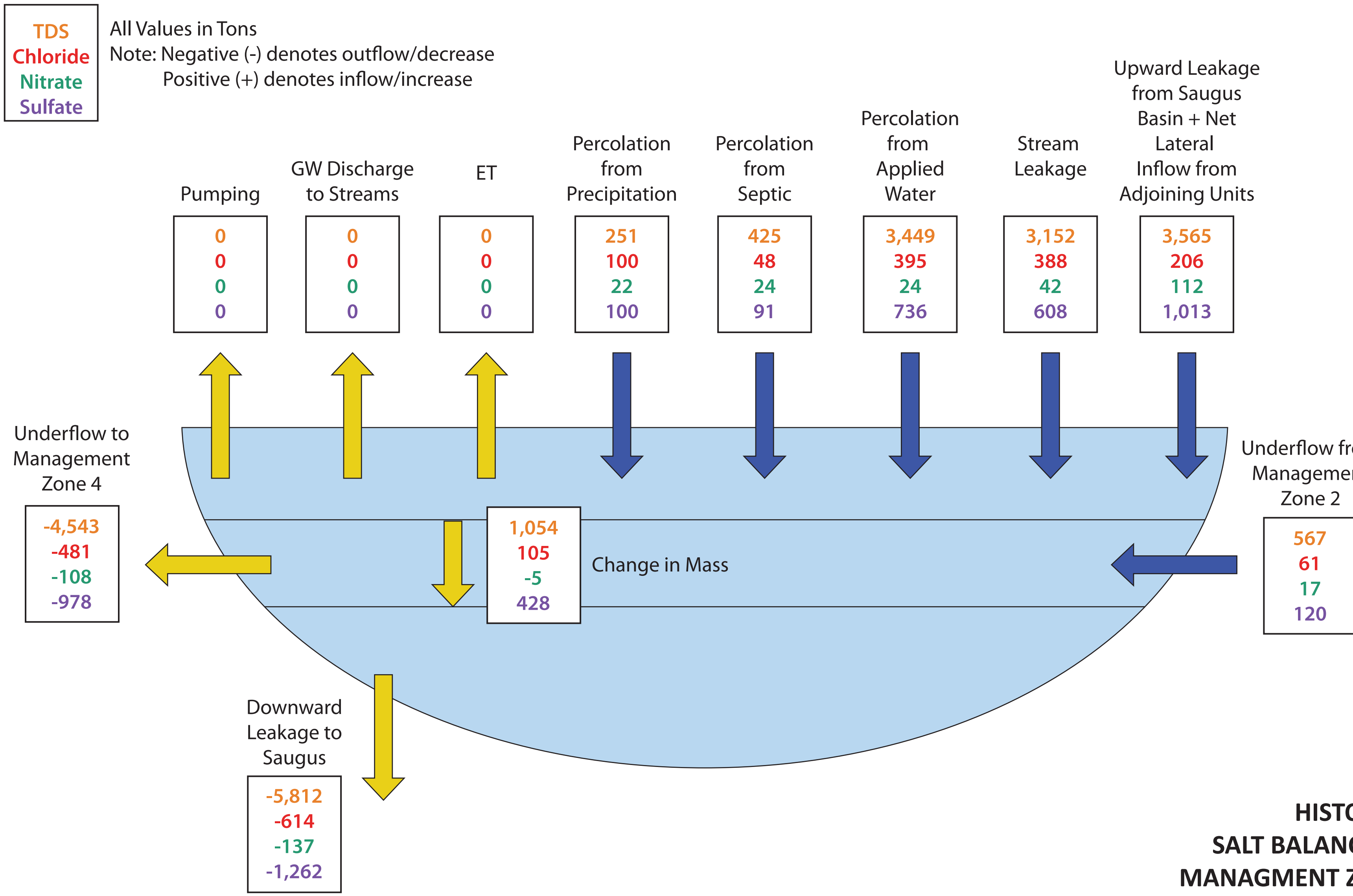
CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



HISTORICAL SALT BALANCE FOR MANAGMENT ZONE 3 (SOUTH FORK SUBUNIT) 2001-2011

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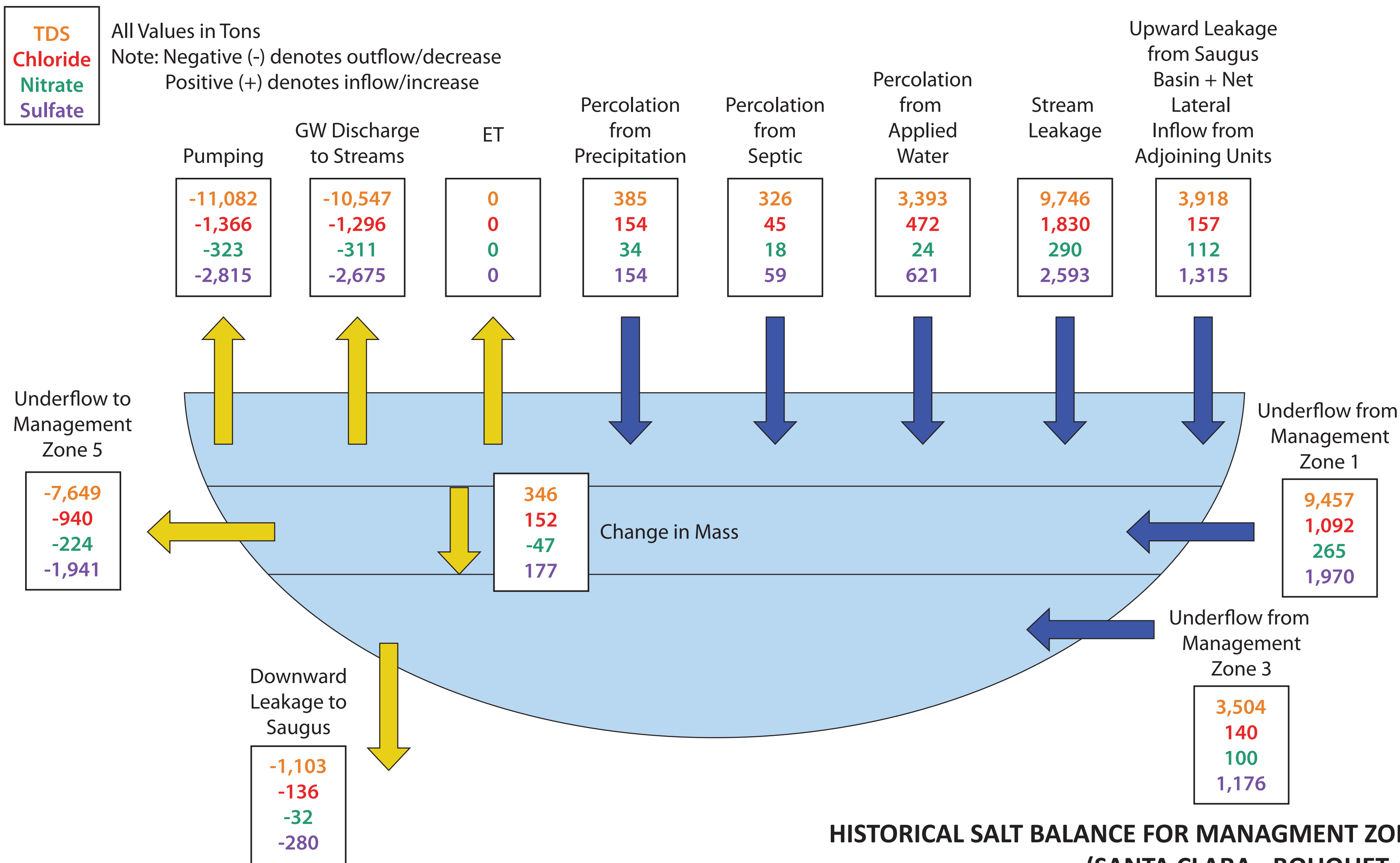
Figure 19d



HISTORICAL SALT BALANCE FOR MANAGMENT ZONE 4 (SANTA CLARA - BOUQUET AND SAN FRANCISQUITO CANYON SUBUNIT) 2001-2011

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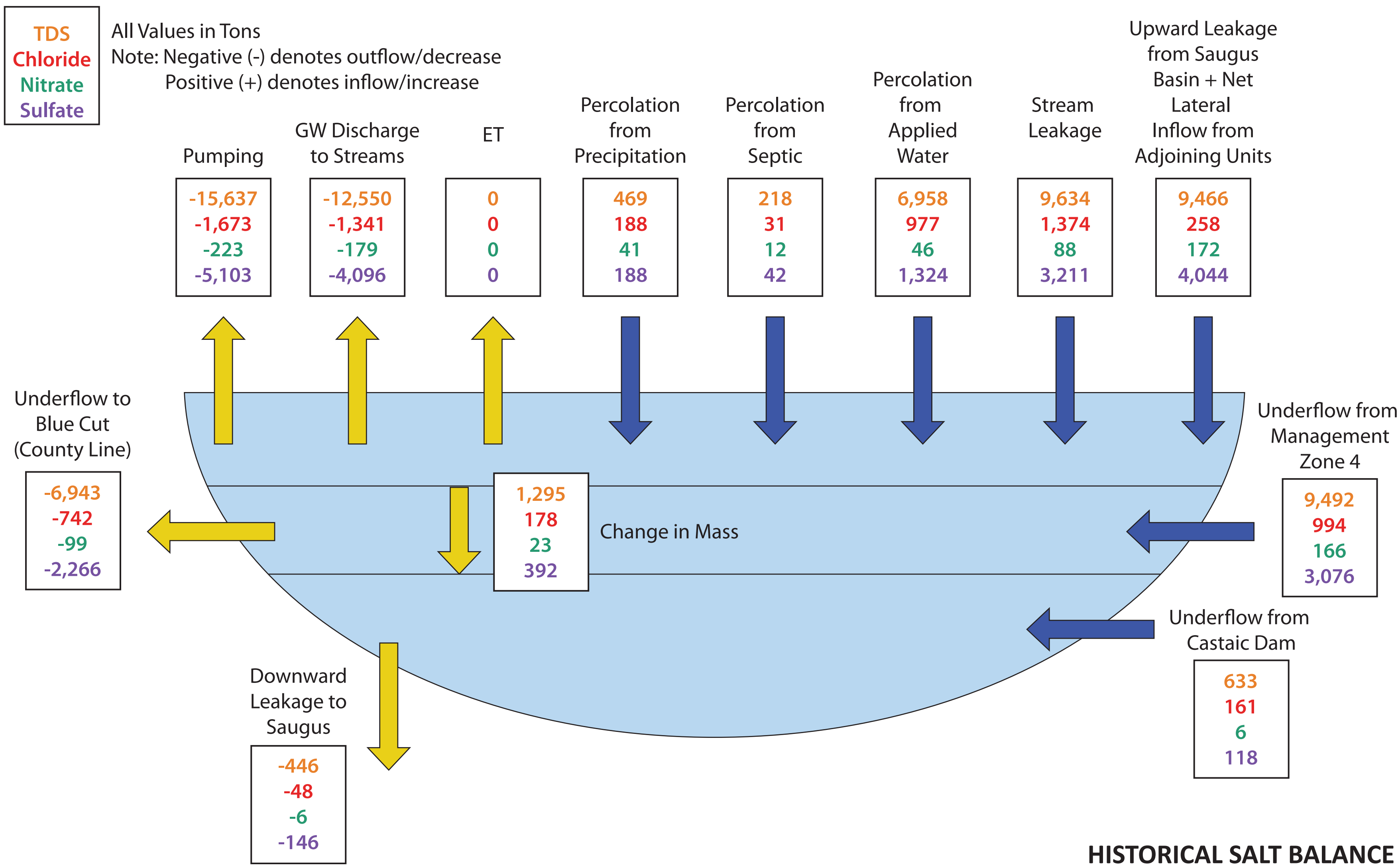
Figure 19e



HISTORICAL SALT BALANCE FOR MANAGMENT ZONE 5 (CASTAIC SUBUNIT) 2001-2011

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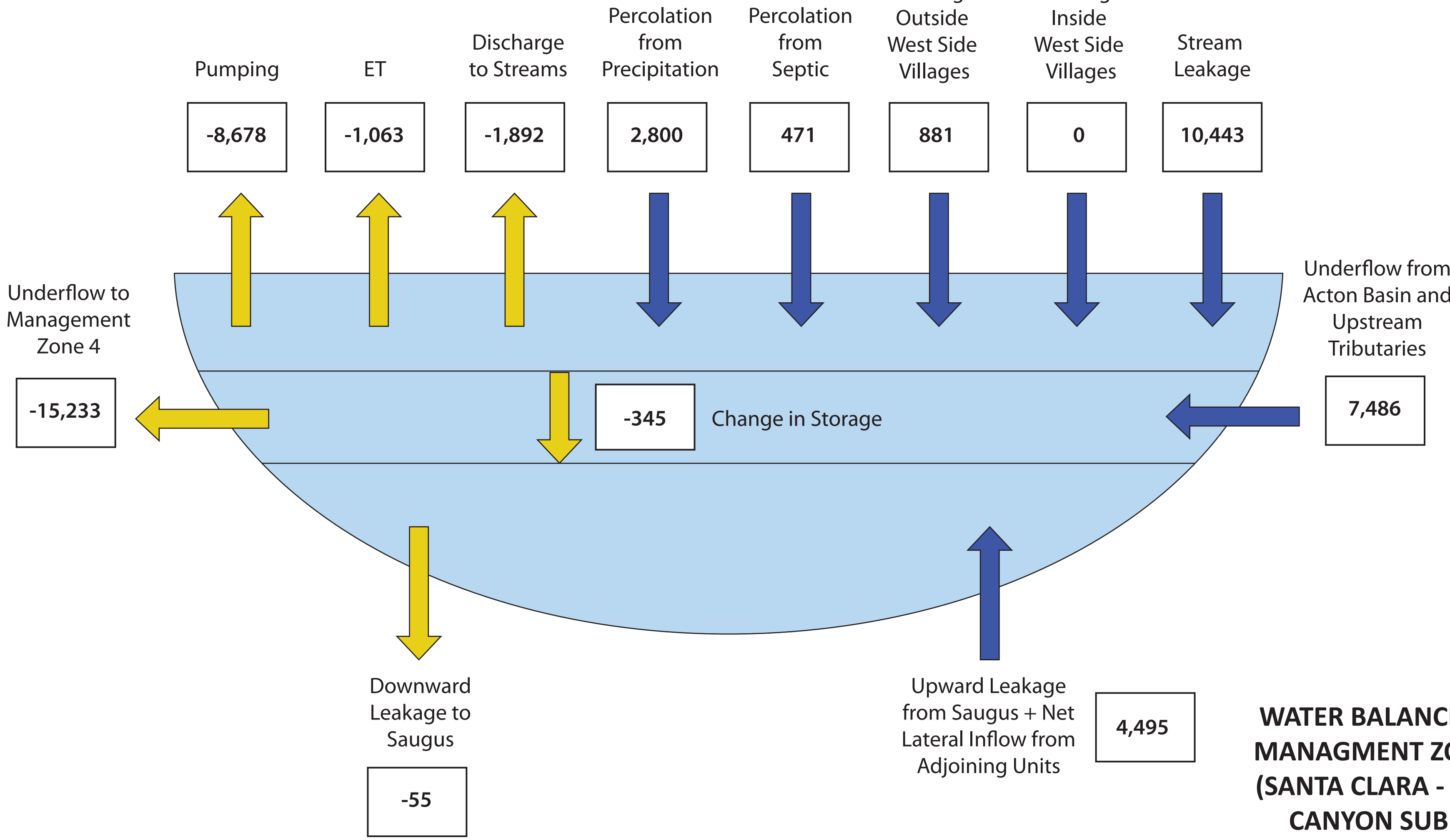
Figure 19f

All Values in Acre-ft/yr
Note: Negative (-) denotes outflow/decrease
Positive (+) denotes inflow/increase



WATER BALANCE FOR MANAGMENT ZONE 1 (SANTA CLARA - MINT CANYON SUBUNIT) LAND USE BUILD-OUT 2012-2035

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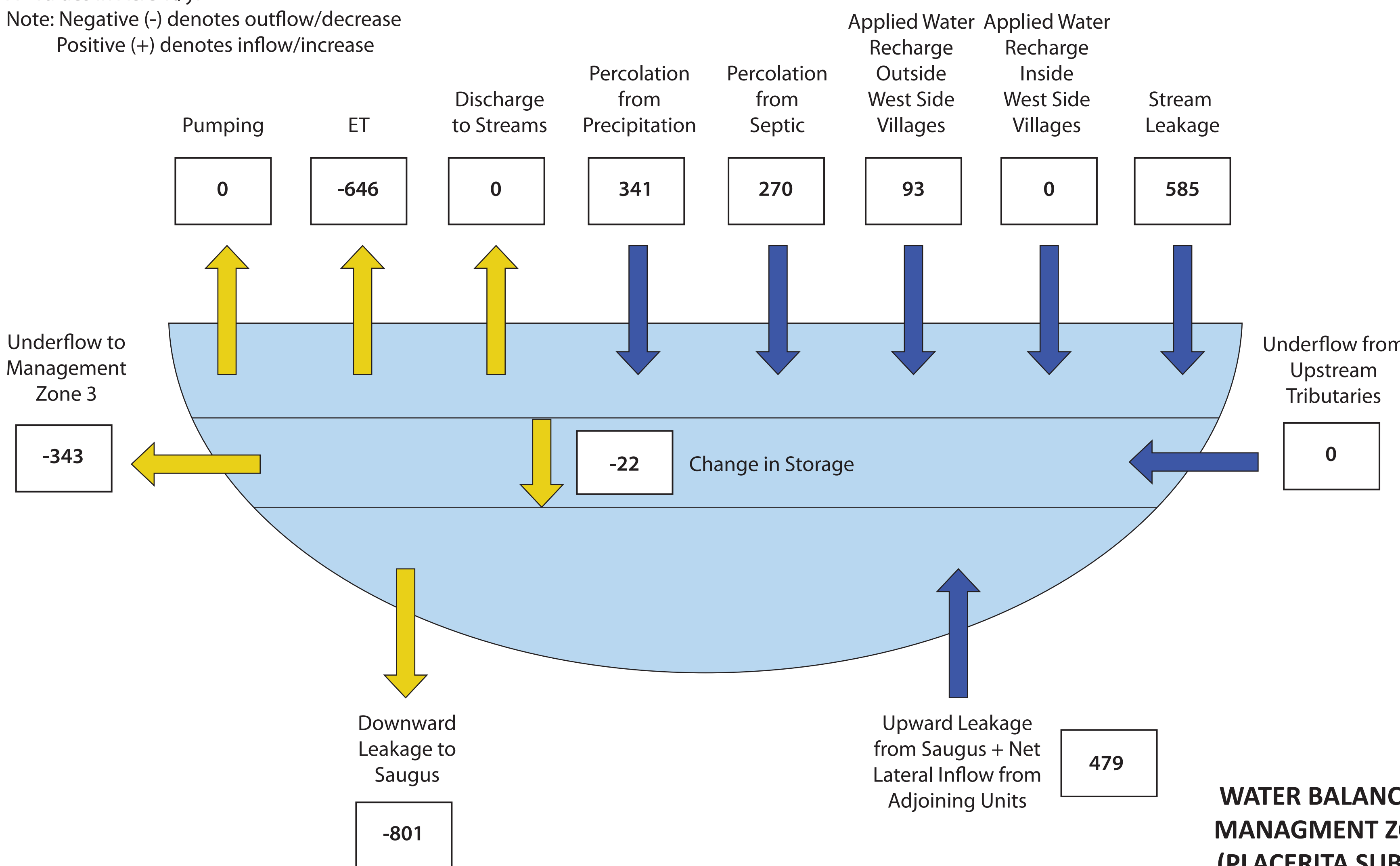
Figure 20a

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN

All Values in Acre-ft/yr
Note: Negative (-) denotes outflow/decrease
Positive (+) denotes inflow/increase



WATER BALANCE FOR MANAGMENT ZONE 2 (PLACERITA SUBUNIT) LAND USE BUILD-OUT 2012-2035

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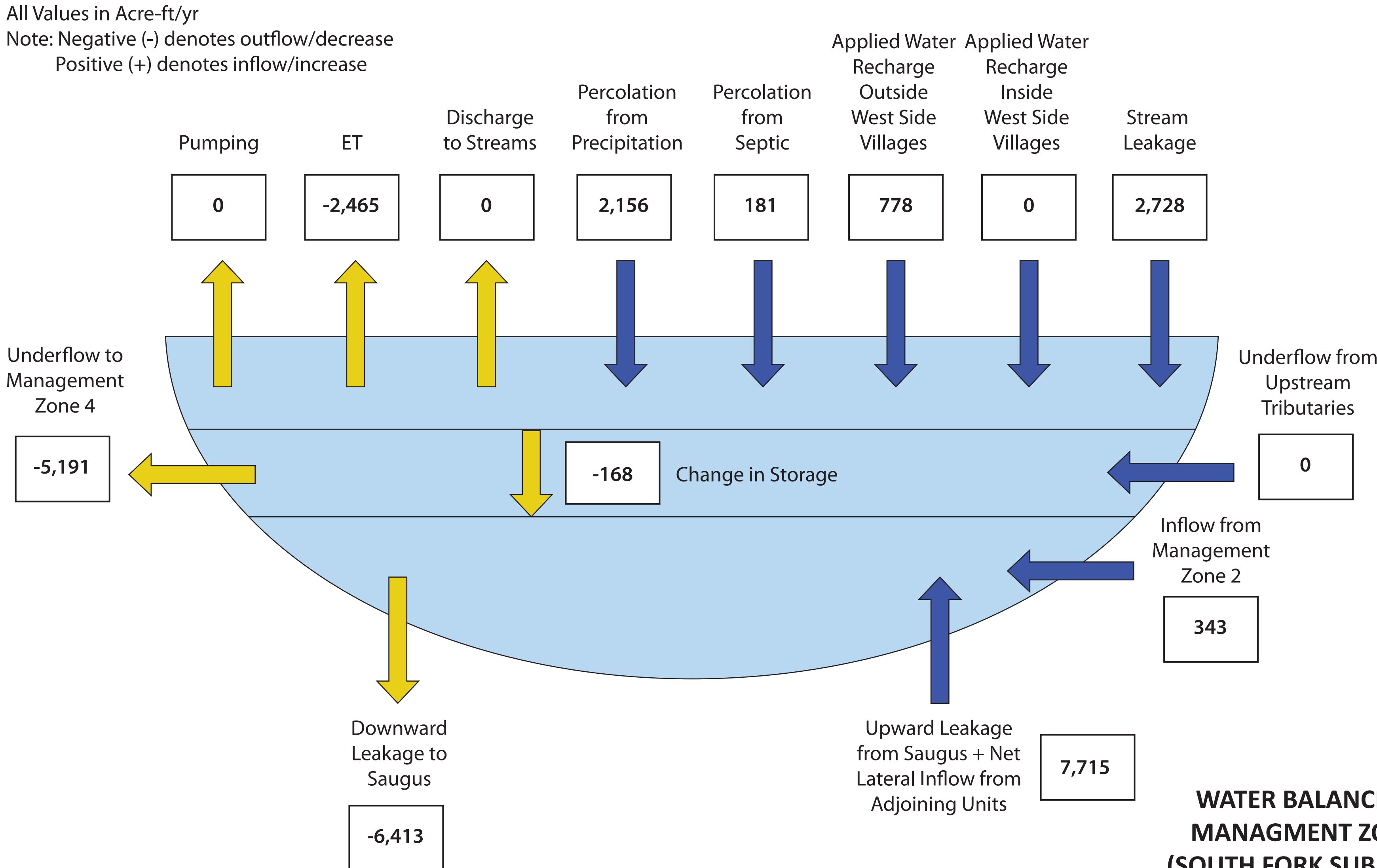
Figure 20b



WATER BALANCE FOR MANAGMENT ZONE 3 (SOUTH FORK SUBUNIT) LAND USE BUILD-OUT 2012-2035

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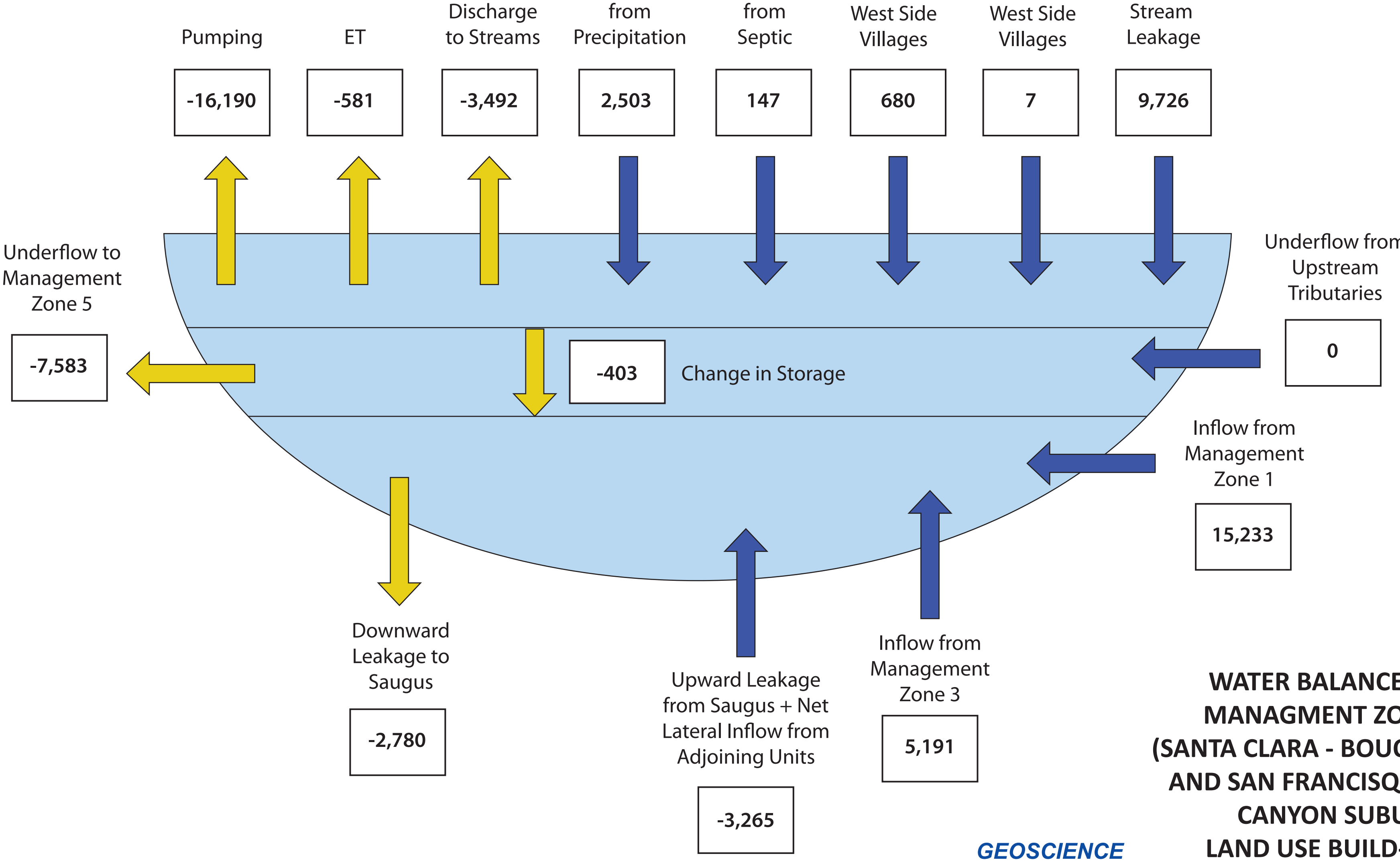
Figure 20c

All Values in Acre-ft/yr
Note: Negative (-) denotes outflow/decrease
Positive (+) denotes inflow/increase



WATER BALANCE FOR MANAGMENT ZONE 4 (SANTA CLARA - BOUQUET AND SAN FRANCISQUITO CANYON SUBUNIT) LAND USE BUILD-OUT 2012-2035

Figure 20d

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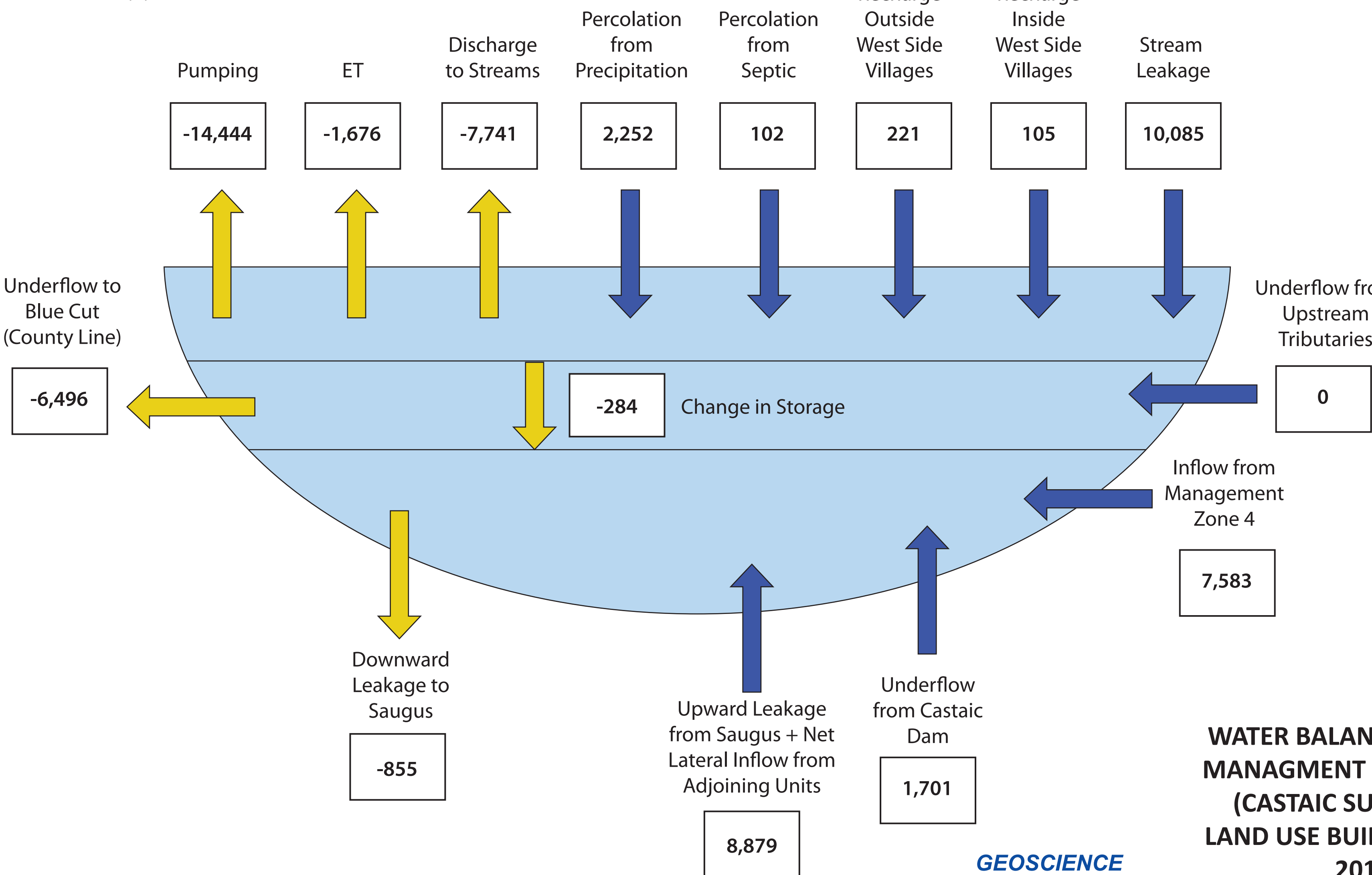
CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN

All Values in Acre-ft/yr
Note: Negative (-) denotes outflow/decrease
Positive (+) denotes inflow/increase



WATER BALANCE FOR MANAGMENT ZONE 5 (CASTAIC SUBUNIT) LAND USE BUILD-OUT 2012-2035

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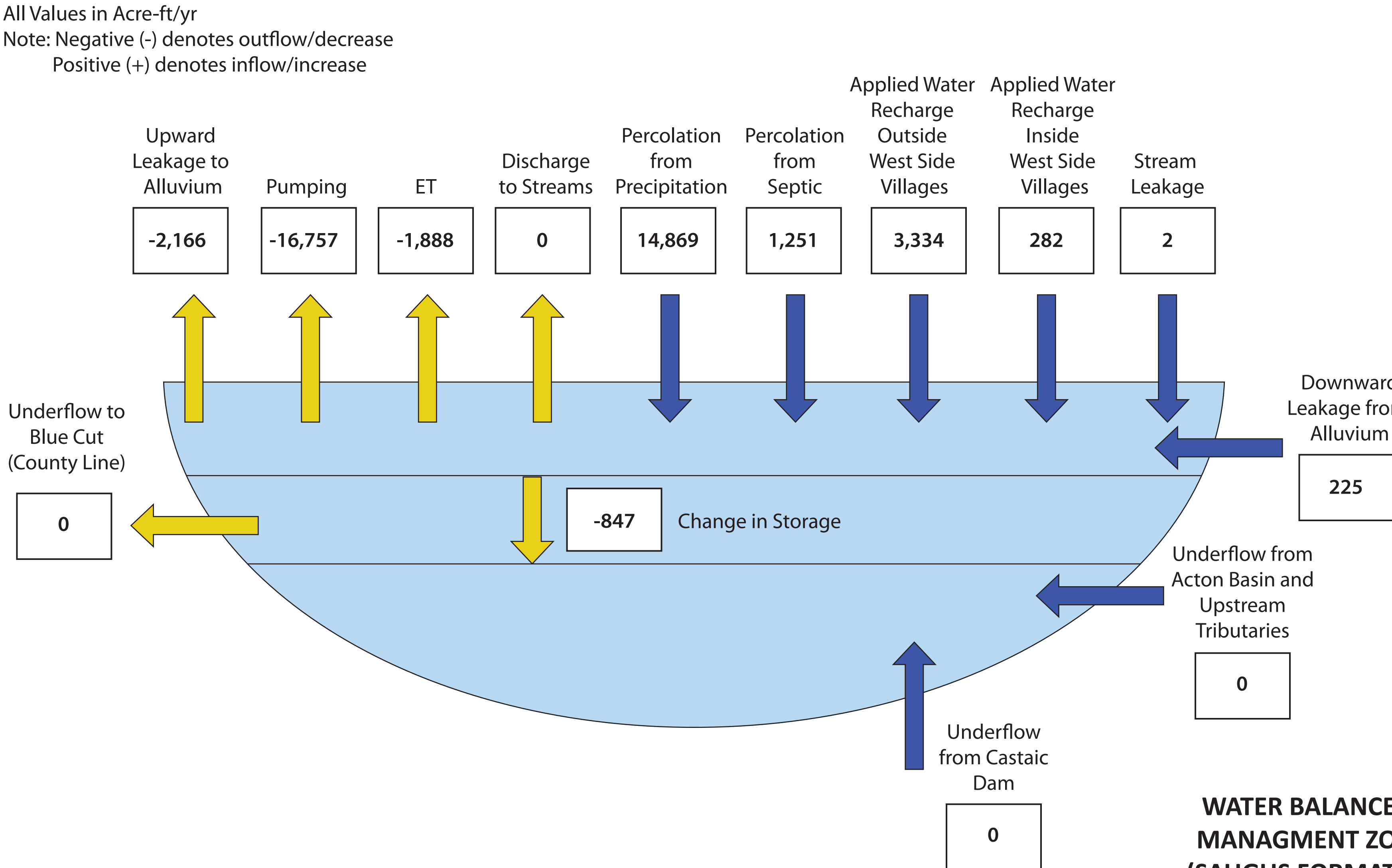
Figure 20e

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



WATER BALANCE FOR MANAGMENT ZONE 6 (SAUGUS FORMATION) LAND USE BUILD-OUT 2012-2035

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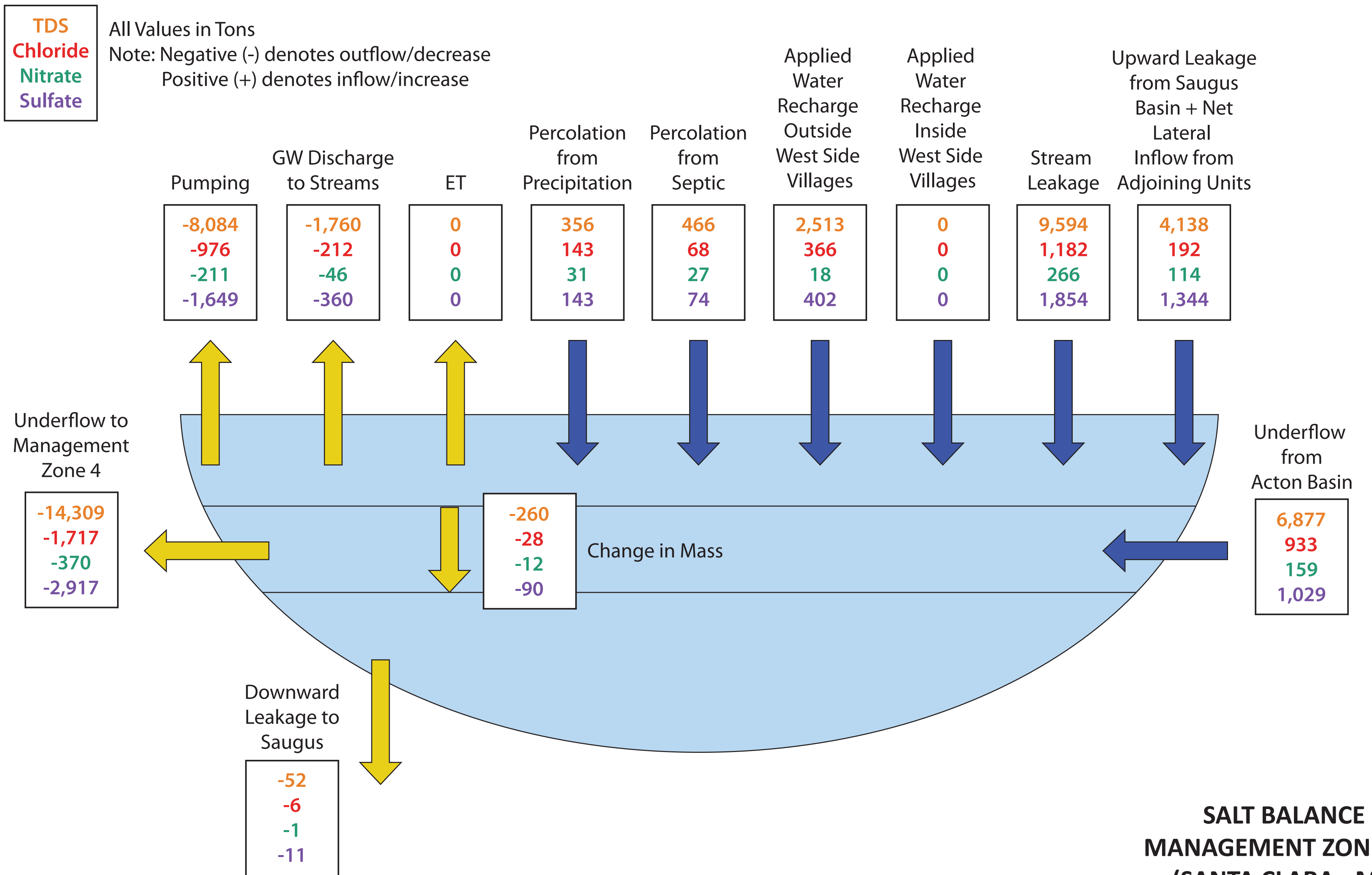
Figure 20f

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 1a (SANTA CLARA - MINT CANYON SUBUNIT) LAND USE BUILD-OUT 2012-2035

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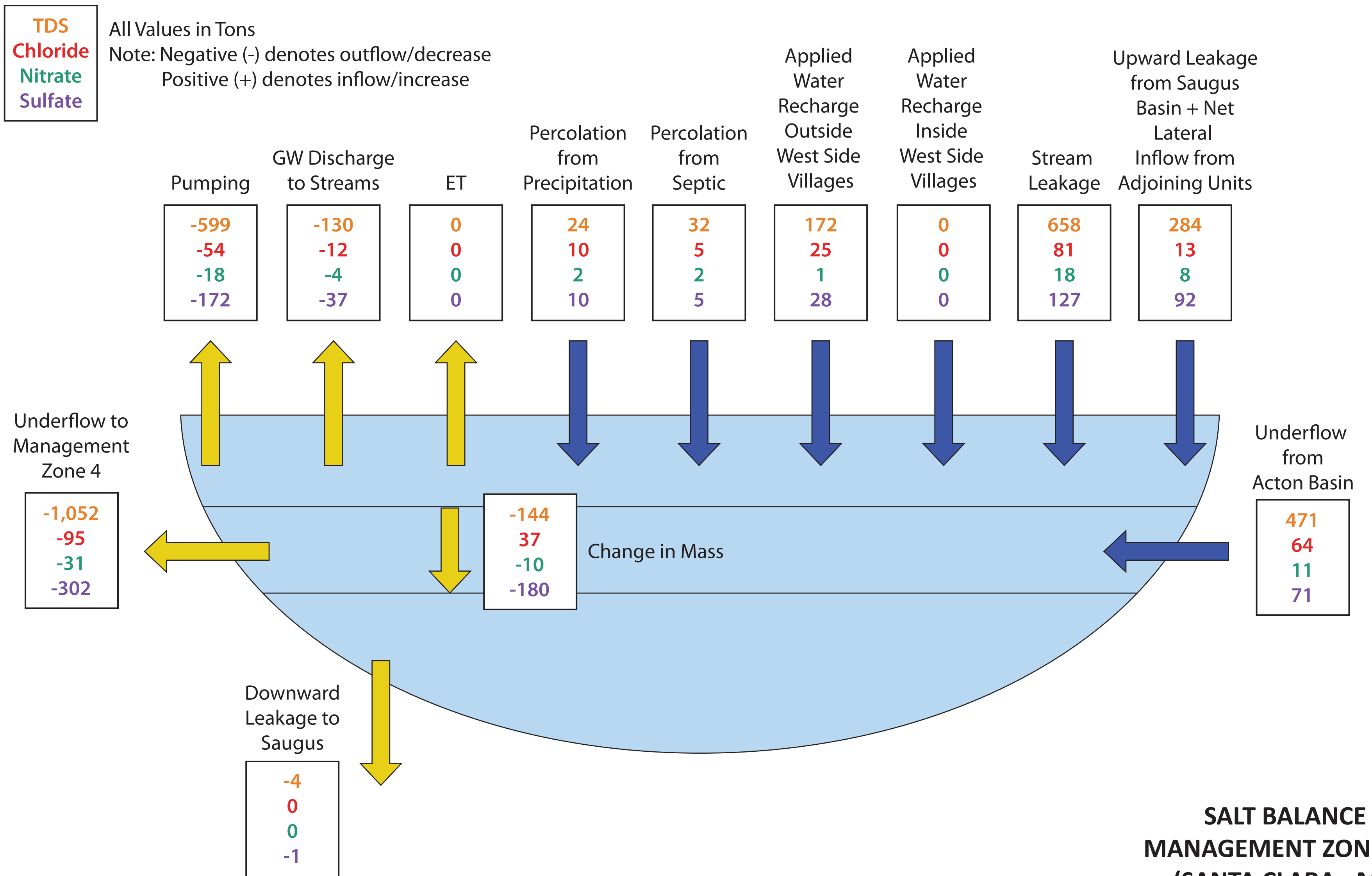
Figure 21a



SALT BALANCE FOR MANAGEMENT ZONE 1b (SANTA CLARA - MINT CANYON SUBUNIT) LAND USE BUILD-OUT 2012-2035

Figure 21b

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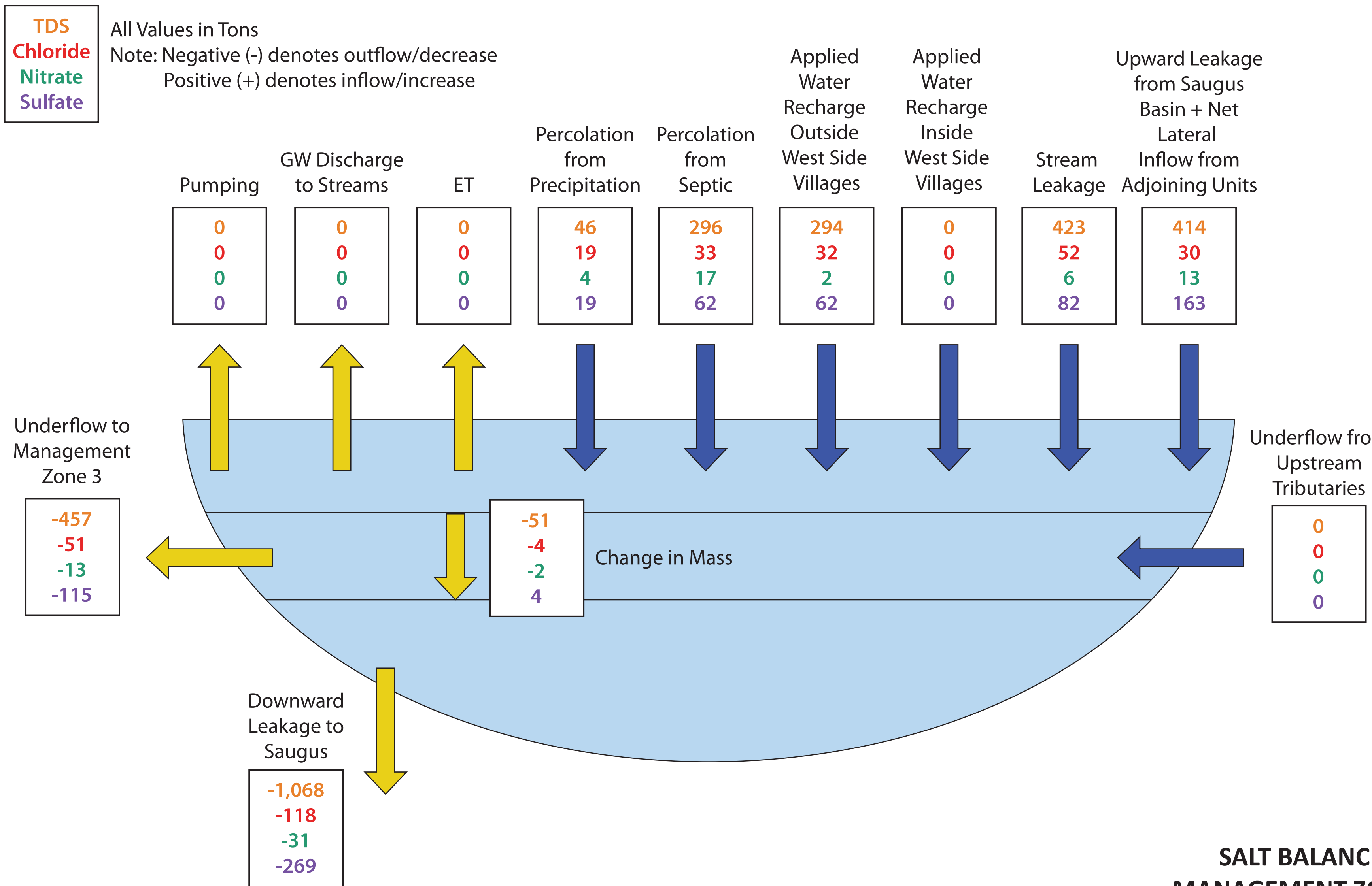

SALT BALANCE FOR MANAGEMENT ZONE 2 (PLACERITA SUBUNIT) LAND USE BUILD-OUT 2012-2035

Figure 21c

8-Dec-16

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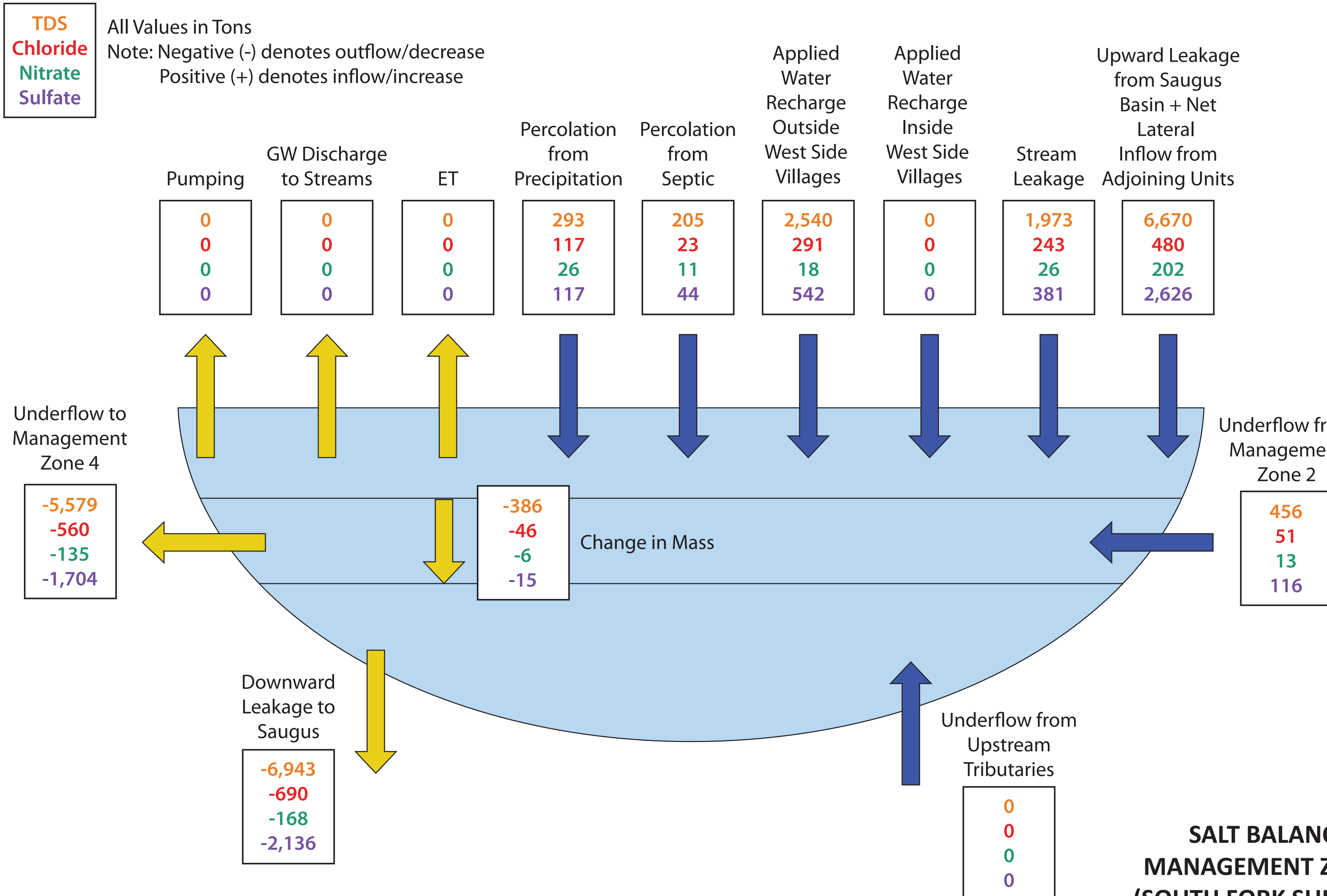

SALT BALANCE FOR MANAGEMENT ZONE 3 (SOUTH FORK SUBUNIT) LAND USE BUILD-OUT 2012-2035

Figure 21d

8-Dec-16

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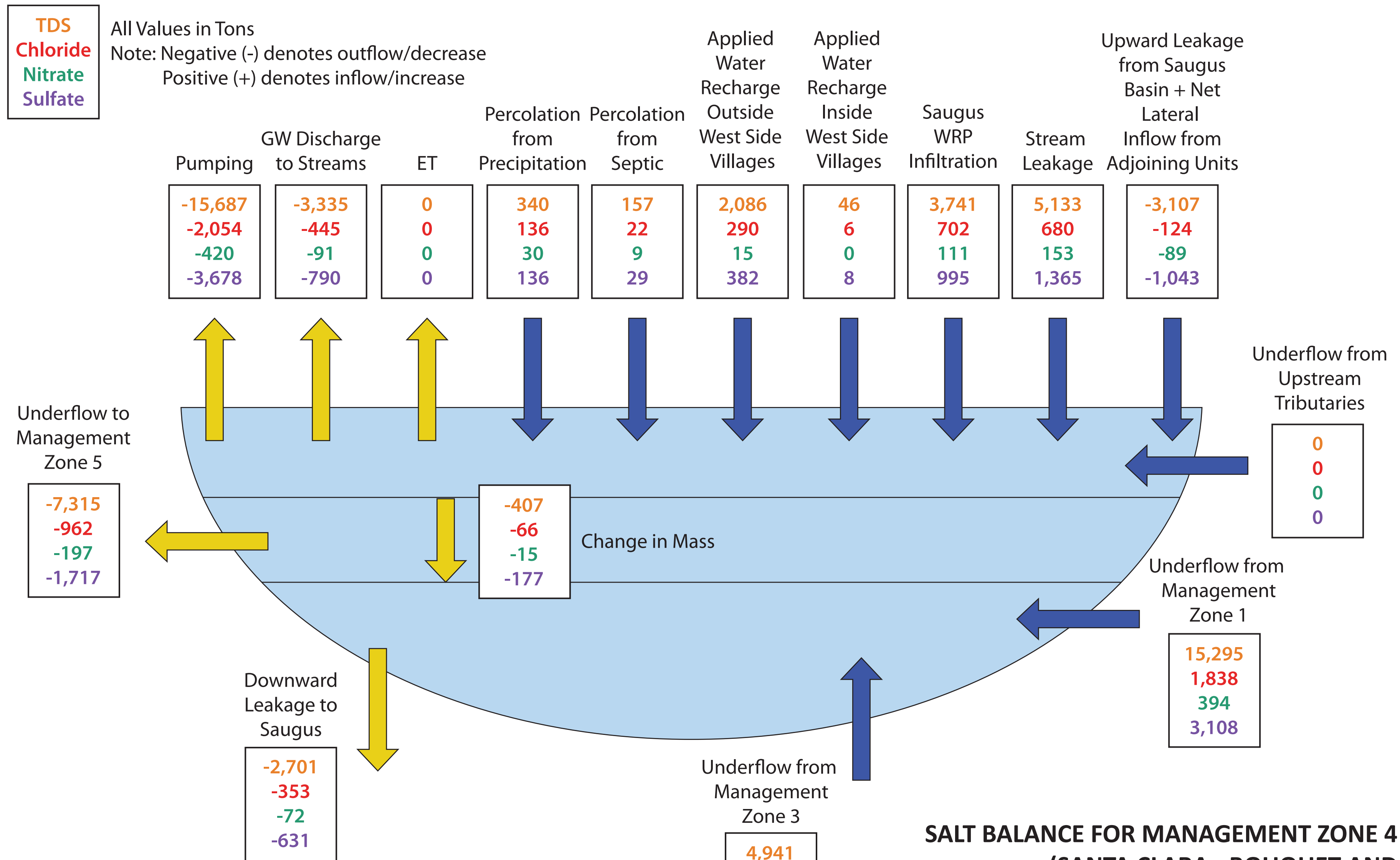
CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 4 (SANTA CLARA - BOUQUET AND SAN FRANCISQUITO CANYON SUBUNIT) LAND USE BUILD-OUT 2012-2035

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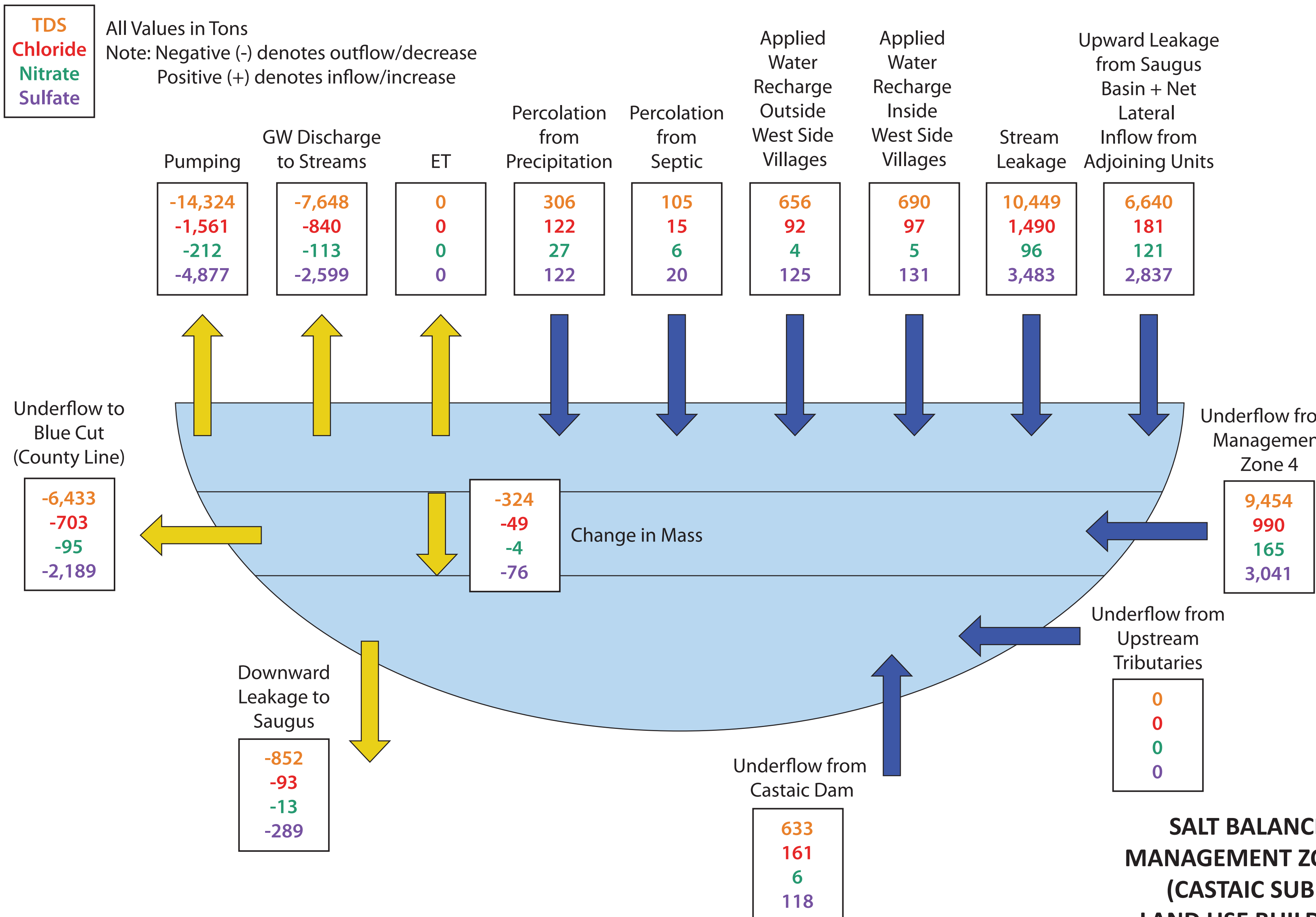
Figure 21e

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 5 (CASTAIC SUBUNIT) LAND USE BUILD-OUT 2012-2035

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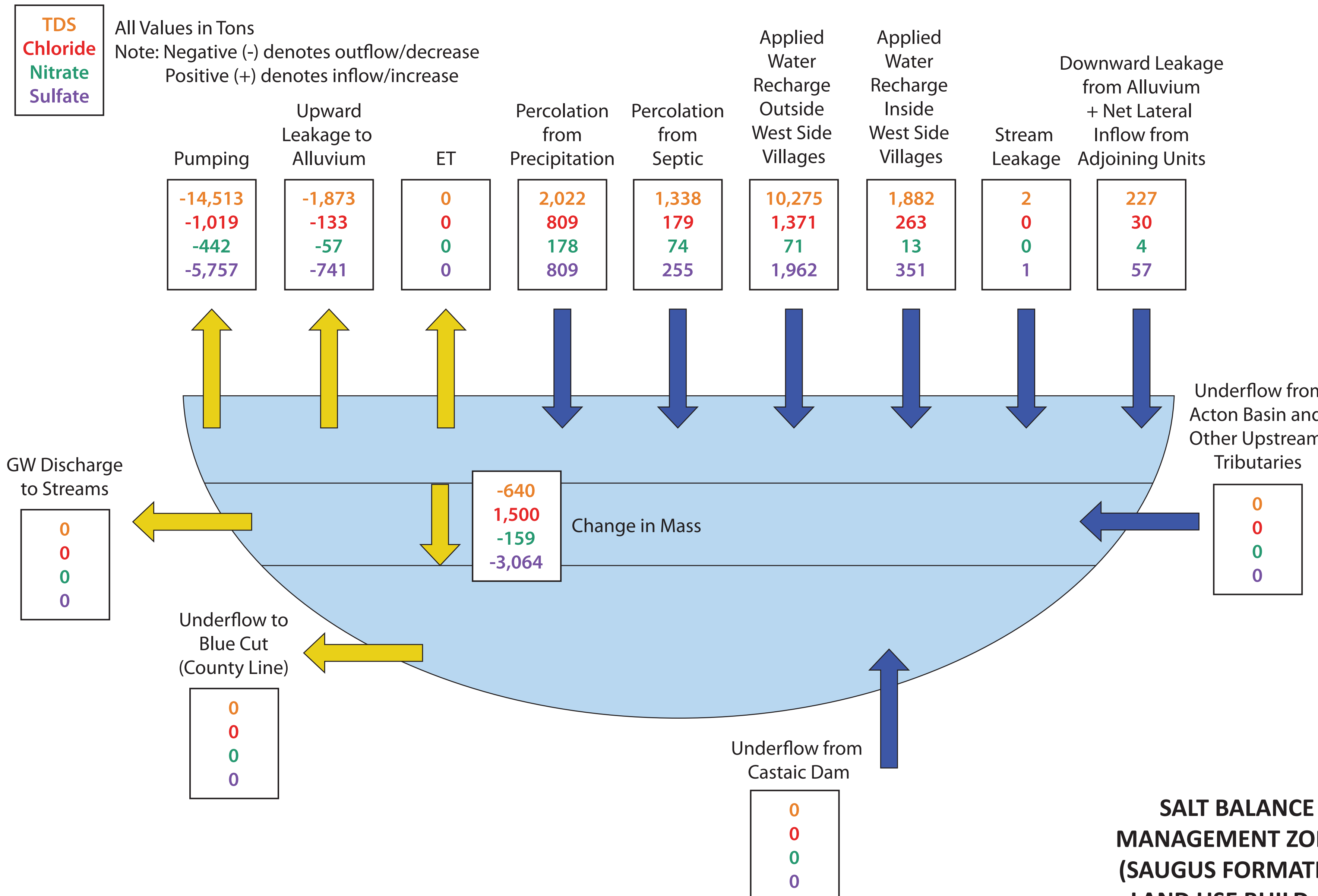
Figure 21f

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 6 (SAUGUS FORMATION) LAND USE BUILD-OUT 2012-2035

8-Dec-16

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Figure 21g

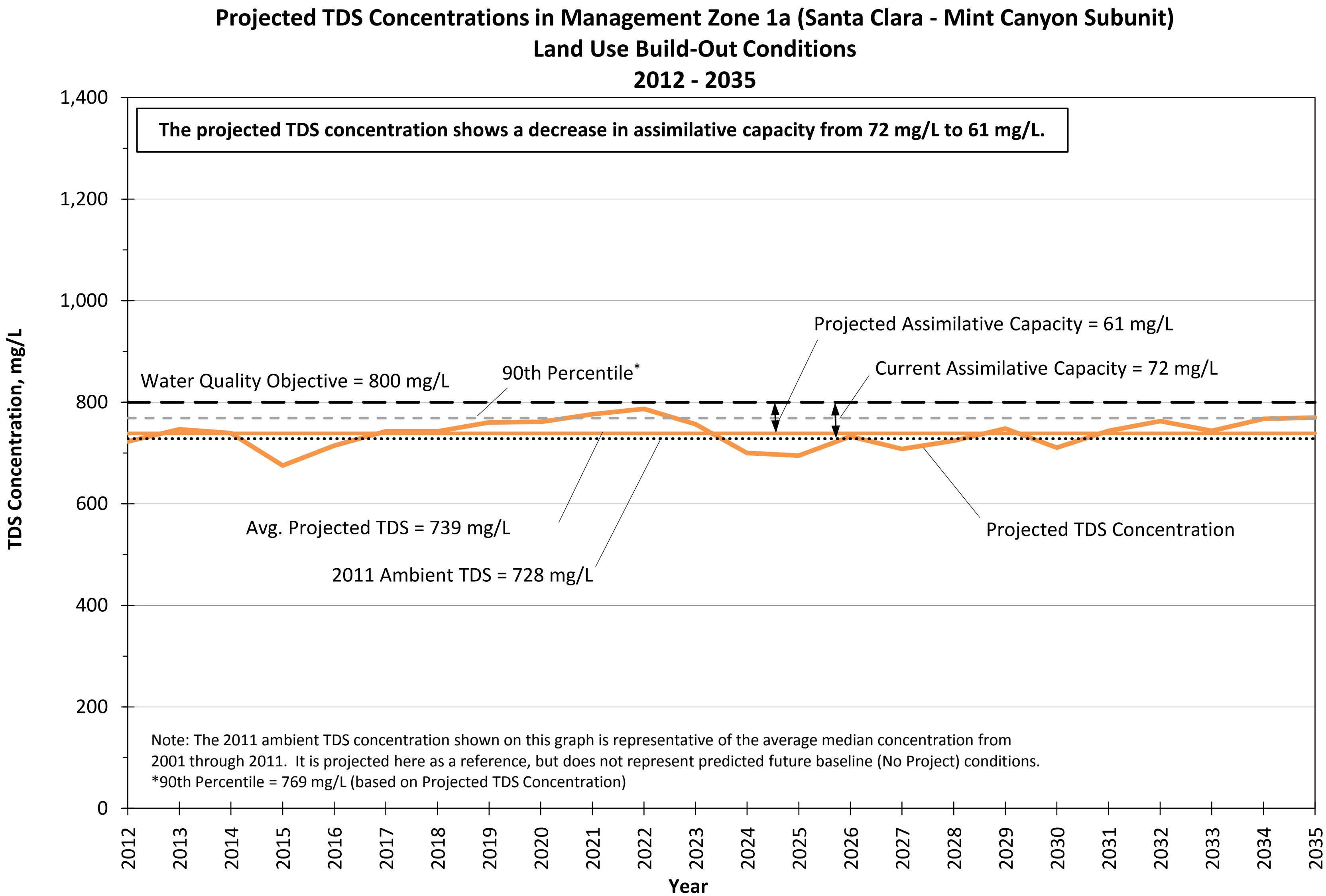

Projected TDS Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
Land Use Build-Out Conditions
2012 - 2035
The projected TDS concentration shows a decrease in assimilative capacity from 72 mg/L to 61 mg/L.
Projected Assimilative Capacity = 61 mg/L
Current Assimilative Capacity = 72 mg/L
Water Quality Objective = 800 mg/L
90th Percentile*
Avg. Projected TDS = 739 mg/L
2011 Ambient TDS = 728 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 769 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
0
200
400
600
800
1,000
1,200
1,400
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 22.1.a

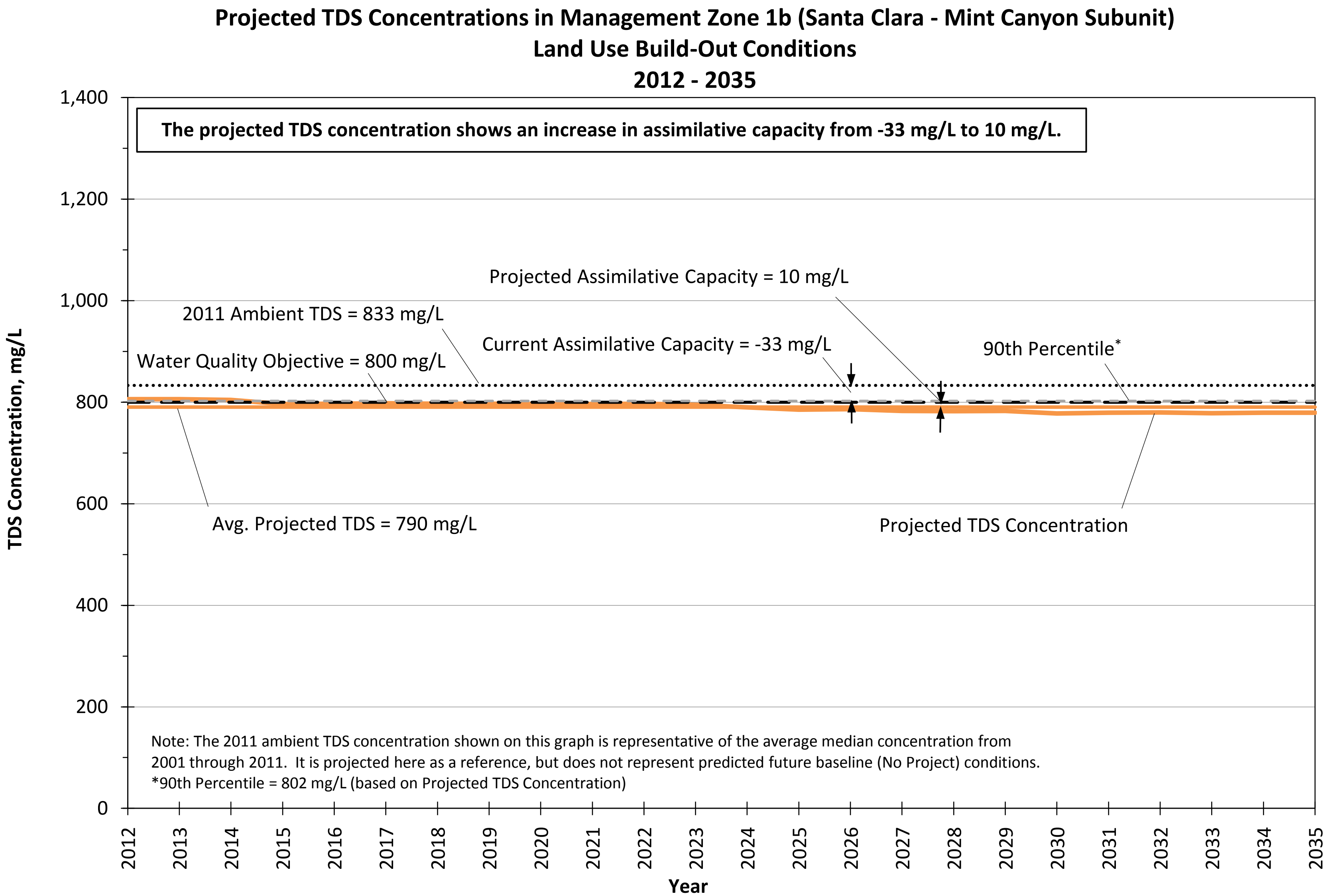

Projected TDS Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
Land Use Build-Out Conditions
2012 - 2035
The projected TDS concentration shows an increase in assimilative capacity from -33 mg/L to 10 mg/L.
Projected Assimilative Capacity = 10 mg/L
2011 Ambient TDS = 833 mg/L
Current Assimilative Capacity = -33 mg/L
90th Percentile*
Water Quality Objective = 800 mg/L
Avg. Projected TDS = 790 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 802 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 22.1.b

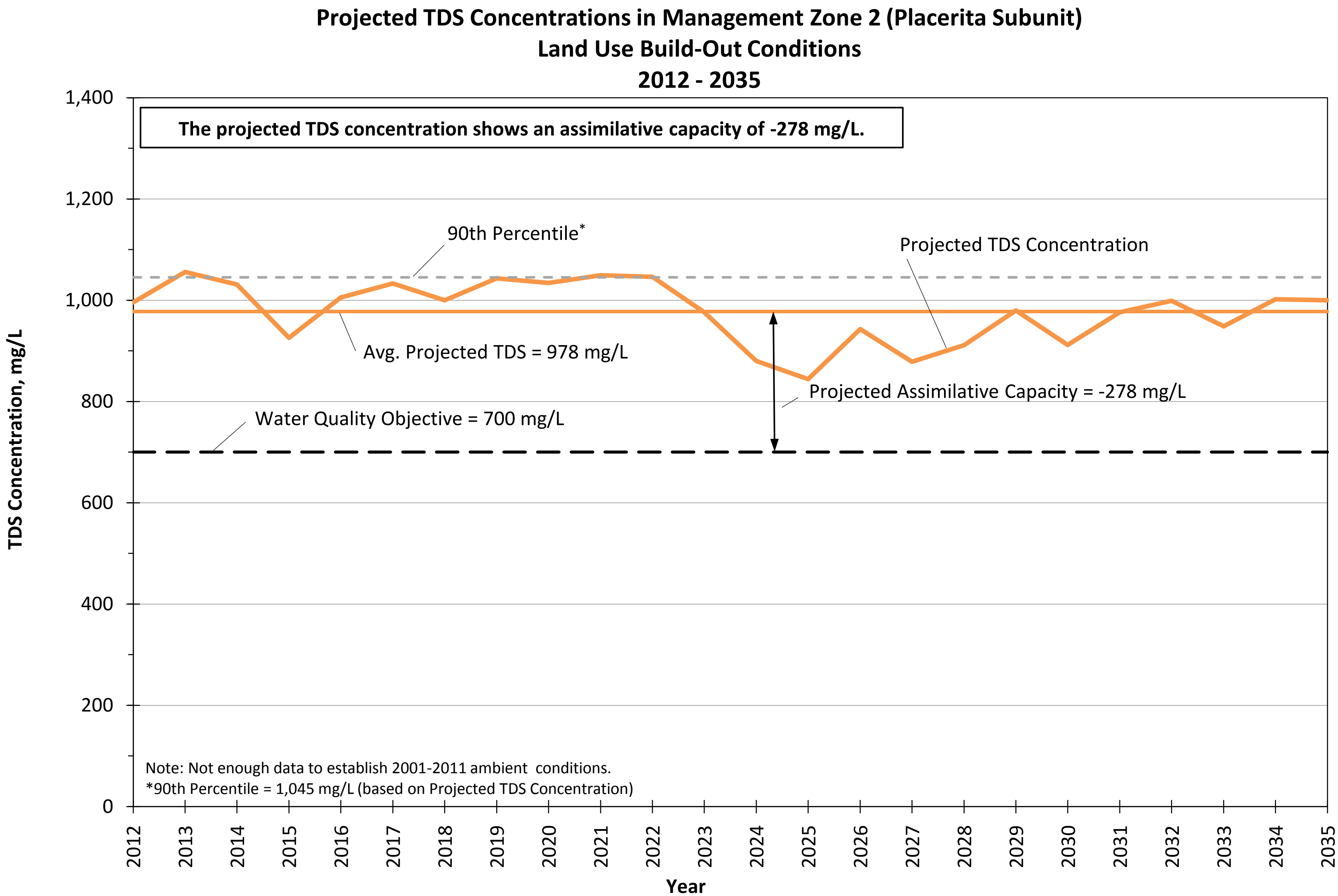

Projected TDS Concentrations in Management Zone 2 (Placerita Subunit)
Land Use Build-Out Conditions
2012 - 2035
The projected TDS concentration shows an assimilative capacity of -278 mg/L.
90th Percentile*
Projected TDS Concentration
Avg. Projected TDS = 978 mg/L
Projected Assimilative Capacity = -278 mg/L
Water Quality Objective = 700 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 1,045 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 22.1.c

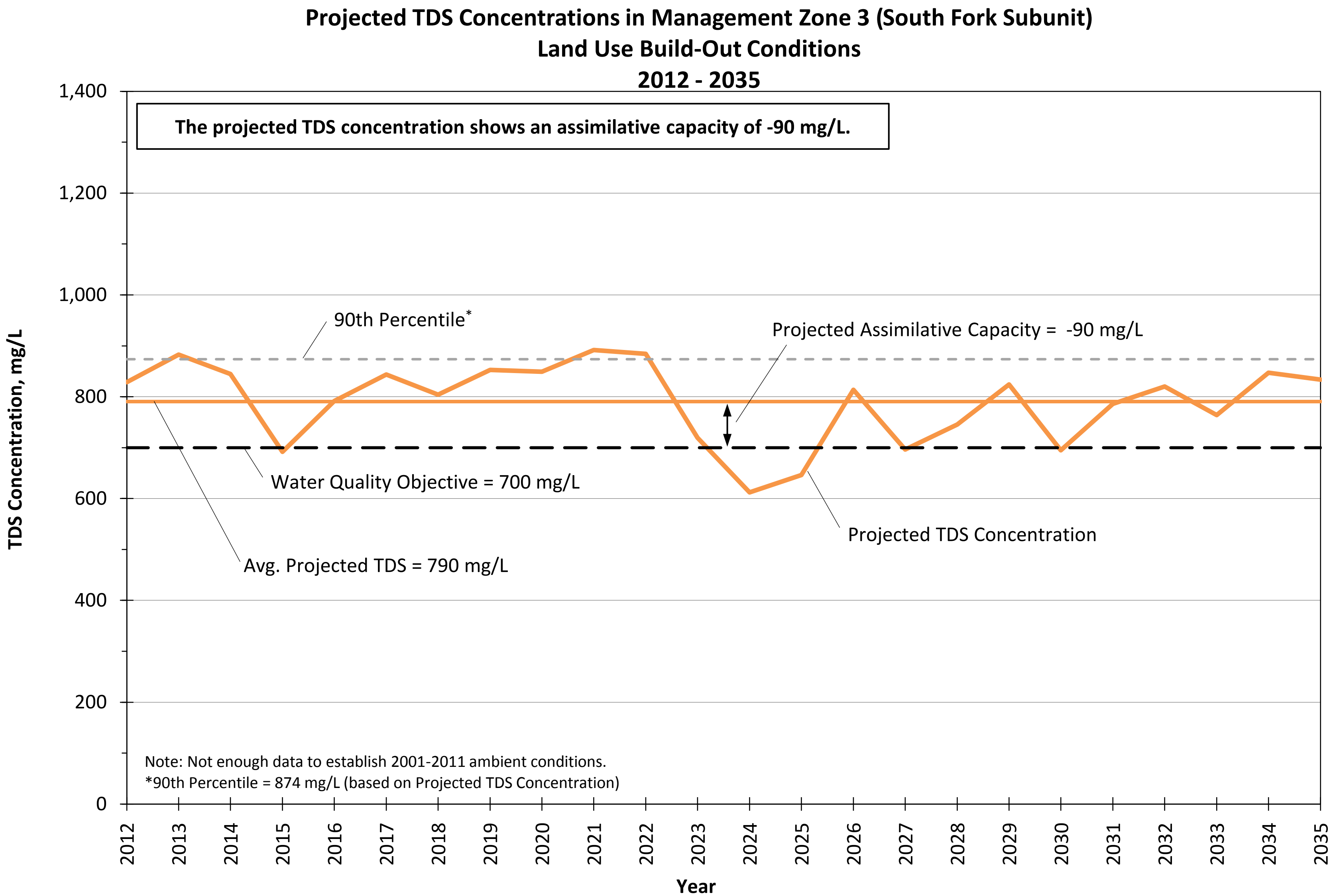

Projected TDS Concentrations in Management Zone 3 (South Fork Subunit)
Land Use Build-Out Conditions
2012 - 2035
The projected TDS concentration shows an assimilative capacity of -90 mg/L.
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
90th Percentile*
Projected Assimilative Capacity = -90 mg/L
Water Quality Objective = 700 mg/L
Projected TDS Concentration
Avg. Projected TDS = 790 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 874 mg/L (based on Projected TDS Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 22.1.d

Projected TDS Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - Land Use Build-Out Conditions 2012 - 2035

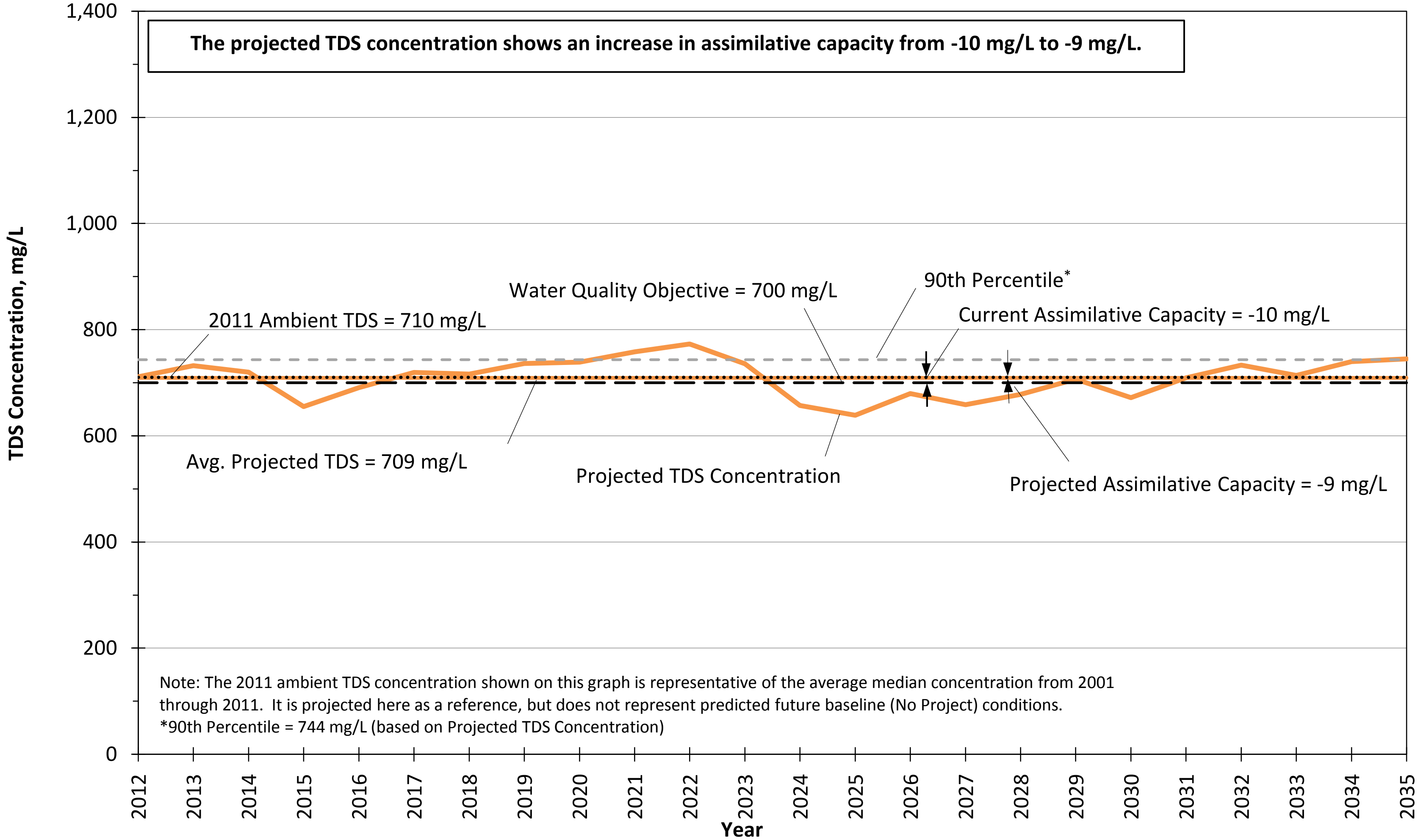


Figure 22.1.e

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

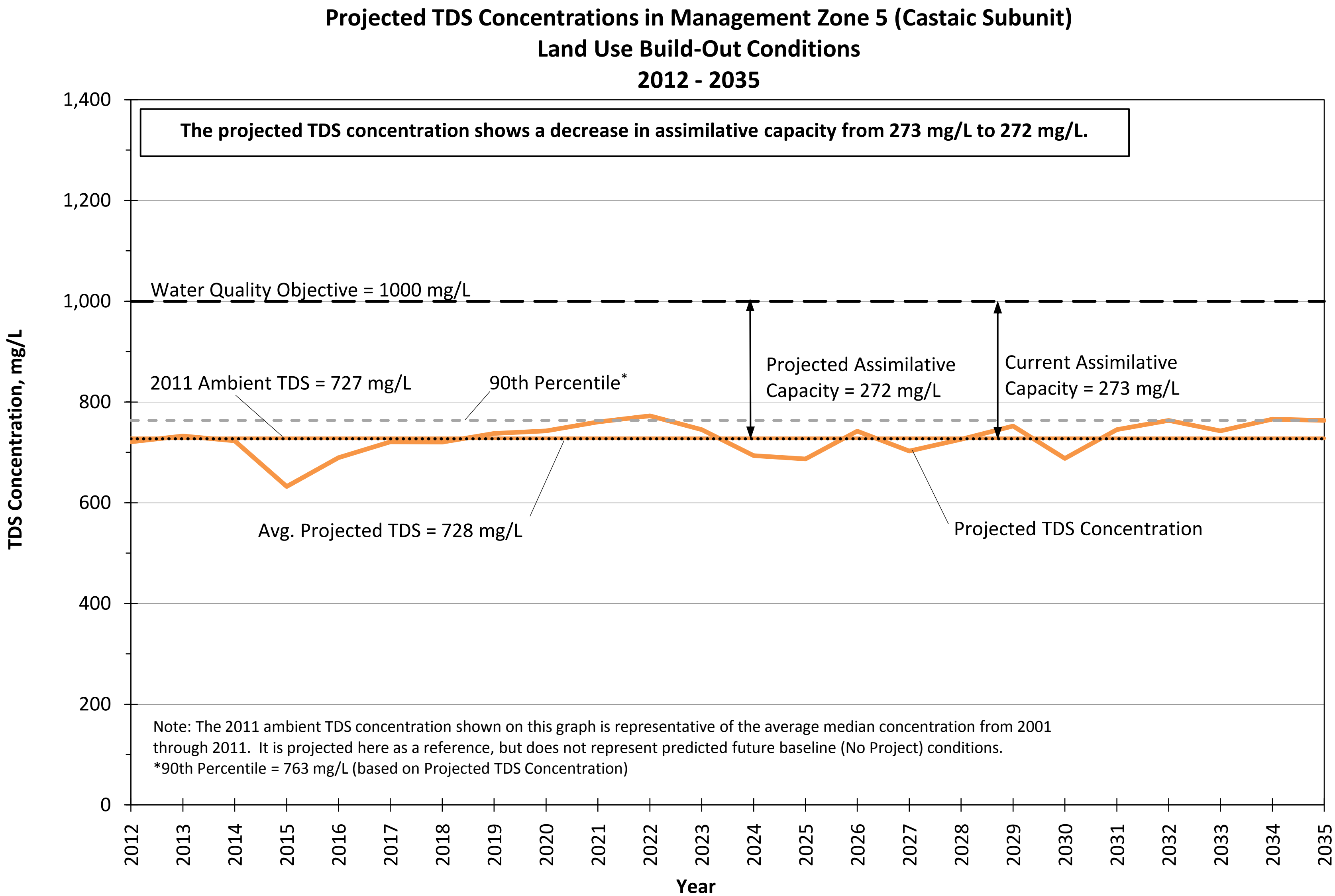


Figure 22.1.f

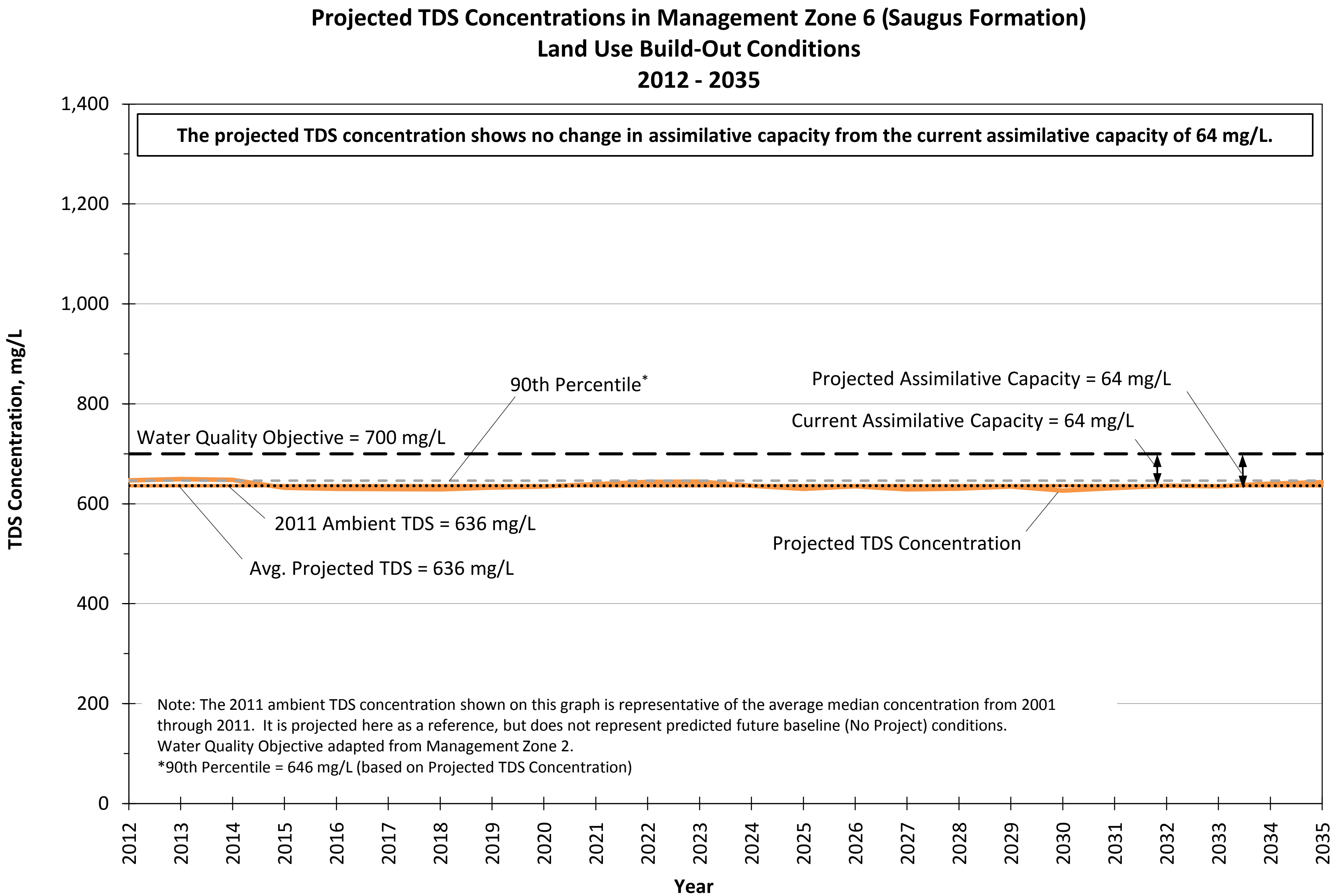

Projected TDS Concentrations in Management Zone 6 (Saugus Formation)
Land Use Build-Out Conditions
2012 - 2035
The projected TDS concentration shows no change in assimilative capacity from the current assimilative capacity of 64 mg/L.
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
90th Percentile*
Projected Assimilative Capacity = 64 mg/L
Current Assimilative Capacity = 64 mg/L
Water Quality Objective = 700 mg/L
2011 Ambient TDS = 636 mg/L
Projected TDS Concentration
Avg. Projected TDS = 636 mg/L
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Water Quality Objective adapted from Management Zone 2.
*90th Percentile = 646 mg/L (based on Projected TDS Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 22.1.g

Projected Chloride Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
Land Use Build-Out Conditions
2012 - 2035

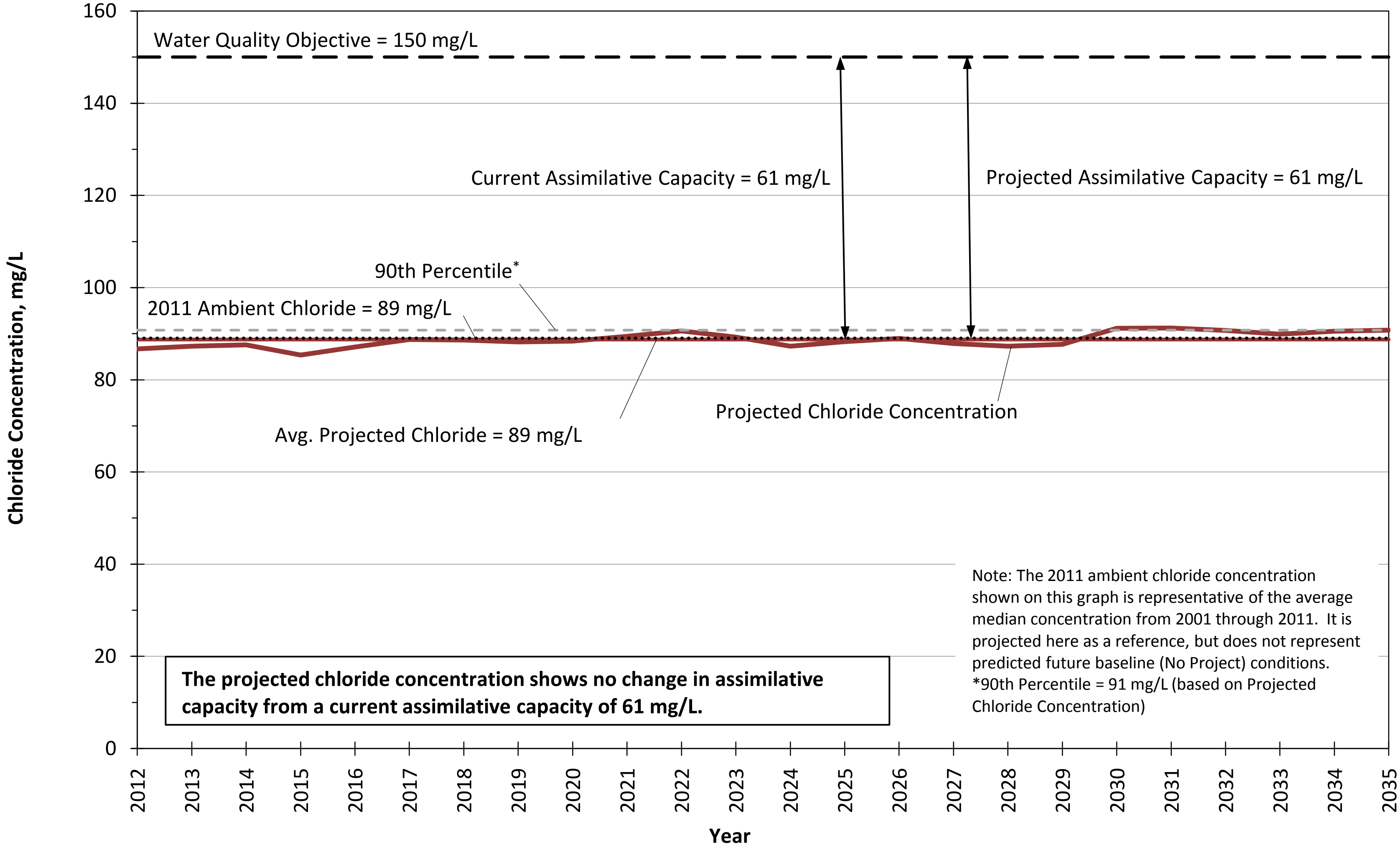


Figure 22.2.a

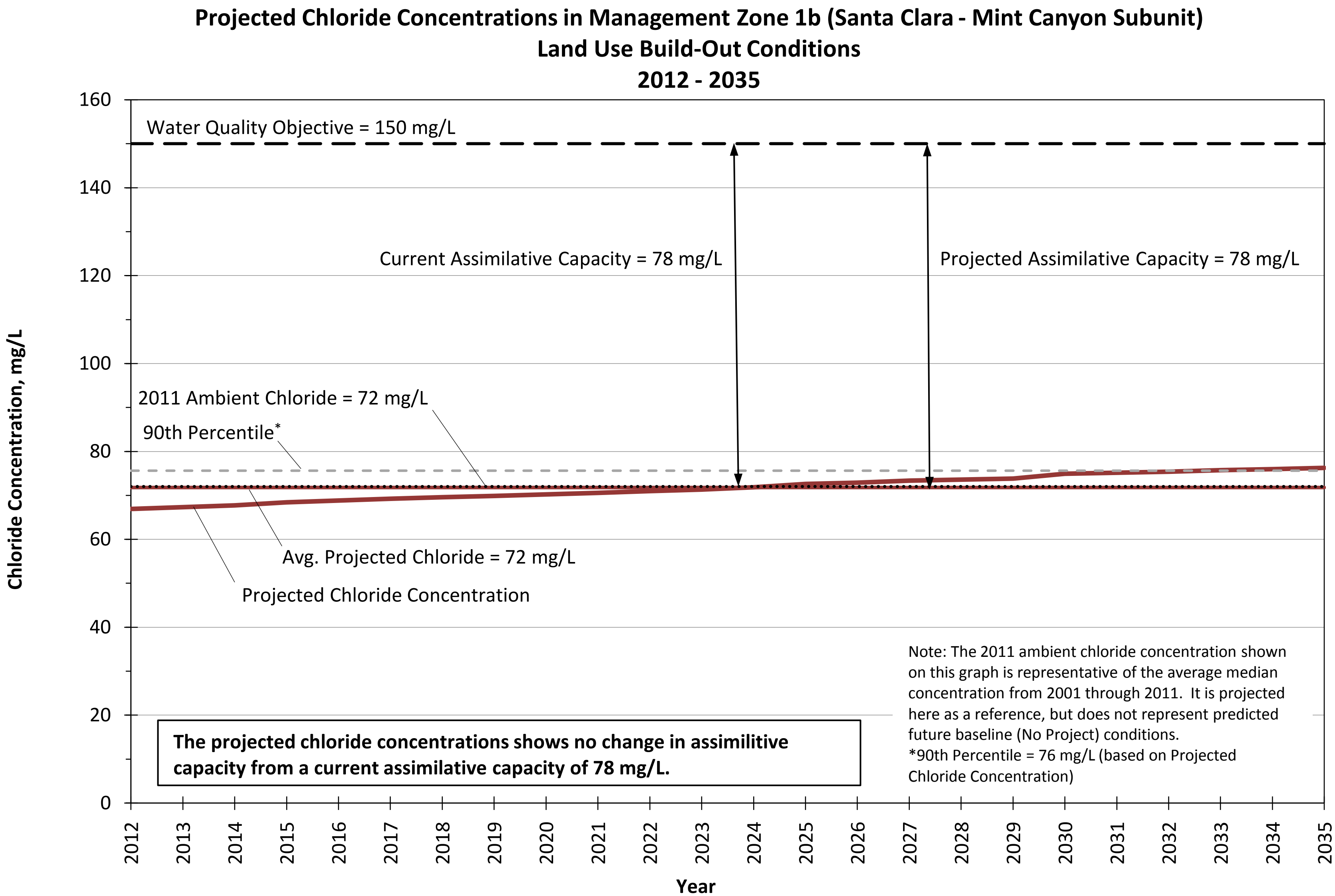

Projected Chloride Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
Land Use Build-Out Conditions
2012 - 2035
Water Quality Objective = 150 mg/L
Current Assimilative Capacity = 78 mg/L
Projected Assimilative Capacity = 78 mg/L
2011 Ambient Chloride = 72 mg/L
90th Percentile*
Avg. Projected Chloride = 72 mg/L
Projected Chloride Concentration
The projected chloride concentrations shows no change in assimilitive capacity from a current assimilative capacity of 78 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 76 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
160
140
120
100
80
60
40
20
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 22.2.b

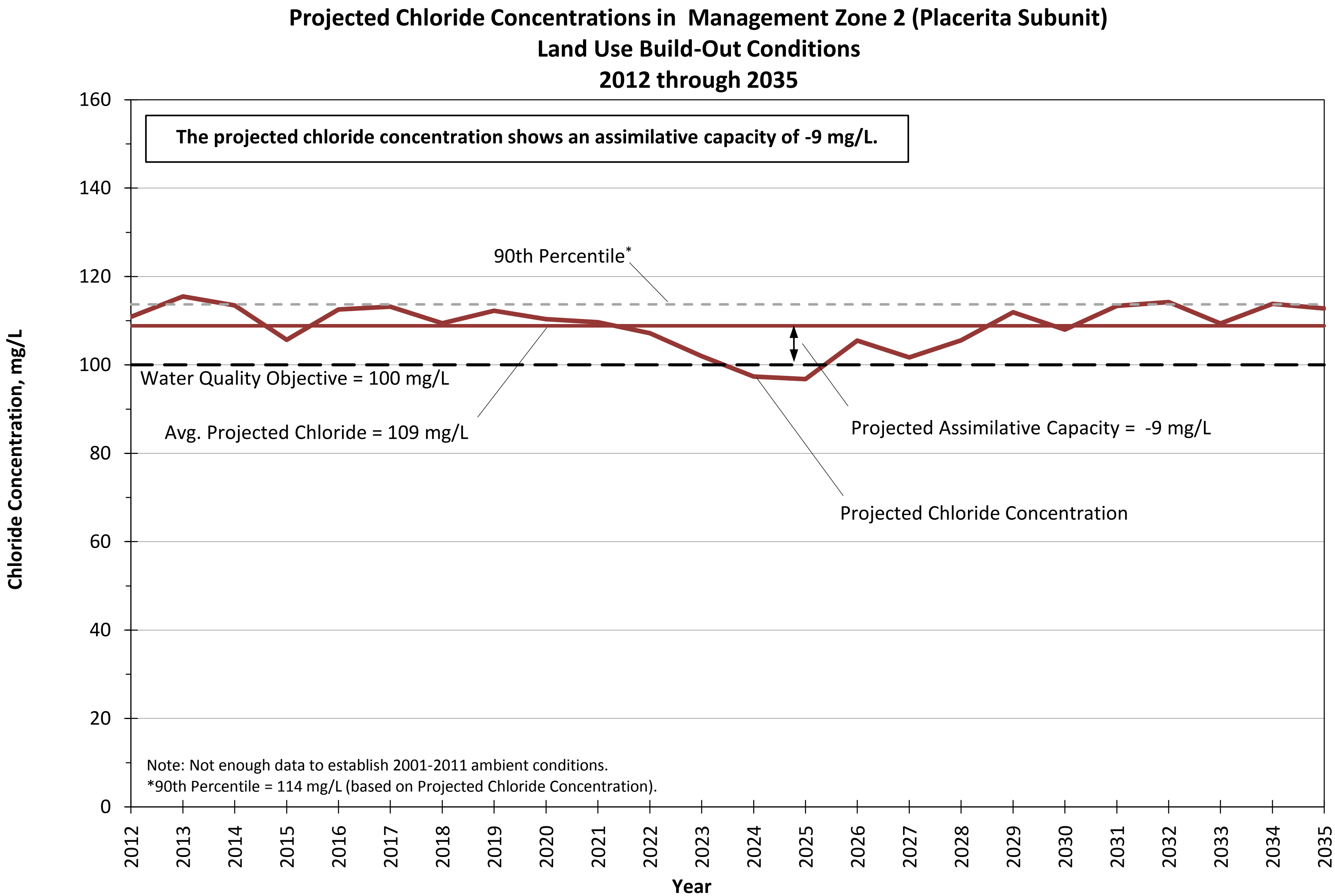

Projected Chloride Concentrations in Management Zone 2 (Placerita Subunit)
Land Use Build-Out Conditions
2012 through 2035
The projected chloride concentration shows an assimilative capacity of -9 mg/L.
90th Percentile*
Water Quality Objective = 100 mg/L
Avg. Projected Chloride = 109 mg/L
Projected Assimilative Capacity = -9 mg/L
Projected Chloride Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 114 mg/L (based on Projected Chloride Concentration).
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 22.2.c

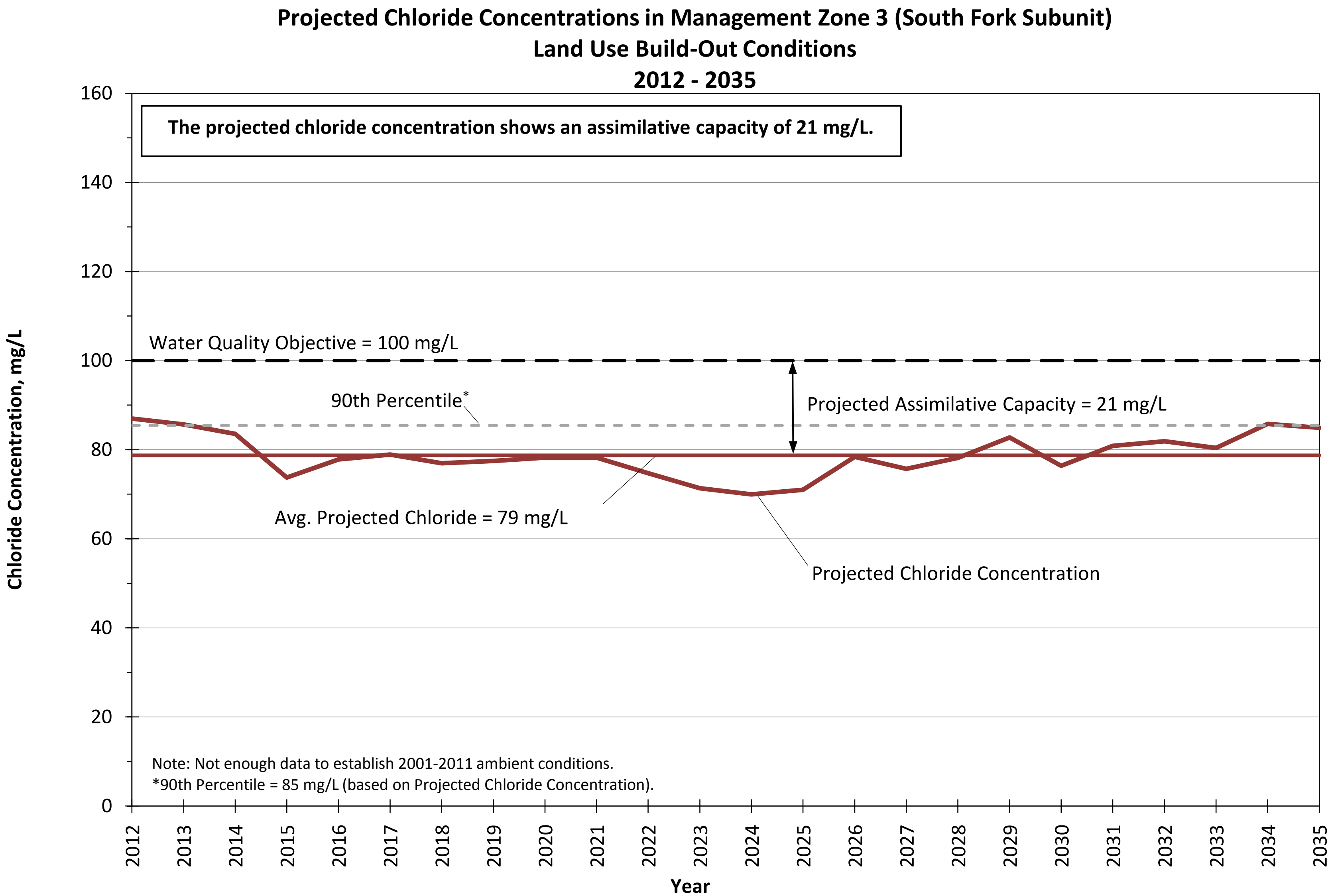

Projected Chloride Concentrations in Management Zone 3 (South Fork Subunit)
Land Use Build-Out Conditions
2012 - 2035
The projected chloride concentration shows an assimilative capacity of 21 mg/L.
Water Quality Objective = 100 mg/L
90th Percentile*
Projected Assimilative Capacity = 21 mg/L
Avg. Projected Chloride = 79 mg/L
Projected Chloride Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 85 mg/L (based on Projected Chloride Concentration).
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 22.2.d

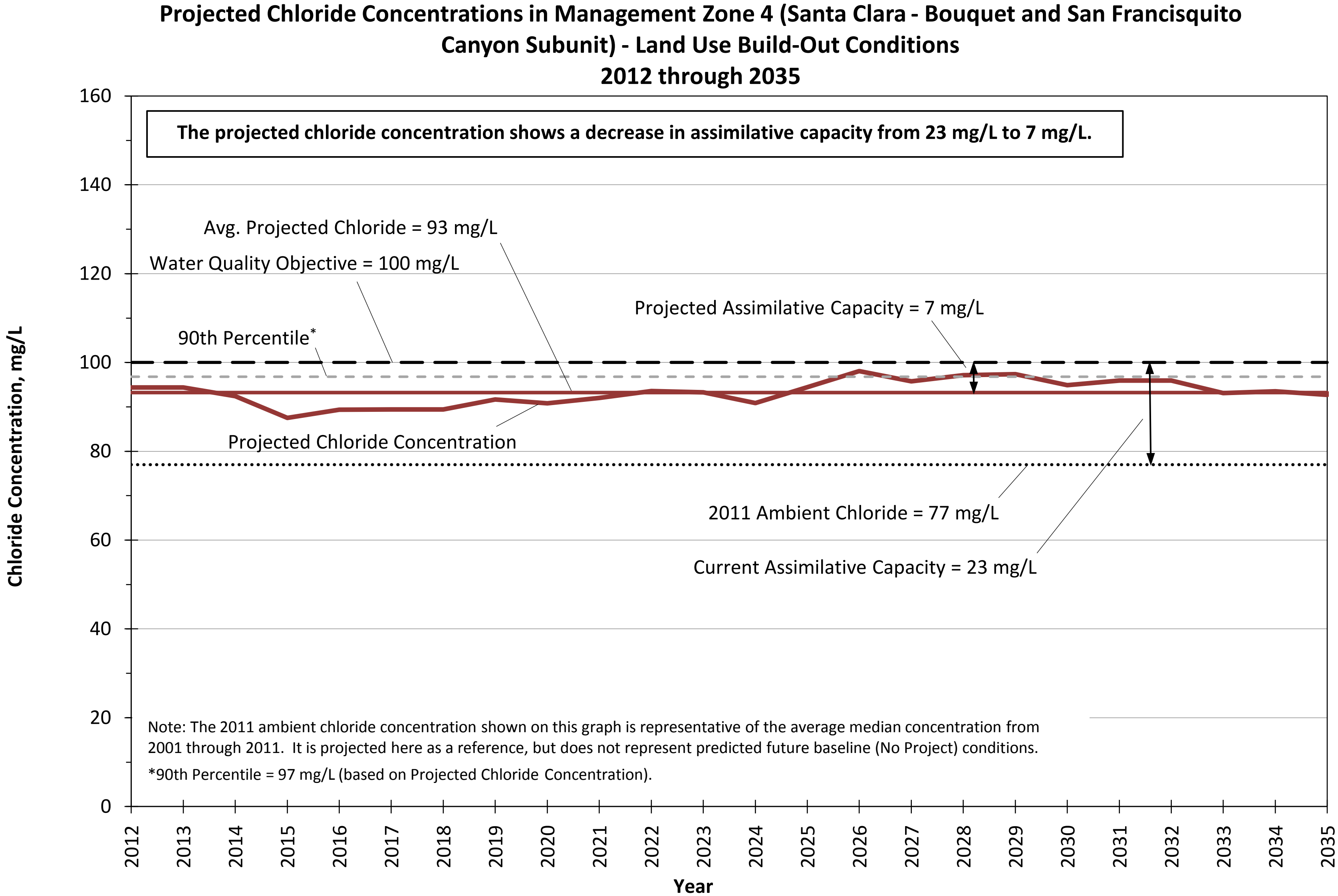
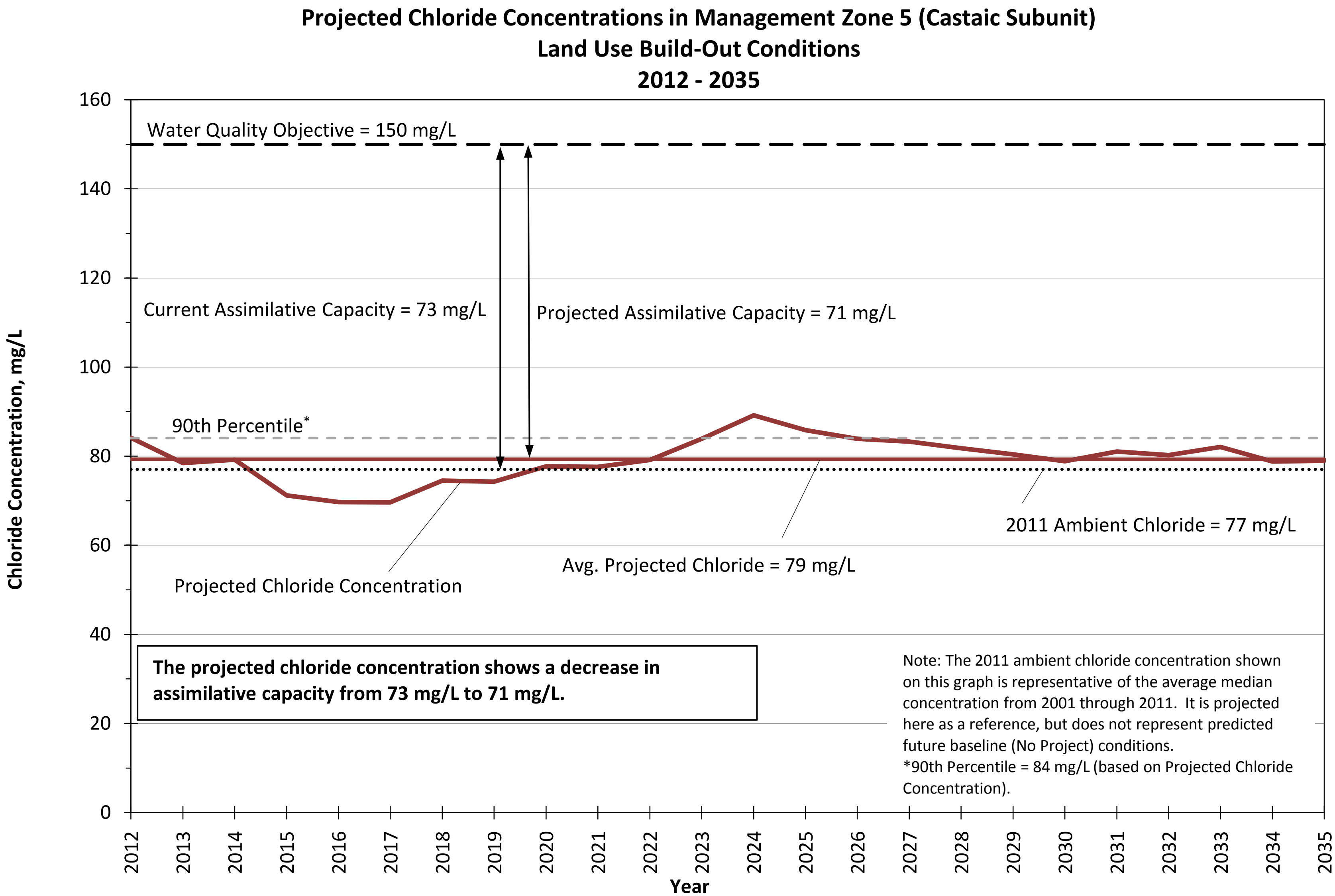

Projected Chloride Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - Land Use Build-Out Conditions
2012 through 2035
The projected chloride concentration shows a decrease in assimilative capacity from 23 mg/L to 7 mg/L.
Avg. Projected Chloride = 93 mg/L
Water Quality Objective = 100 mg/L
Projected Assimilative Capacity = 7 mg/L
90th Percentile*
Projected Chloride Concentration
2011 Ambient Chloride = 77 mg/L
Current Assimilative Capacity = 23 mg/L
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 97 mg/L (based on Projected Chloride Concentration).
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 22.2.e


Projected Chloride Concentrations in Management Zone 5 (Castaic Subunit)
Land Use Build-Out Conditions
2012 - 2035
Water Quality Objective = 150 mg/L
Current Assimilative Capacity = 73 mg/L
Projected Assimilative Capacity = 71 mg/L
90th Percentile*
2011 Ambient Chloride = 77 mg/L
Avg. Projected Chloride = 79 mg/L
Projected Chloride Concentration
The projected chloride concentration shows a decrease in assimilative capacity from 73 mg/L to 71 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 84 mg/L (based on Projected Chloride Concentration).
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
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2033
2034
2035

Figure 22.2.f

Projected Chloride Concentrations in Management Zone 6 (Saugus Formation)
Land Use Build-Out Conditions
2012 - 2035

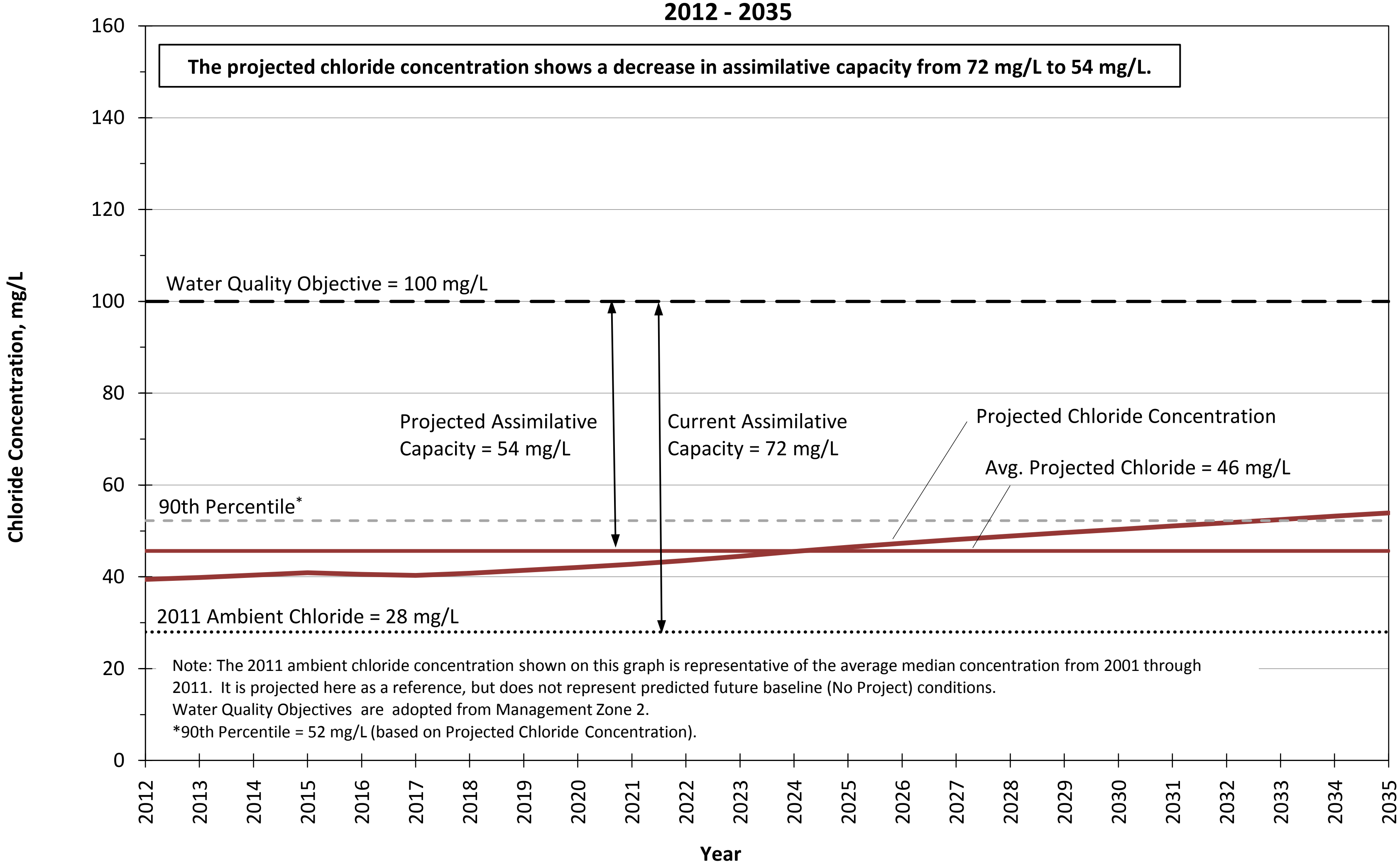


Figure 22.2.g

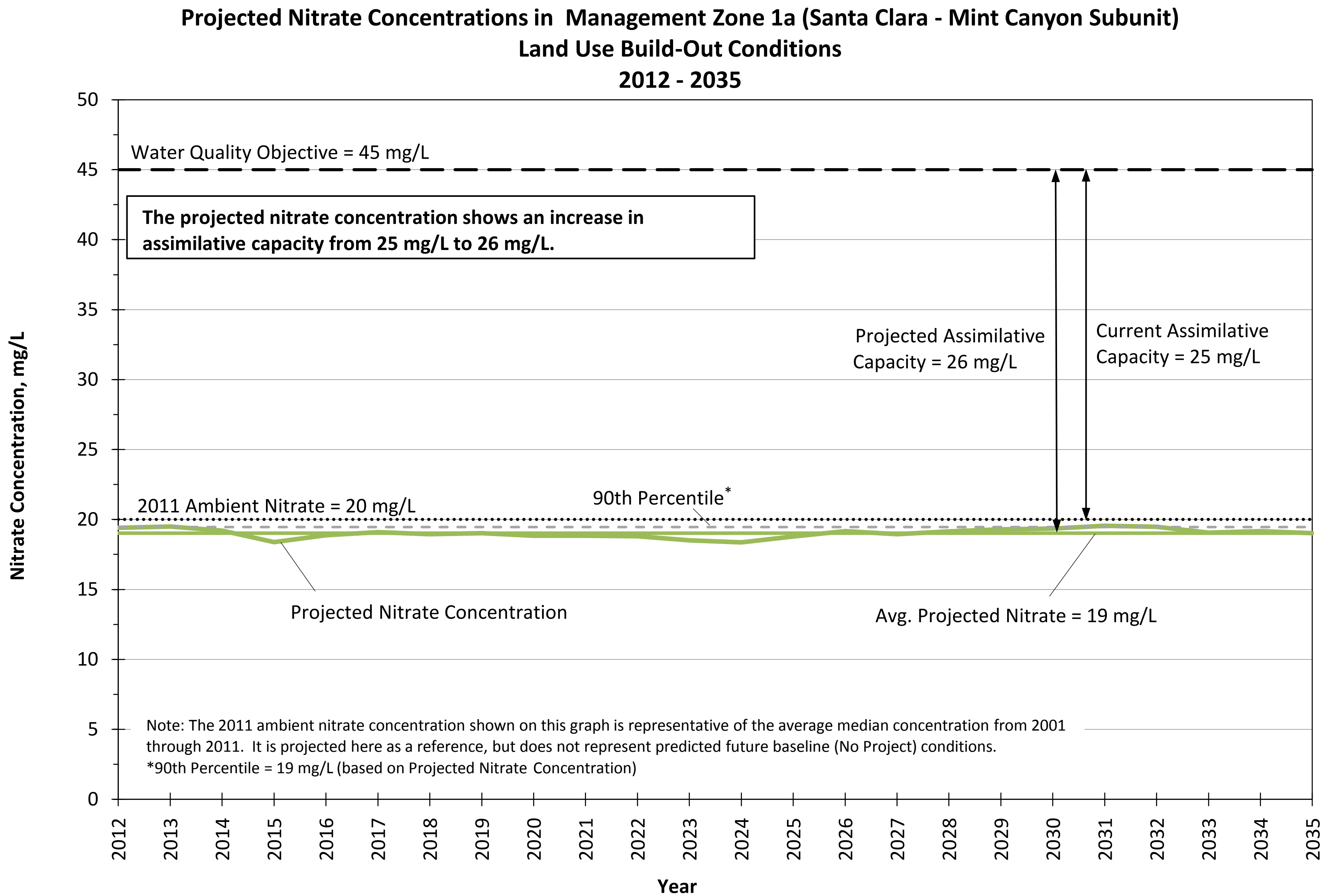
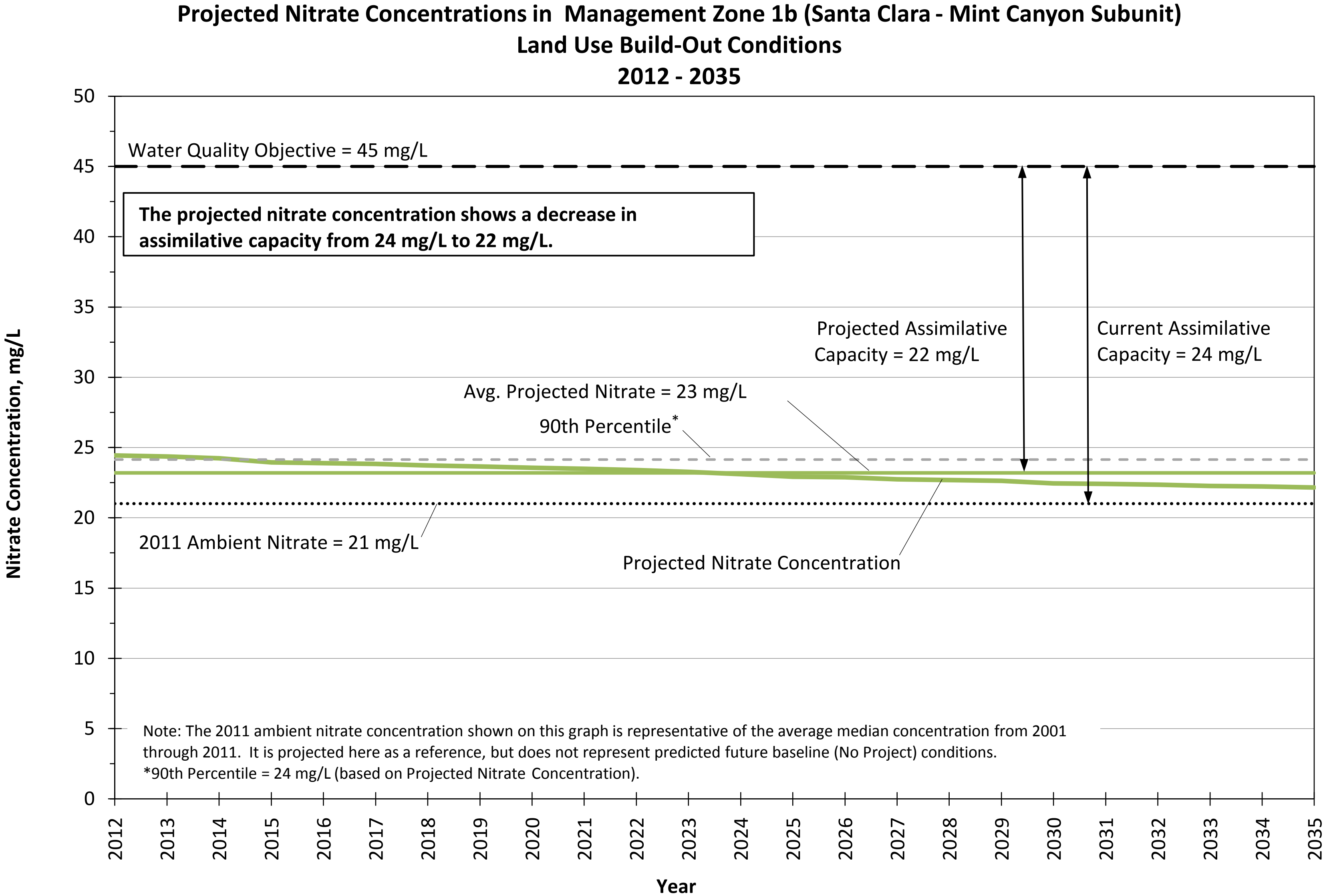

Projected Nitrate Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
Land Use Build-Out Conditions
2012 - 2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an increase in assimilative capacity from 25 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 25 mg/L
2011 Ambient Nitrate = 20 mg/L
90th Percentile*
Projected Nitrate Concentration
Avg. Projected Nitrate = 19 mg/L
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 19 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 22.3.a


Projected Nitrate Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
Land Use Build-Out Conditions
2012 - 2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 24 mg/L to 22 mg/L.
Projected Assimilative Capacity = 22 mg/L
Current Assimilative Capacity = 24 mg/L
Avg. Projected Nitrate = 23 mg/L
90th Percentile*
2011 Ambient Nitrate = 21 mg/L
Projected Nitrate Concentration
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 24 mg/L (based on Projected Nitrate Concentration).
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
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2034
2035

Figure 22.3.b

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

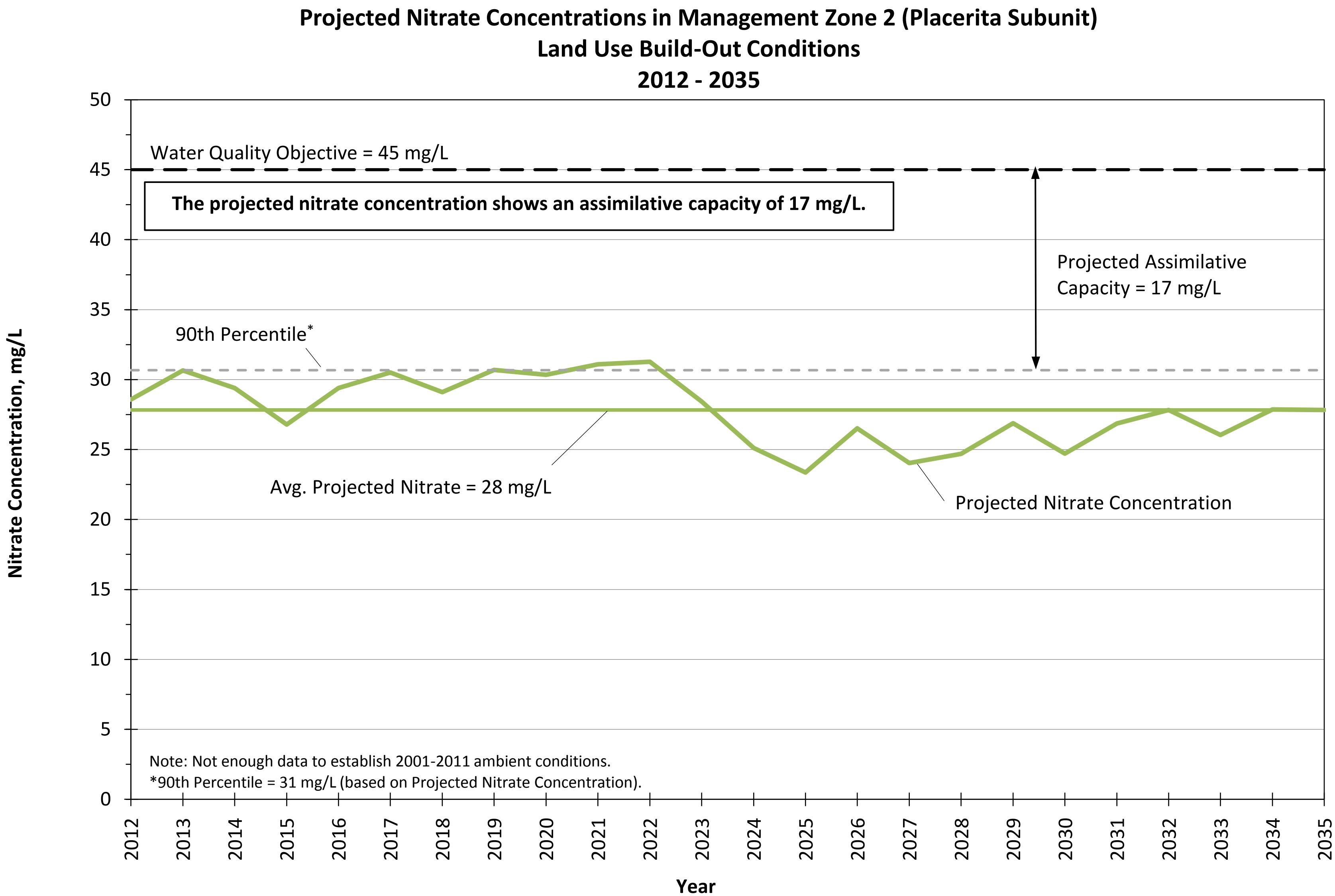
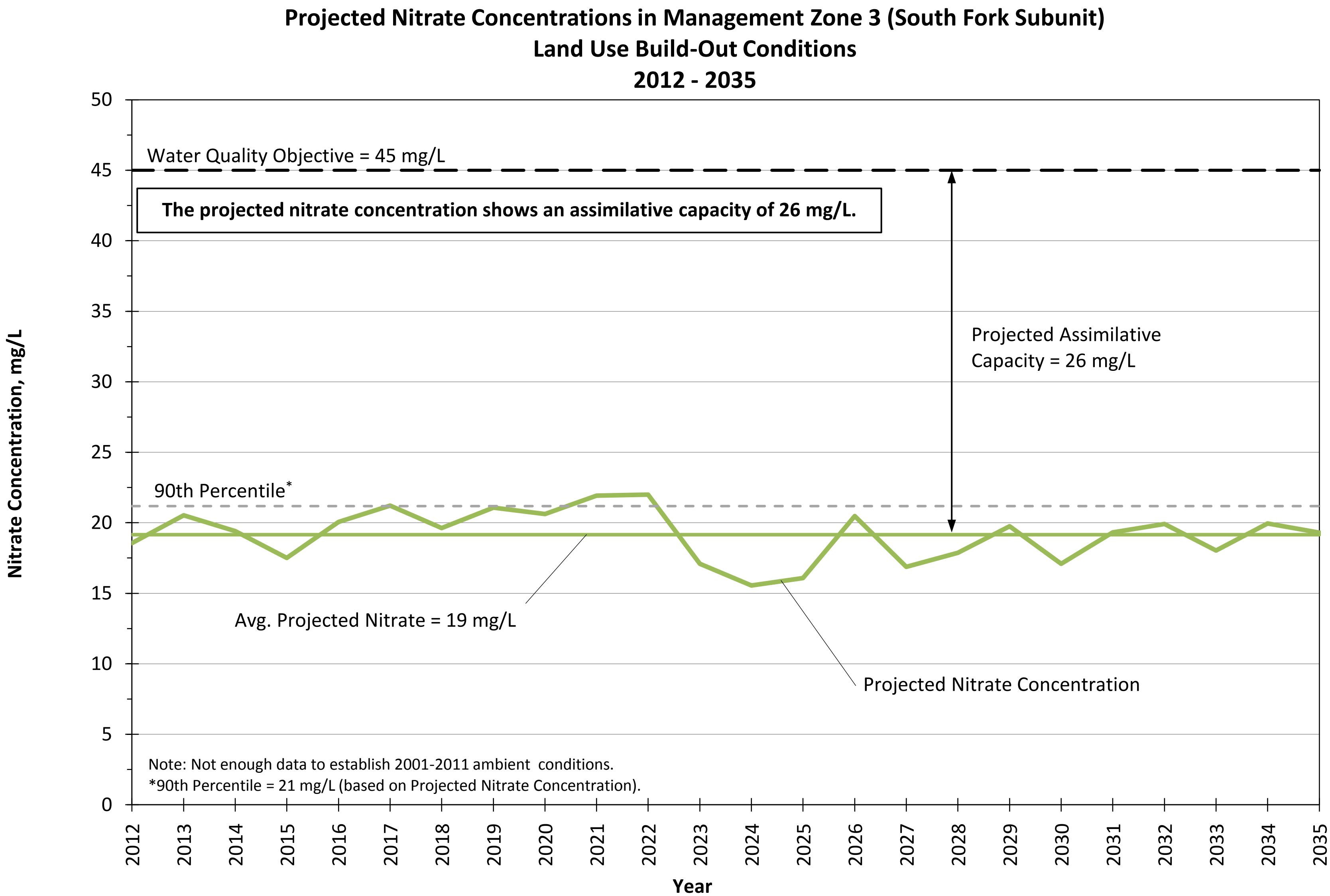


Figure 22.3.c


Projected Nitrate Concentrations in Management Zone 3 (South Fork Subunit)
Land Use Build-Out Conditions
2012 - 2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an assimilative capacity of 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
90th Percentile*
Avg. Projected Nitrate = 19 mg/L
Projected Nitrate Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 21 mg/L (based on Projected Nitrate Concentration).
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
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2026
2027
2028
2029
2030
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2032
2033
2034
2035

Figure 22.3.d

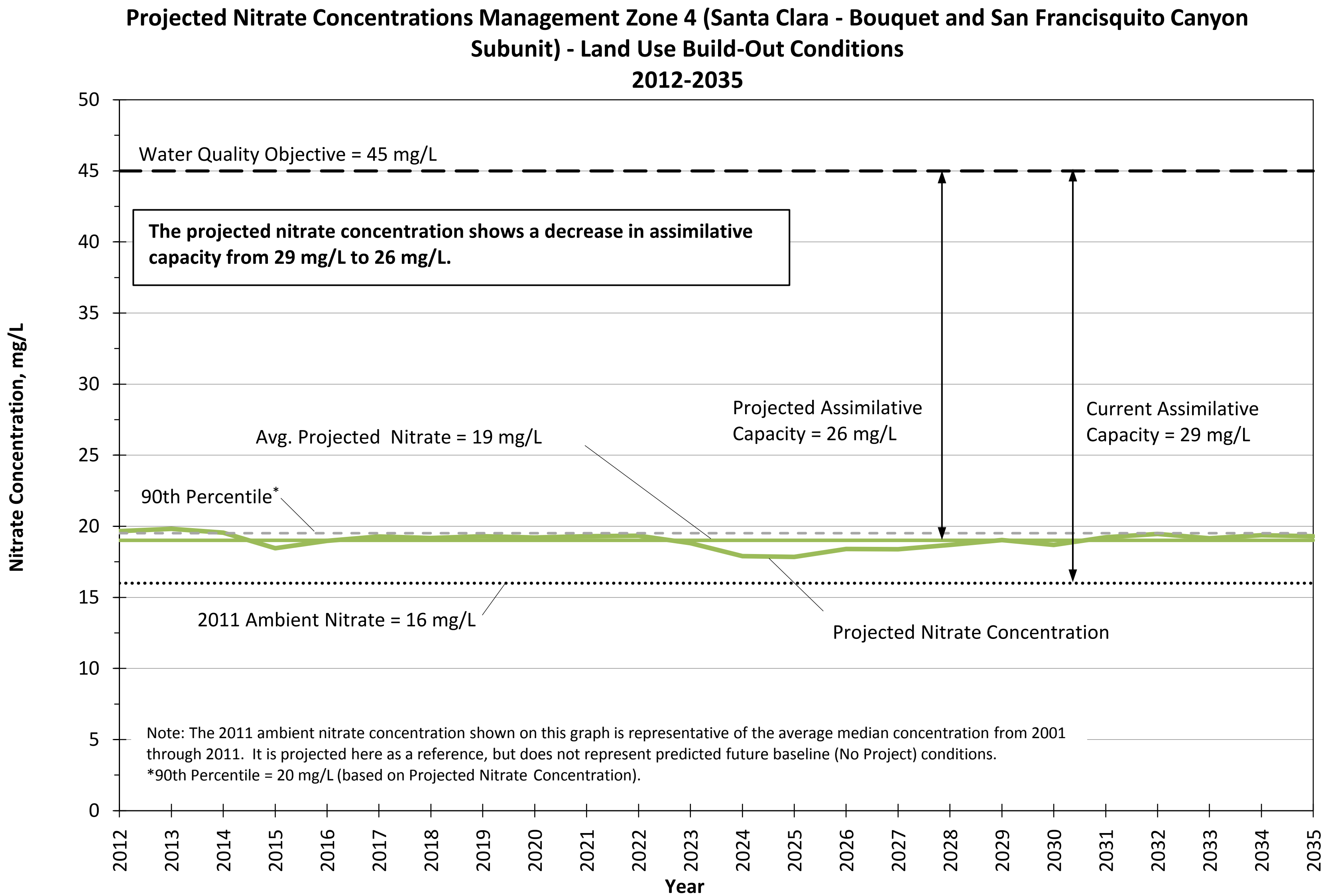

Projected Nitrate Concentrations Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - Land Use Build-Out Conditions
2012-2035
Nitrate Concentration, mg/L
50
45
40
35
30
25
20
15
10
5
0
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 29 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 29 mg/L
Avg. Projected Nitrate = 19 mg/L
90th Percentile*
2011 Ambient Nitrate = 16 mg/L
Projected Nitrate Concentration
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 20 mg/L (based on Projected Nitrate Concentration).
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 22.3.e

Projected Nitrate Concentrations in Management Zone 5 (Castaic Subunit)
Land Use Build-Out Conditions
2012 - 2035

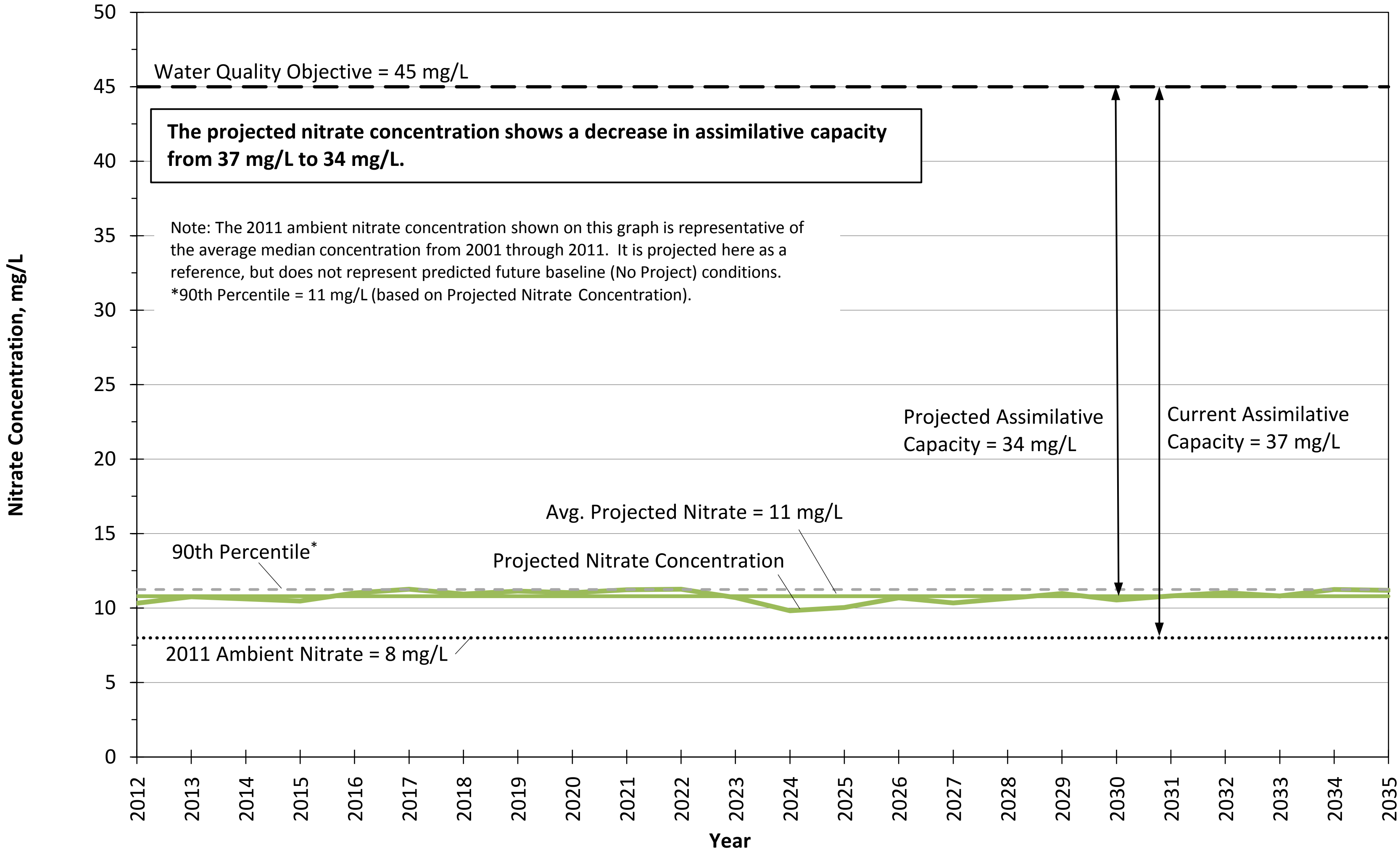
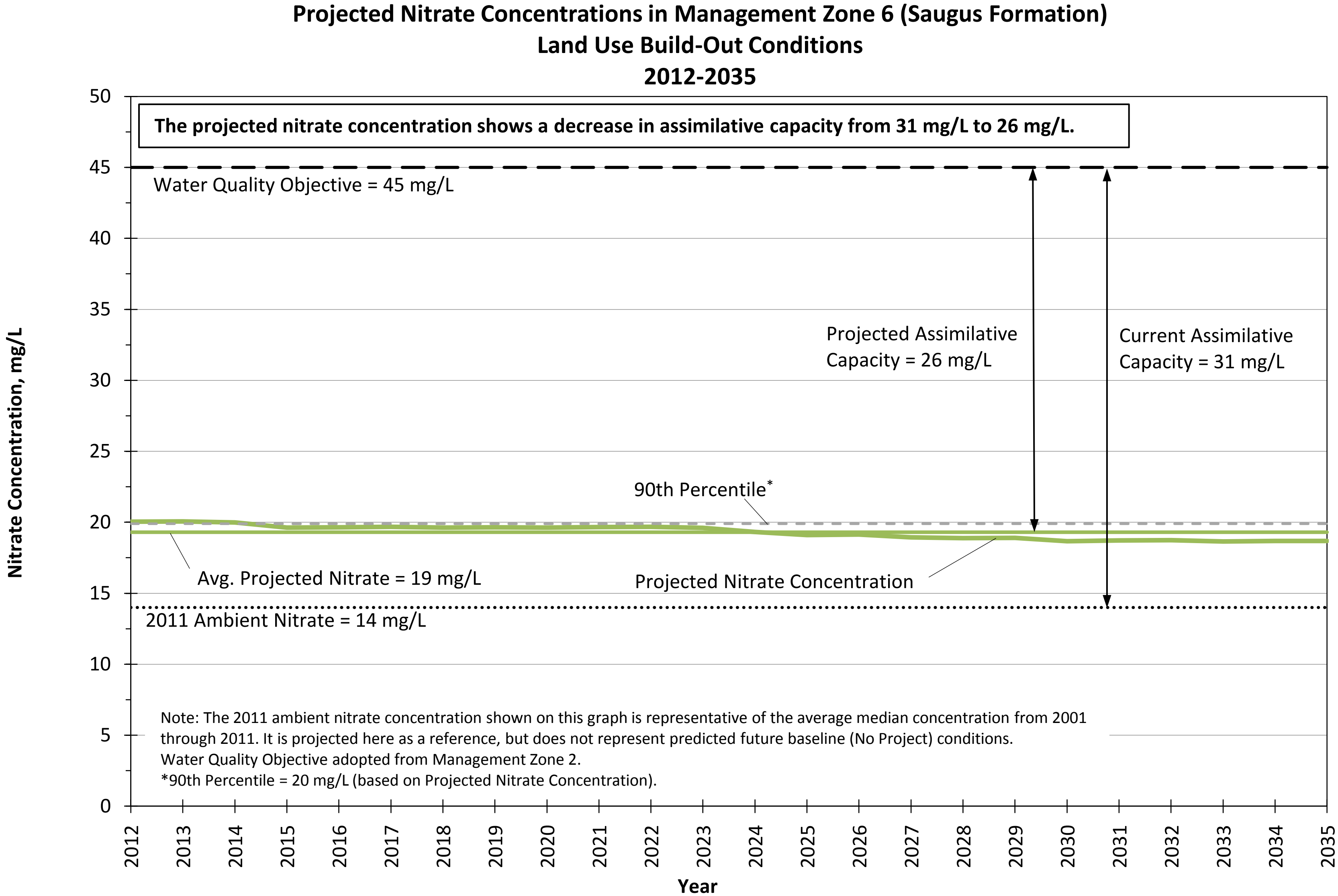


Figure 22.3.f


Projected Nitrate Concentrations in Management Zone 6 (Saugus Formation)
Land Use Build-Out Conditions
2012-2035
The projected nitrate concentration shows a decrease in assimilative capacity from 31 mg/L to 26 mg/L.
Water Quality Objective = 45 mg/L
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 31 mg/L
90th Percentile*
Avg. Projected Nitrate = 19 mg/L
Projected Nitrate Concentration
2011 Ambient Nitrate = 14 mg/L
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Water Quality Objective adopted from Management Zone 2.
*90th Percentile = 20 mg/L (based on Projected Nitrate Concentration).
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
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2026
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2034
2035

Figure 22.3.g

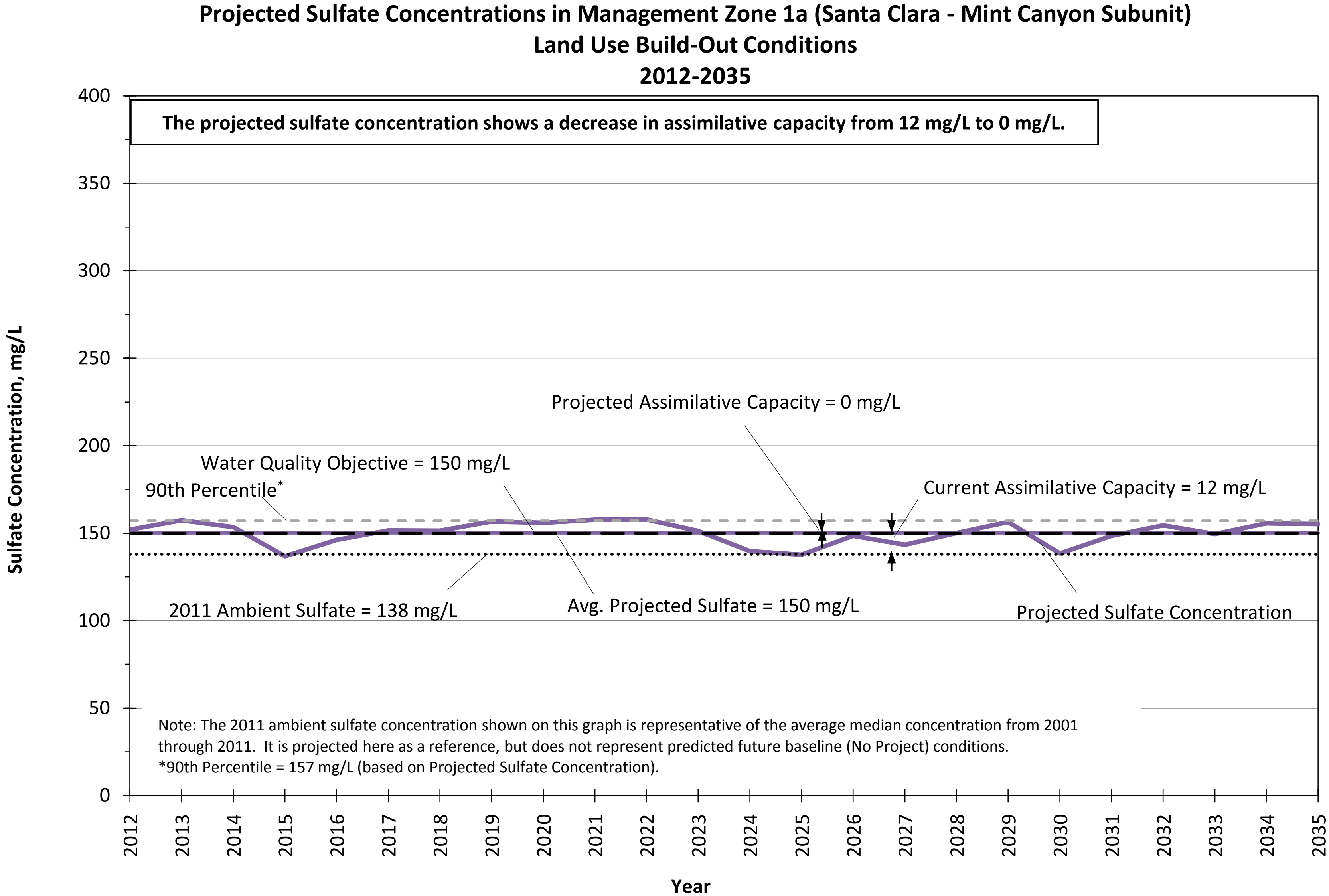

Projected Sulfate Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
Land Use Build-Out Conditions
2012-2035
The projected sulfate concentration shows a decrease in assimilative capacity from 12 mg/L to 0 mg/L.
Sulfate Concentration, mg/L
400
350
300
250
200
150
100
50
0
Projected Assimilative Capacity = 0 mg/L
Water Quality Objective = 150 mg/L
90th Percentile*
Current Assimilative Capacity = 12 mg/L
2011 Ambient Sulfate = 138 mg/L
Avg. Projected Sulfate = 150 mg/L
Projected Sulfate Concentration
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 157 mg/L (based on Projected Sulfate Concentration).
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 22.4.a

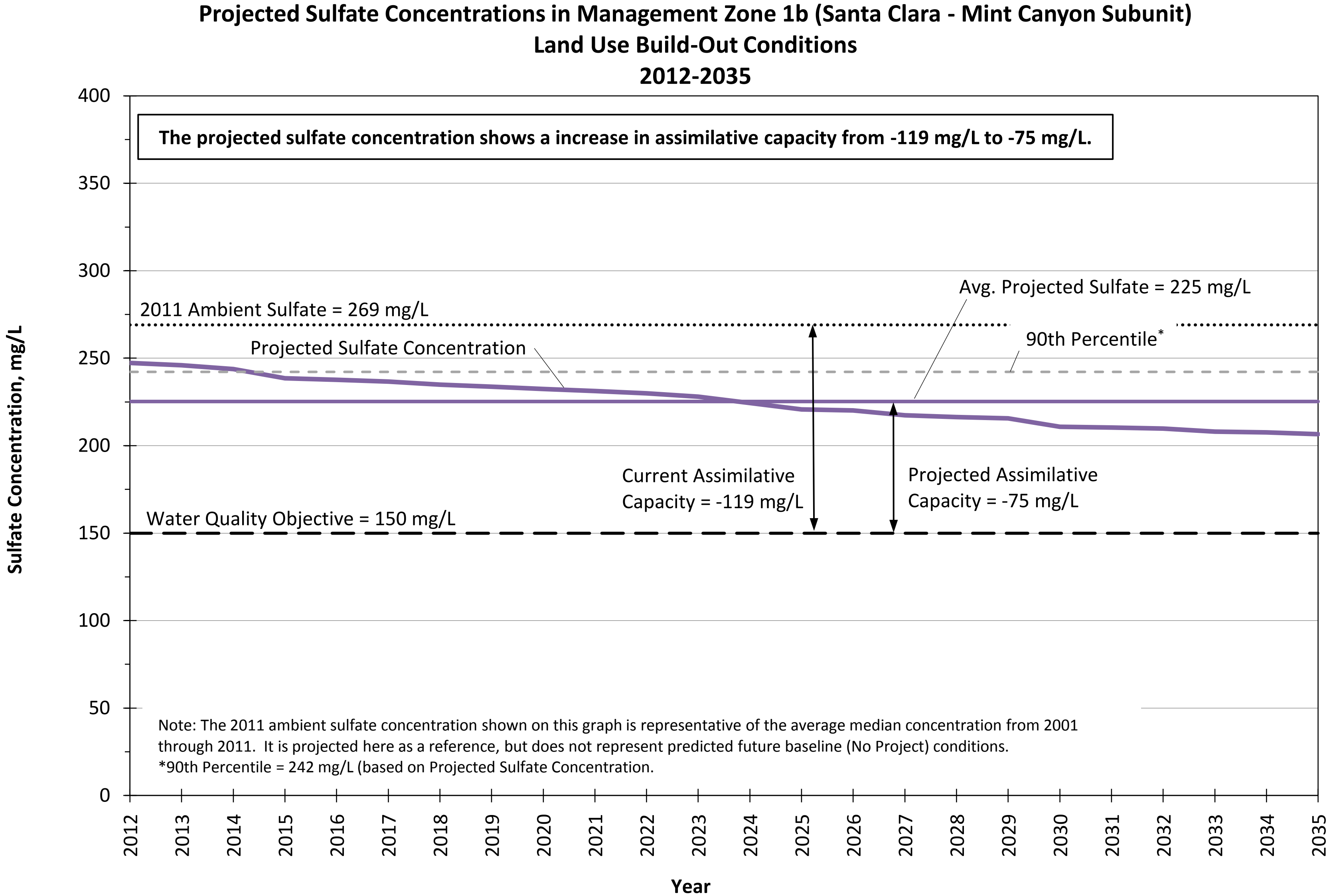

Projected Sulfate Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
Land Use Build-Out Conditions
2012-2035
The projected sulfate concentration shows a increase in assimilative capacity from -119 mg/L to -75 mg/L.
Sulfate Concentration, mg/L
400
350
300
250
200
150
100
50
0
2011 Ambient Sulfate = 269 mg/L
Projected Sulfate Concentration
Avg. Projected Sulfate = 225 mg/L
90th Percentile*
Current Assimilative Capacity = -119 mg/L
Projected Assimilative Capacity = -75 mg/L
Water Quality Objective = 150 mg/L
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 242 mg/L (based on Projected Sulfate Concentration.
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 22.4.b

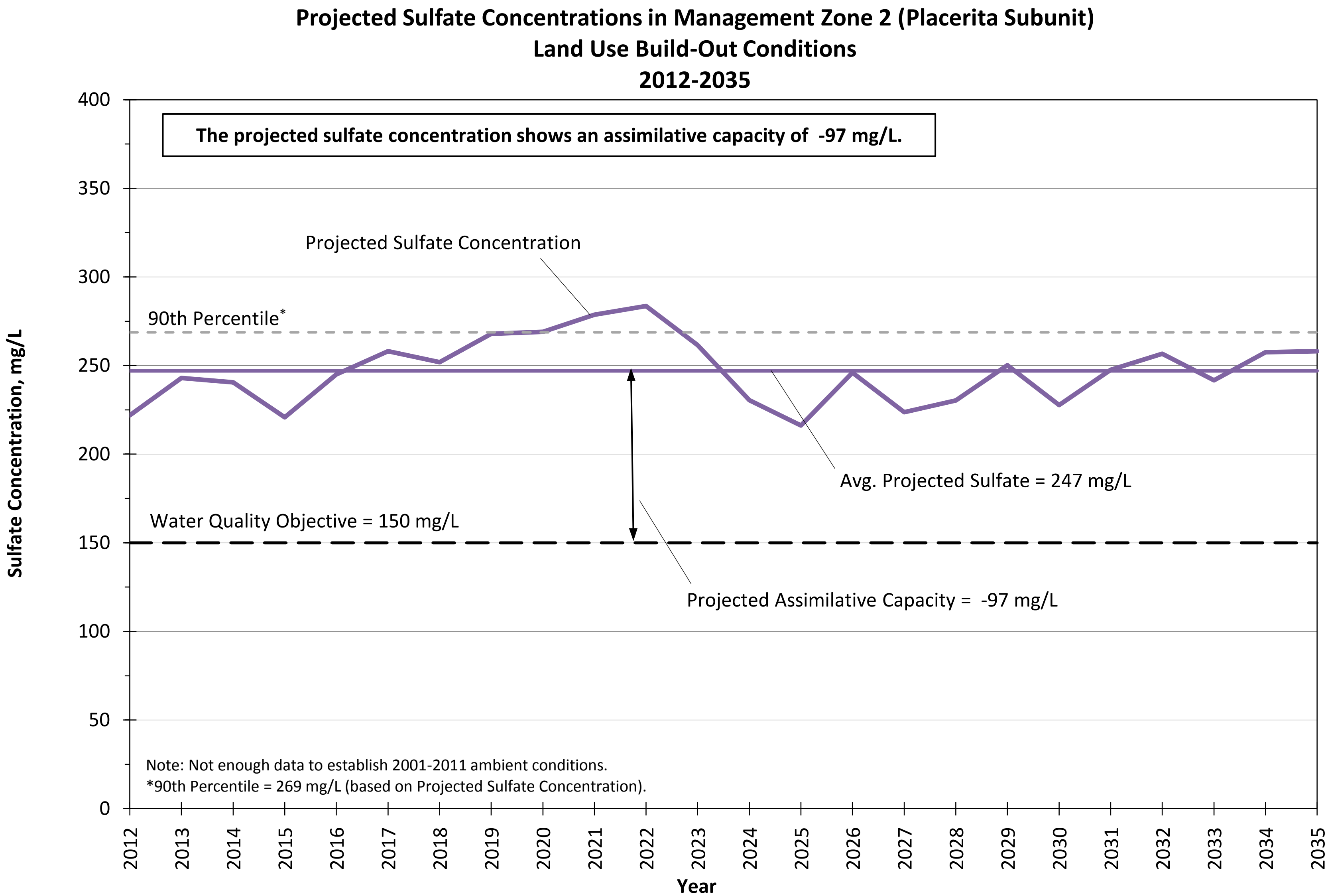

Projected Sulfate Concentrations in Management Zone 2 (Placerita Subunit)
Land Use Build-Out Conditions
2012-2035
The projected sulfate concentration shows an assimilative capacity of -97 mg/L.
Projected Sulfate Concentration
90th Percentile*
Avg. Projected Sulfate = 247 mg/L
Water Quality Objective = 150 mg/L
Projected Assimilative Capacity = -97 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 269 mg/L (based on Projected Sulfate Concentration).
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 22.4.c

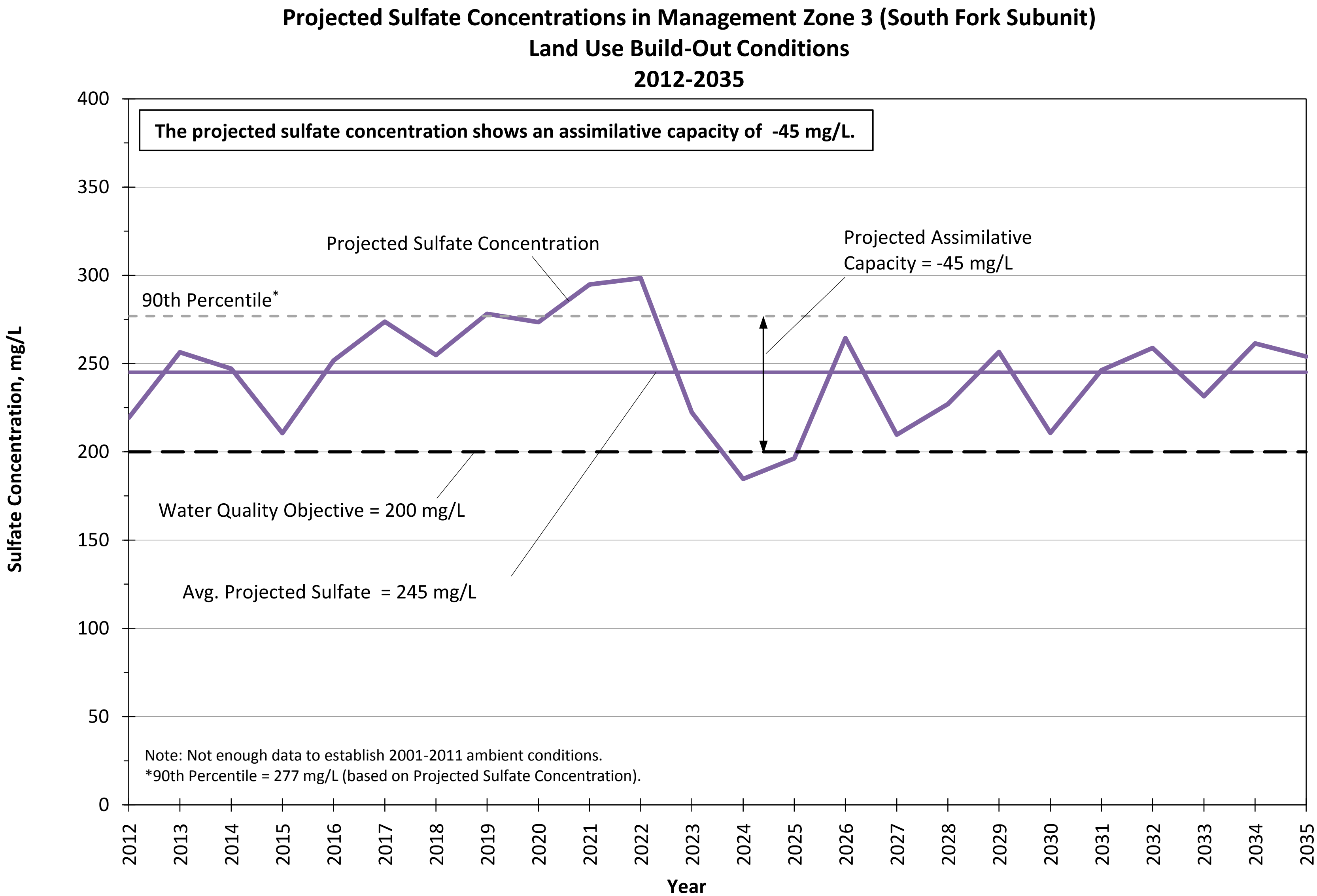

Projected Sulfate Concentrations in Management Zone 3 (South Fork Subunit)
Land Use Build-Out Conditions
2012-2035
The projected sulfate concentration shows an assimilative capacity of -45 mg/L.
Projected Sulfate Concentration
Projected Assimilative Capacity = -45 mg/L
90th Percentile*
Water Quality Objective = 200 mg/L
Avg. Projected Sulfate = 245 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 277 mg/L (based on Projected Sulfate Concentration).
Sulfate Concentration, mg/L
0
50
100
150
200
250
300
350
400
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 22.4.d

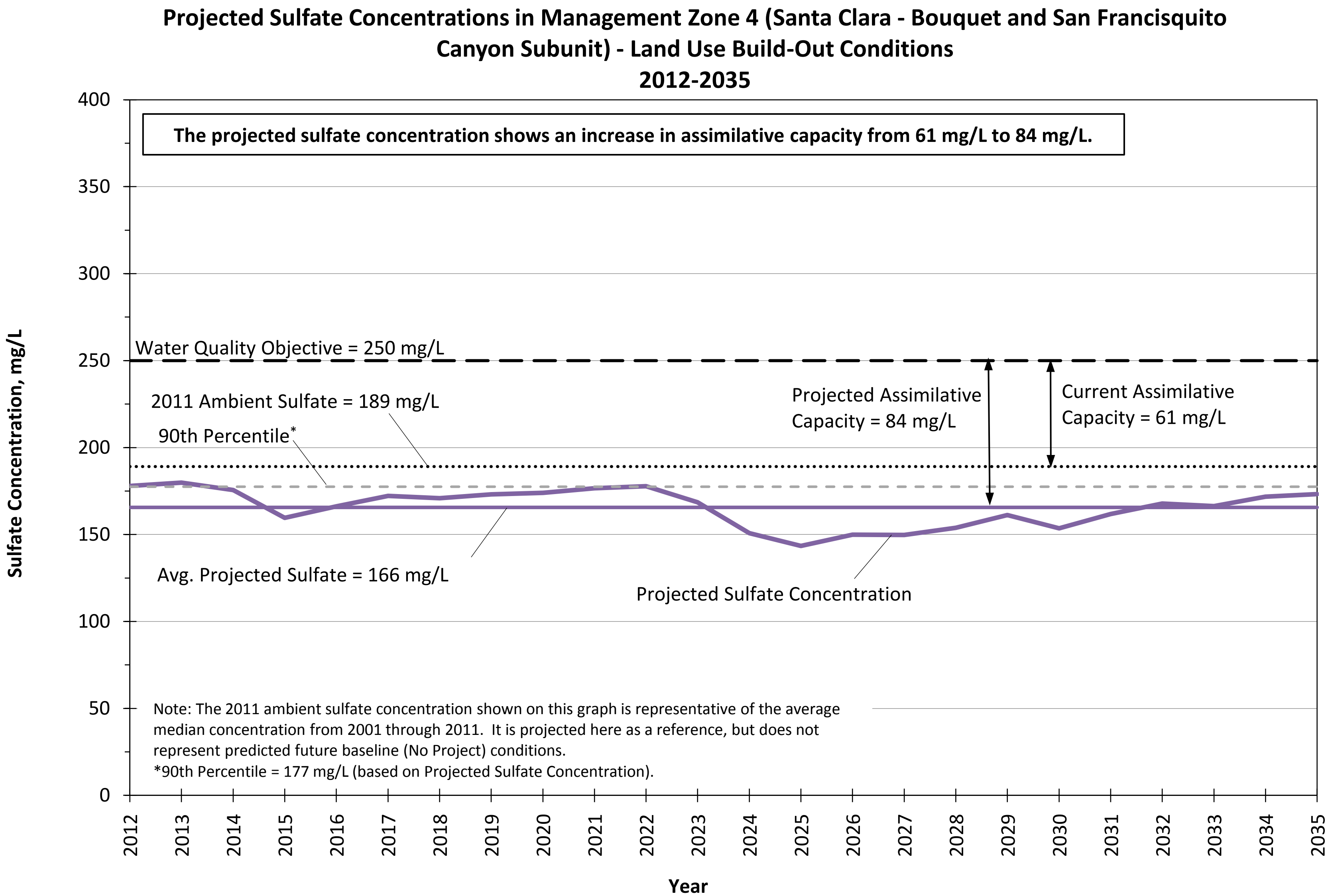

Projected Sulfate Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - Land Use Build-Out Conditions
2012-2035
The projected sulfate concentration shows an increase in assimilative capacity from 61 mg/L to 84 mg/L.
Water Quality Objective = 250 mg/L
2011 Ambient Sulfate = 189 mg/L
90th Percentile*
Projected Assimilative Capacity = 84 mg/L
Current Assimilative Capacity = 61 mg/L
Avg. Projected Sulfate = 166 mg/L
Projected Sulfate Concentration
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 177 mg/L (based on Projected Sulfate Concentration).
Sulfate Concentration, mg/L
0
50
100
150
200
250
300
350
400
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 22.4.e

Projected Sulfate Concentrations in Management Zone 5 (Castaic Subunit)
Land Use Build-Out Conditions
2012-2035

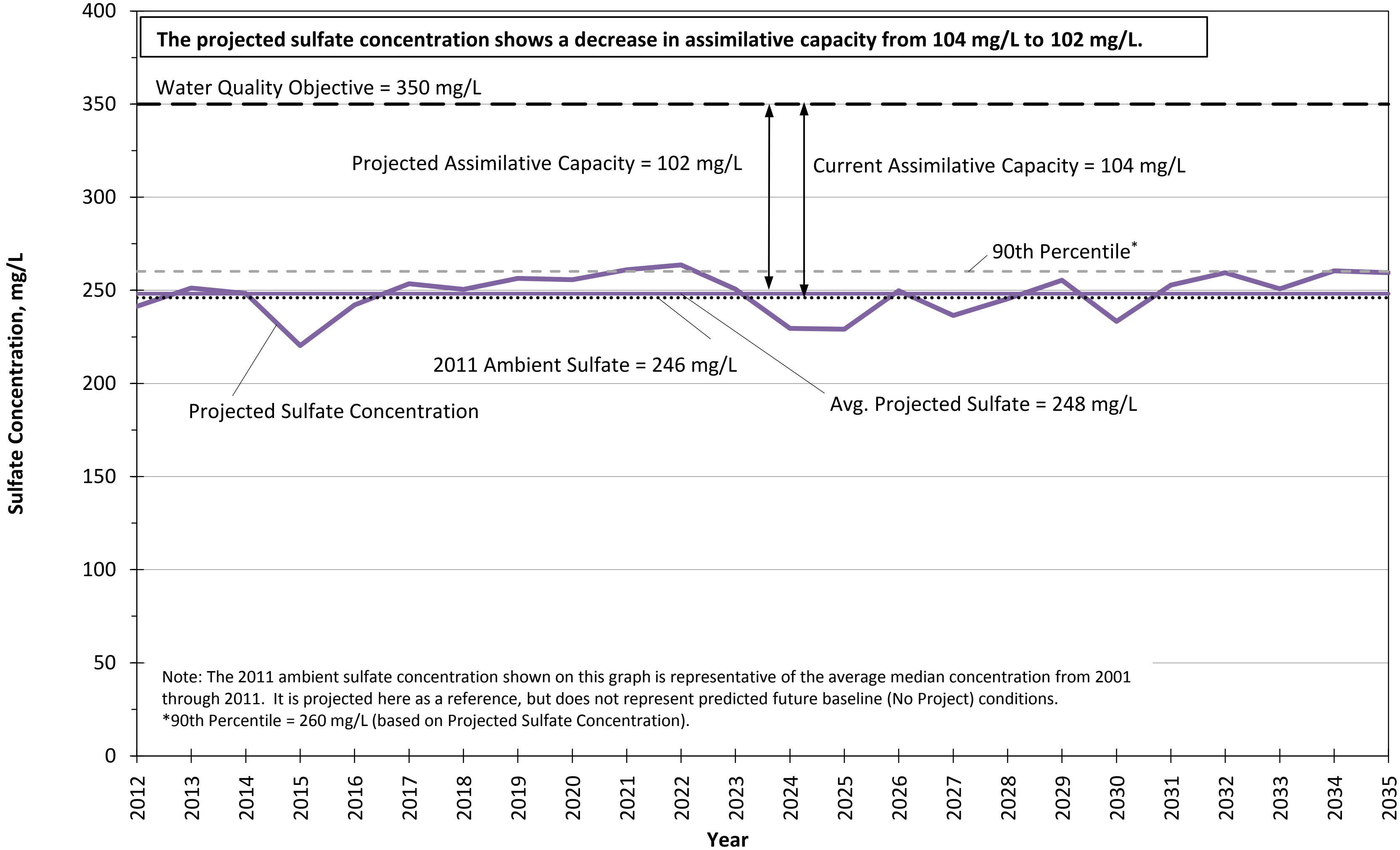


Figure 22.4.f

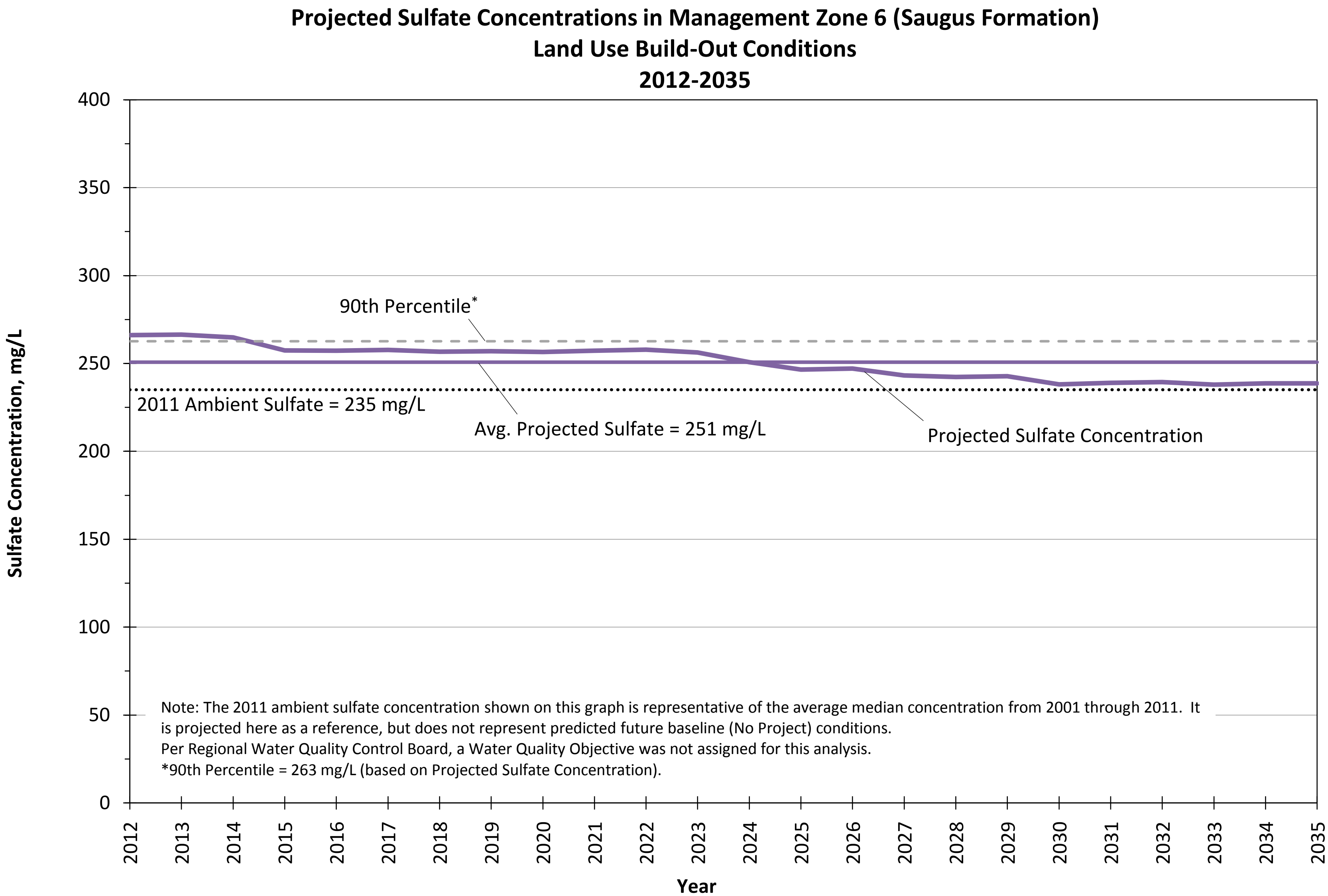
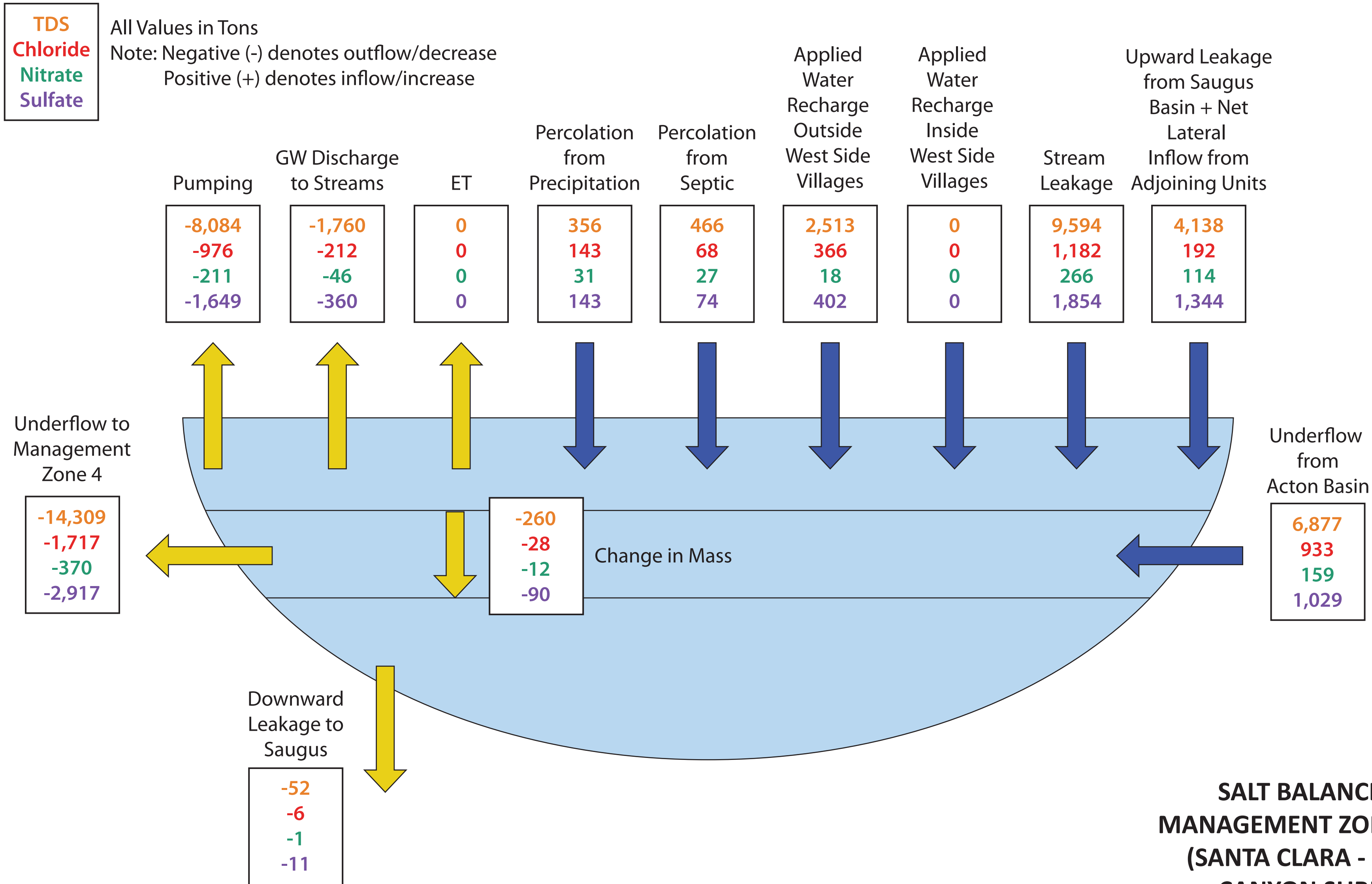

Projected Sulfate Concentrations in Management Zone 6 (Saugus Formation)
Land Use Build-Out Conditions
2012-2035
Sulfate Concentration, mg/L
400
350
300
250
200
150
100
50
0
90th Percentile*
2011 Ambient Sulfate = 235 mg/L
Avg. Projected Sulfate = 251 mg/L
Projected Sulfate Concentration
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Per Regional Water Quality Control Board, a Water Quality Objective was not assigned for this analysis.
*90th Percentile = 263 mg/L (based on Projected Sulfate Concentration).
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 22.4.g



SALT BALANCE FOR MANAGEMENT ZONE 1a (SANTA CLARA - MINT CANYON SUBUNIT) SCVSD CHLORIDE COMPLIANCE CONDITIONS 2012-2035

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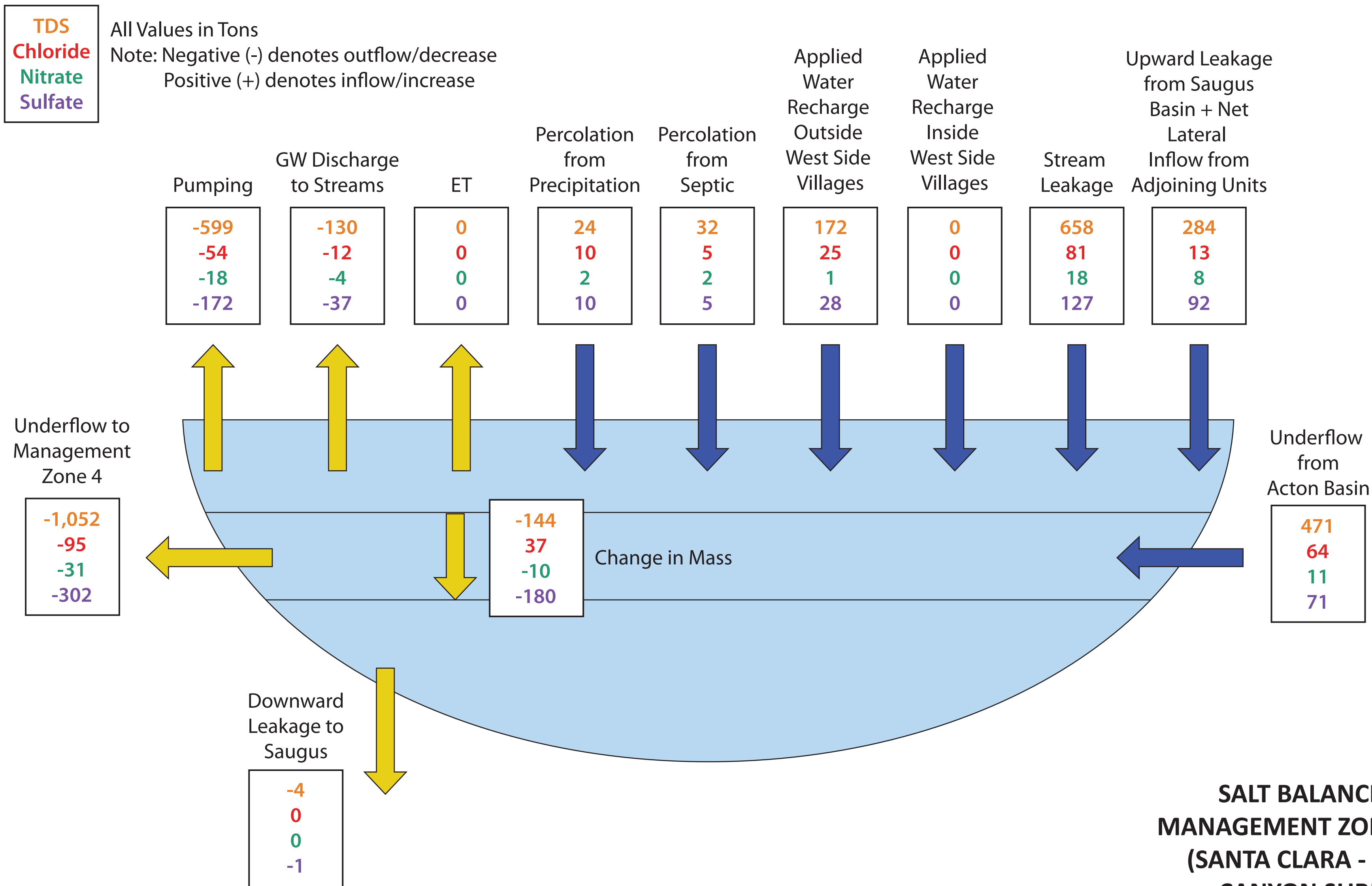
Figure 23a

8-Dec-16



SALT BALANCE FOR MANAGEMENT ZONE 1b (SANTA CLARA - MINT CANYON SUBUNIT) SCVSD CHLORIDE COMPLIANCE CONDITIONS 2012-2035

Figure 23b

8-Dec-16

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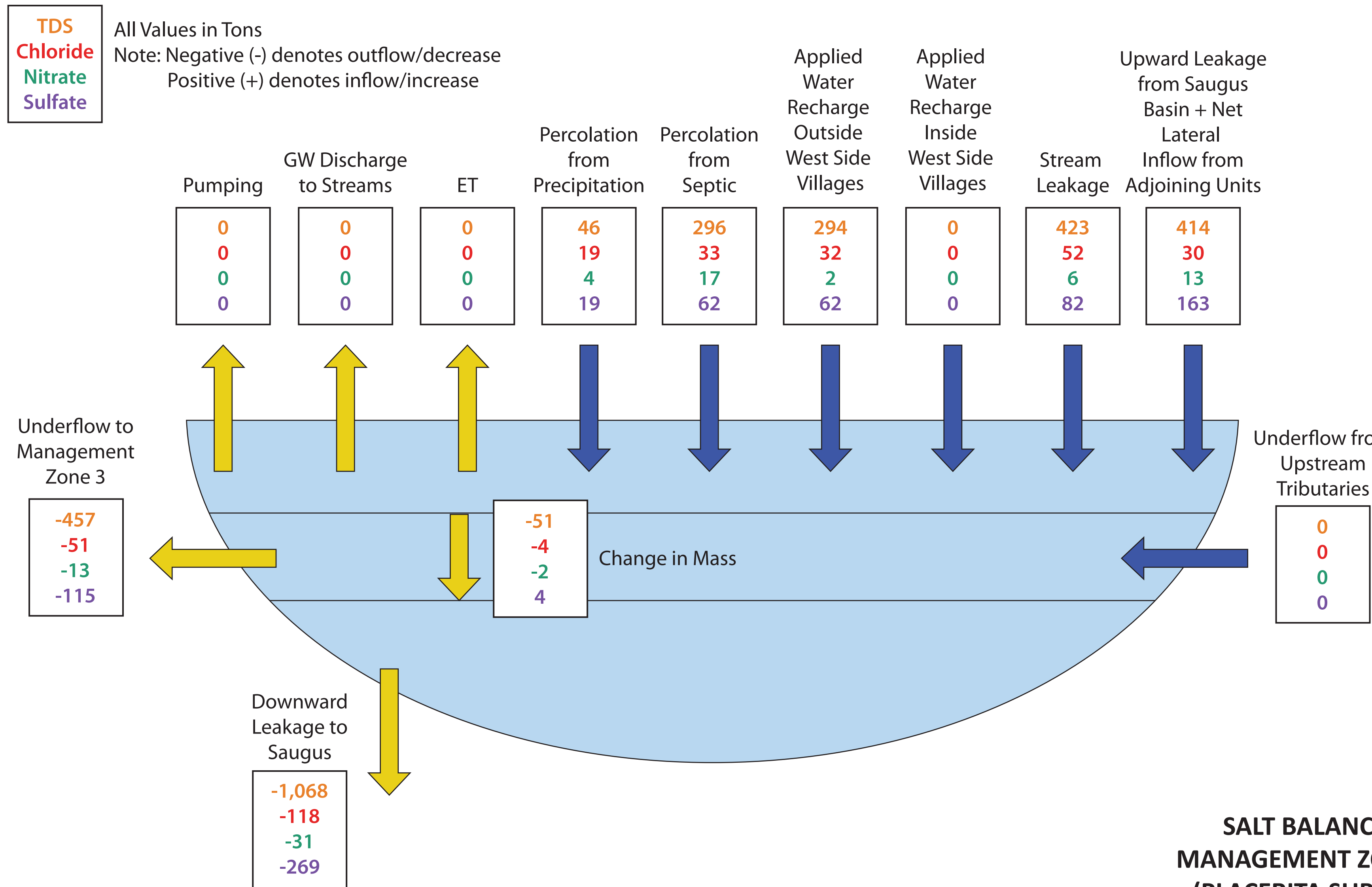
CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 2 (PLACERITA SUBUNIT) SCVSD CHLORIDE COMPLIANCE CONDITIONS 2012-2035

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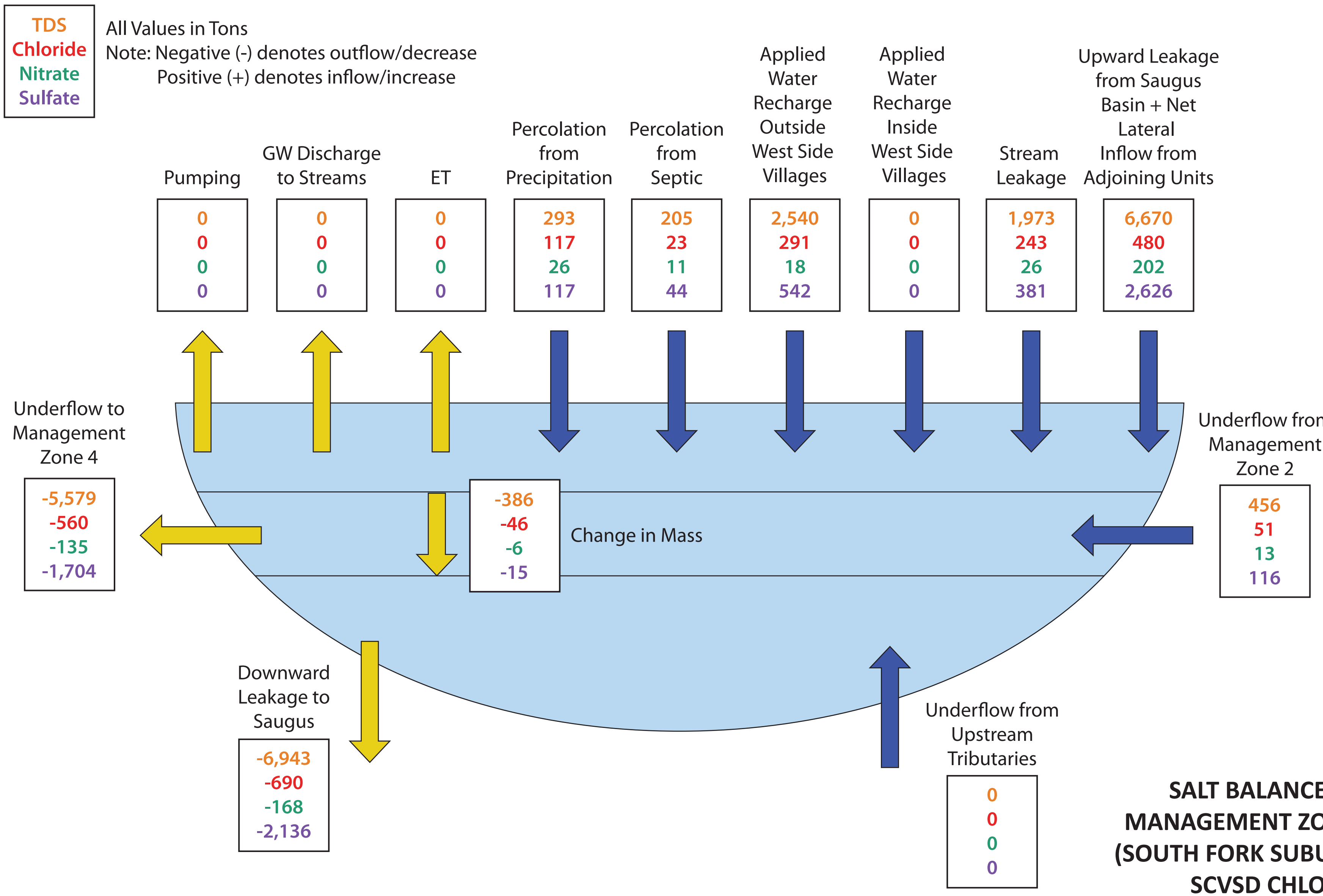
Figure 23c



SALT BALANCE FOR MANAGEMENT ZONE 3 (SOUTH FORK SUBUNIT) SCVSD CHLORIDE COMPLIANCE CONDITIONS 2012-2035

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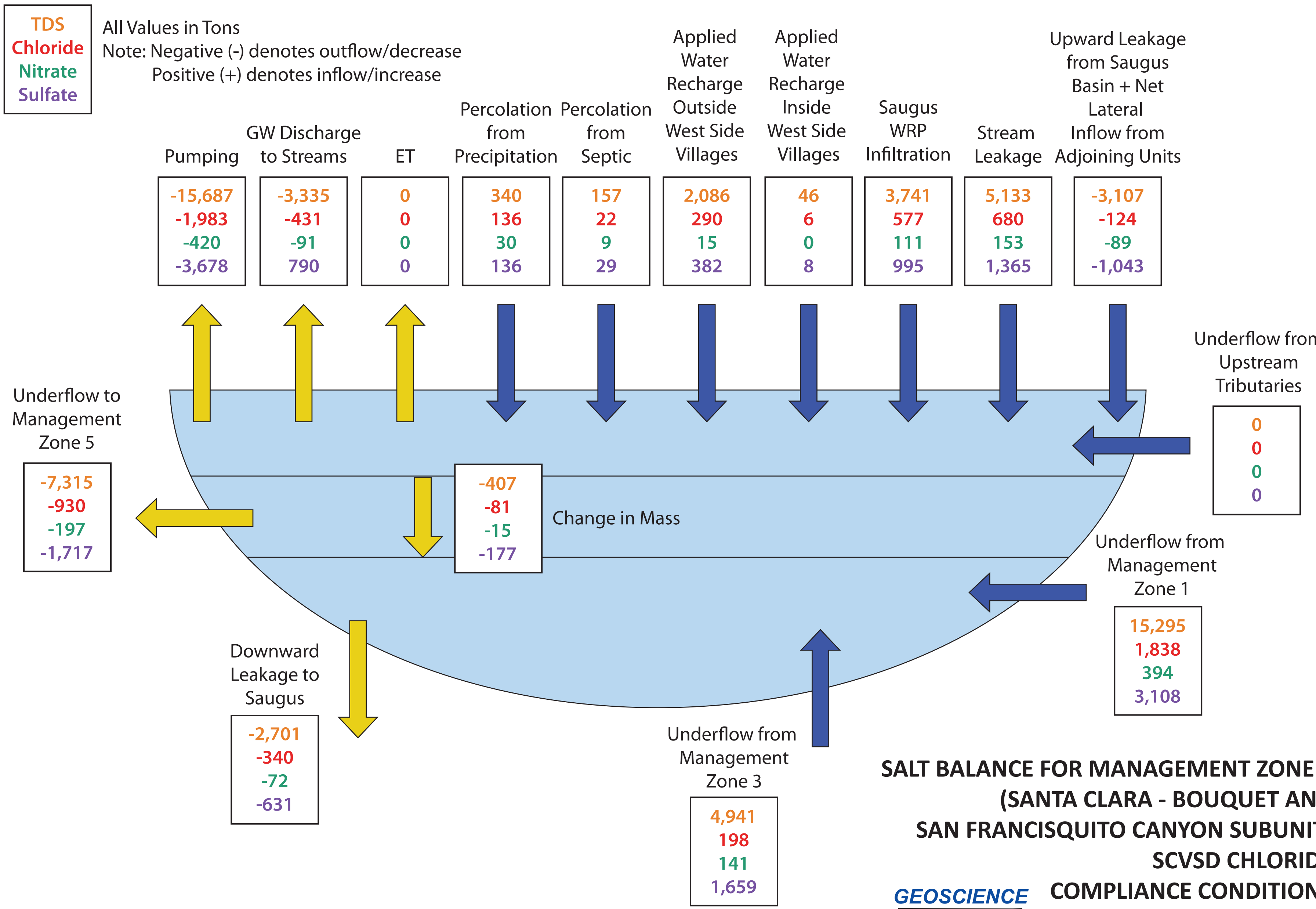
Figure 23d



SALT BALANCE FOR MANAGEMENT ZONE 4 (SANTA CLARA - BOUQUET AND SAN FRANCISQUITO CANYON SUBUNIT) SCVSD CHLORIDE COMPLIANCE CONDITIONS 2012-2035

8-Dec-16

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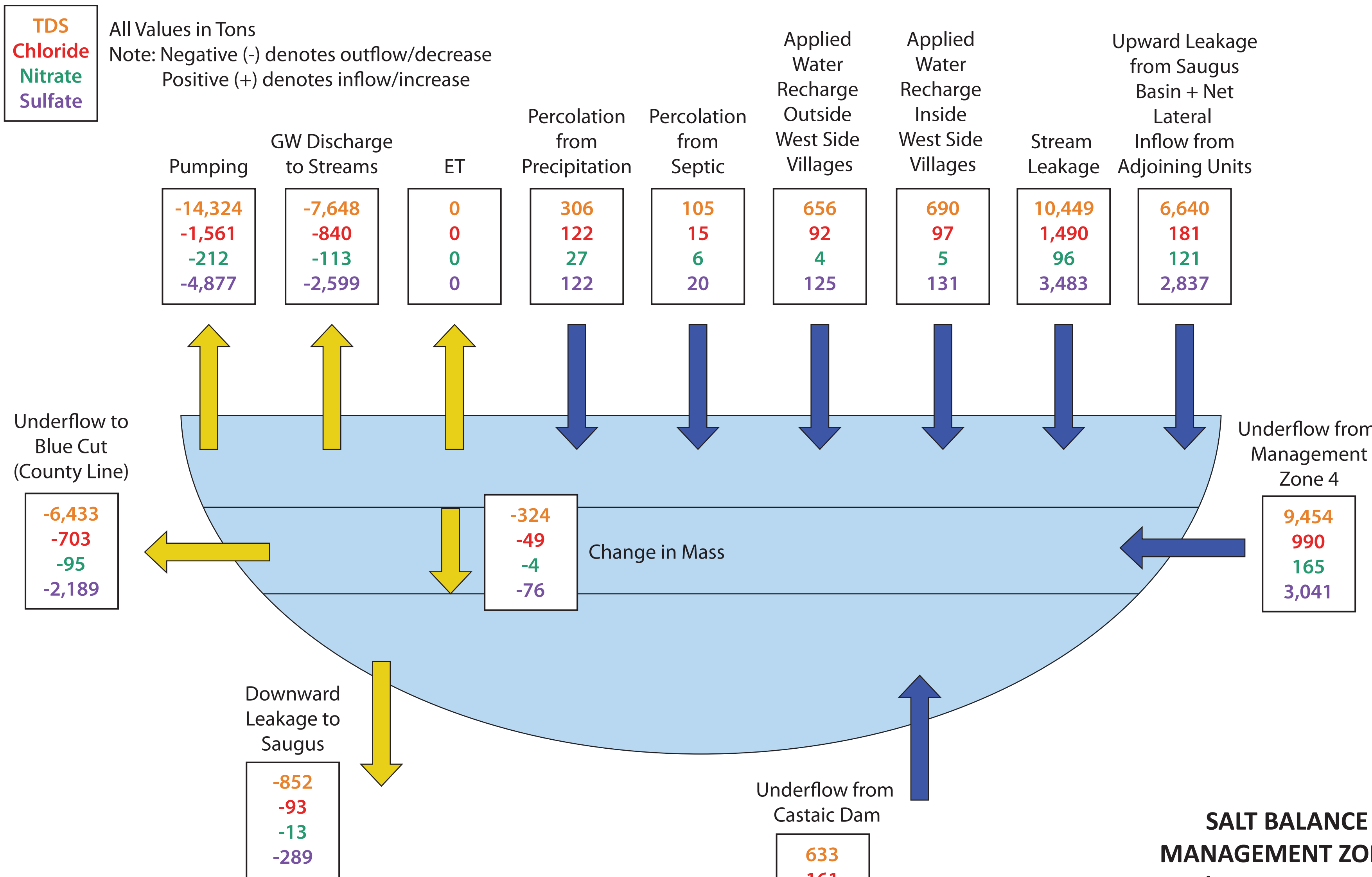
Figure 23e

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 5 (CASTAIC SUBUNIT) SCVSD CHLORIDE COMPLIANCE CONDITIONS 2012-2035

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Figure 23f

8-Dec-16

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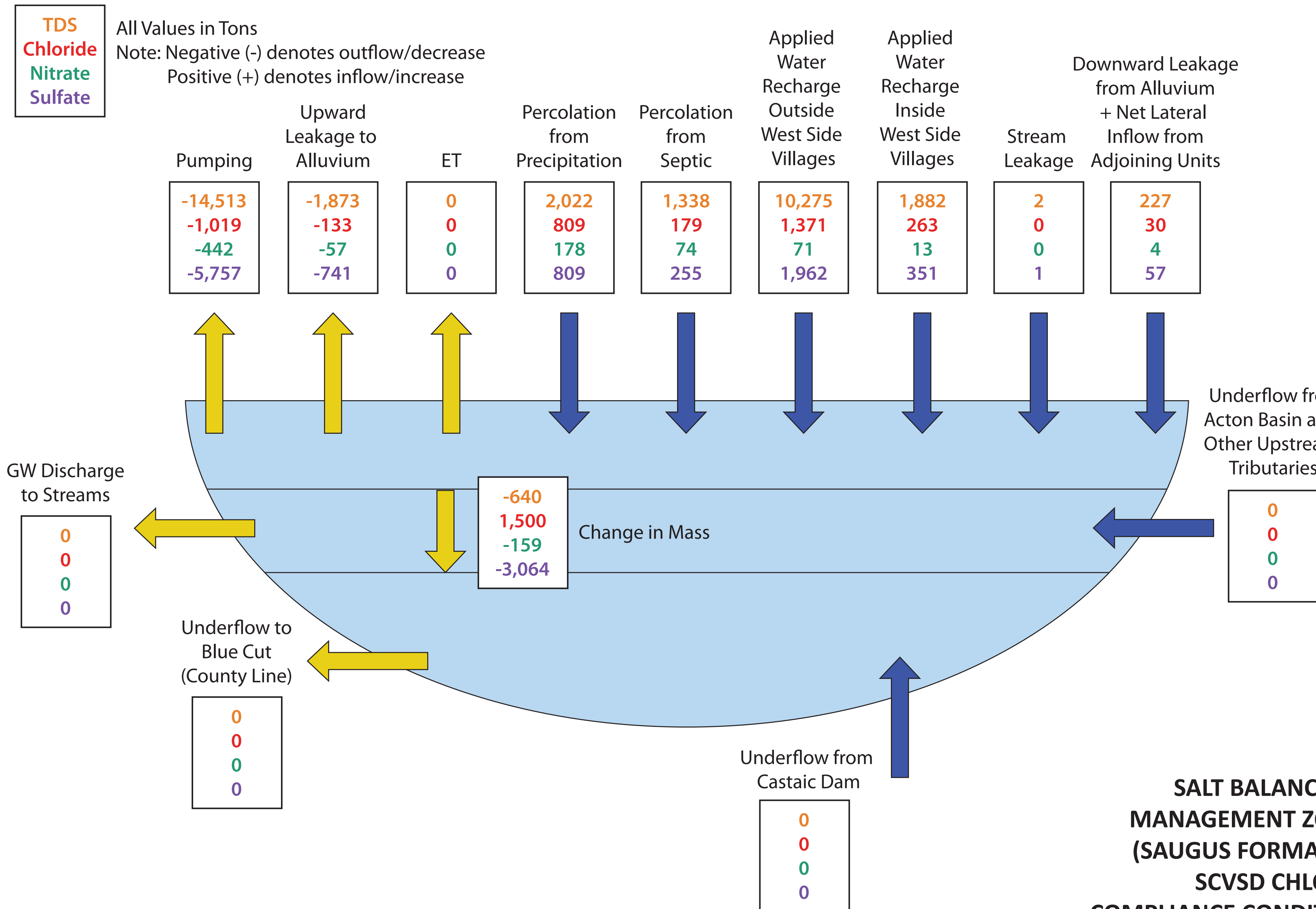

SALT BALANCE FOR MANAGEMENT ZONE 6 (SAUGUS FORMATION) SCVSD CHLORIDE COMPLIANCE CONDITIONS 2012-2035

Figure 23g

8-Dec-16

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Projected TDS Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
SCVSD Chloride Compliance Conditions
2012-2035

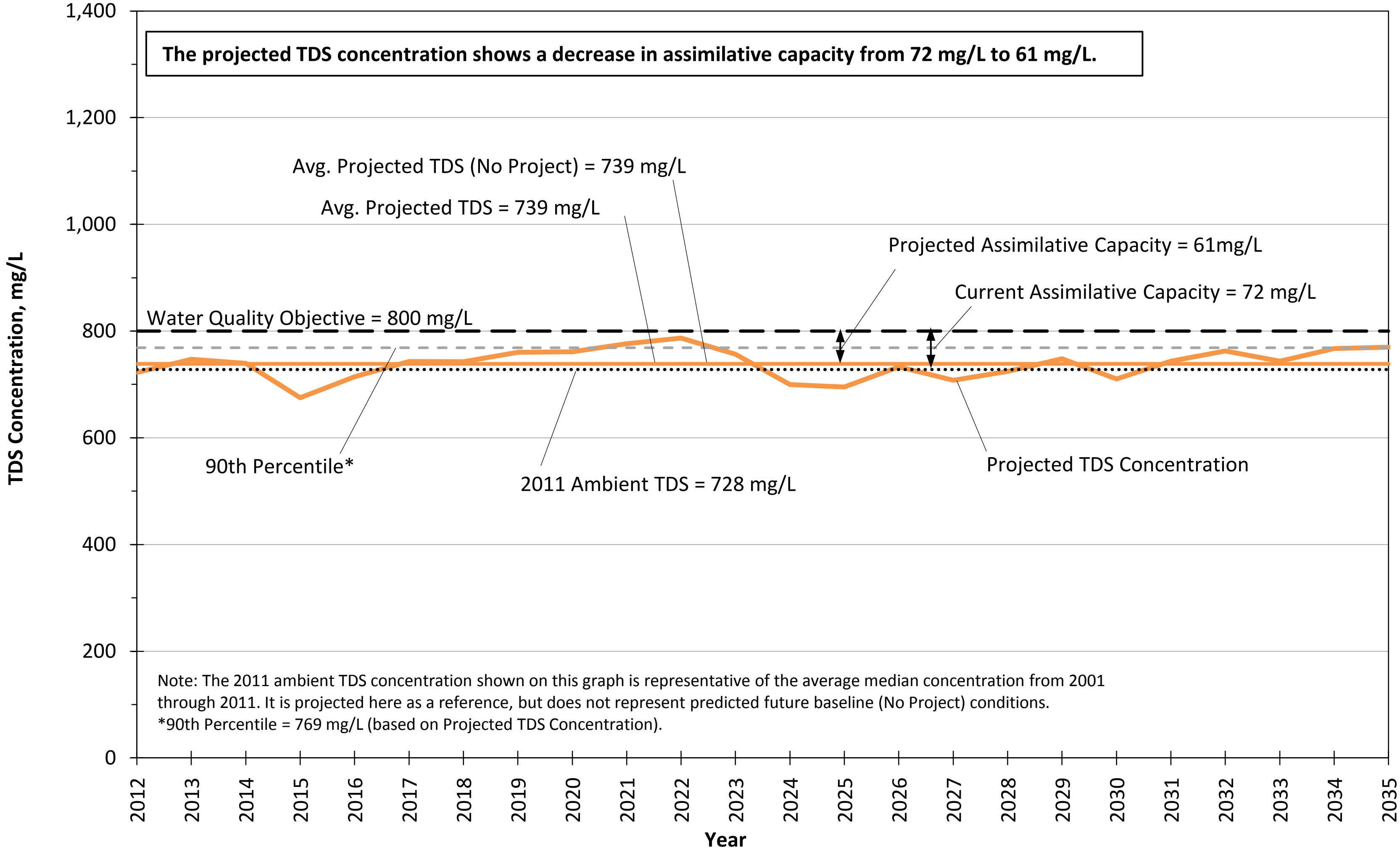


Figure 24.1.a

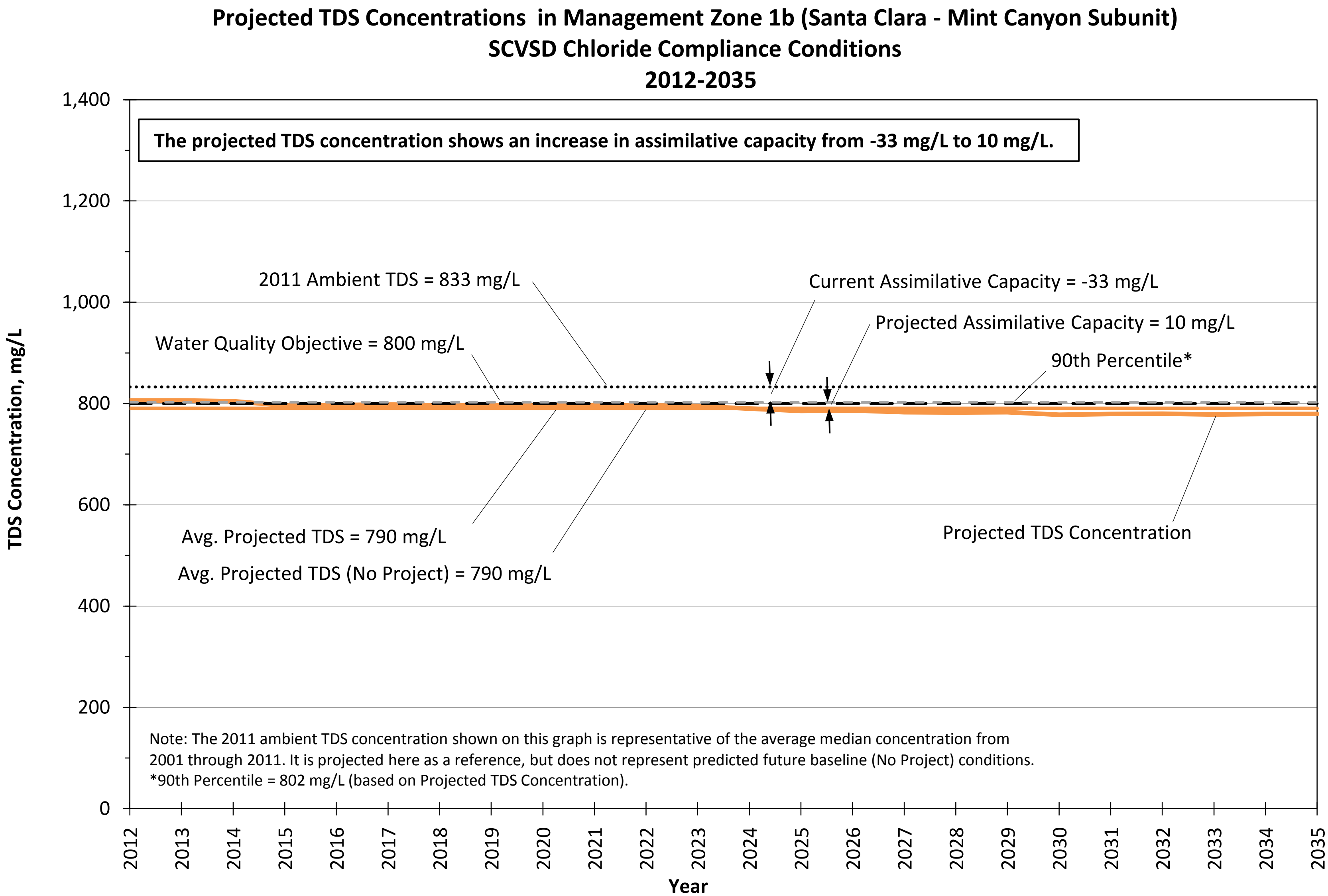

Projected TDS Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
SCVSD Chloride Compliance Conditions
2012-2035
The projected TDS concentration shows an increase in assimilative capacity from -33 mg/L to 10 mg/L.
2011 Ambient TDS = 833 mg/L
Current Assimilative Capacity = -33 mg/L
Projected Assimilative Capacity = 10 mg/L
Water Quality Objective = 800 mg/L
90th Percentile*
Avg. Projected TDS = 790 mg/L
Avg. Projected TDS (No Project) = 790 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 802 mg/L (based on Projected TDS Concentration).
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035
Year

Figure 24.1.b

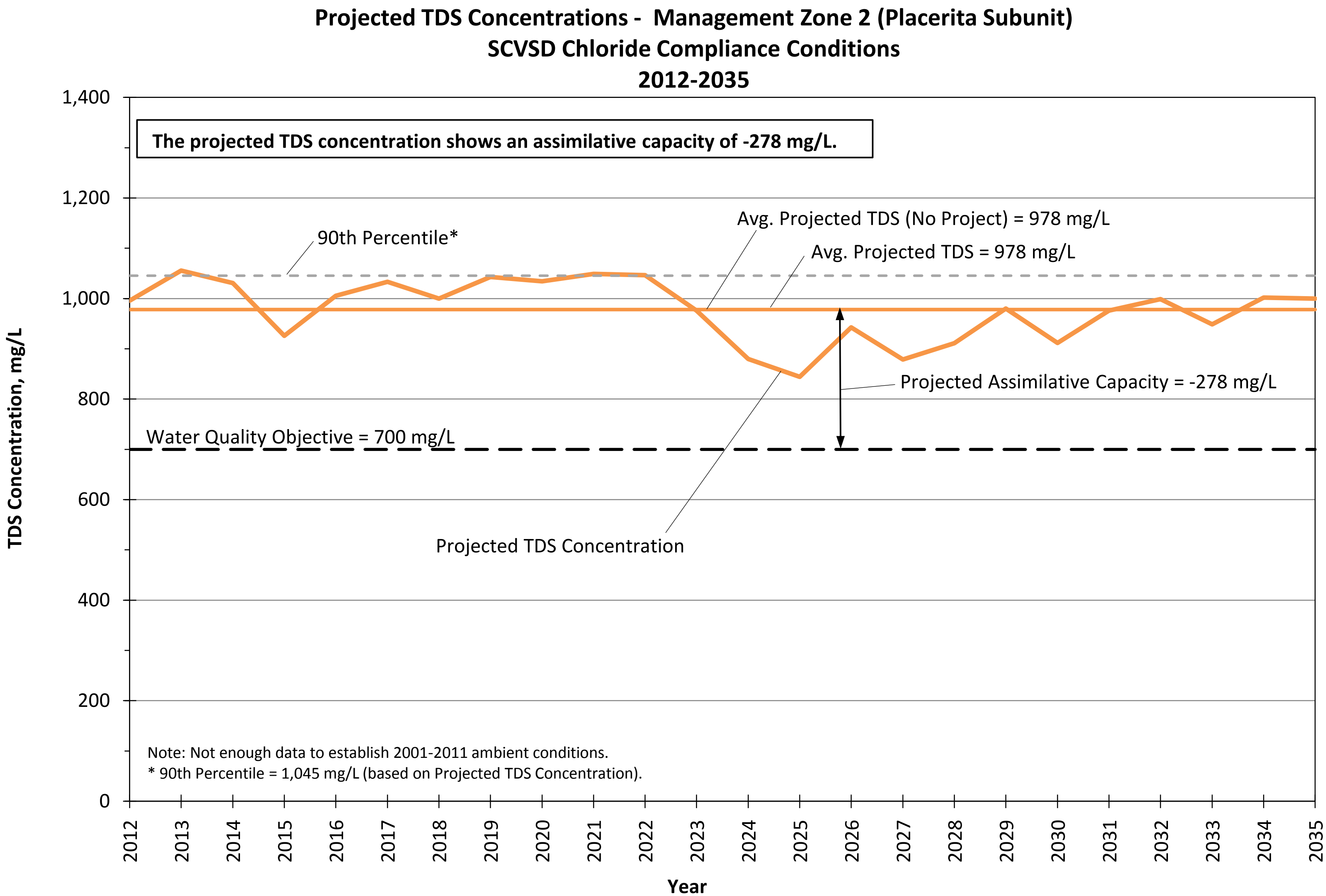

Projected TDS Concentrations - Management Zone 2 (Placerita Subunit)
SCVSD Chloride Compliance Conditions
2012-2035
The projected TDS concentration shows an assimilative capacity of -278 mg/L.
Avg. Projected TDS (No Project) = 978 mg/L
90th Percentile*
Avg. Projected TDS = 978 mg/L
Projected Assimilative Capacity = -278 mg/L
Water Quality Objective = 700 mg/L
Projected TDS Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
* 90th Percentile = 1,045 mg/L (based on Projected TDS Concentration).
TDS Concentration, mg/L
Year
1,400
1,200
1,000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 24.1.c

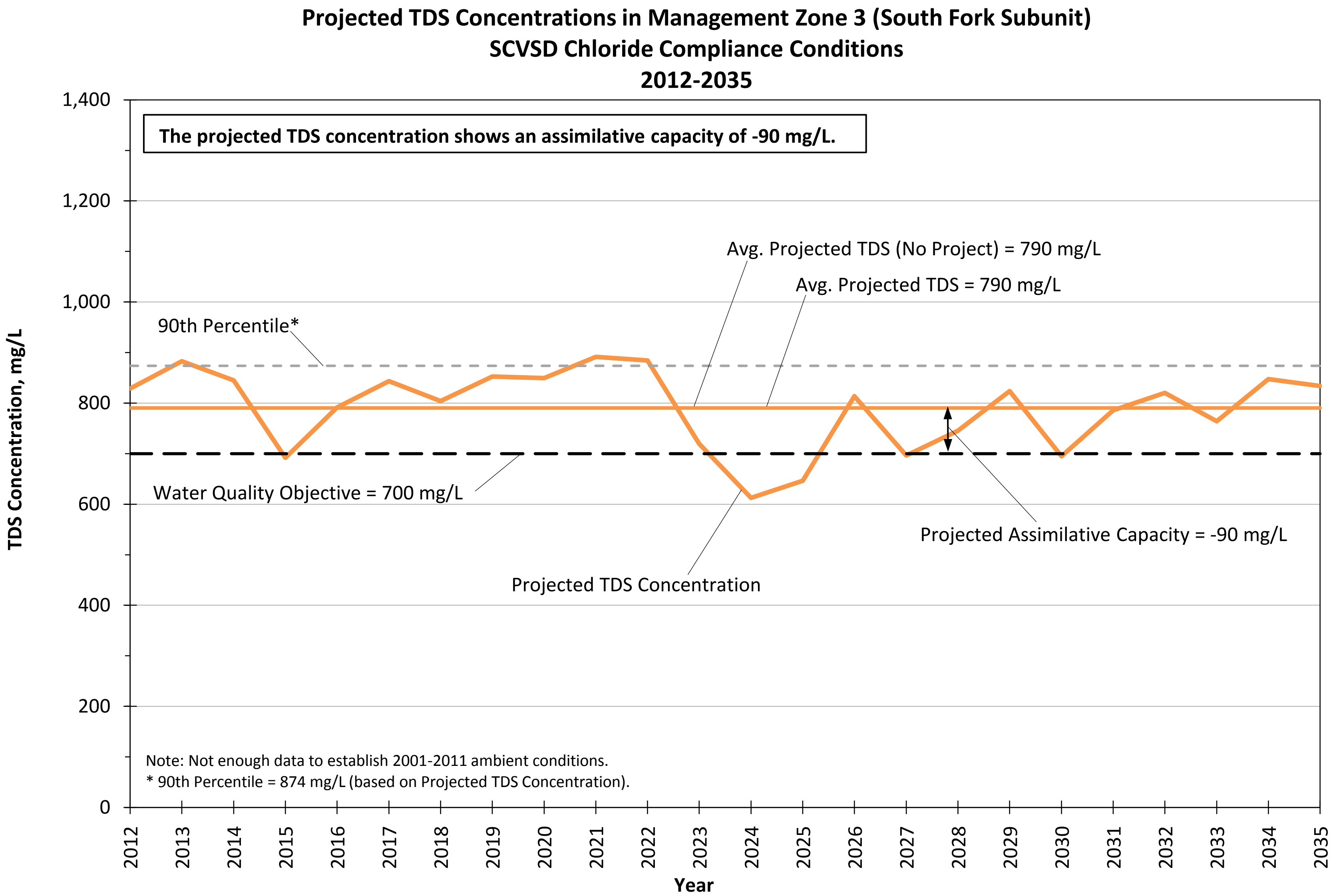

Projected TDS Concentrations in Management Zone 3 (South Fork Subunit)
SCVSD Chloride Compliance Conditions
2012-2035
The projected TDS concentration shows an assimilative capacity of -90 mg/L.
Avg. Projected TDS (No Project) = 790 mg/L
Avg. Projected TDS = 790 mg/L
90th Percentile*
Water Quality Objective = 700 mg/L
Projected Assimilative Capacity = -90 mg/L
Projected TDS Concentration
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year
Note: Not enough data to establish 2001-2011 ambient conditions.
* 90th Percentile = 874 mg/L (based on Projected TDS Concentration).

Figure 24.1.d

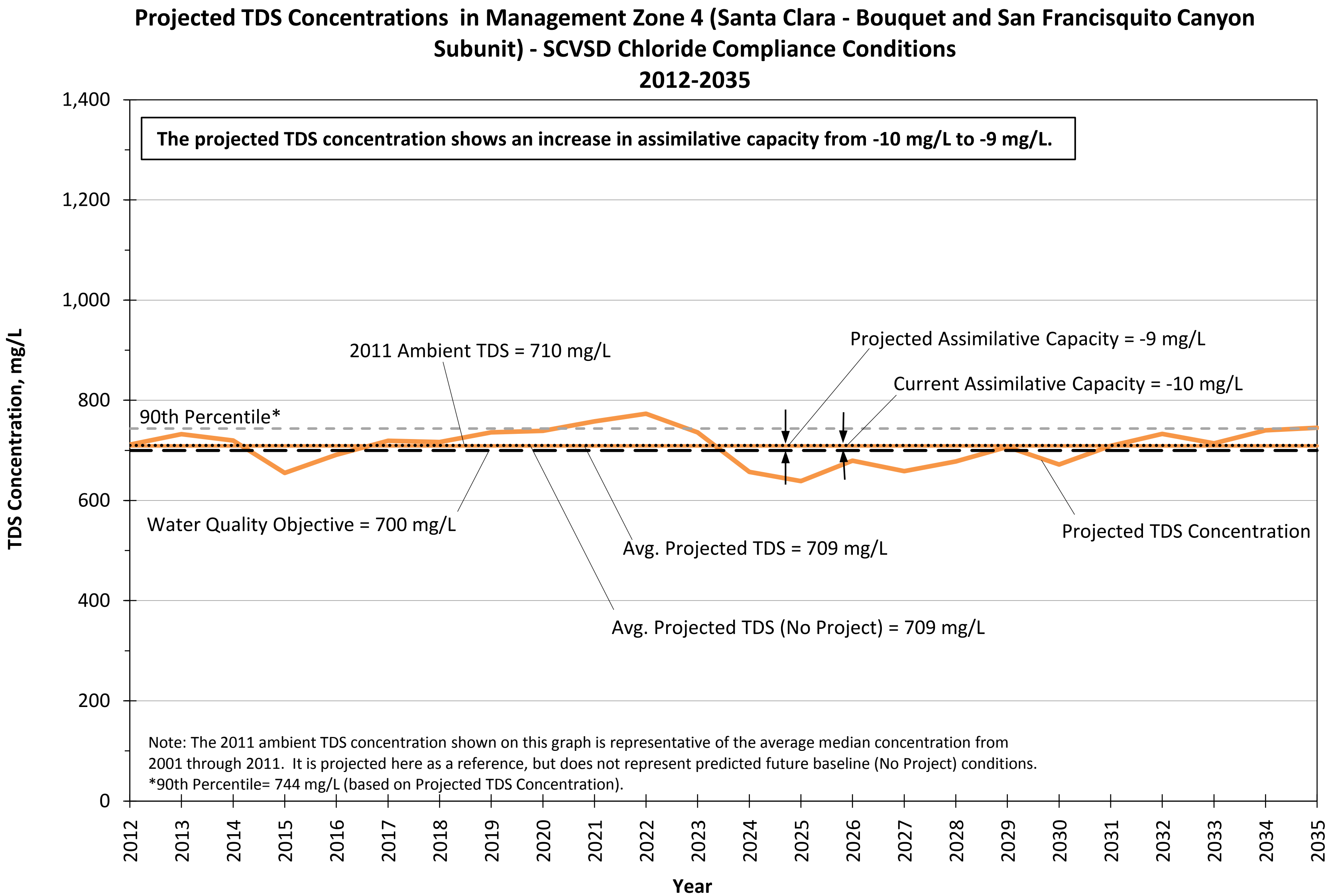

Projected TDS Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - SCVSD Chloride Compliance Conditions
2012-2035
The projected TDS concentration shows an increase in assimilative capacity from -10 mg/L to -9 mg/L.
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
2011 Ambient TDS = 710 mg/L
Projected Assimilative Capacity = -9 mg/L
Current Assimilative Capacity = -10 mg/L
90th Percentile*
Water Quality Objective = 700 mg/L
Avg. Projected TDS = 709 mg/L
Projected TDS Concentration
Avg. Projected TDS (No Project) = 709 mg/L
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile= 744 mg/L (based on Projected TDS Concentration).
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 24.1.e

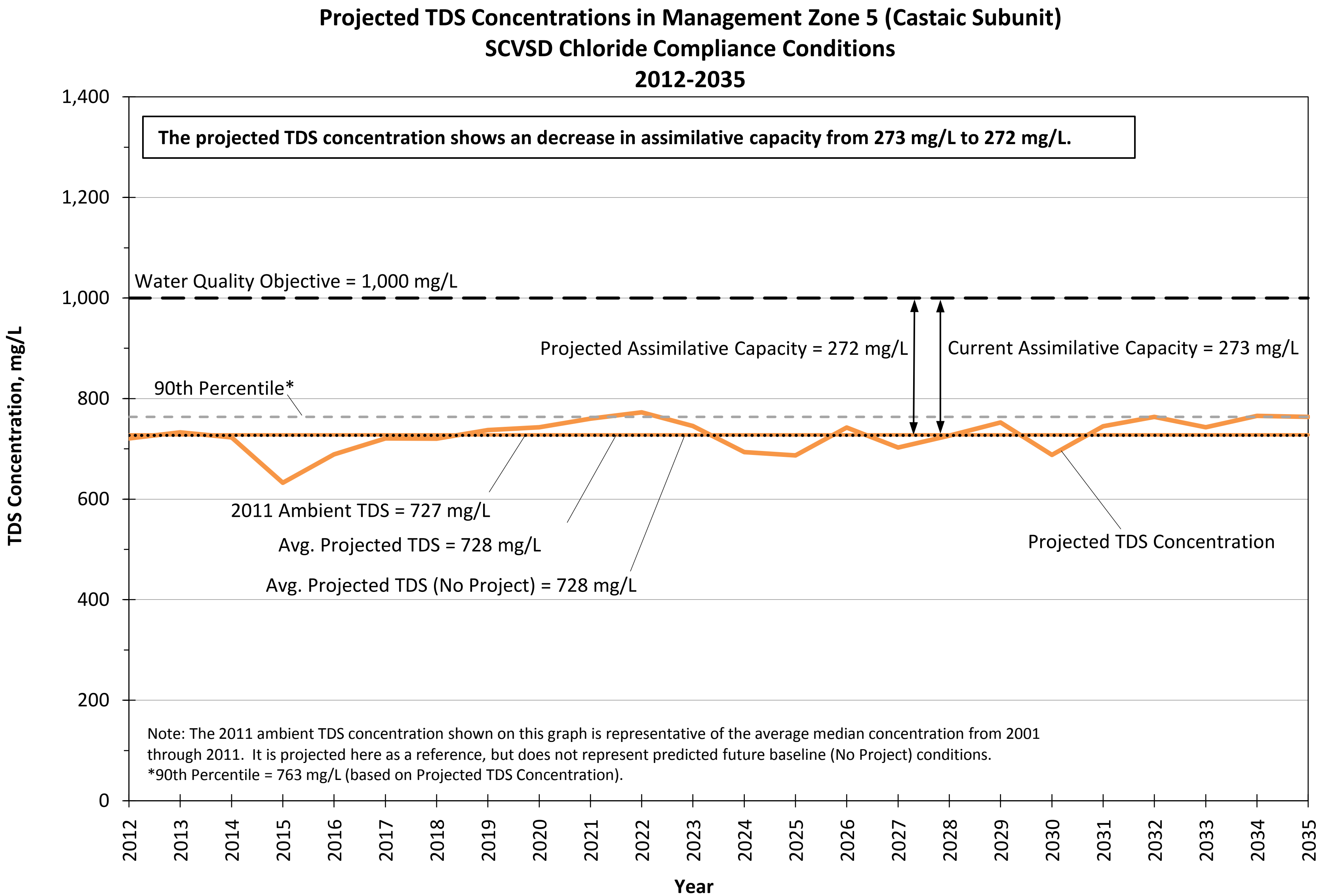

Projected TDS Concentrations in Management Zone 5 (Castaic Subunit)
SCVSD Chloride Compliance Conditions
2012-2035
The projected TDS concentration shows an decrease in assimilative capacity from 273 mg/L to 272 mg/L.
Water Quality Objective = 1,000 mg/L
Projected Assimilative Capacity = 272 mg/L
Current Assimilative Capacity = 273 mg/L
90th Percentile*
2011 Ambient TDS = 727 mg/L
Avg. Projected TDS = 728 mg/L
Avg. Projected TDS (No Project) = 728 mg/L
Projected TDS Concentration
TDS Concentration, mg/L
Year
0
200
400
600
800
1,000
1,200
1,400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 763 mg/L (based on Projected TDS Concentration).

Figure 24.1.f

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

Projected TDS Concentrations in Management Zone 6 (Saugus Formation)
SCVSD Chloride Compliance Conditions
2012-2035

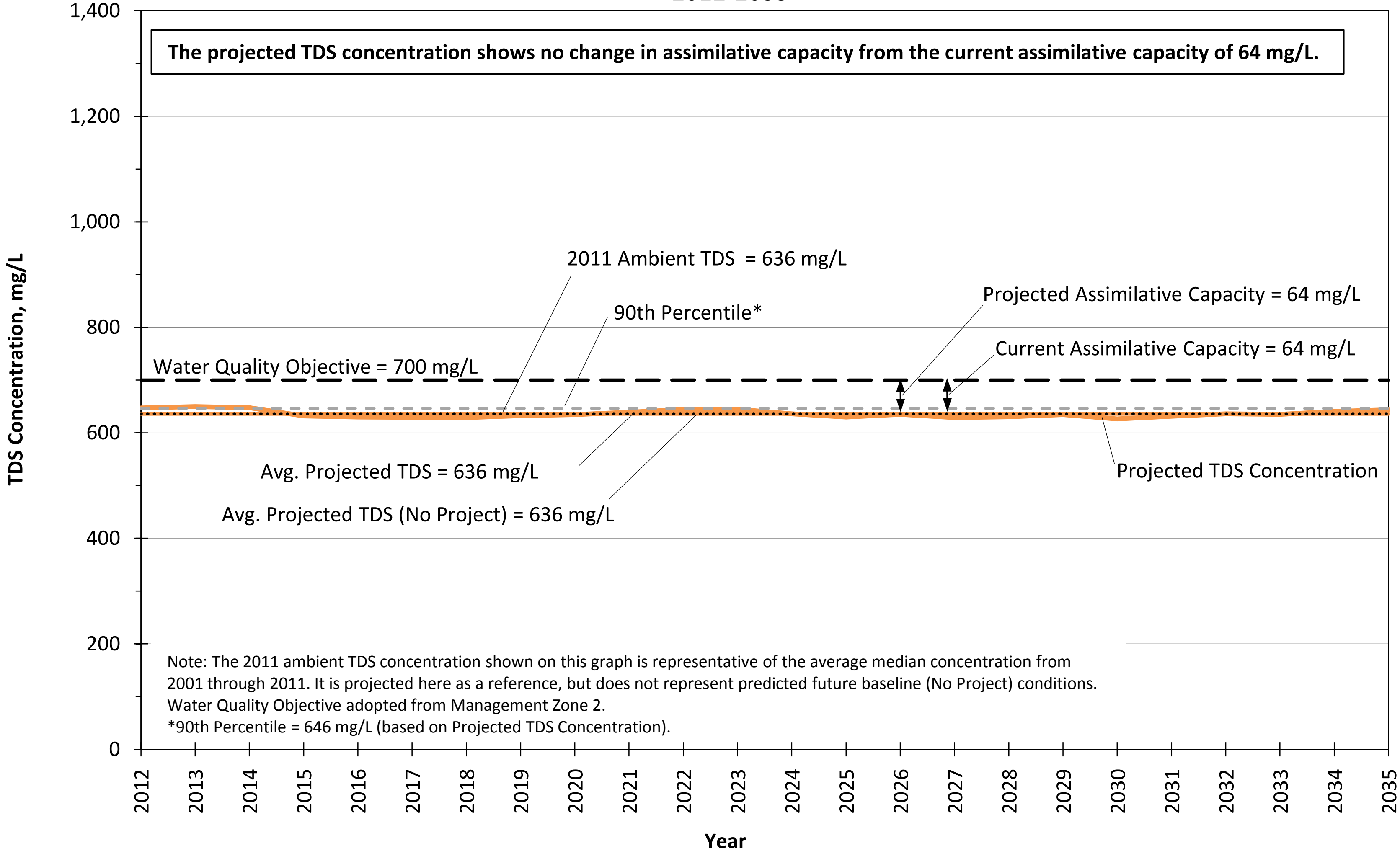


Figure 24.1.g

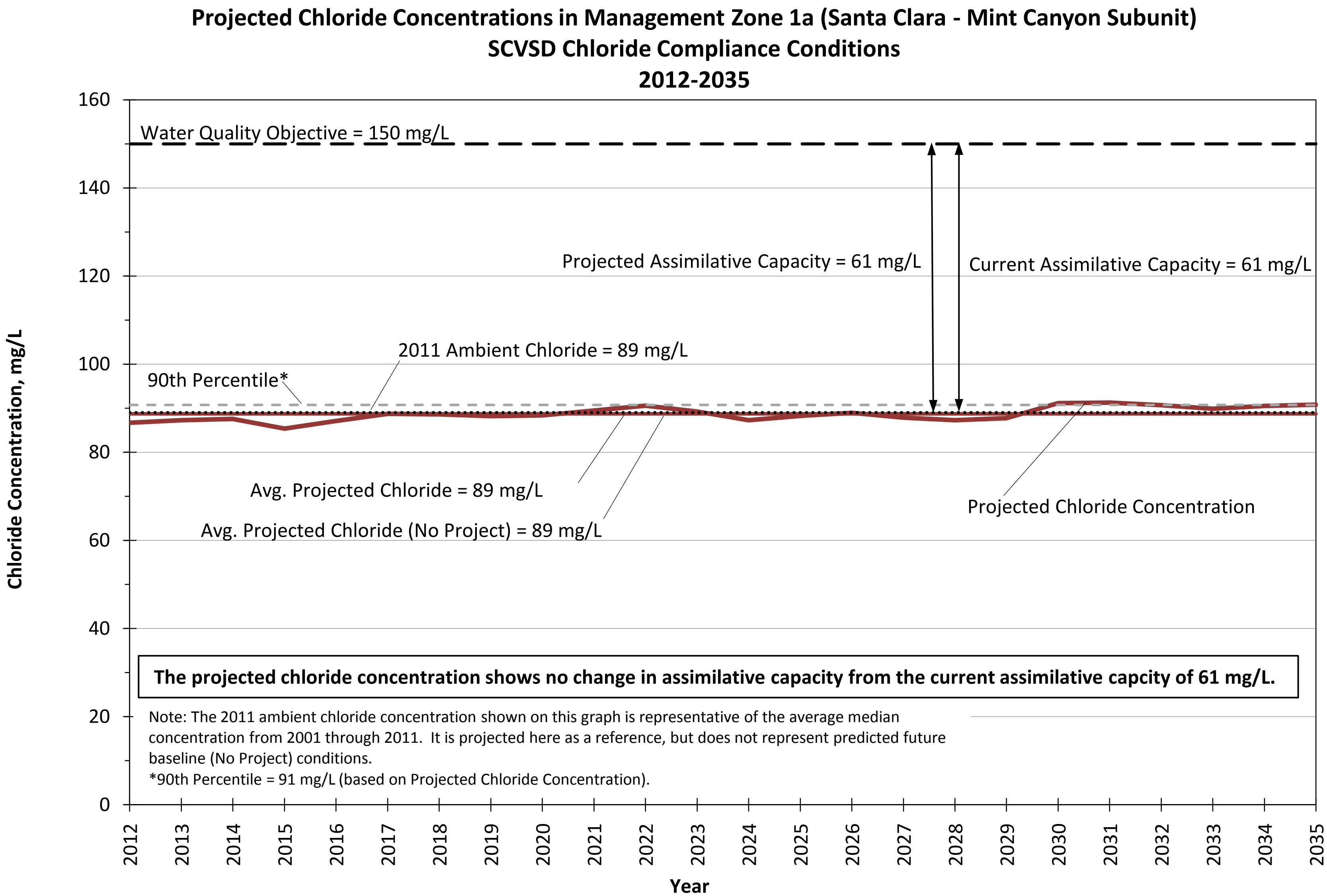
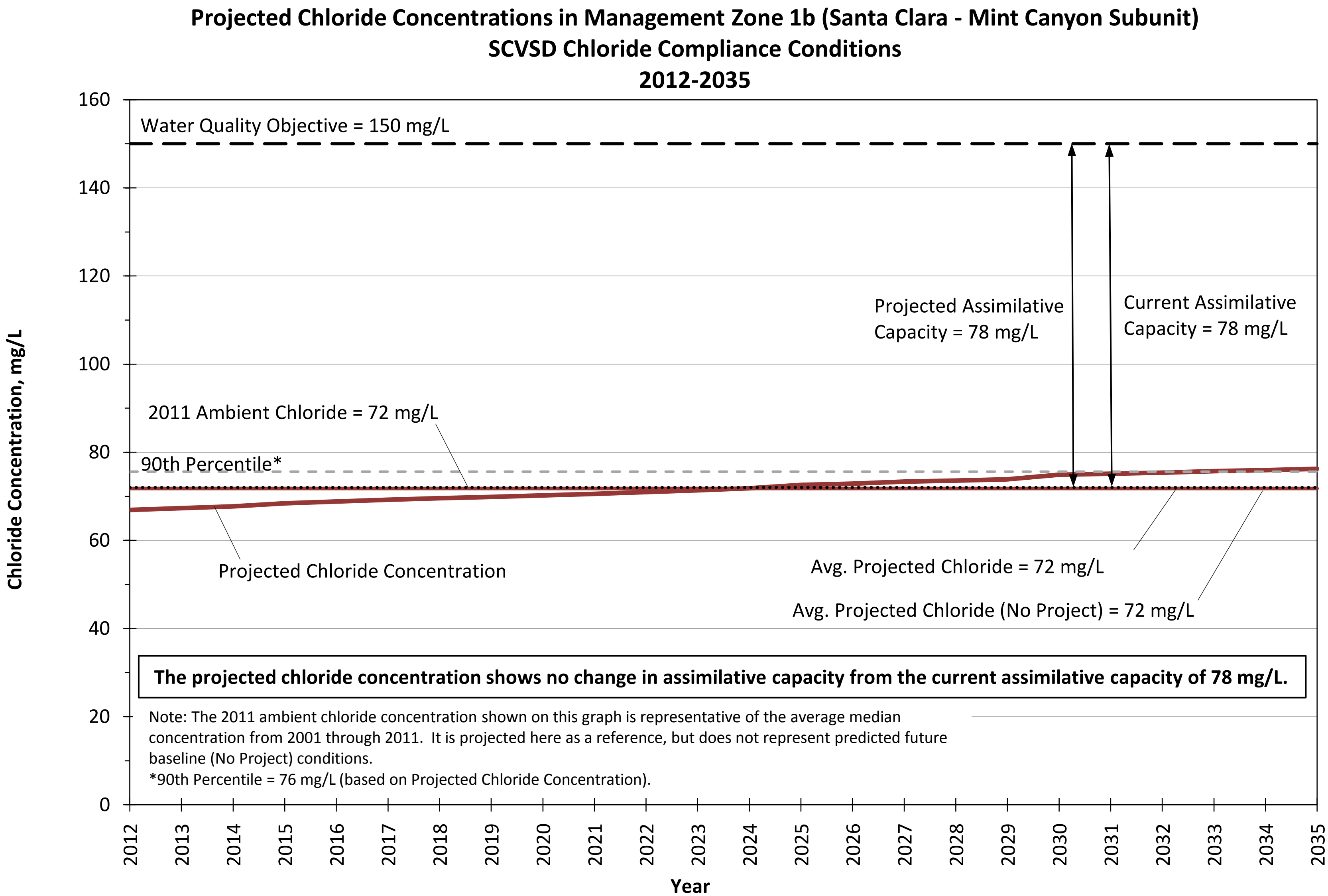

Projected Chloride Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
SCVSD Chloride Compliance Conditions
2012-2035
Water Quality Objective = 150 mg/L
Projected Assimilative Capacity = 61 mg/L
Current Assimilative Capacity = 61 mg/L
2011 Ambient Chloride = 89 mg/L
90th Percentile*
Avg. Projected Chloride = 89 mg/L
Avg. Projected Chloride (No Project) = 89 mg/L
Projected Chloride Concentration
The projected chloride concentration shows no change in assimilative capacity from the current assimilative capcity of 61 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 91 mg/L (based on Projected Chloride Concentration).
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 24.2.a


Projected Chloride Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
SCVSD Chloride Compliance Conditions
2012-2035
Chloride Concentration, mg/L
Year
Water Quality Objective = 150 mg/L
Projected Assimilative Capacity = 78 mg/L
Current Assimilative Capacity = 78 mg/L
2011 Ambient Chloride = 72 mg/L
90th Percentile*
Projected Chloride Concentration
Avg. Projected Chloride = 72 mg/L
Avg. Projected Chloride (No Project) = 72 mg/L
The projected chloride concentration shows no change in assimilative capacity from the current assimilative capacity of 78 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 76 mg/L (based on Projected Chloride Concentration).
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
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2035

Figure 24.2.b

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

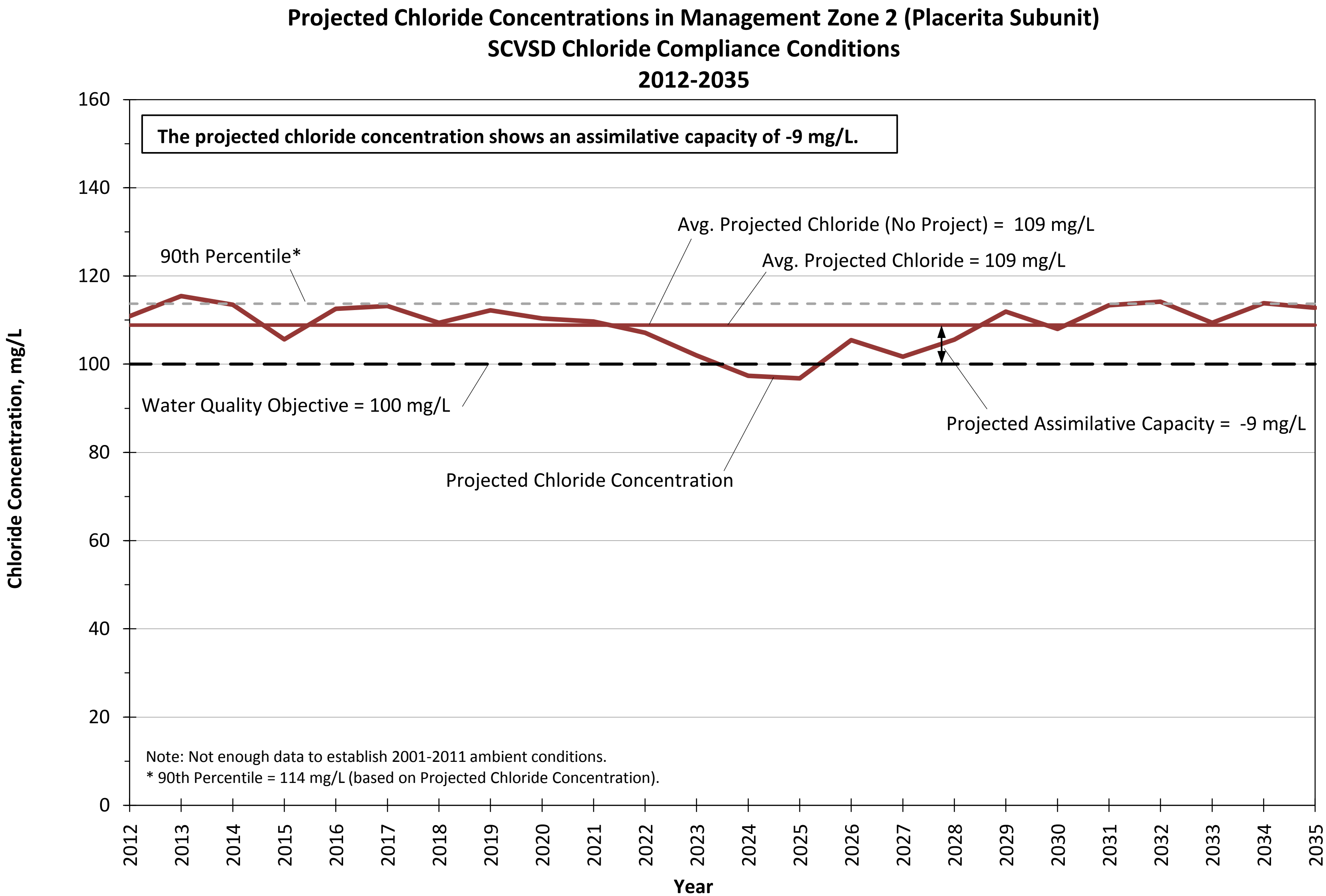

Figure 24.2.c

8-Dec-16

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**Projected Chloride Concentrations in Management Zone 3 (South Fork Subunit)
SCVSD Chloride Compliance Conditions
2012-2035**

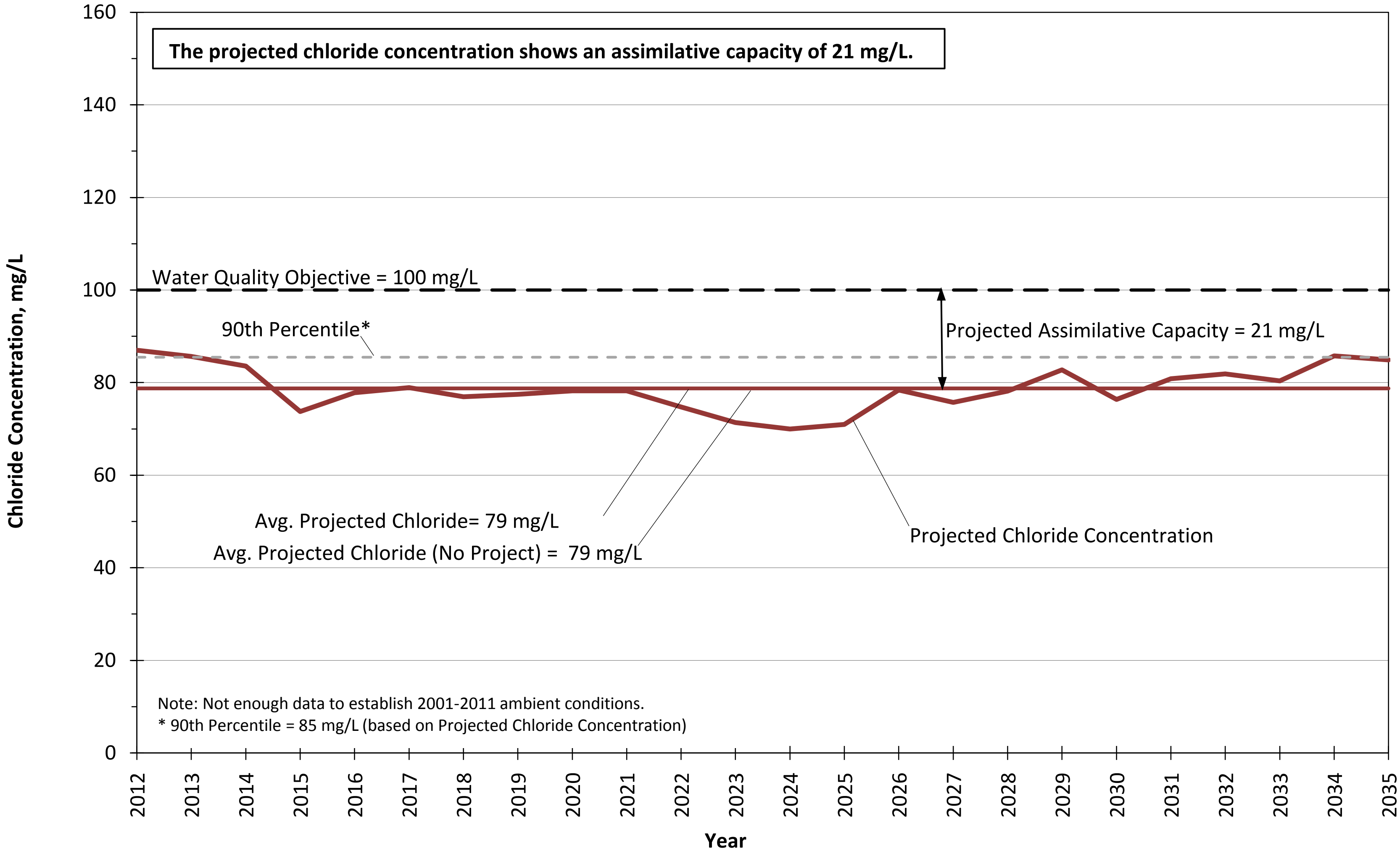


Figure 24.2.d

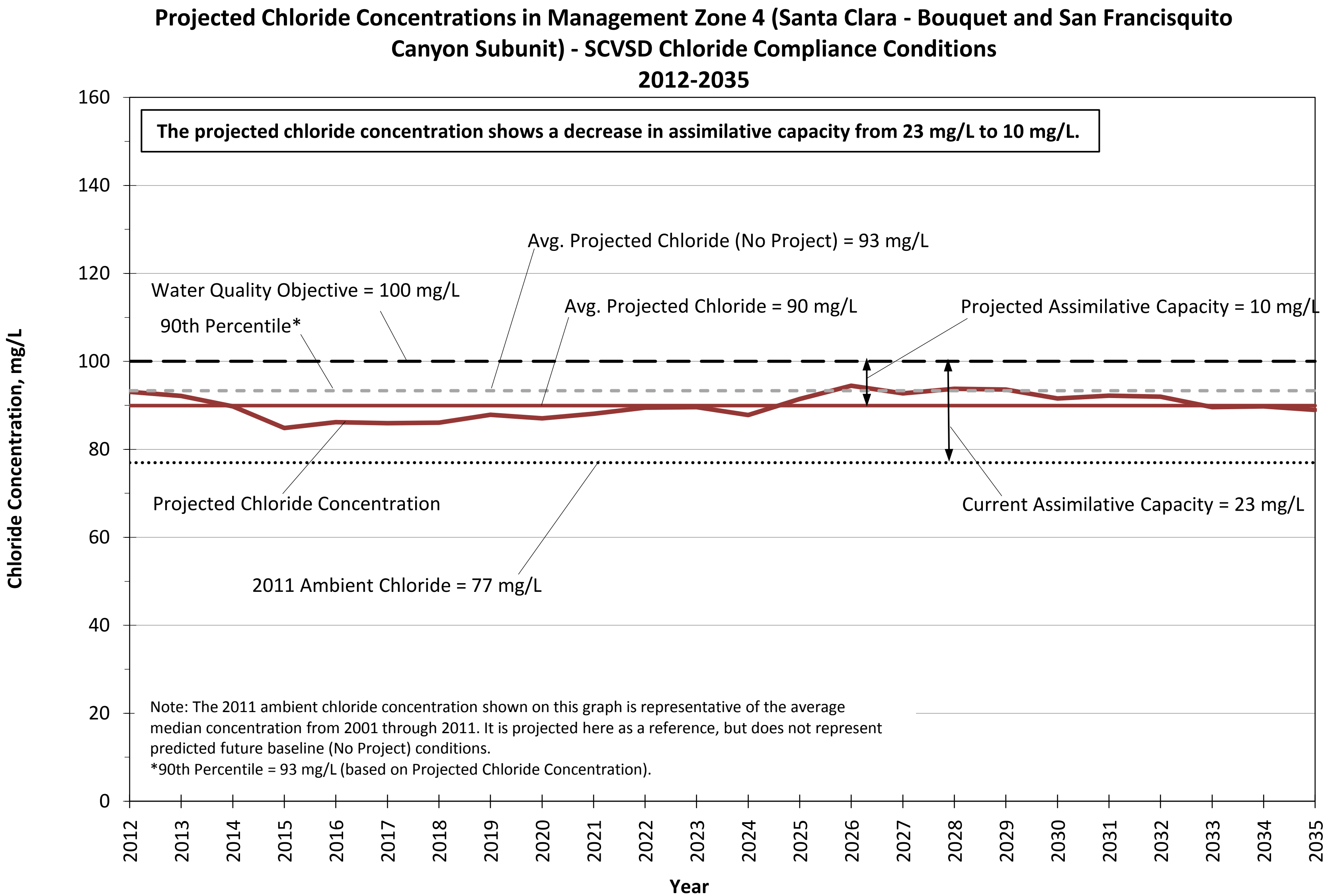

Projected Chloride Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - SCVSD Chloride Compliance Conditions
2012-2035
The projected chloride concentration shows a decrease in assimilative capacity from 23 mg/L to 10 mg/L.
Avg. Projected Chloride (No Project) = 93 mg/L
Water Quality Objective = 100 mg/L
90th Percentile*
Avg. Projected Chloride = 90 mg/L
Projected Assimilative Capacity = 10 mg/L
Projected Chloride Concentration
Current Assimilative Capacity = 23 mg/L
2011 Ambient Chloride = 77 mg/L
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 93 mg/L (based on Projected Chloride Concentration).
Chloride Concentration, mg/L
160
140
120
100
80
60
40
20
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 24.2.e

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

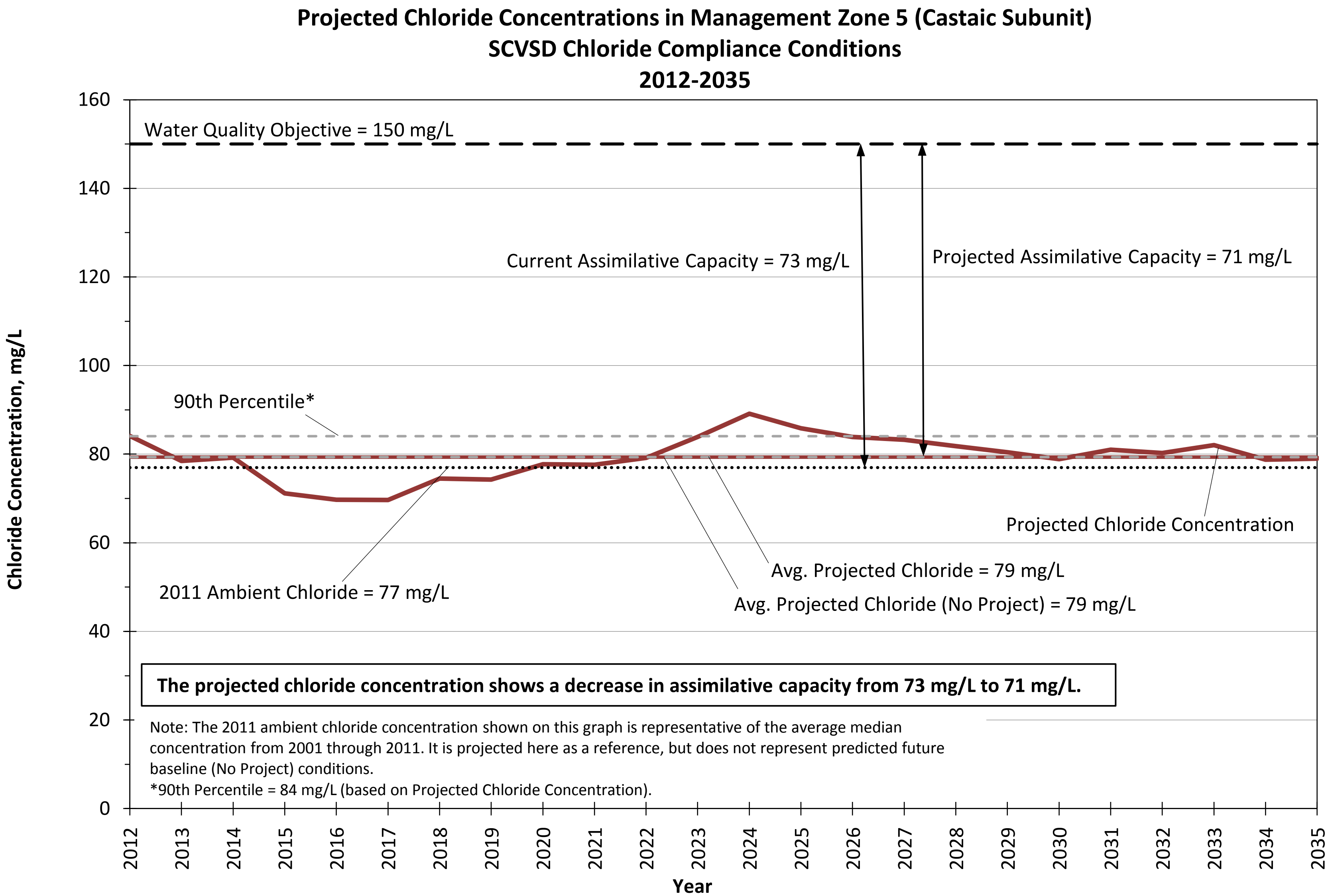


Figure 24.2.f

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

Projected Chloride Concentrations in Management Zone 6 (Saugus Formation)
SCVSD Chloride Compliance Conditions
2012-2035

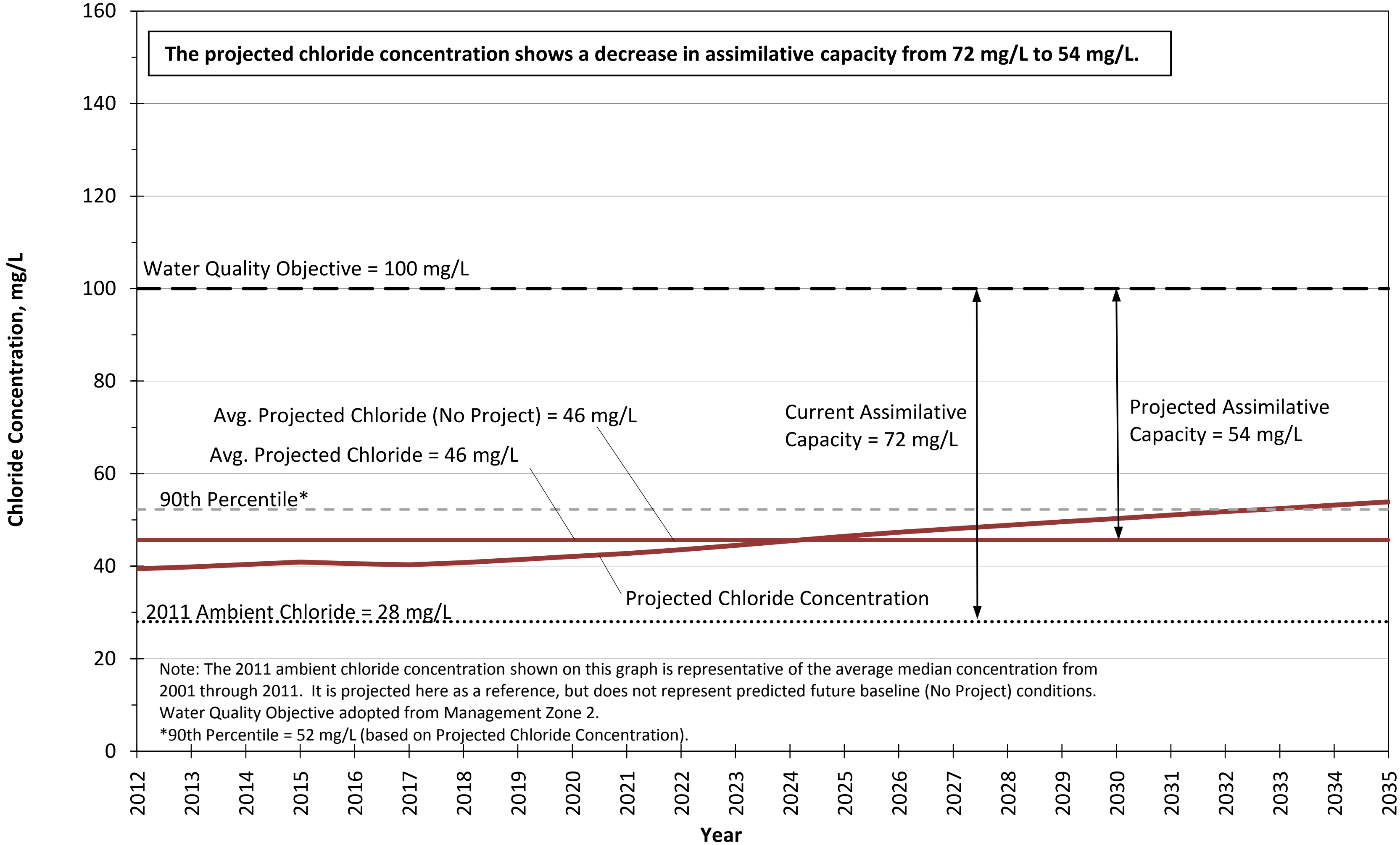
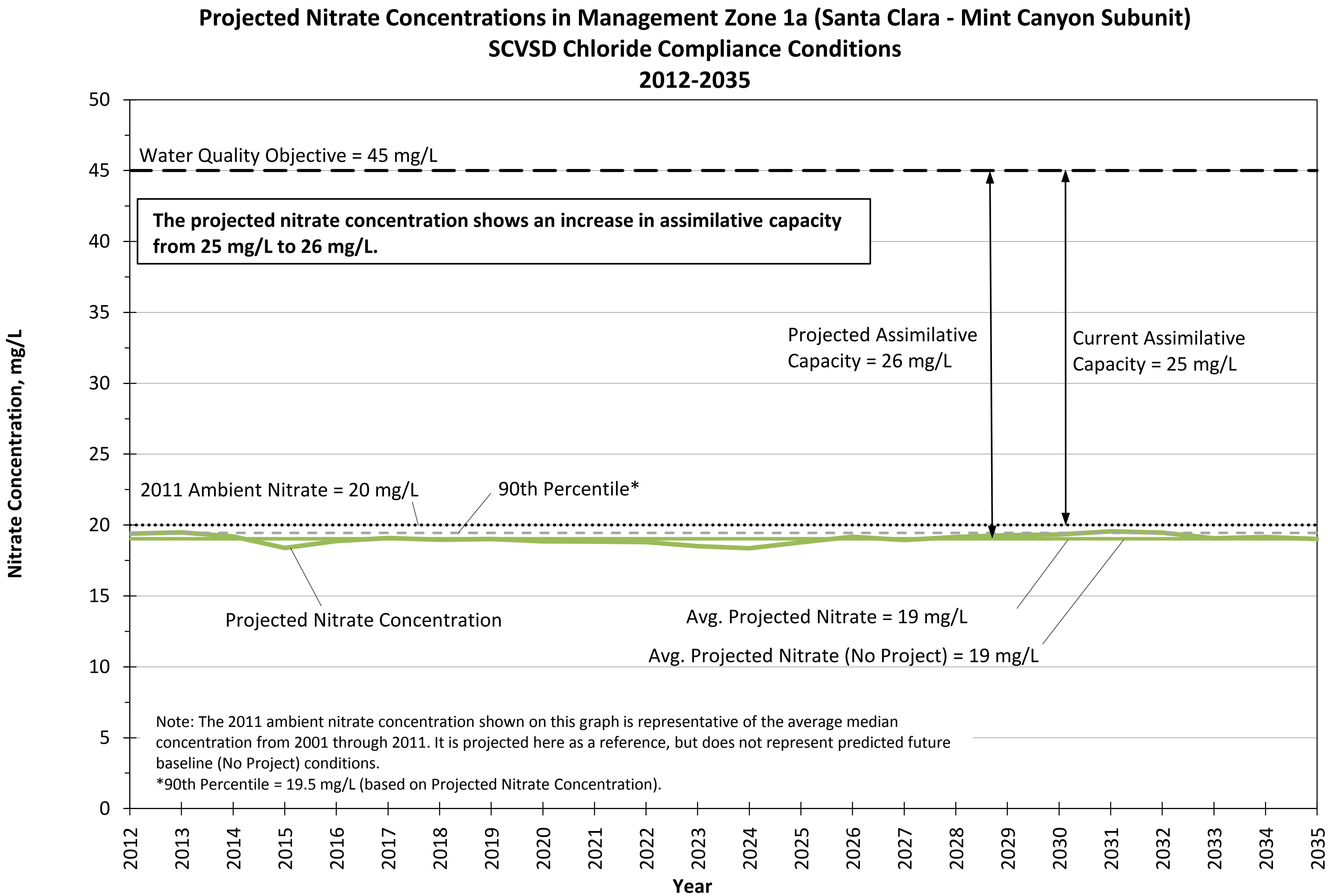


Figure 24.2.g


Projected Nitrate Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
SCVSD Chloride Compliance Conditions
2012-2035
Nitrate Concentration, mg/L
Year
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an increase in assimilative capacity from 25 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 25 mg/L
2011 Ambient Nitrate = 20 mg/L
90th Percentile*
Projected Nitrate Concentration
Avg. Projected Nitrate = 19 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 19.5 mg/L (based on Projected Nitrate Concentration).
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
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2035

Figure 24.3.a

Projected Nitrate Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
SCVSD Chloride Compliance Conditions
2012-2035

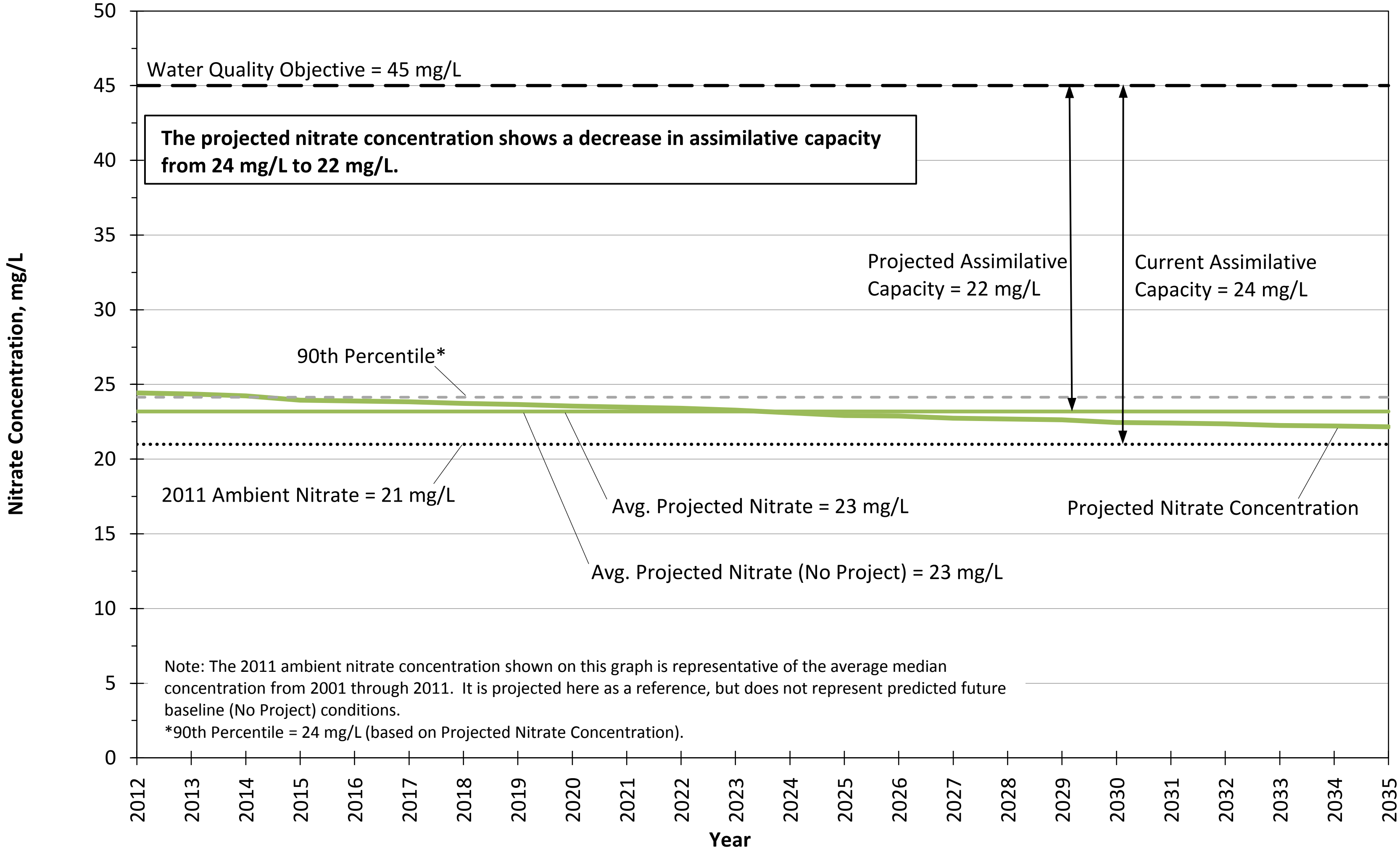
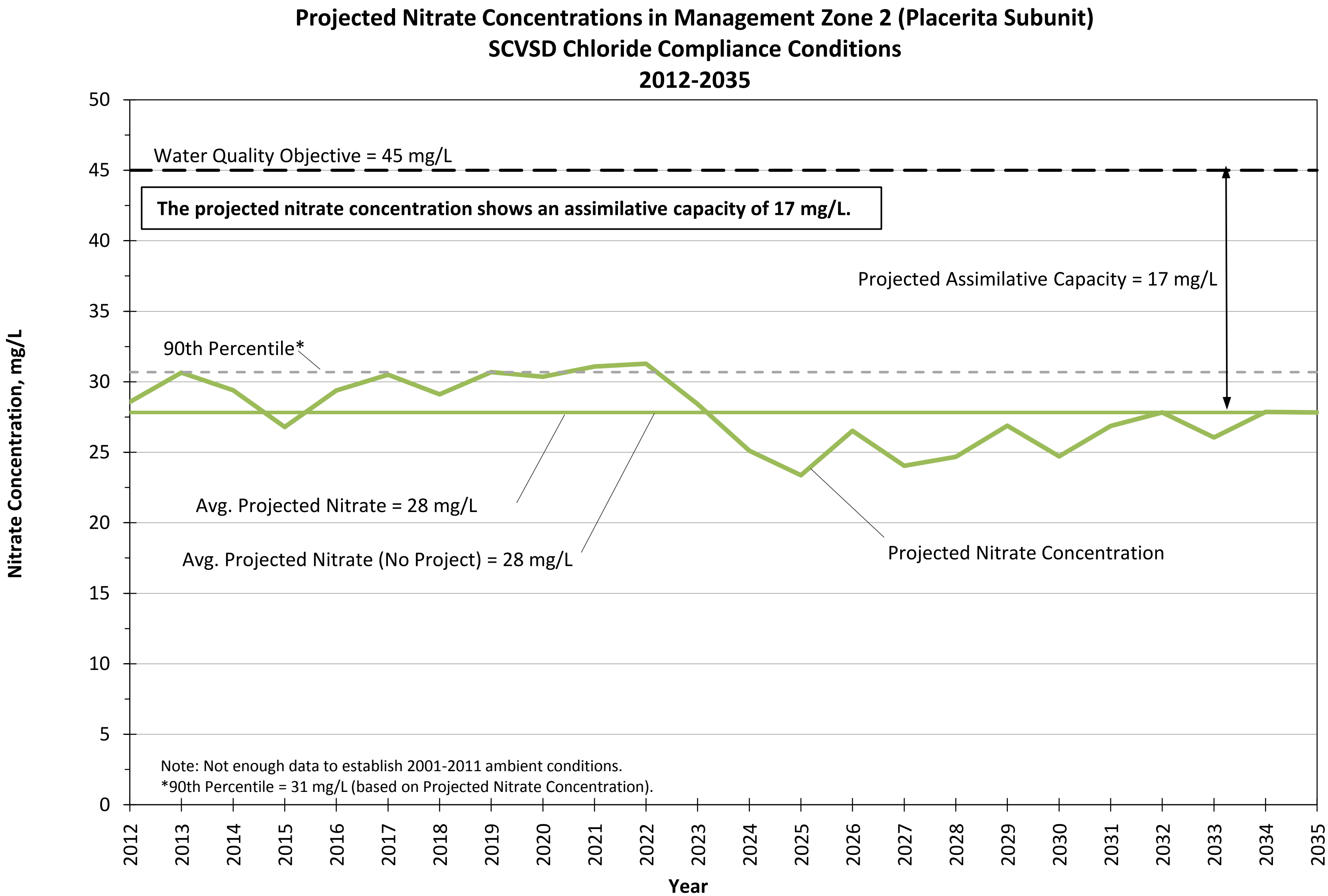


Figure 24.3.b


Projected Nitrate Concentrations in Management Zone 2 (Placerita Subunit)
SCVSD Chloride Compliance Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an assimilative capacity of 17 mg/L.
Projected Assimilative Capacity = 17 mg/L
90th Percentile*
Avg. Projected Nitrate = 28 mg/L
Avg. Projected Nitrate (No Project) = 28 mg/L
Projected Nitrate Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 31 mg/L (based on Projected Nitrate Concentration).
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
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2035

Figure 24.3.c

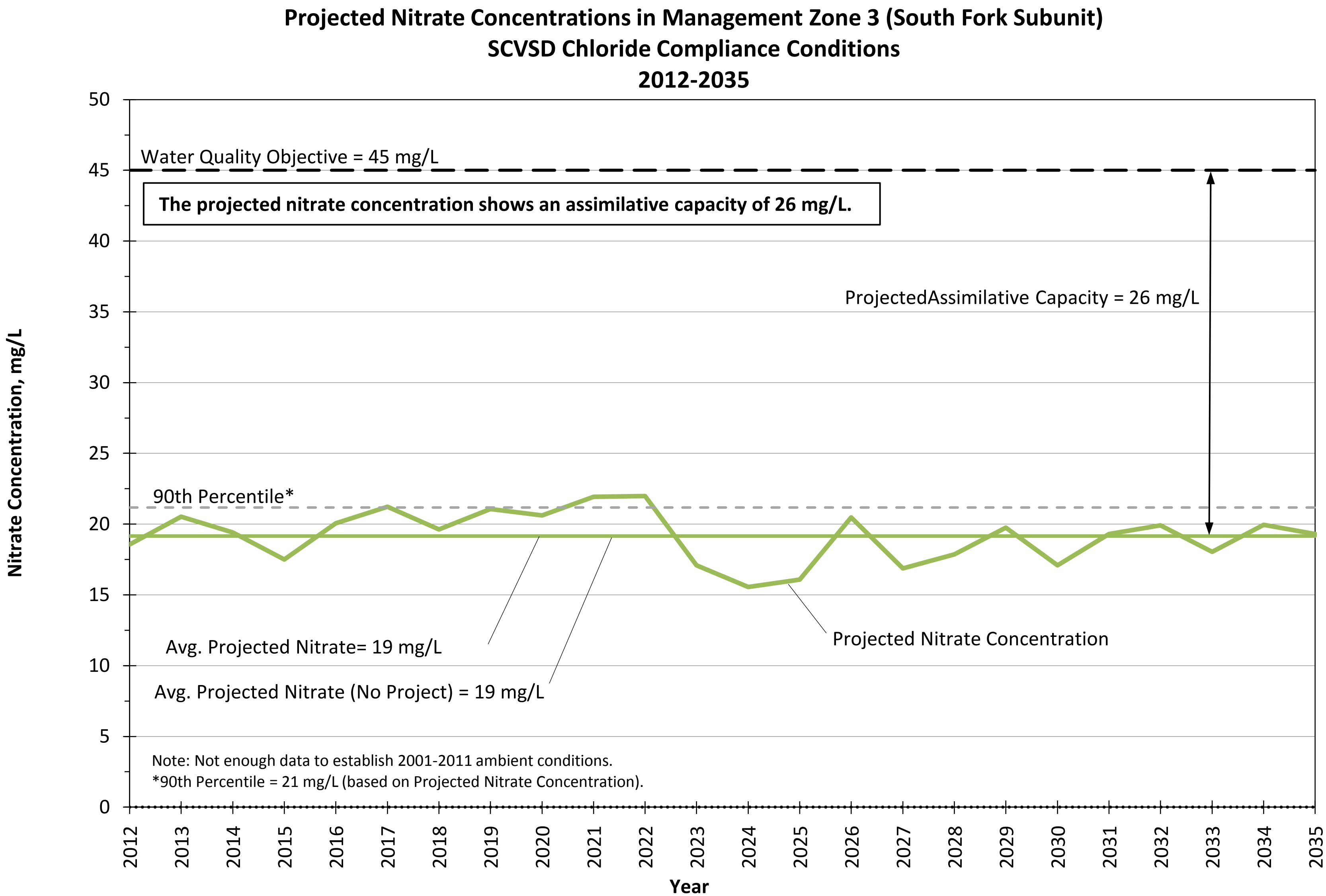
Projected Nitrate Concentrations in Management Zone 3 (South Fork Subunit)
SCVSD Chloride Compliance Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an assimilative capacity of 26 mg/L.
ProjectedAssimilative Capacity = 26 mg/L
90th Percentile*
Avg. Projected Nitrate= 19 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Projected Nitrate Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 21 mg/L (based on Projected Nitrate Concentration).
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
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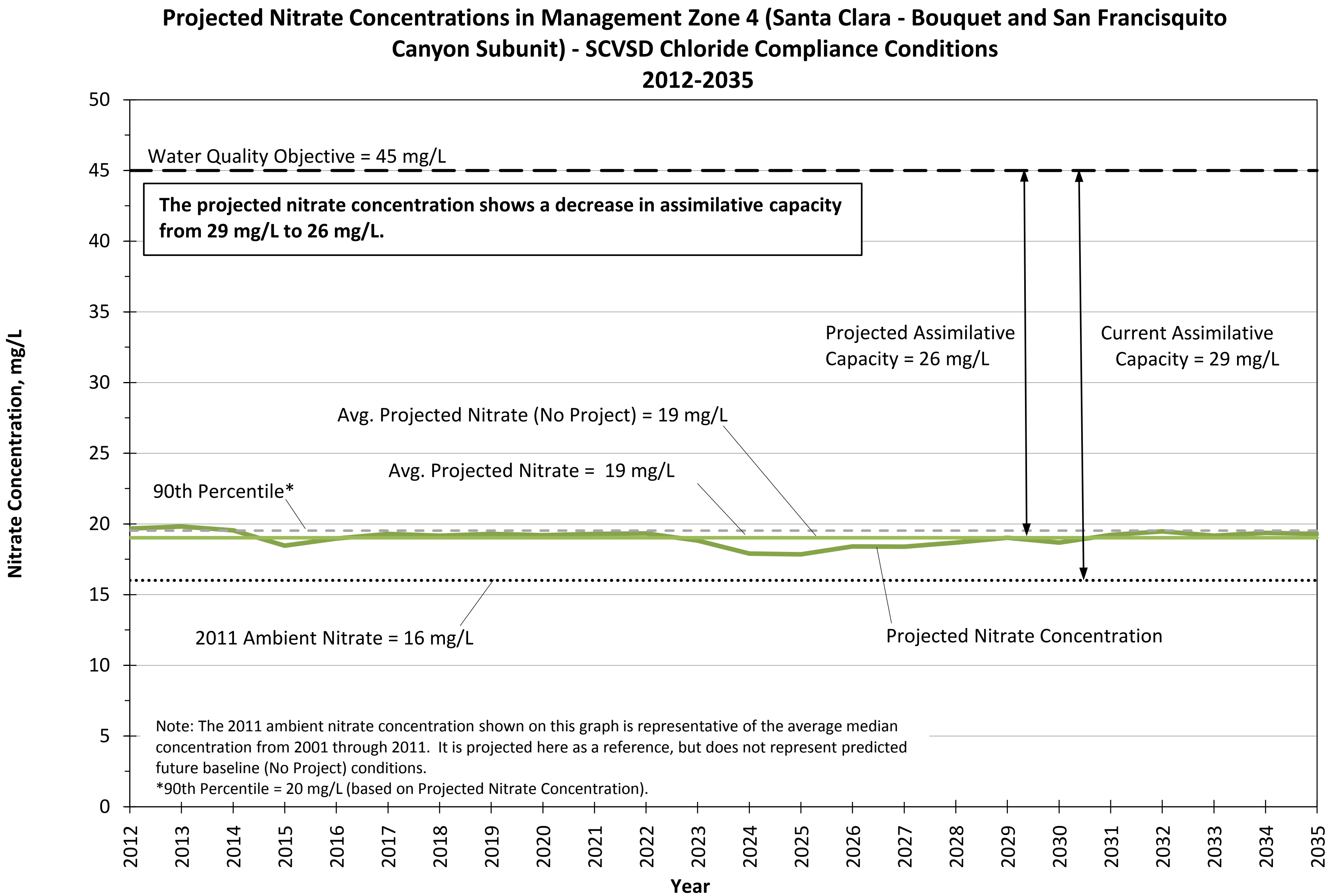
Figure 24.3.d


Projected Nitrate Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - SCVSD Chloride Compliance Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 29 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 29 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Avg. Projected Nitrate = 19 mg/L
90th Percentile*
2011 Ambient Nitrate = 16 mg/L
Projected Nitrate Concentration
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 20 mg/L (based on Projected Nitrate Concentration).
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
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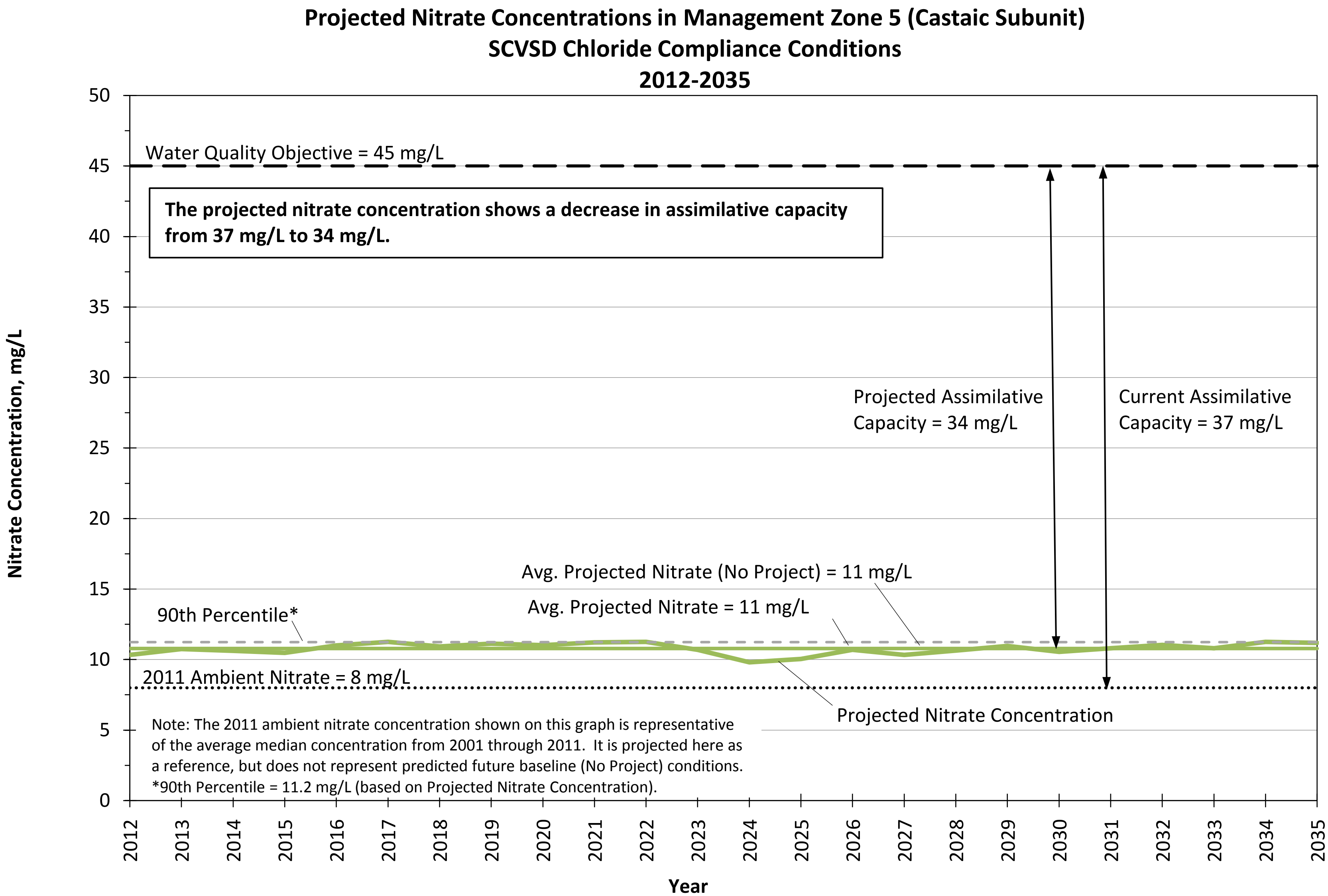
2035

Figure 24.3.e


Projected Nitrate Concentrations in Management Zone 5 (Castaic Subunit)
SCVSD Chloride Compliance Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 37 mg/L to 34 mg/L.
Projected Assimilative Capacity = 34 mg/L
Current Assimilative Capacity = 37 mg/L
Avg. Projected Nitrate (No Project) = 11 mg/L
Avg. Projected Nitrate = 11 mg/L
90th Percentile*
2011 Ambient Nitrate = 8 mg/L
Projected Nitrate Concentration
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 11.2 mg/L (based on Projected Nitrate Concentration).
Nitrate Concentration, mg/L
0
5
10
15
20
25
30
35
40
45
50
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
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2035

Figure 24.3.f

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

Projected Nitrate Concentrations in Management Zone 6 (Saugus Formation)
SCVSD Chloride Compliance Conditions
2012-2035

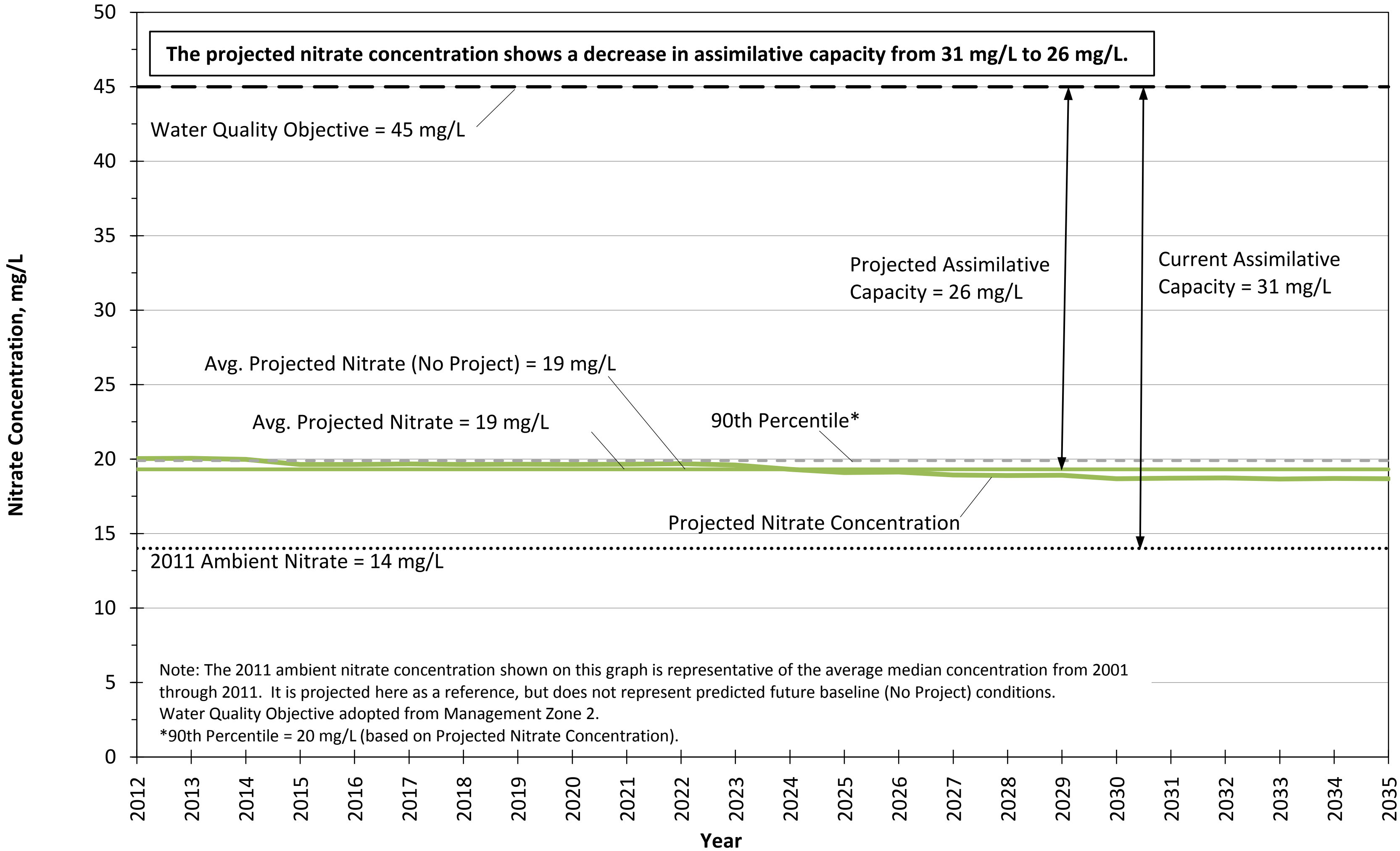

Figure 24.3.g

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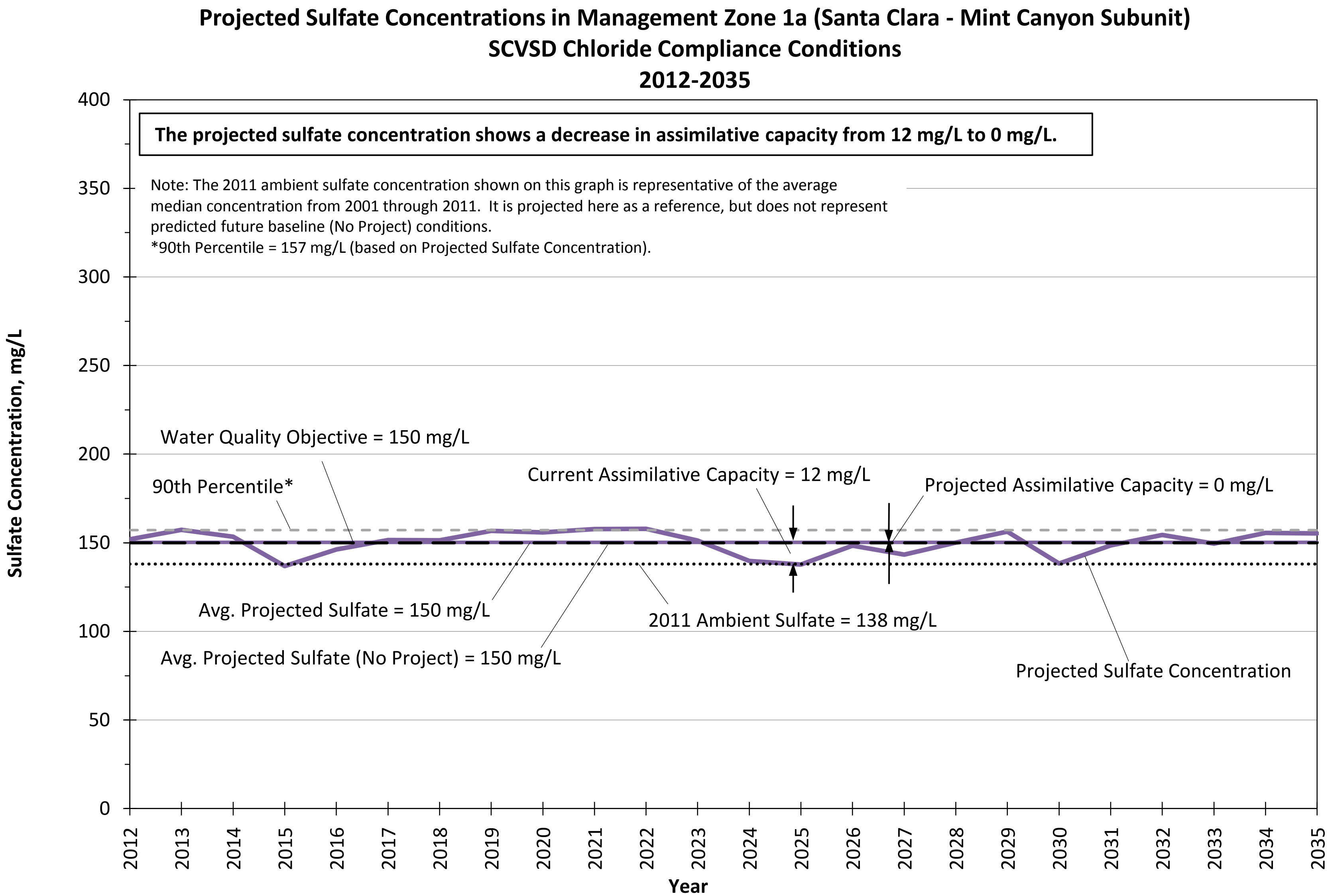
Projected Sulfate Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
SCVSD Chloride Compliance Conditions
2012-2035
The projected sulfate concentration shows a decrease in assimilative capacity from 12 mg/L to 0 mg/L.
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 157 mg/L (based on Projected Sulfate Concentration).
Water Quality Objective = 150 mg/L
90th Percentile*
Current Assimilative Capacity = 12 mg/L
Projected Assimilative Capacity = 0 mg/L
Avg. Projected Sulfate = 150 mg/L
2011 Ambient Sulfate = 138 mg/L
Avg. Projected Sulfate (No Project) = 150 mg/L
Projected Sulfate Concentration
Sulfate Concentration, mg/L
0
50
100
150
200
250
300
350
400
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
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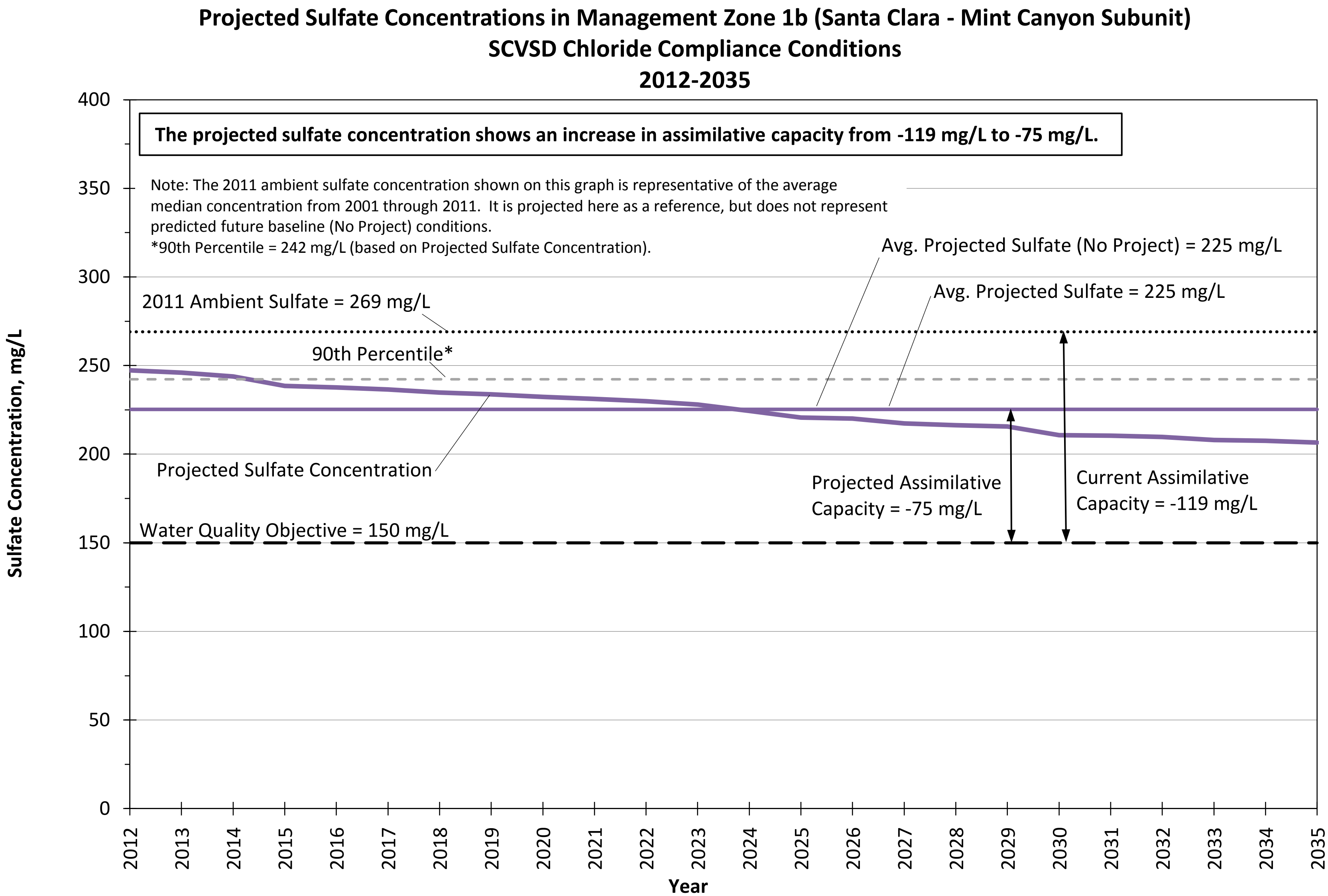
2032
2033
2034
2035

Figure 24.4.a


Projected Sulfate Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
SCVSD Chloride Compliance Conditions
2012-2035
The projected sulfate concentration shows an increase in assimilative capacity from -119 mg/L to -75 mg/L.
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 242 mg/L (based on Projected Sulfate Concentration).
Avg. Projected Sulfate (No Project) = 225 mg/L
Avg. Projected Sulfate = 225 mg/L
2011 Ambient Sulfate = 269 mg/L
90th Percentile*
Projected Sulfate Concentration
Projected Assimilative Capacity = -75 mg/L
Current Assimilative Capacity = -119 mg/L
Water Quality Objective = 150 mg/L
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
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2030
2031
2032
2033
2034
2035

Figure 24.4.b

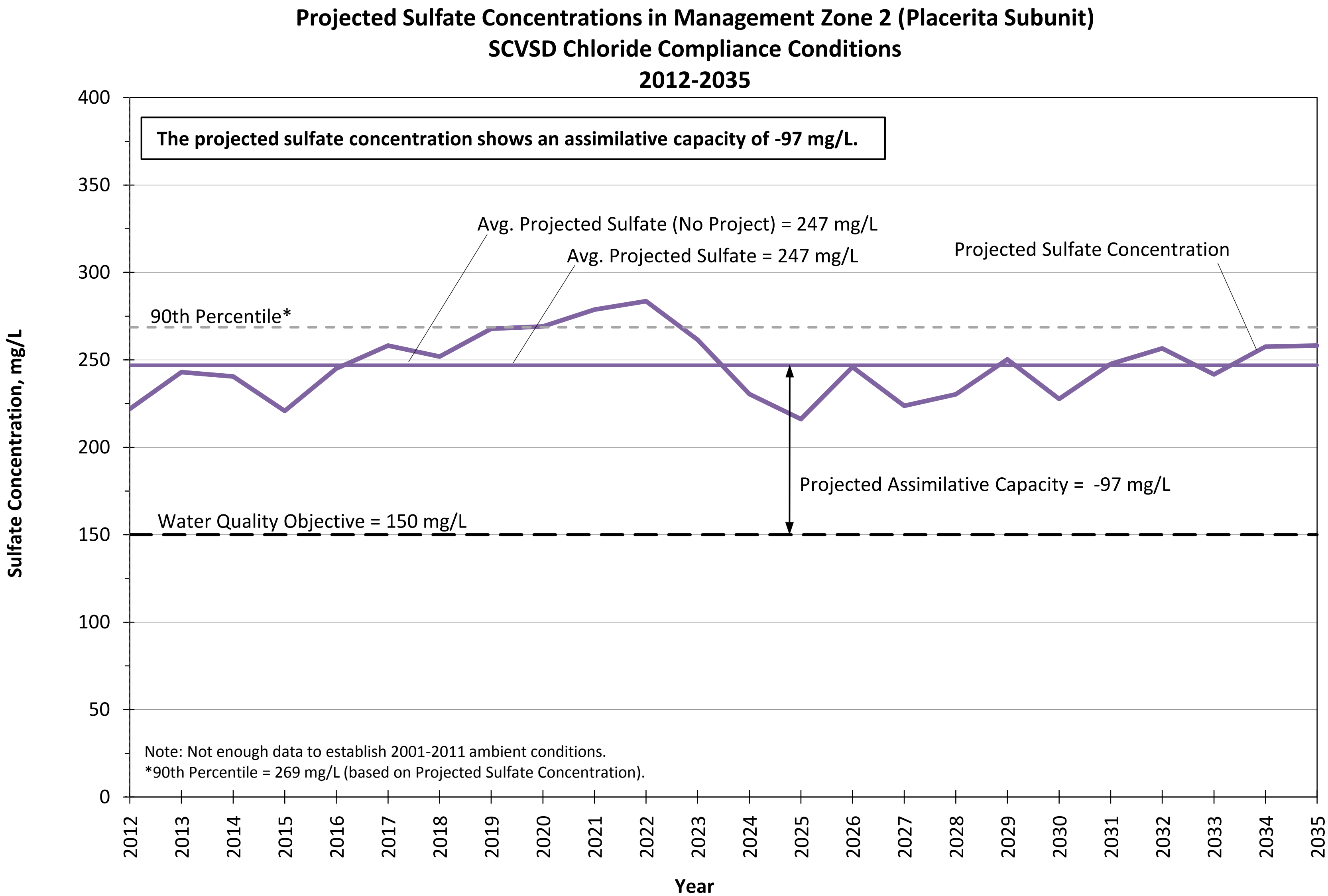
Projected Sulfate Concentrations in Management Zone 2 (Placerita Subunit)
SCVSD Chloride Compliance Conditions
2012-2035
The projected sulfate concentration shows an assimilative capacity of -97 mg/L.
Avg. Projected Sulfate (No Project) = 247 mg/L
Avg. Projected Sulfate = 247 mg/L
Projected Sulfate Concentration
90th Percentile*
Projected Assimilative Capacity = -97 mg/L
Water Quality Objective = 150 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 269 mg/L (based on Projected Sulfate Concentration).
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
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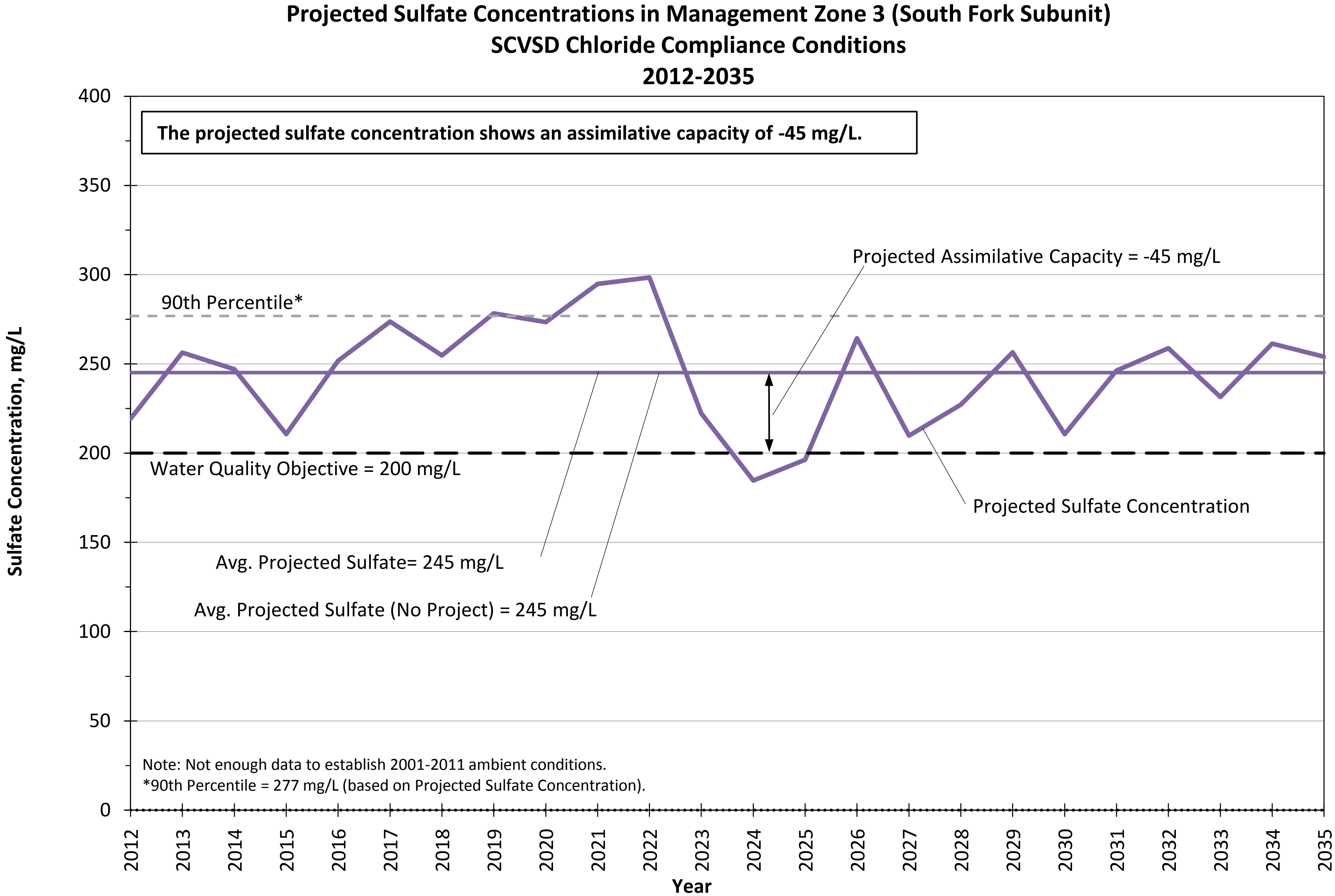
Figure 24.4.c


Projected Sulfate Concentrations in Management Zone 3 (South Fork Subunit)
SCVSD Chloride Compliance Conditions
2012-2035
The projected sulfate concentration shows an assimilative capacity of -45 mg/L.
Projected Assimilative Capacity = -45 mg/L
90th Percentile*
Water Quality Objective = 200 mg/L
Projected Sulfate Concentration
Avg. Projected Sulfate= 245 mg/L
Avg. Projected Sulfate (No Project) = 245 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 277 mg/L (based on Projected Sulfate Concentration).
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
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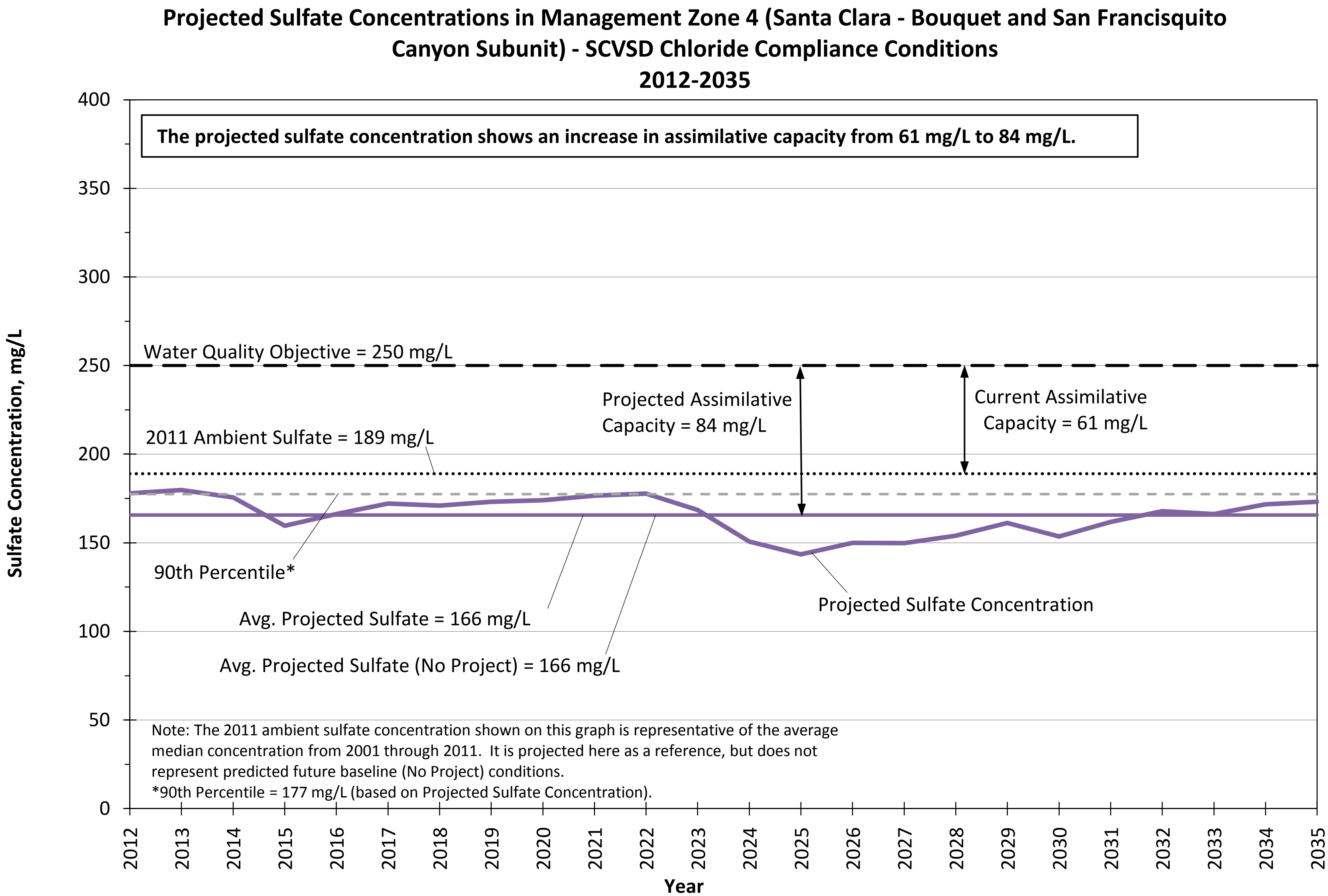
2034
2035

Figure 24.4.d


Projected Sulfate Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - SCVSD Chloride Compliance Conditions
2012-2035
The projected sulfate concentration shows an increase in assimilative capacity from 61 mg/L to 84 mg/L.
Water Quality Objective = 250 mg/L
Projected Assimilative Capacity = 84 mg/L
Current Assimilative Capacity = 61 mg/L
2011 Ambient Sulfate = 189 mg/L
90th Percentile*
Avg. Projected Sulfate = 166 mg/L
Avg. Projected Sulfate (No Project) = 166 mg/L
Projected Sulfate Concentration
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 177 mg/L (based on Projected Sulfate Concentration).
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
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2034
2035

Figure 24.4.e

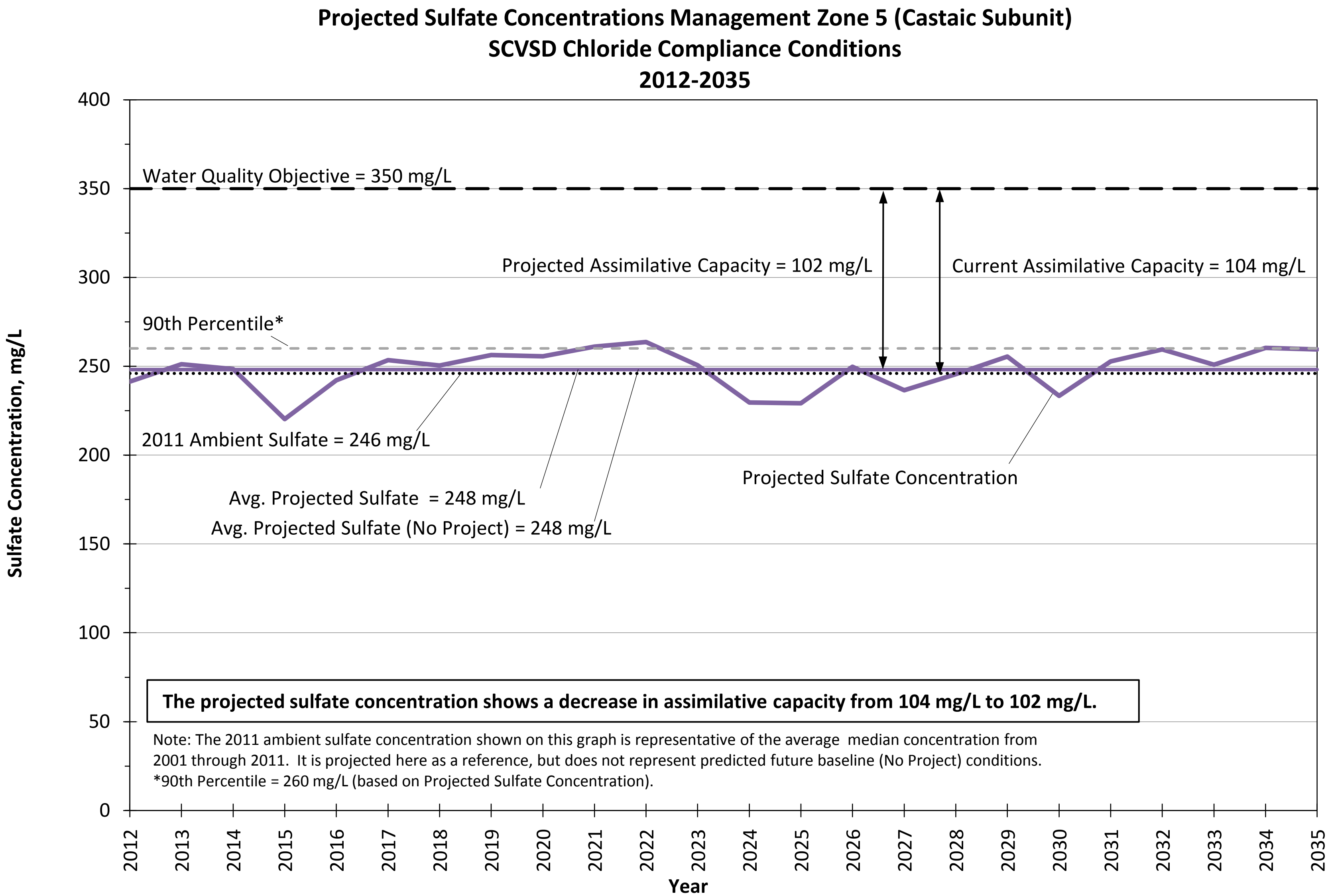

Projected Sulfate Concentrations Management Zone 5 (Castaic Subunit)
SCVSD Chloride Compliance Conditions
2012-2035
Water Quality Objective = 350 mg/L
Projected Assimilative Capacity = 102 mg/L
Current Assimilative Capacity = 104 mg/L
90th Percentile*
2011 Ambient Sulfate = 246 mg/L
Avg. Projected Sulfate = 248 mg/L
Avg. Projected Sulfate (No Project) = 248 mg/L
Projected Sulfate Concentration
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
The projected sulfate concentration shows a decrease in assimilative capacity from 104 mg/L to 102 mg/L.
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 260 mg/L (based on Projected Sulfate Concentration).

Figure 24.4.f

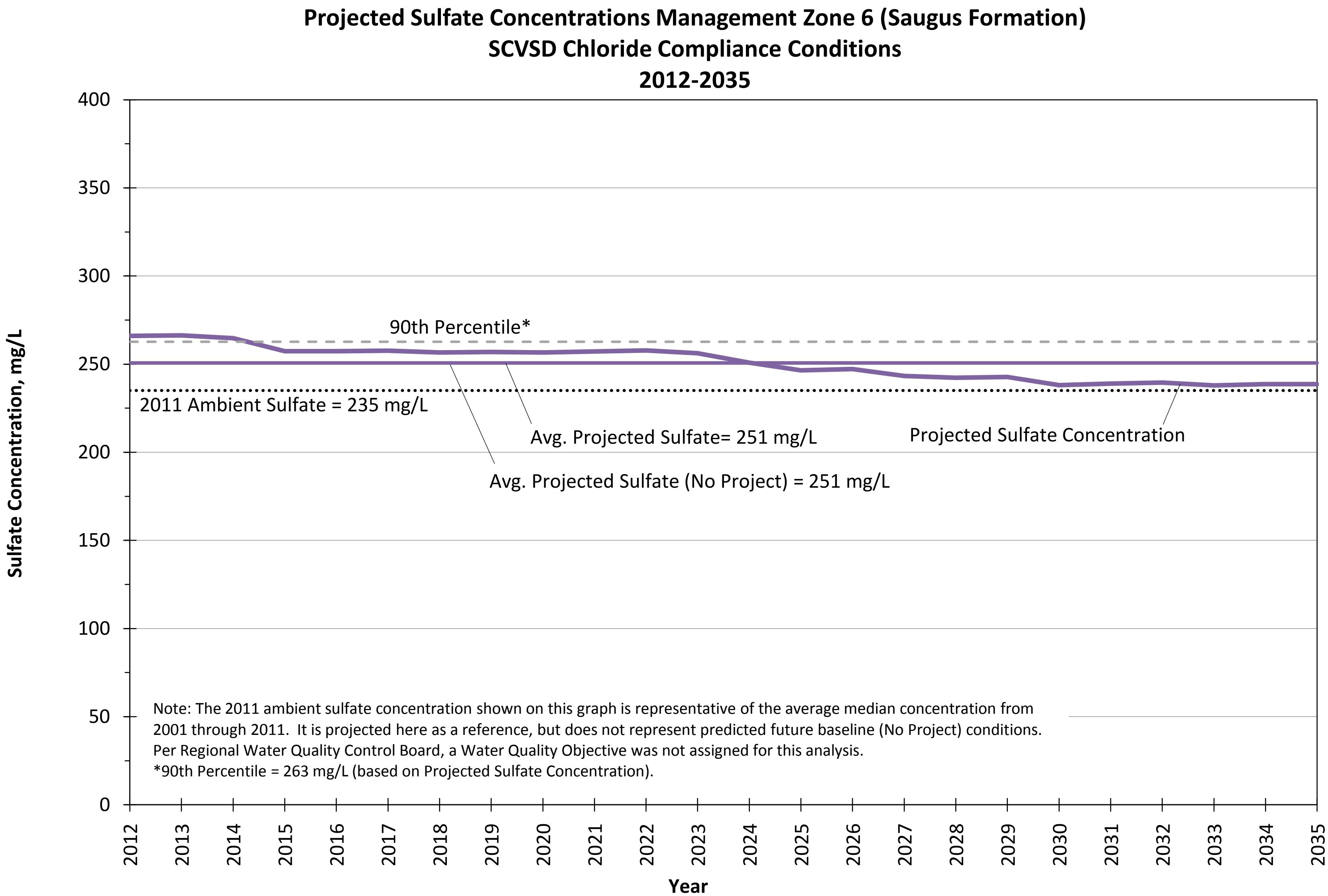
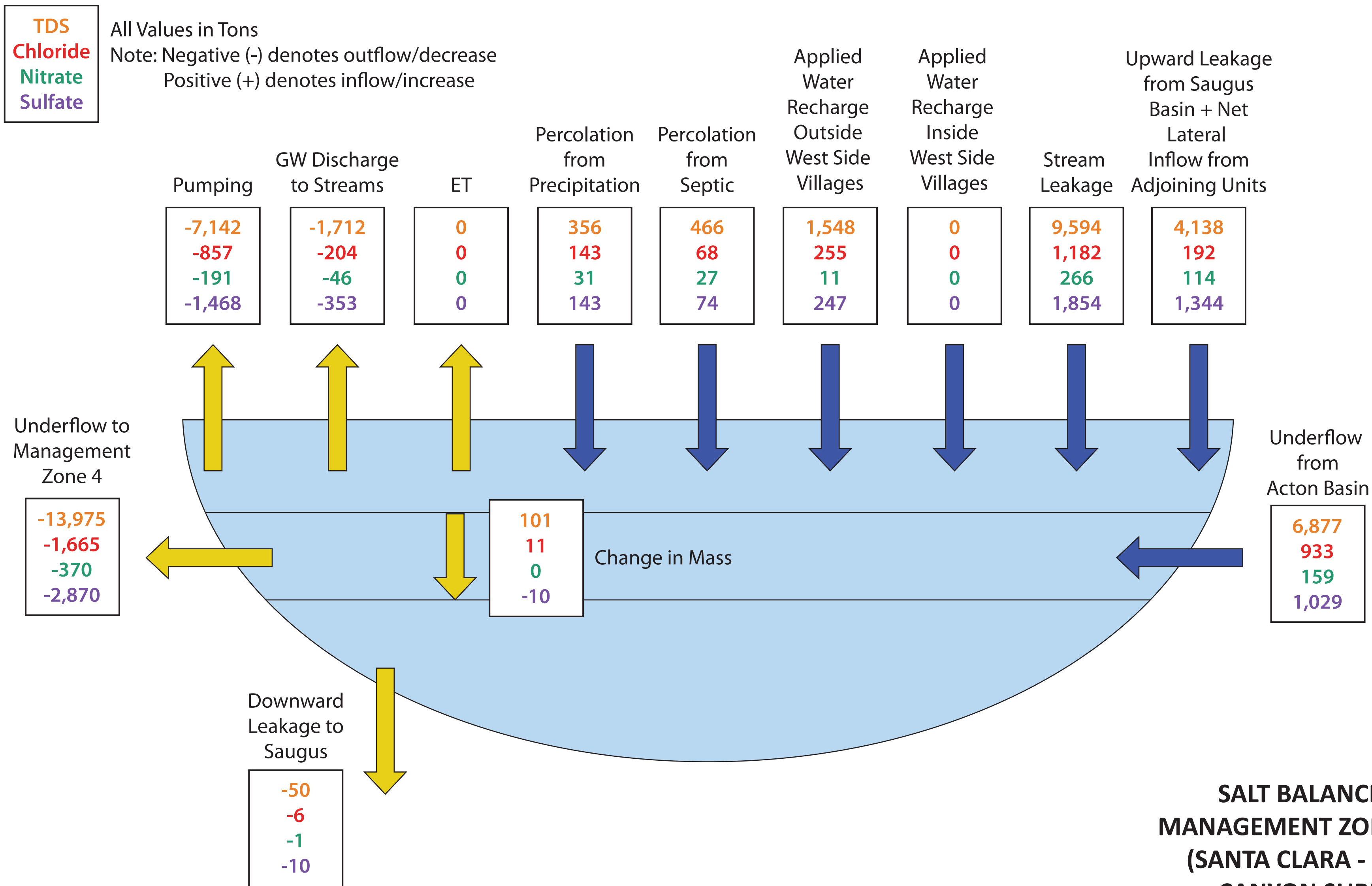

Projected Sulfate Concentrations Management Zone 6 (Saugus Formation)
SCVSD Chloride Compliance Conditions
2012-2035
Sulfate Concentration, mg/L
0
50
100
150
200
250
300
350
400
90th Percentile*
2011 Ambient Sulfate = 235 mg/L
Avg. Projected Sulfate= 251 mg/L
Projected Sulfate Concentration
Avg. Projected Sulfate (No Project) = 251 mg/L
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions. Per Regional Water Quality Control Board, a Water Quality Objective was not assigned for this analysis.
*90th Percentile = 263 mg/L (based on Projected Sulfate Concentration).
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 24.4.8



SALT BALANCE FOR MANAGEMENT ZONE 1a (SANTA CLARA - MINT CANYON SUBUNIT) SCWD WATER USE EFFICIENCY PROGRAM CONDITIONS 2012-2035

8-Dec-16

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P.O. Box 220, Claremont, CA 91711
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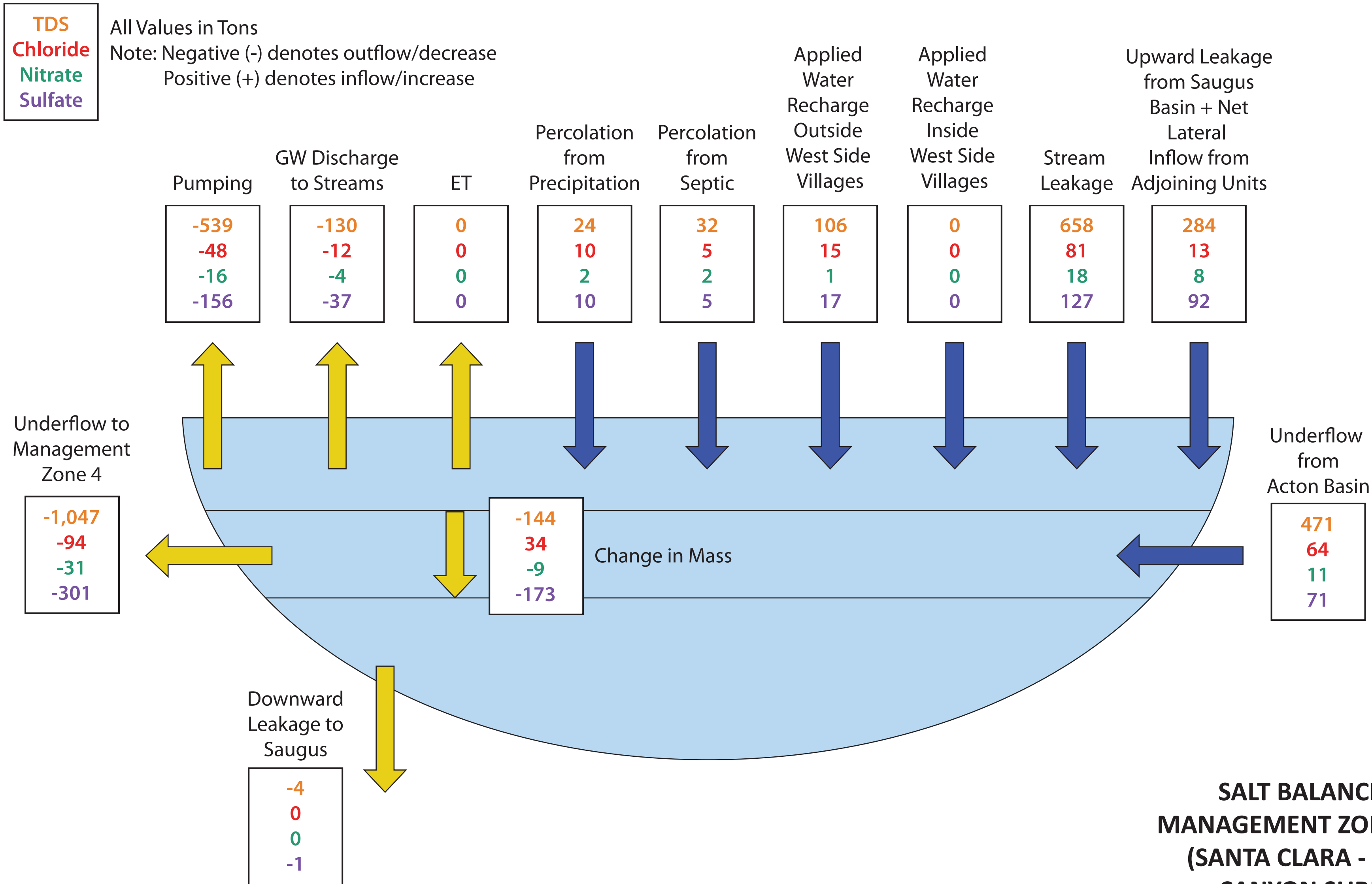
Figure 25a



SALT BALANCE FOR MANAGEMENT ZONE 1b (SANTA CLARA - MINT CANYON SUBUNIT) SCWD WATER USE EFFICIENCY PROGRAM CONDITIONS 2012-2035

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Figure 25b

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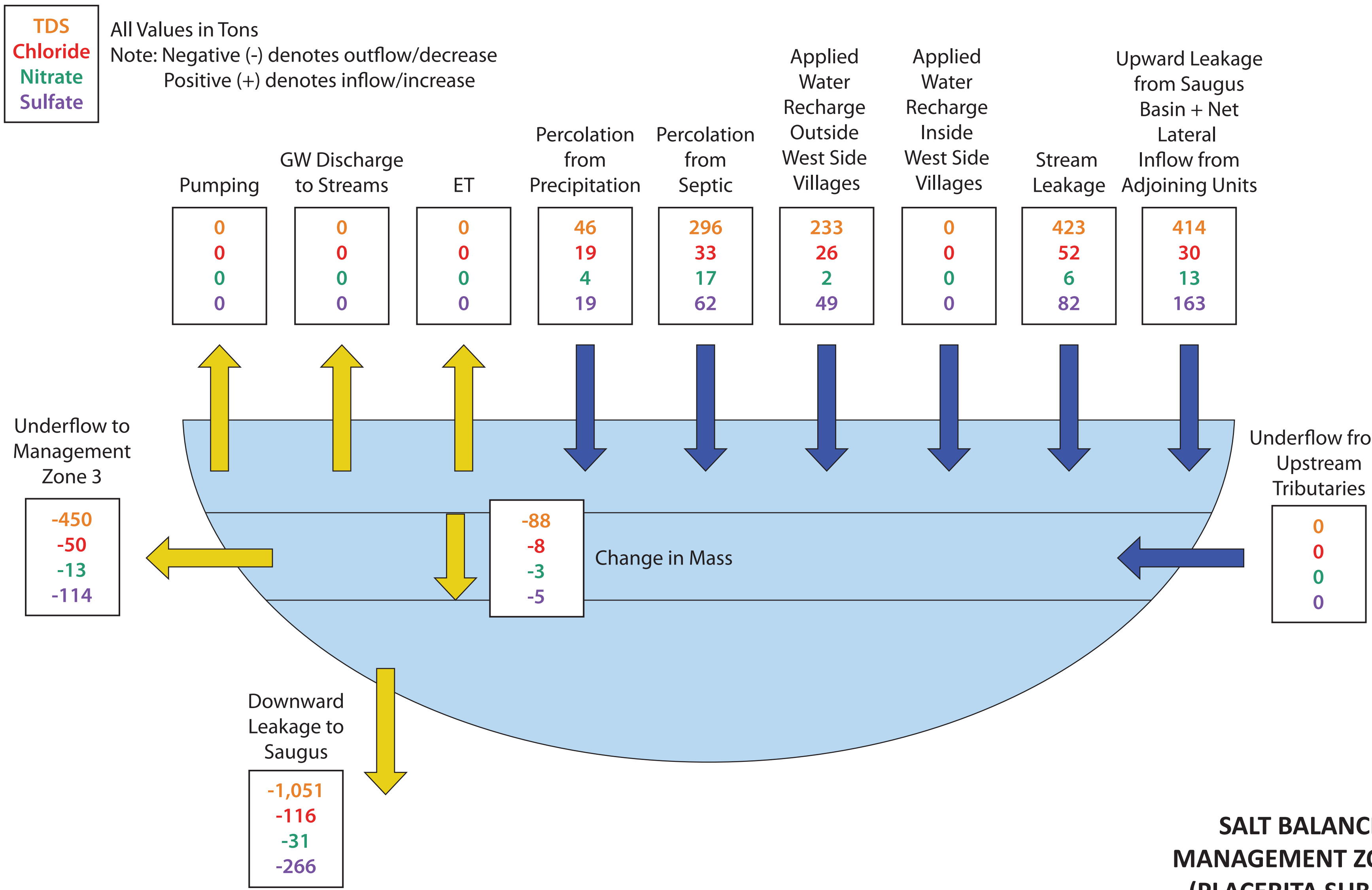

SALT BALANCE FOR MANAGEMENT ZONE 2 (PLACERITA SUBUNIT) SCWD WATER USE EFFICIENCY PROGRAM CONDITIONS 2012-2035

8-Dec-16

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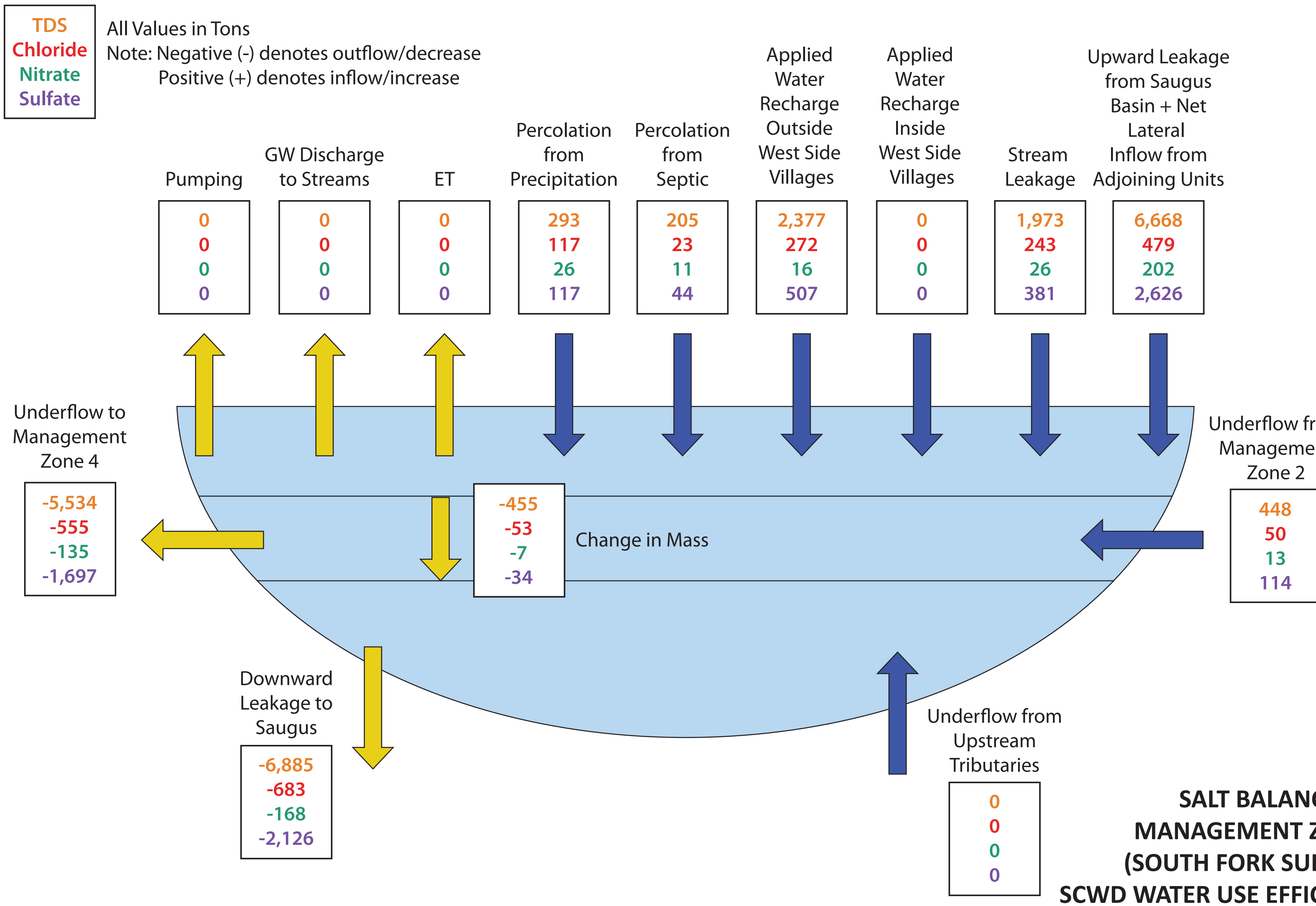
Figure 25c



SALT BALANCE FOR MANAGEMENT ZONE 3 (SOUTH FORK SUBUNIT) SCWD WATER USE EFFICIENCY PROGRAM CONDITIONS 2012-2035

Figure 25d

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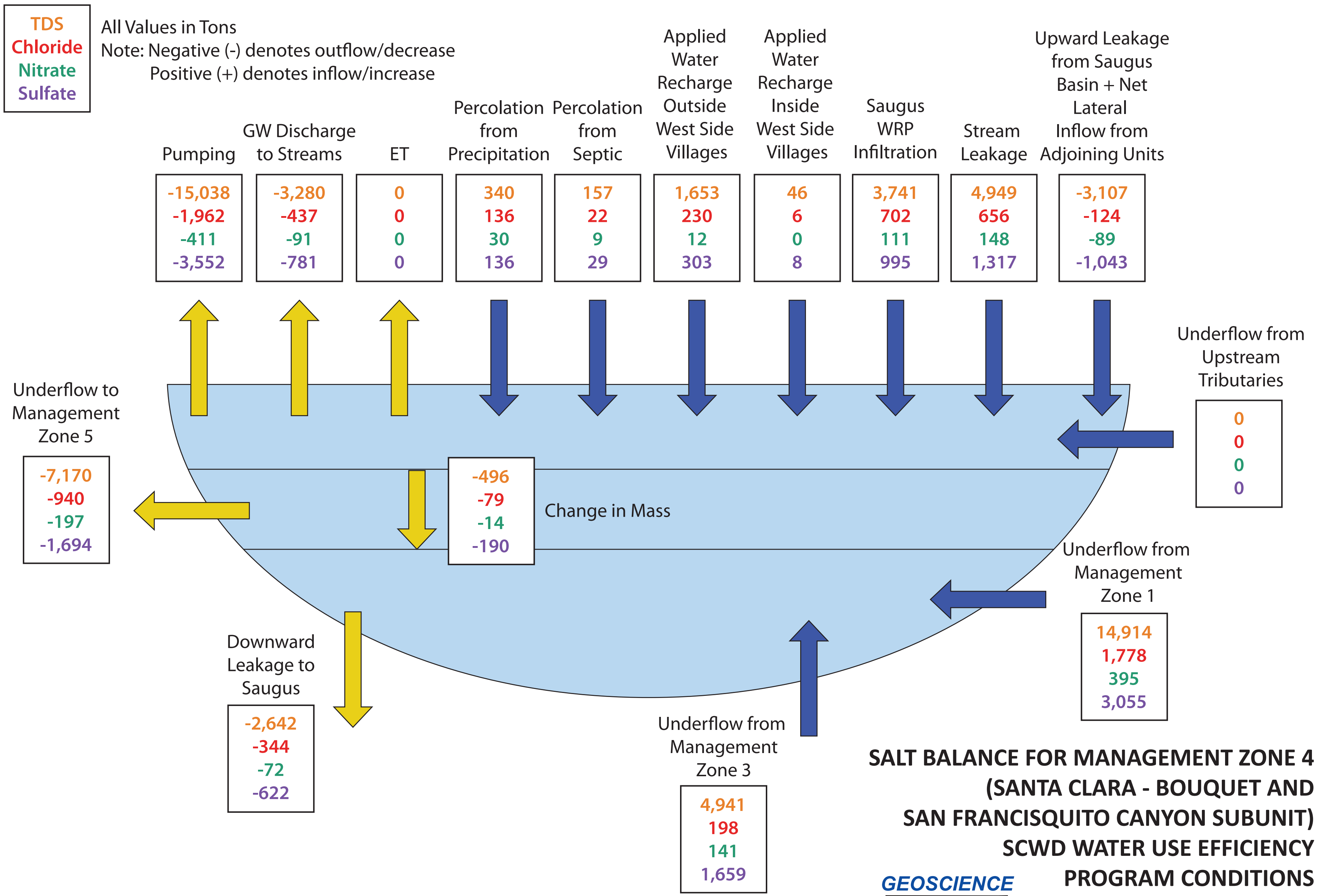

SALT BALANCE FOR MANAGEMENT ZONE 4 (SANTA CLARA - BOUQUET AND SAN FRANCISQUITO CANYON SUBUNIT) SCWD WATER USE EFFICIENCY PROGRAM CONDITIONS 2012-2035

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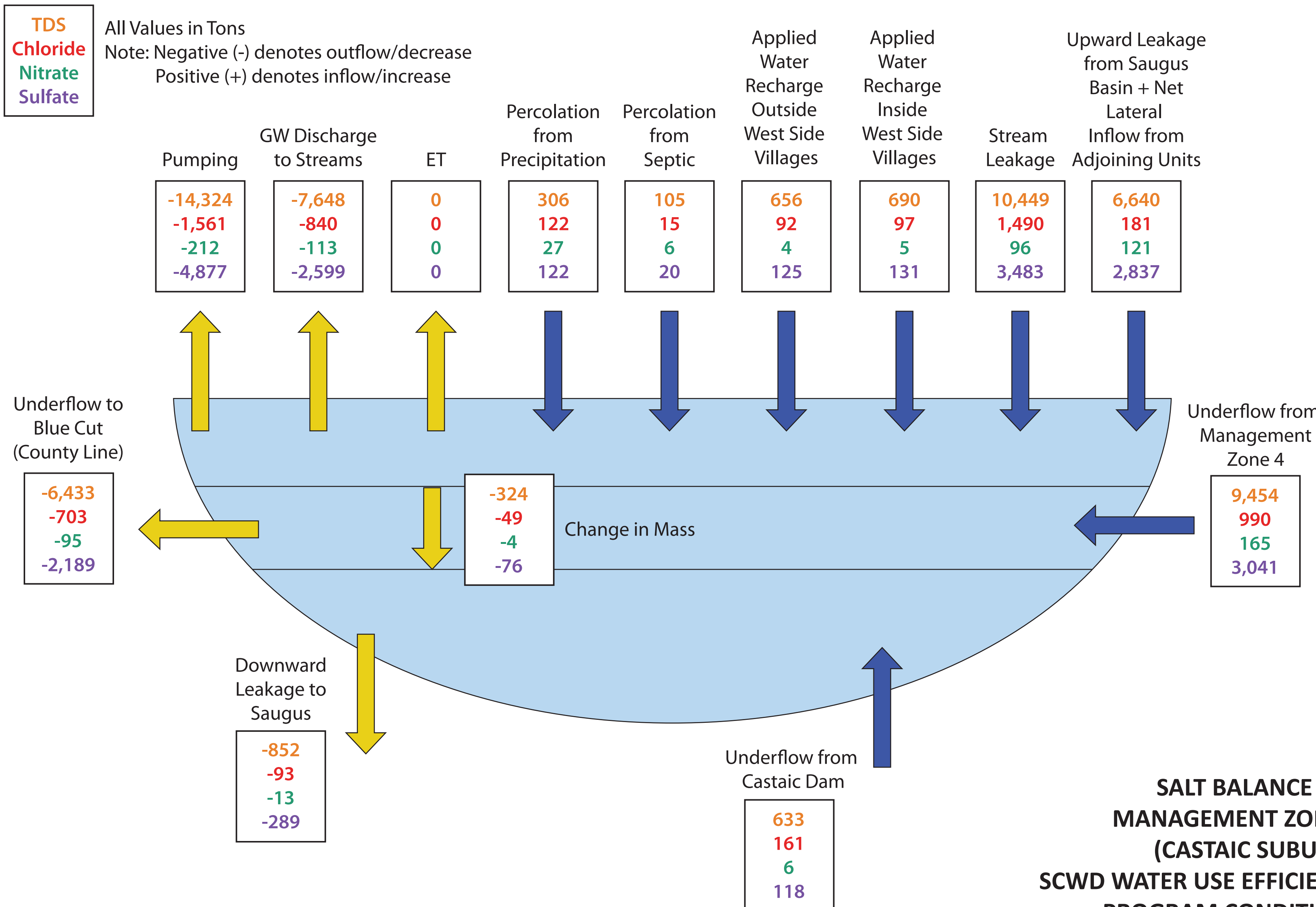
Figure 25e



SALT BALANCE FOR MANAGEMENT ZONE 5 (CASTAIC SUBUNIT) SCWD WATER USE EFFICIENCY PROGRAM CONDITIONS 2012-2035

Figure 25f

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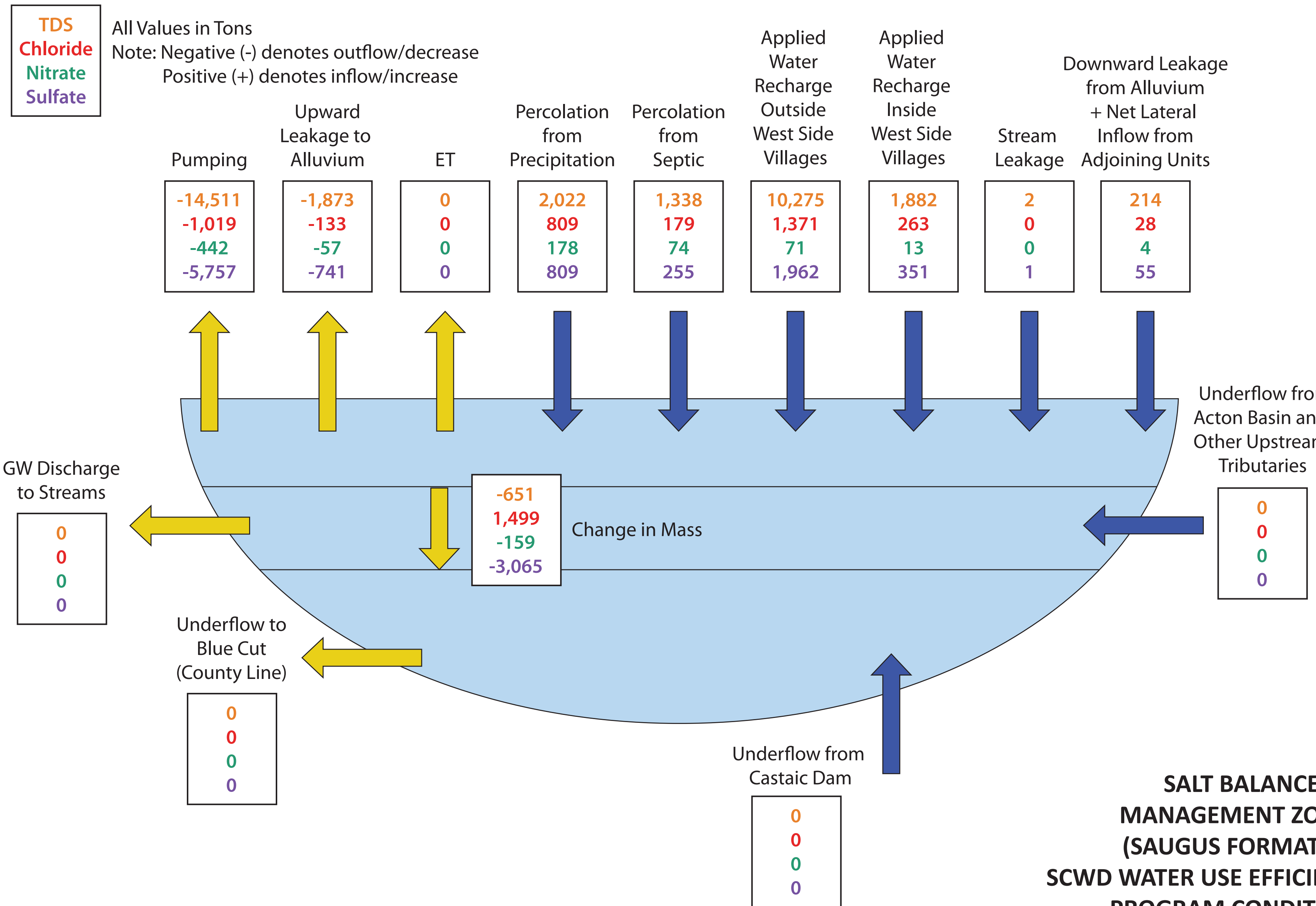
CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 6 (SAUGUS FORMATION) SCWD WATER USE EFFICIENCY PROGRAM CONDITIONS 2012-2035

Figure 25g

8-Dec-16

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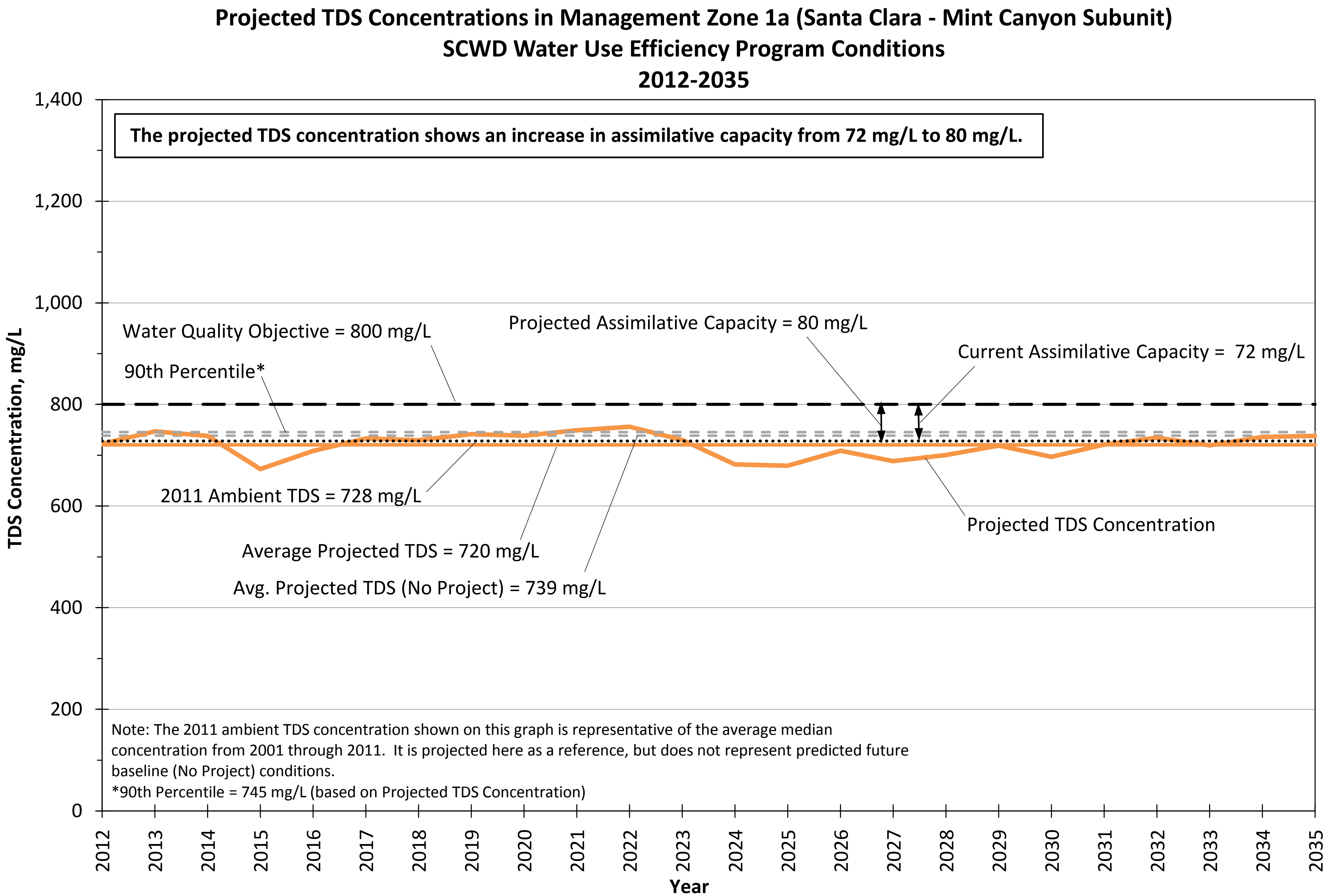

Projected TDS Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035
The projected TDS concentration shows an increase in assimilative capacity from 72 mg/L to 80 mg/L.
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
Water Quality Objective = 800 mg/L
90th Percentile*
Projected Assimilative Capacity = 80 mg/L
Current Assimilative Capacity = 72 mg/L
2011 Ambient TDS = 728 mg/L
Average Projected TDS = 720 mg/L
Avg. Projected TDS (No Project) = 739 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 745 mg/L (based on Projected TDS Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 26.1.a

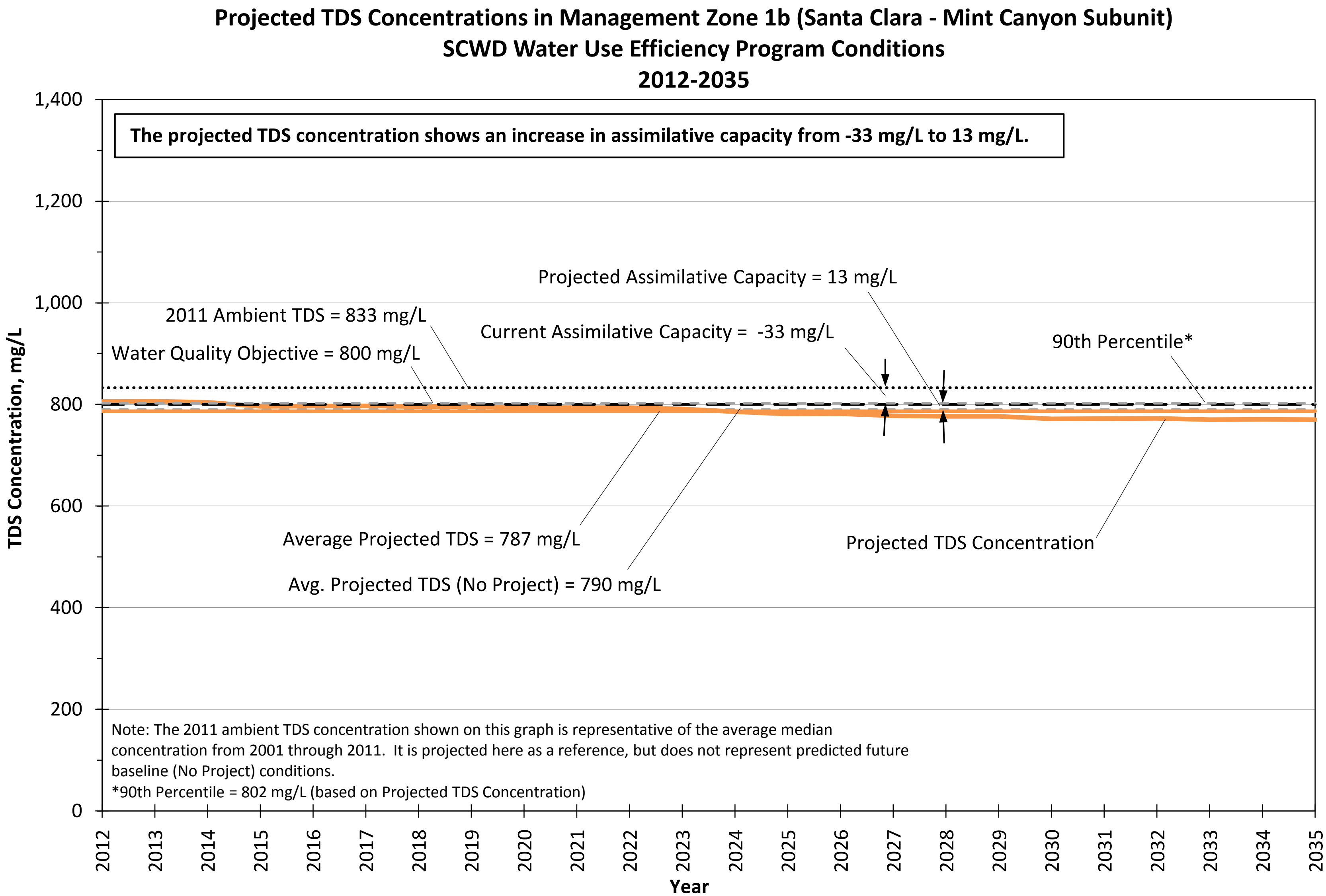

Projected TDS Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035
The projected TDS concentration shows an increase in assimilative capacity from -33 mg/L to 13 mg/L.
Projected Assimilative Capacity = 13 mg/L
2011 Ambient TDS = 833 mg/L
Current Assimilative Capacity = -33 mg/L
Water Quality Objective = 800 mg/L
90th Percentile*
Average Projected TDS = 787 mg/L
Projected TDS Concentration
Avg. Projected TDS (No Project) = 790 mg/L
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 802 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 26.1.b

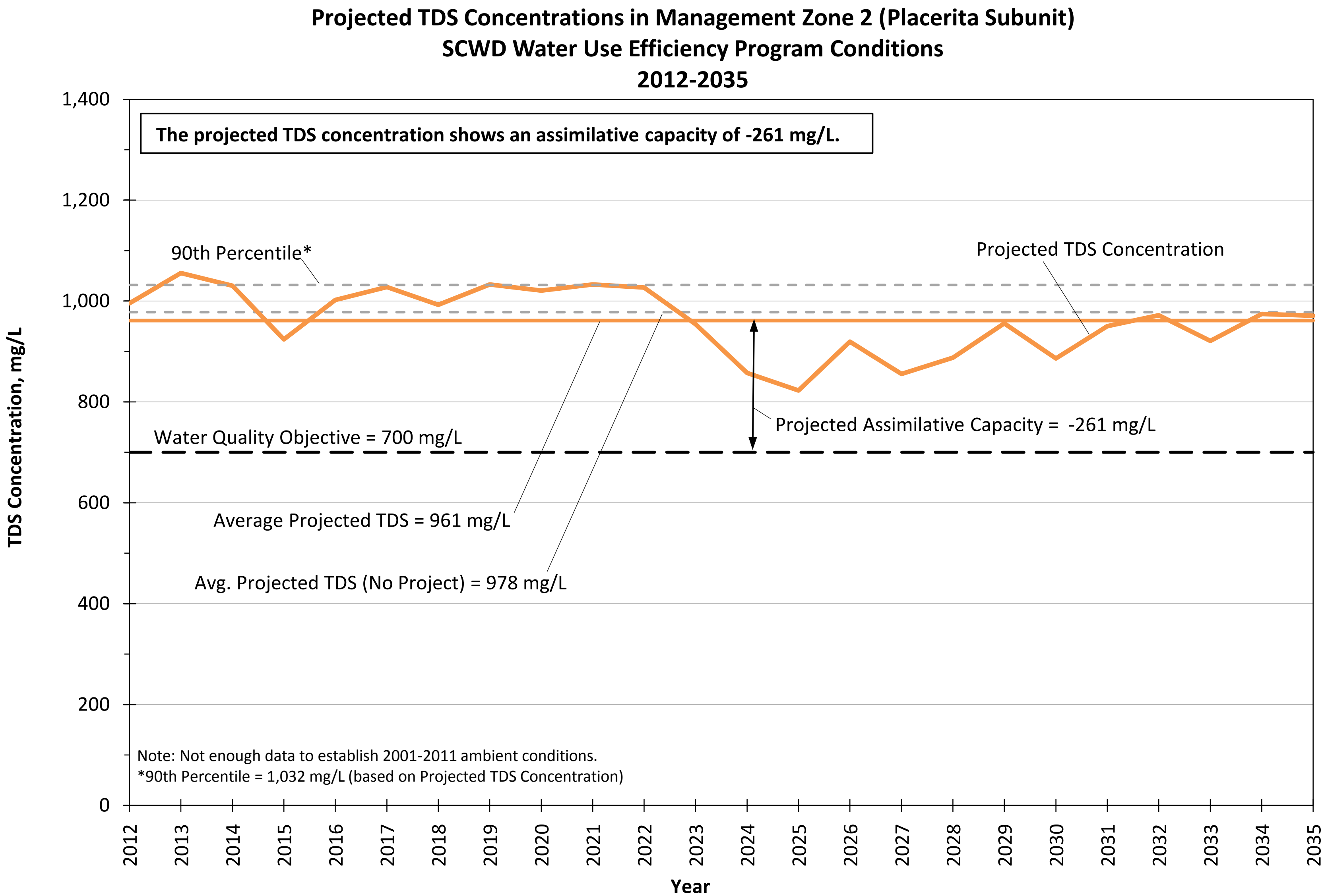

Projected TDS Concentrations in Management Zone 2 (Placerita Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035
The projected TDS concentration shows an assimilative capacity of -261 mg/L.
90th Percentile*
Projected TDS Concentration
Water Quality Objective = 700 mg/L
Projected Assimilative Capacity = -261 mg/L
Average Projected TDS = 961 mg/L
Avg. Projected TDS (No Project) = 978 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 1,032 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 26.1.c

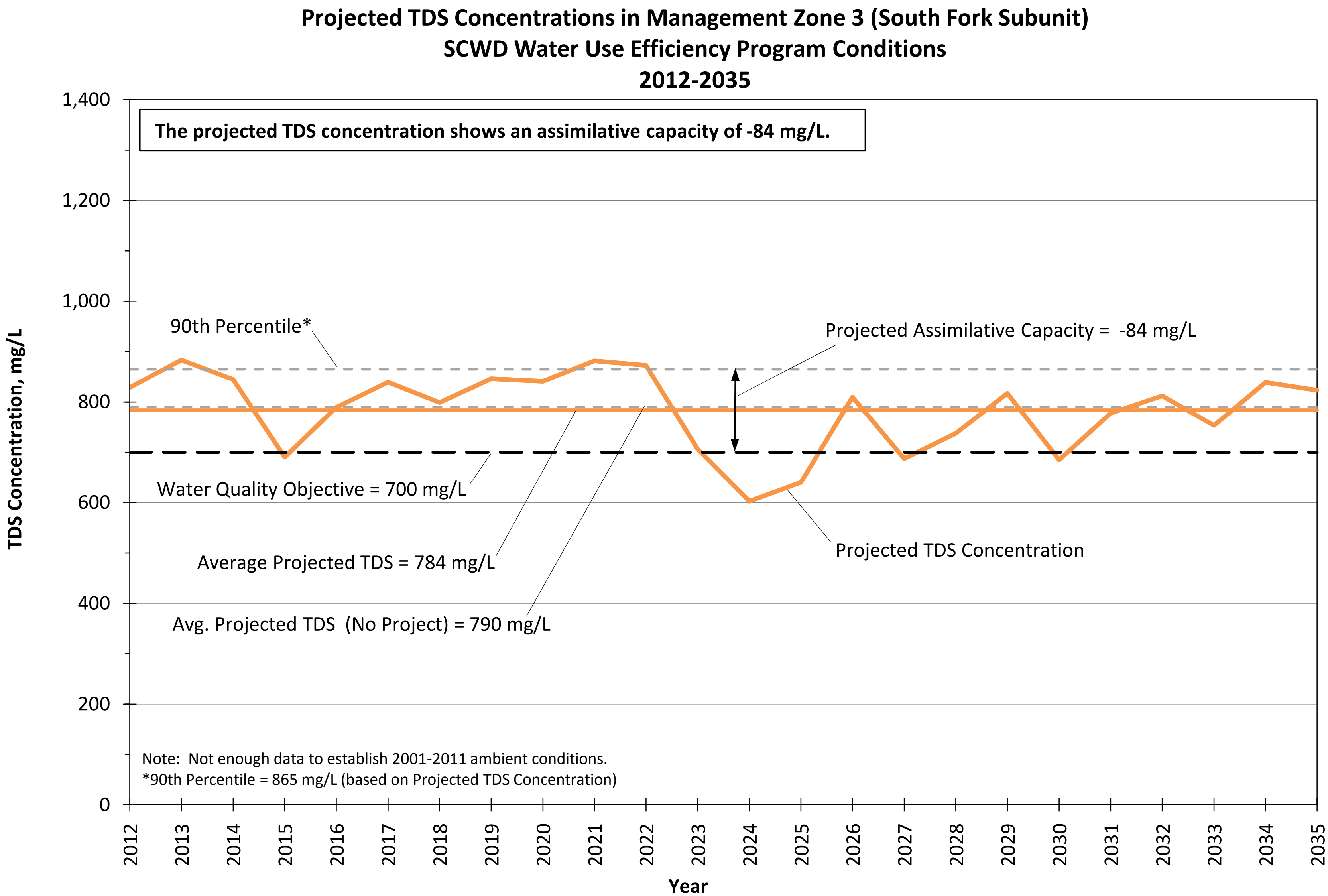

Projected TDS Concentrations in Management Zone 3 (South Fork Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035
The projected TDS concentration shows an assimilative capacity of -84 mg/L.
90th Percentile*
Projected Assimilative Capacity = -84 mg/L
Water Quality Objective = 700 mg/L
Average Projected TDS = 784 mg/L
Avg. Projected TDS (No Project) = 790 mg/L
Projected TDS Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 865 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
Year
1,400
1,200
1,000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 26.1.d

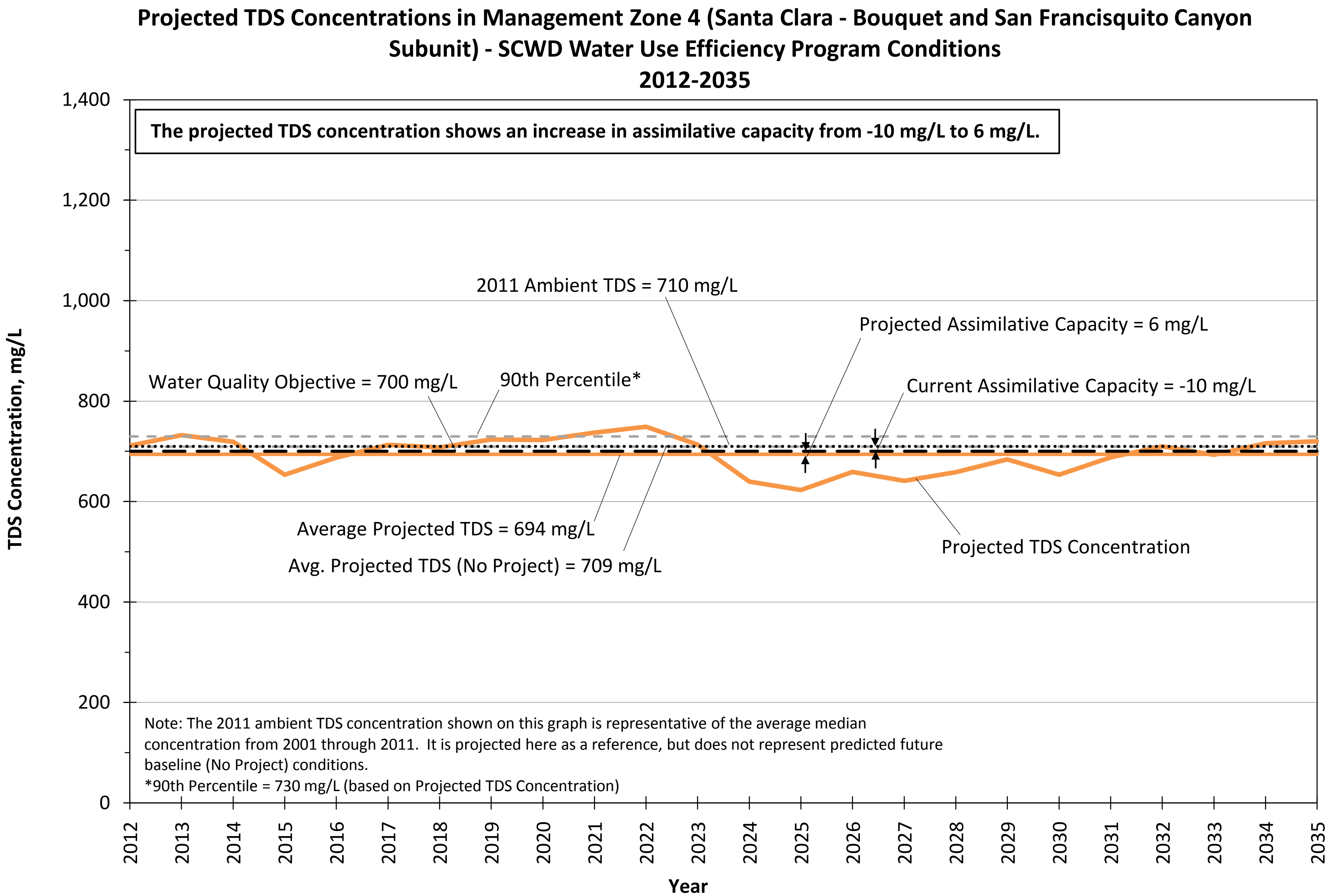

Projected TDS Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - SCWD Water Use Efficiency Program Conditions
2012-2035
The projected TDS concentration shows an increase in assimilative capacity from -10 mg/L to 6 mg/L.
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
2011 Ambient TDS = 710 mg/L
Projected Assimilative Capacity = 6 mg/L
Water Quality Objective = 700 mg/L
90th Percentile*
Current Assimilative Capacity = -10 mg/L
Average Projected TDS = 694 mg/L
Avg. Projected TDS (No Project) = 709 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 730 mg/L (based on Projected TDS Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 26.1.e

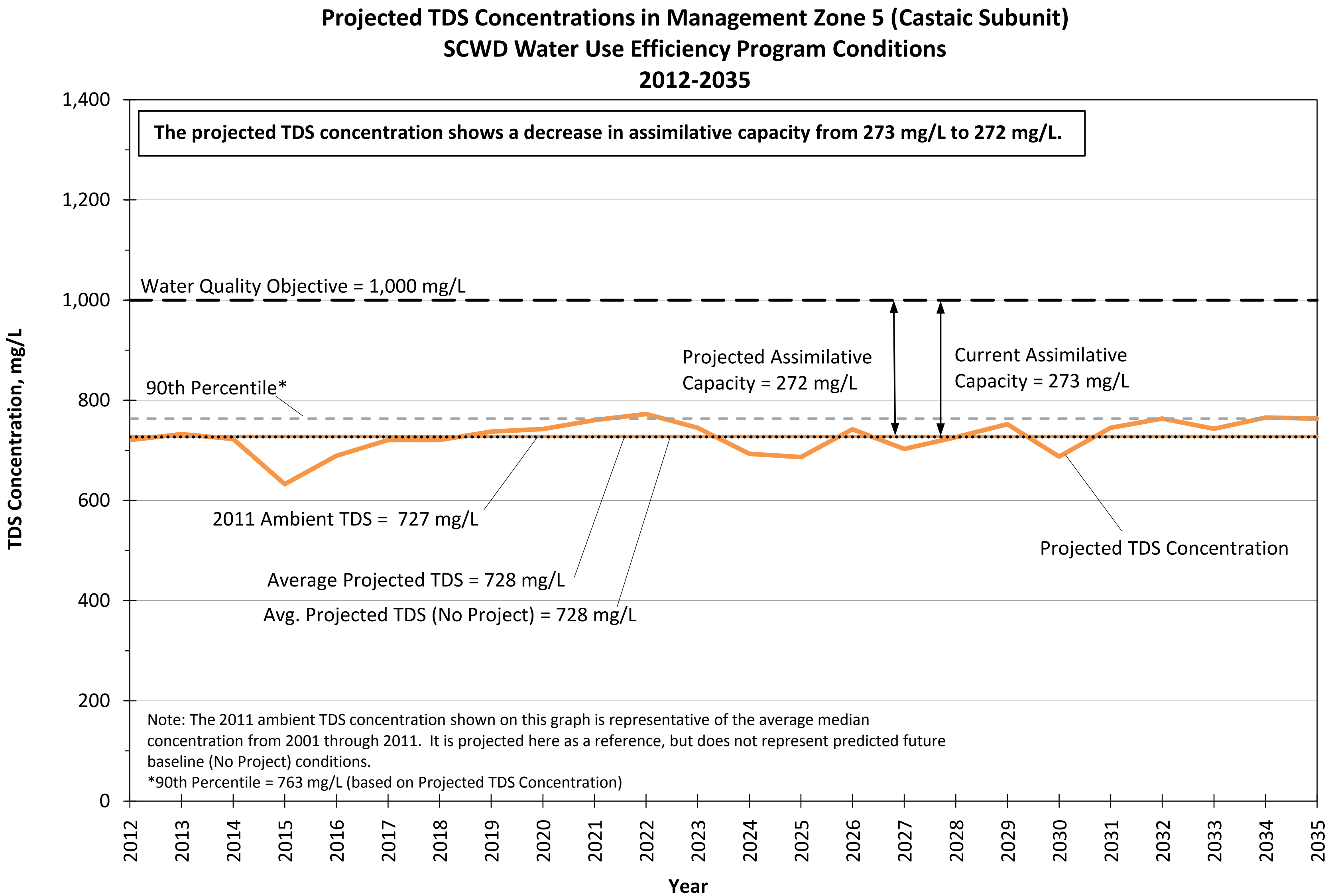

Projected TDS Concentrations in Management Zone 5 (Castaic Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035
The projected TDS concentration shows a decrease in assimilative capacity from 273 mg/L to 272 mg/L.
Water Quality Objective = 1,000 mg/L
Projected Assimilative Capacity = 272 mg/L
Current Assimilative Capacity = 273 mg/L
90th Percentile*
2011 Ambient TDS = 727 mg/L
Average Projected TDS = 728 mg/L
Avg. Projected TDS (No Project) = 728 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 763 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 26.1.f

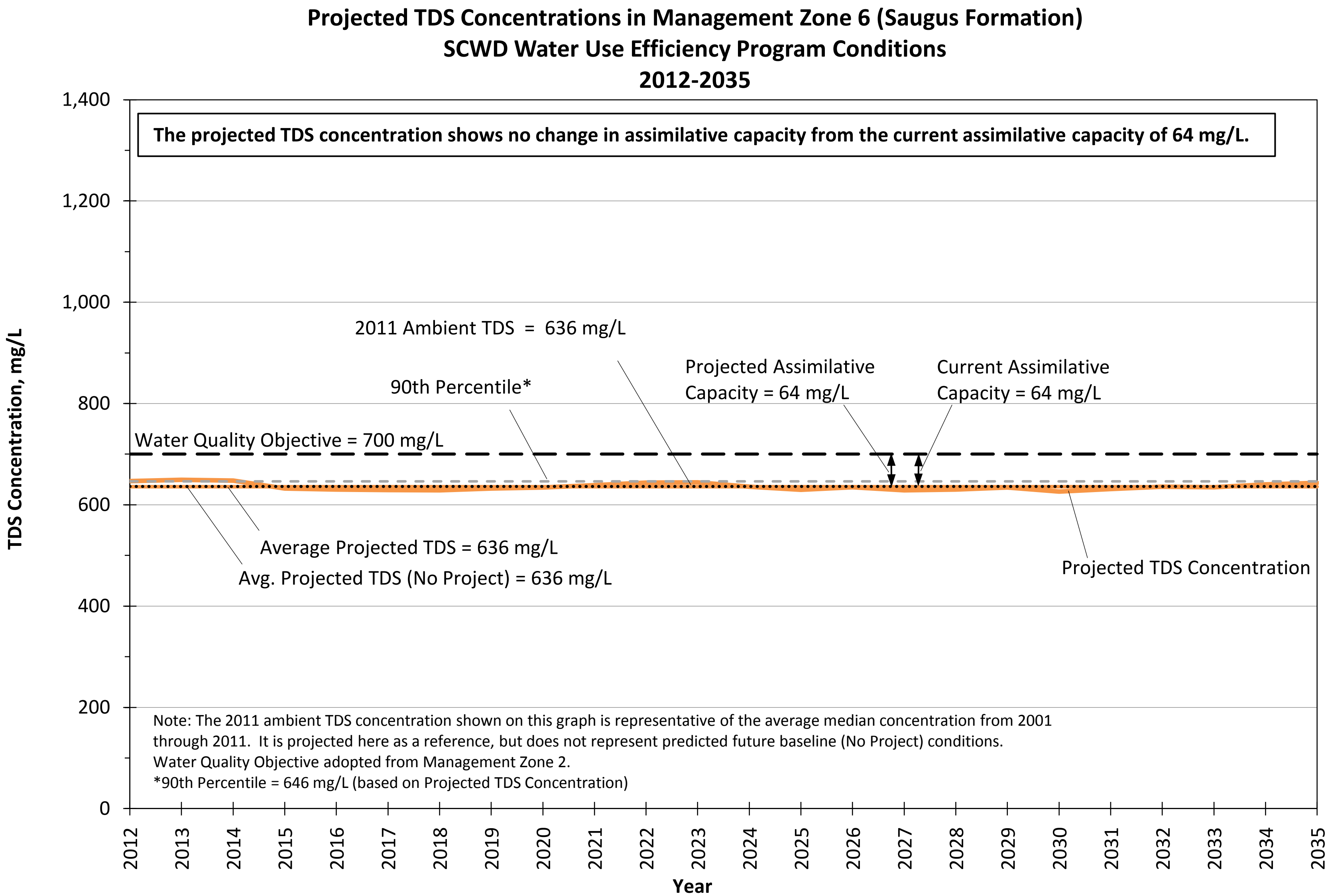

Projected TDS Concentrations in Management Zone 6 (Saugus Formation)
SCWD Water Use Efficiency Program Conditions
2012-2035
The projected TDS concentration shows no change in assimilative capacity from the current assimilative capacity of 64 mg/L.
2011 Ambient TDS = 636 mg/L
Projected Assimilative Capacity = 64 mg/L
Current Assimilative Capacity = 64 mg/L
90th Percentile*
Water Quality Objective = 700 mg/L
Average Projected TDS = 636 mg/L
Avg. Projected TDS (No Project) = 636 mg/L
Projected TDS Concentration
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Water Quality Objective adopted from Management Zone 2.
*90th Percentile = 646 mg/L (based on Projected TDS Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 26.1.g

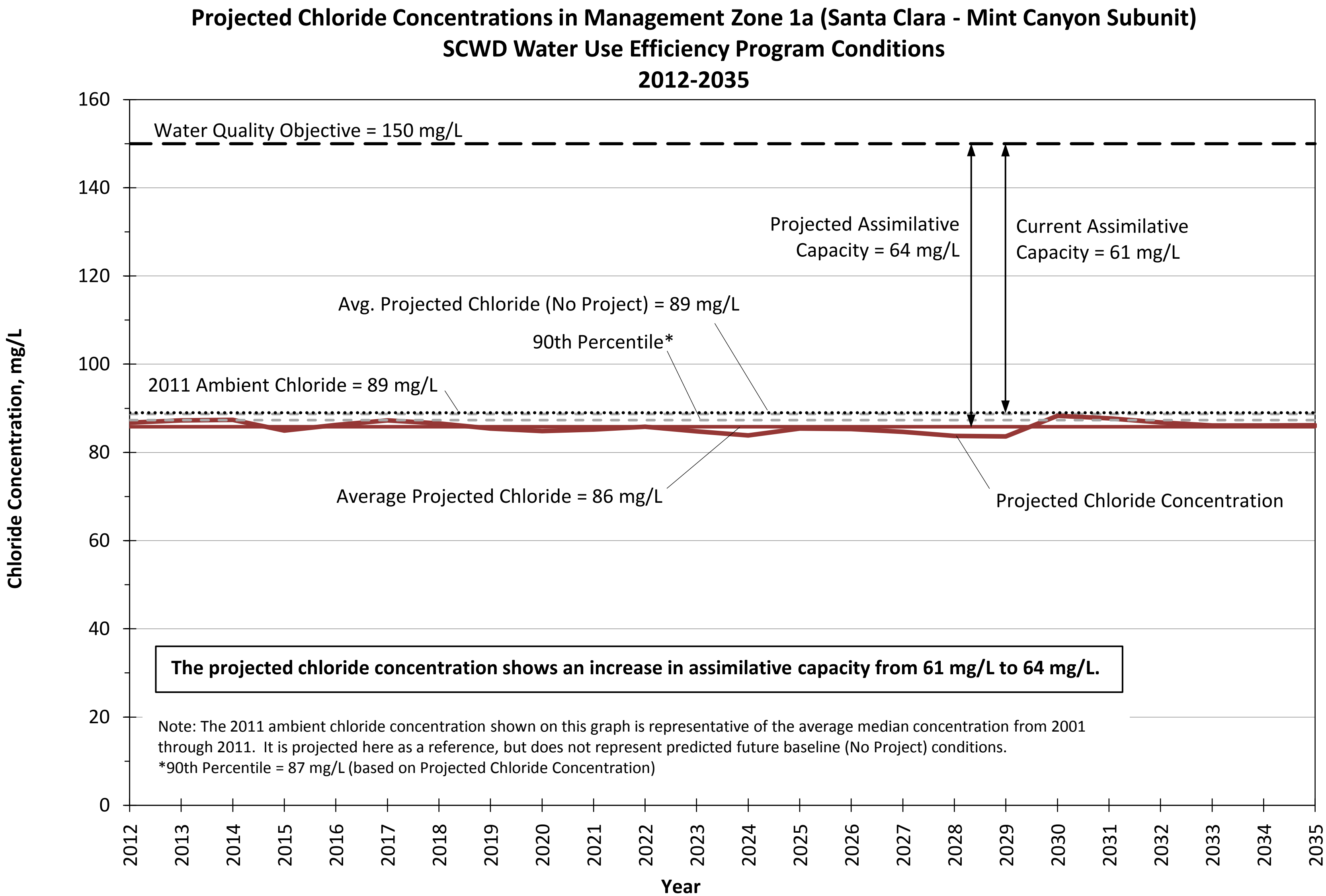

Projected Chloride Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035
Water Quality Objective = 150 mg/L
Projected Assimilative Capacity = 64 mg/L
Current Assimilative Capacity = 61 mg/L
Avg. Projected Chloride (No Project) = 89 mg/L
90th Percentile*
2011 Ambient Chloride = 89 mg/L
Average Projected Chloride = 86 mg/L
Projected Chloride Concentration
The projected chloride concentration shows an increase in assimilative capacity from 61 mg/L to 64 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 87 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 26.2.a

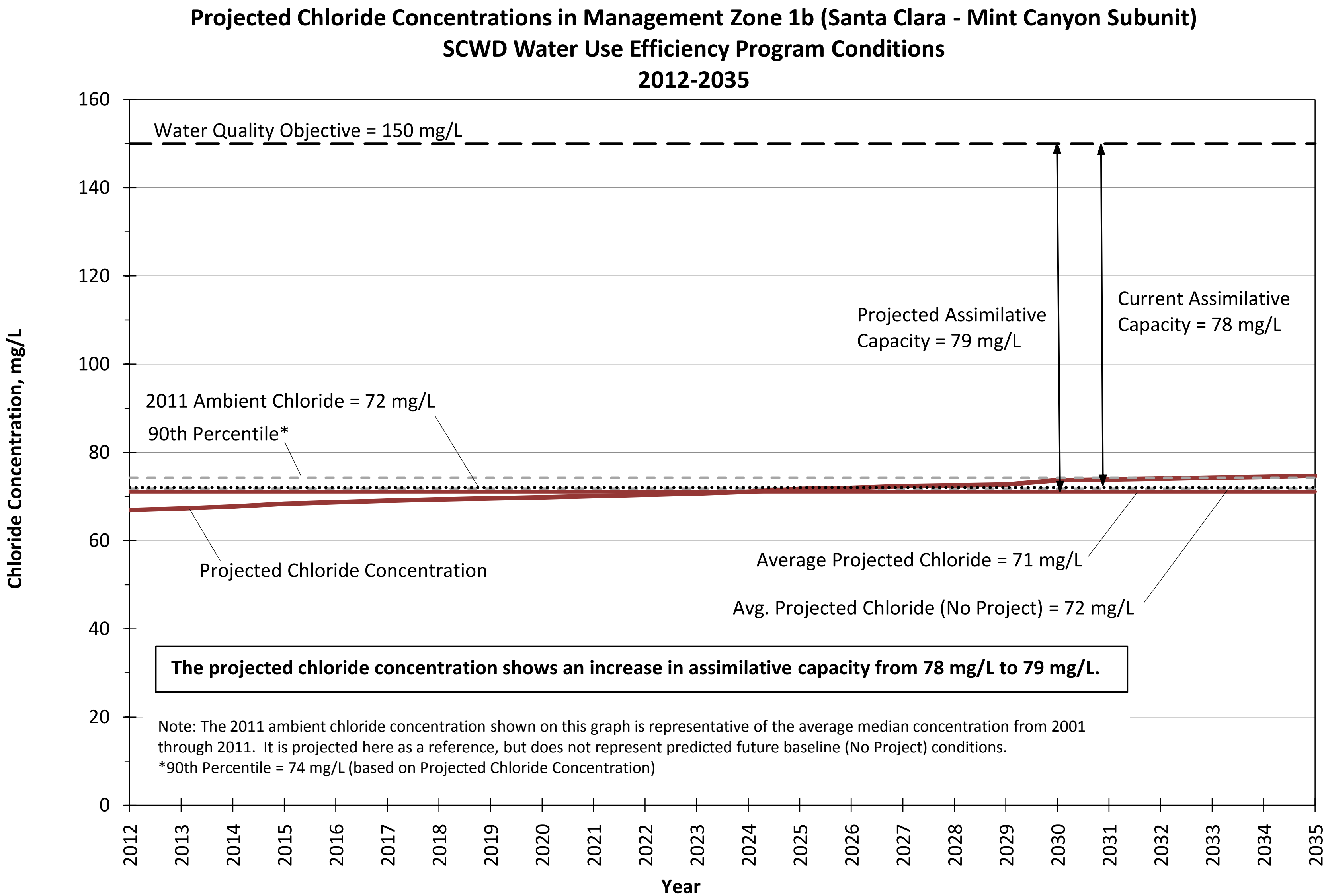

Projected Chloride Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035
Water Quality Objective = 150 mg/L
Projected Assimilative Capacity = 79 mg/L
Current Assimilative Capacity = 78 mg/L
2011 Ambient Chloride = 72 mg/L
90th Percentile*
Projected Chloride Concentration
Average Projected Chloride = 71 mg/L
Avg. Projected Chloride (No Project) = 72 mg/L
The projected chloride concentration shows an increase in assimilative capacity from 78 mg/L to 79 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 74 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
0
20
40
60
80
100
120
140
160
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 26.2.b

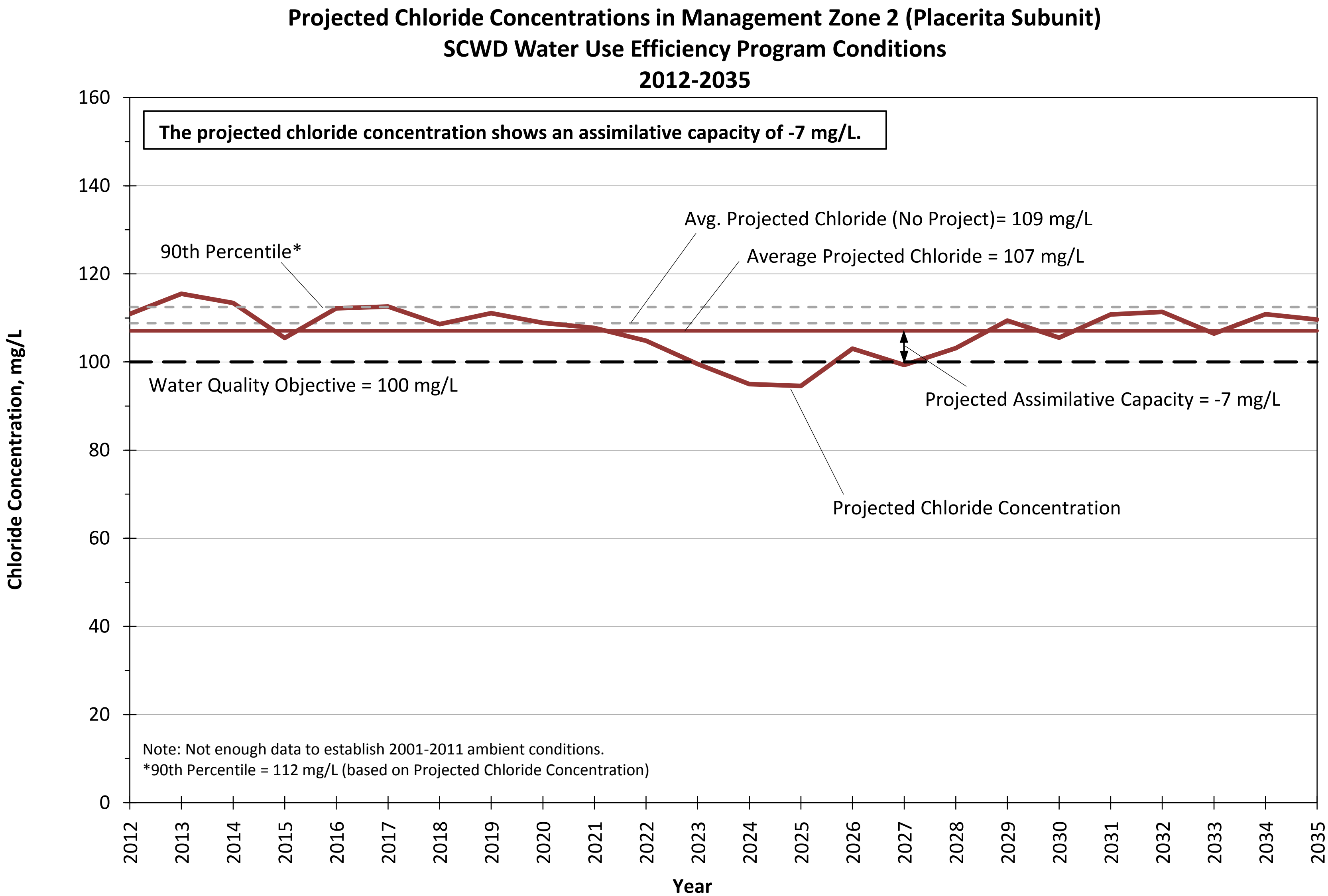

Projected Chloride Concentrations in Management Zone 2 (Placerita Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035
The projected chloride concentration shows an assimilative capacity of -7 mg/L.
Avg. Projected Chloride (No Project)= 109 mg/L
Average Projected Chloride = 107 mg/L
90th Percentile*
Water Quality Objective = 100 mg/L
Projected Assimilative Capacity = -7 mg/L
Projected Chloride Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 112 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 26.2.c

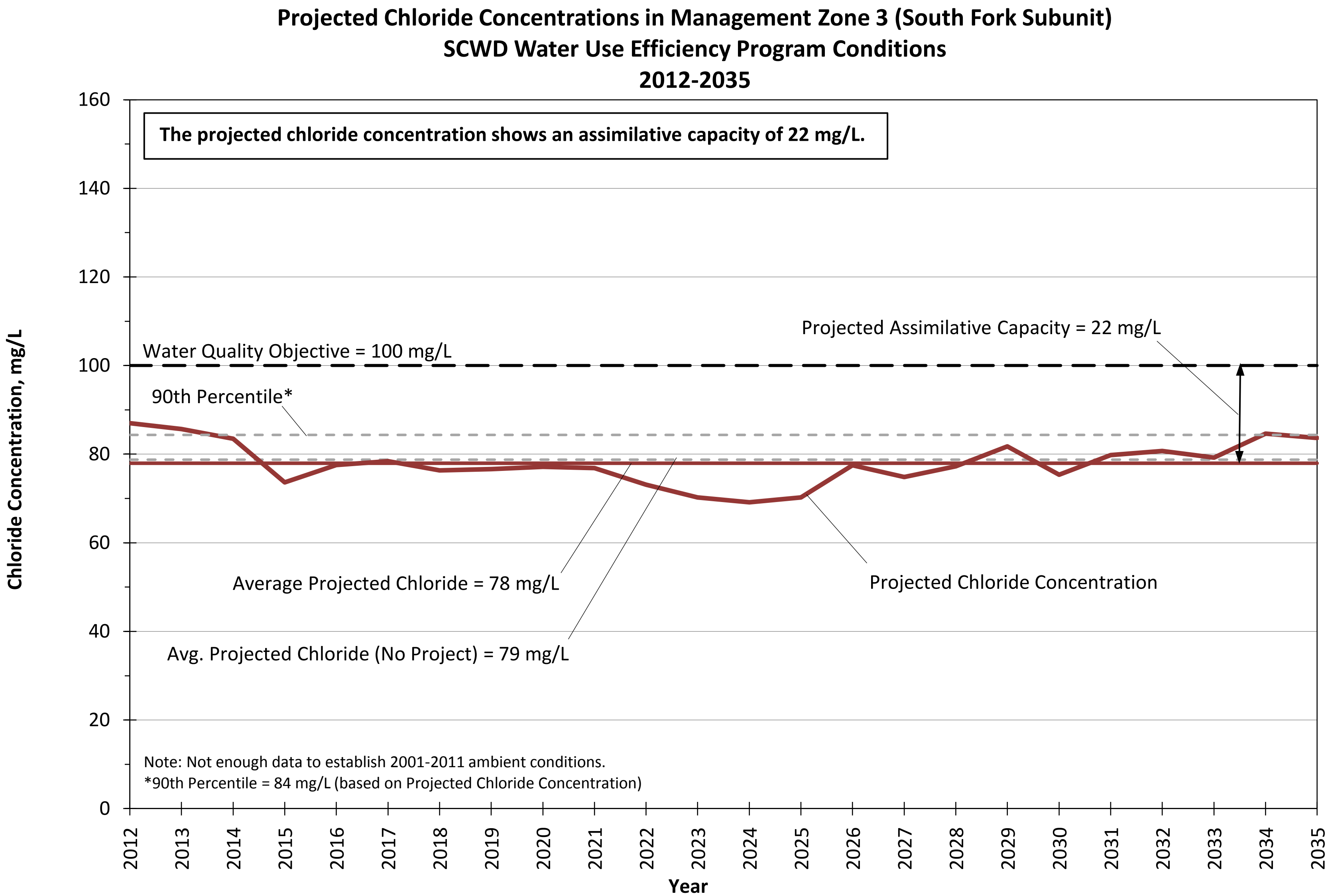

Projected Chloride Concentrations in Management Zone 3 (South Fork Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035
The projected chloride concentration shows an assimilative capacity of 22 mg/L.
Water Quality Objective = 100 mg/L
90th Percentile*
Projected Assimilative Capacity = 22 mg/L
Average Projected Chloride = 78 mg/L
Avg. Projected Chloride (No Project) = 79 mg/L
Projected Chloride Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 84 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 26.2.d

Projected Chloride Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - SCWD Water Use Efficiency Program Conditions 2012-2035

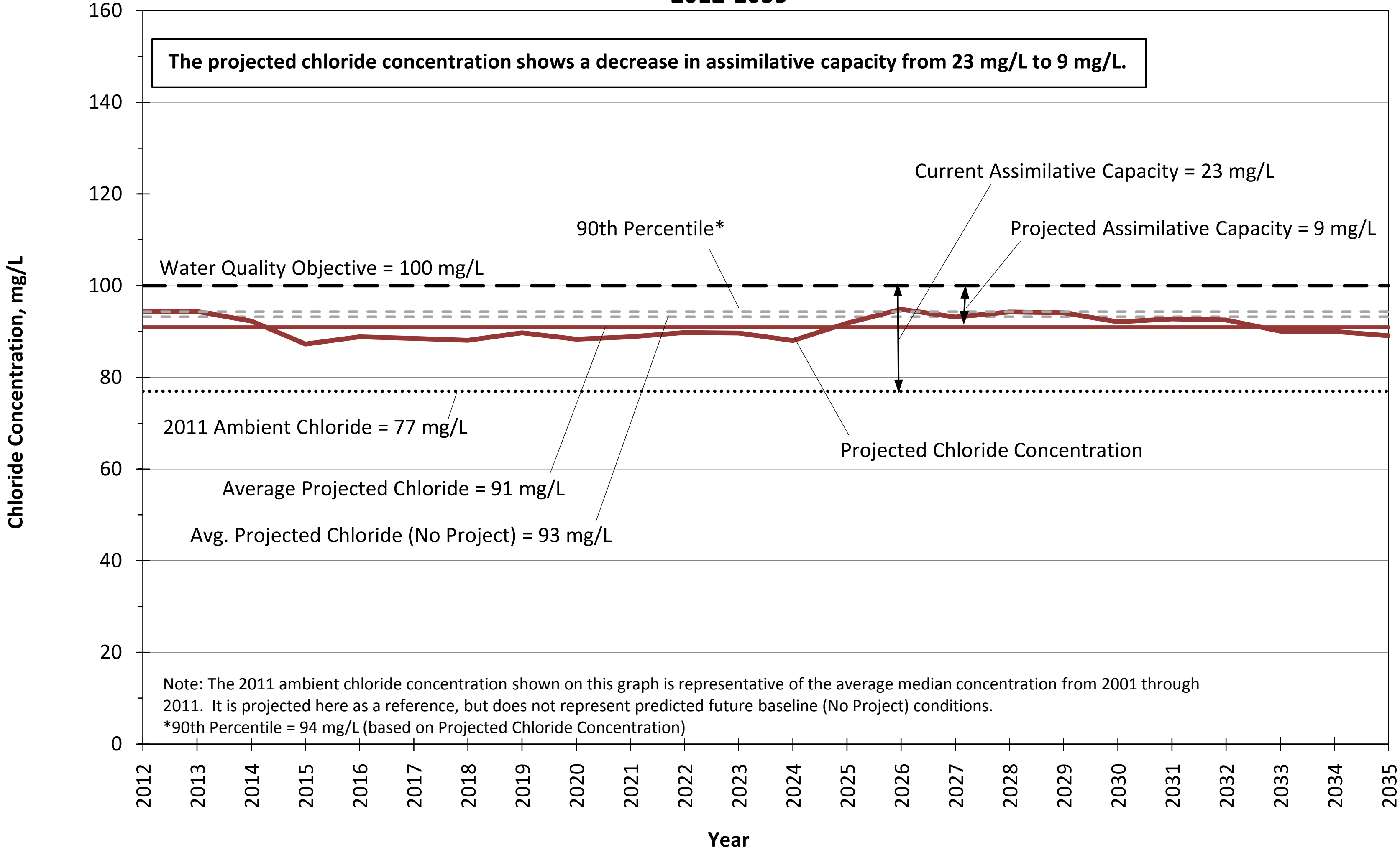


Figure 26.2.e

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

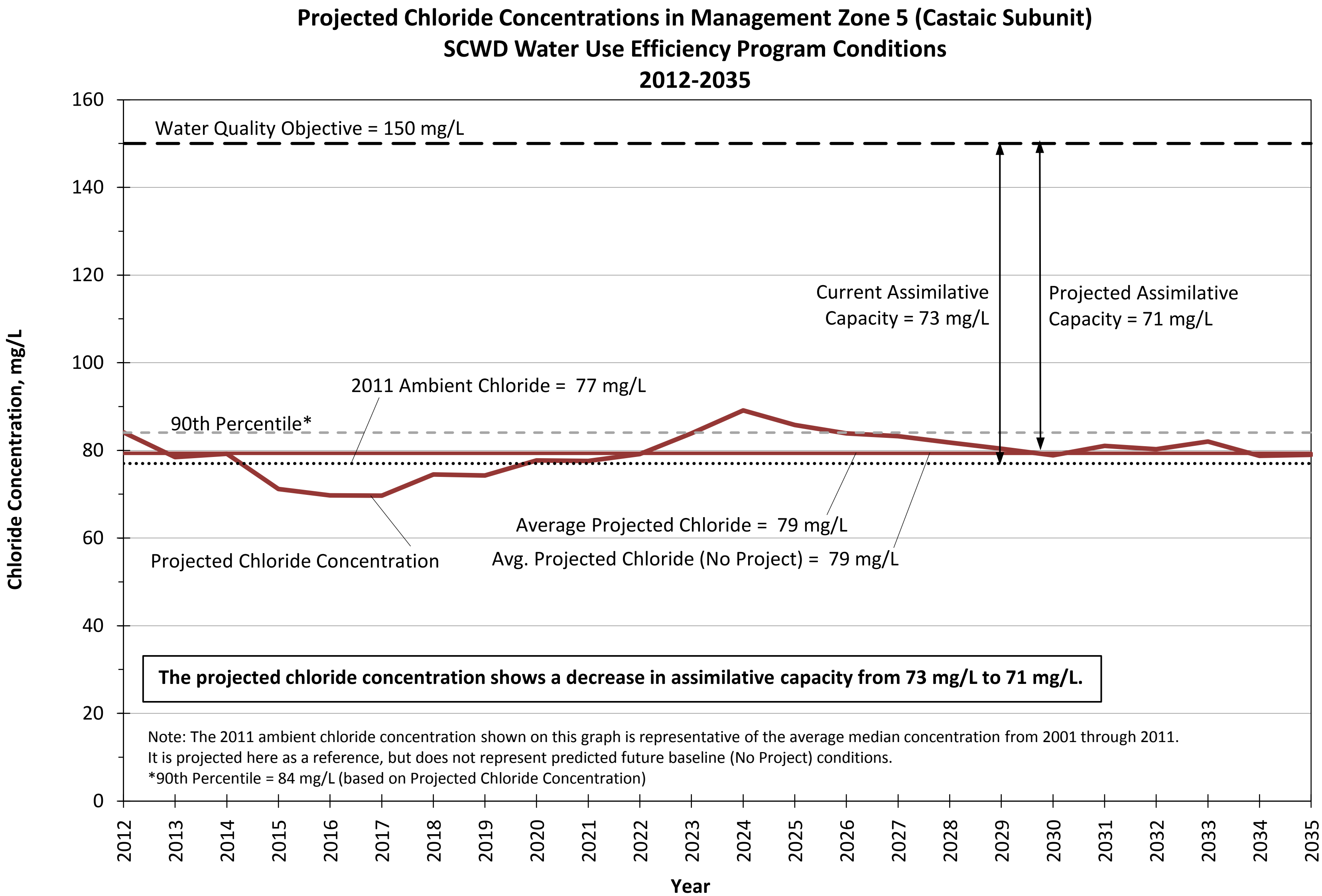


Figure 26.2.f

Projected Chloride Concentrations in Management Zone 6 (Saugus Formation)
SCWD Water Use Efficiency Program Conditions
2012-2035

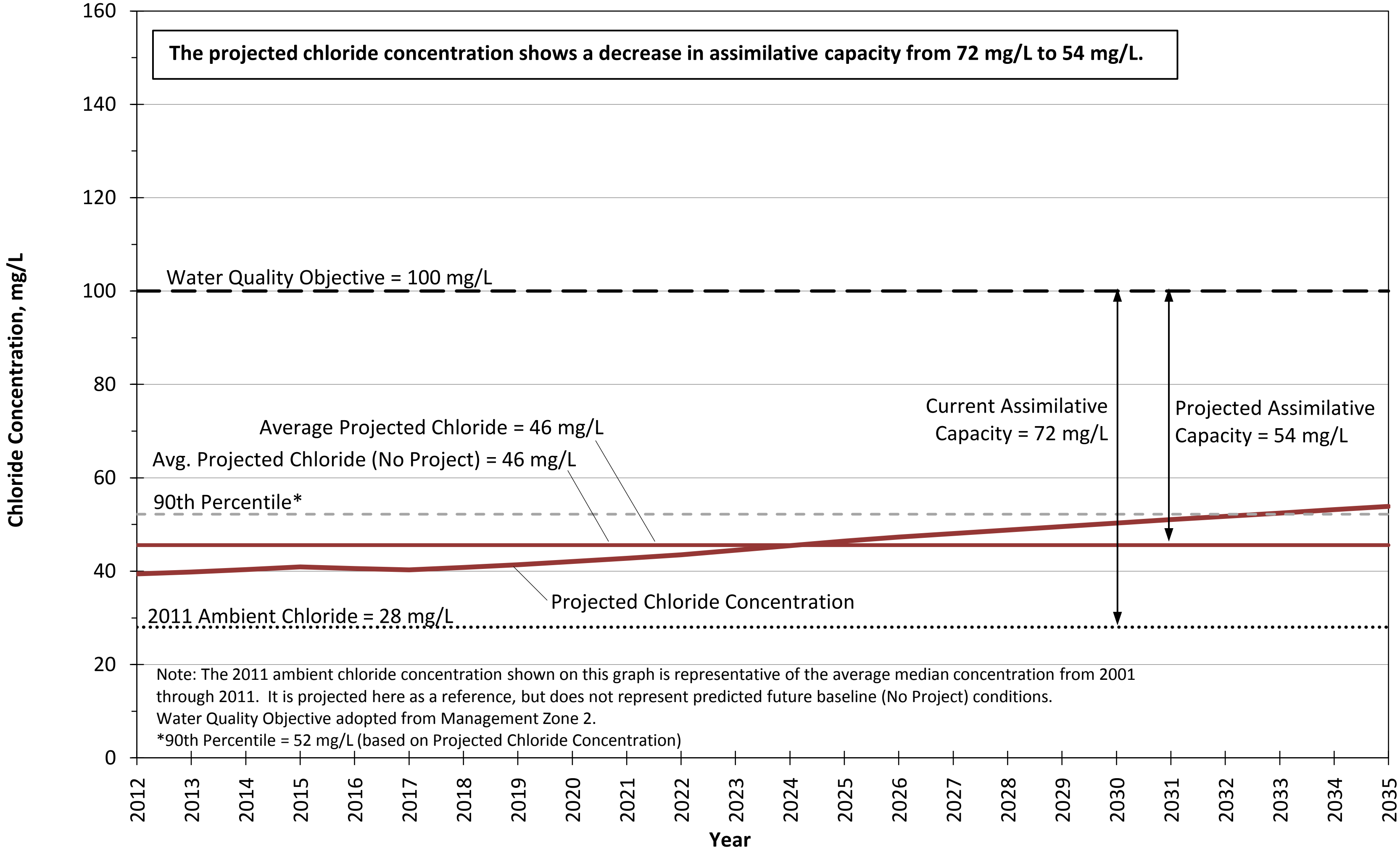
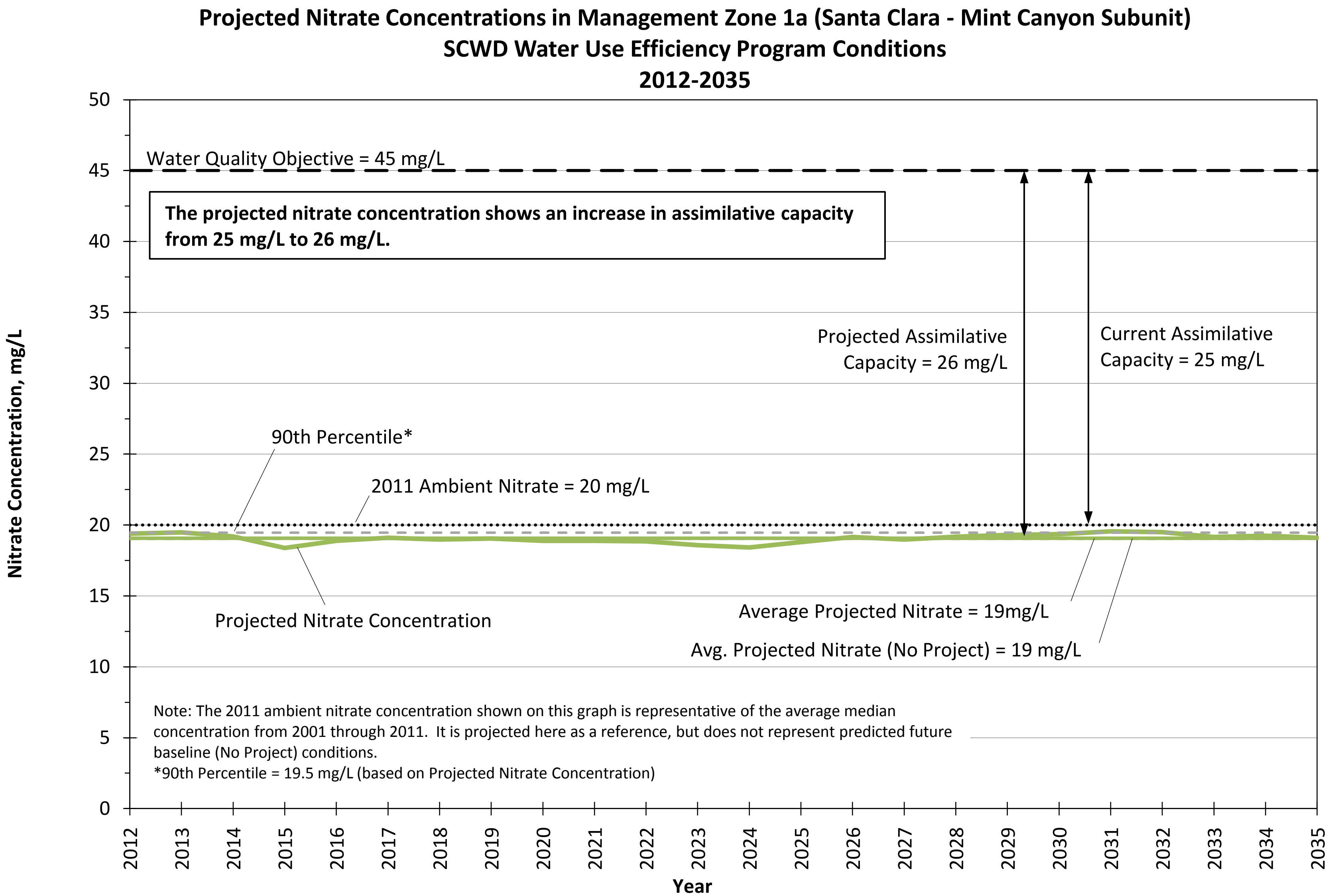


Figure 26.2.g


Projected Nitrate Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an increase in assimilative capacity from 25 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 25 mg/L
90th Percentile*
2011 Ambient Nitrate = 20 mg/L
Projected Nitrate Concentration
Average Projected Nitrate = 19mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 19.5 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
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2026
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2034
2035

Figure 26.3.a

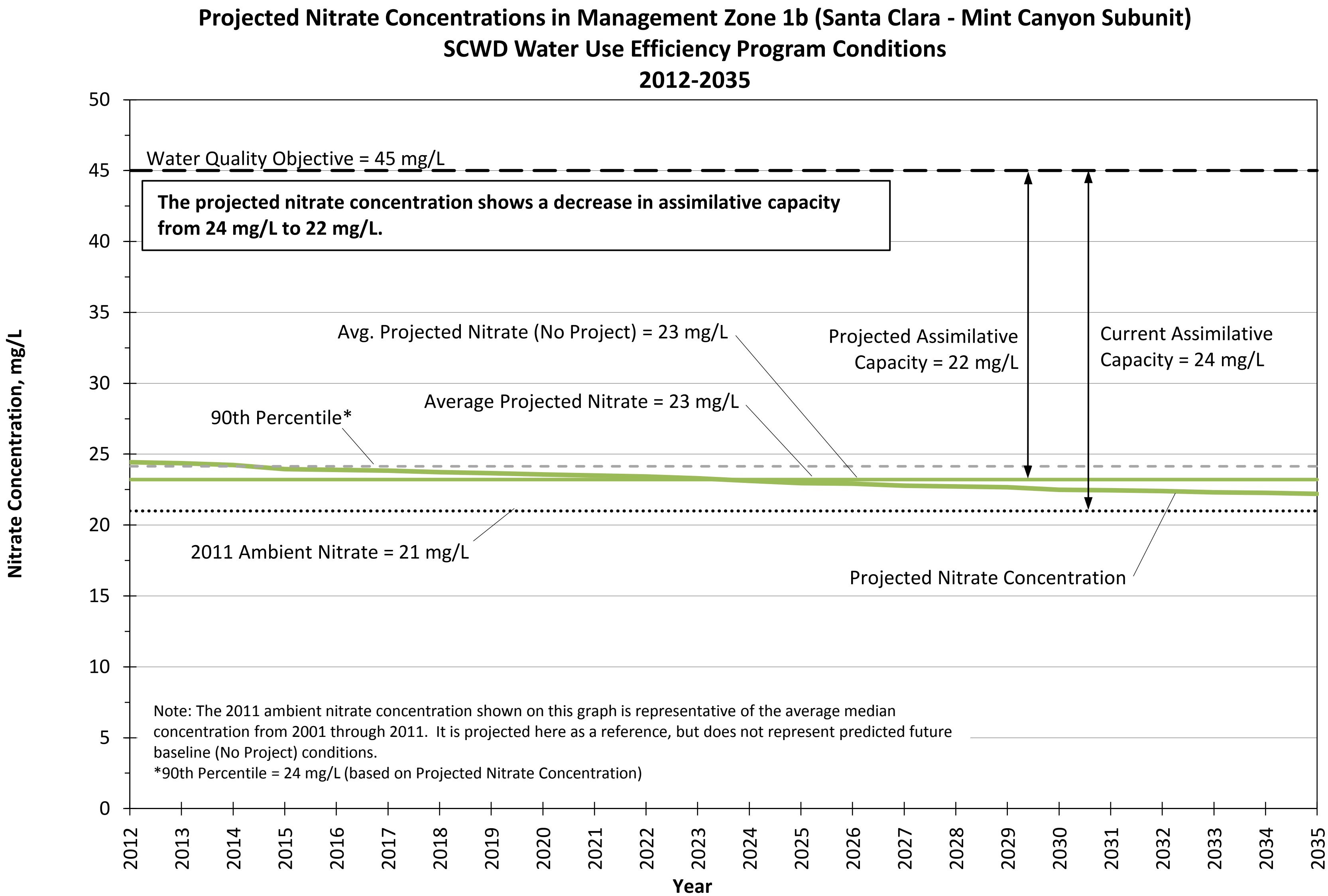
Projected Nitrate Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 24 mg/L to 22 mg/L.
Avg. Projected Nitrate (No Project) = 23 mg/L
Projected Assimilative Capacity = 22 mg/L
Current Assimilative Capacity = 24 mg/L
Average Projected Nitrate = 23 mg/L
90th Percentile*
2011 Ambient Nitrate = 21 mg/L
Projected Nitrate Concentration
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 24 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 26.3.b

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

Projected Nitrate Concentrations in Management Zone 2 (Placerita Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035

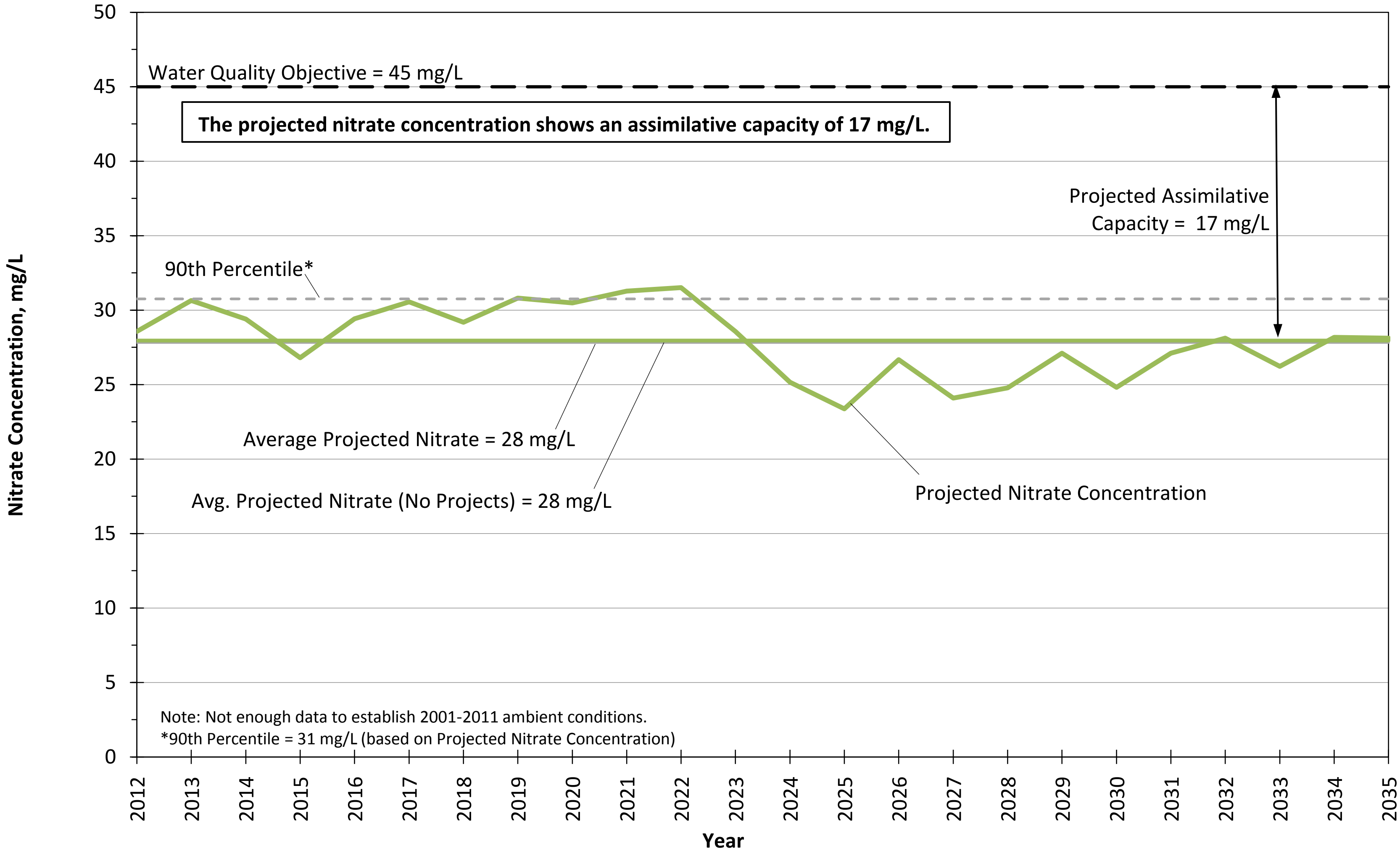

Figure 26.3.c

8-Dec-16

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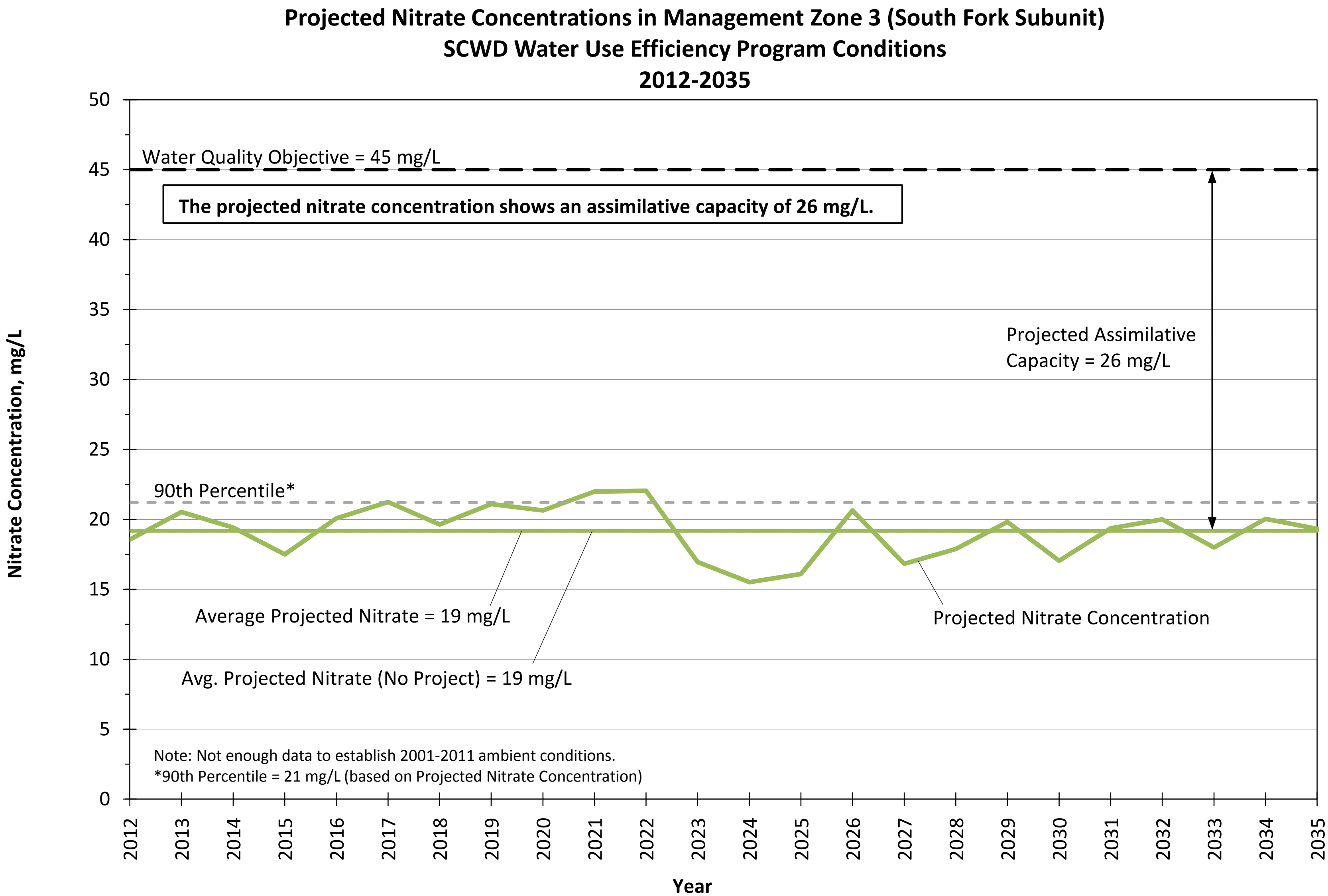

Projected Nitrate Concentrations in Management Zone 3 (South Fork Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an assimilative capacity of 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
90th Percentile*
Average Projected Nitrate = 19 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Projected Nitrate Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 21 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 26.3.d

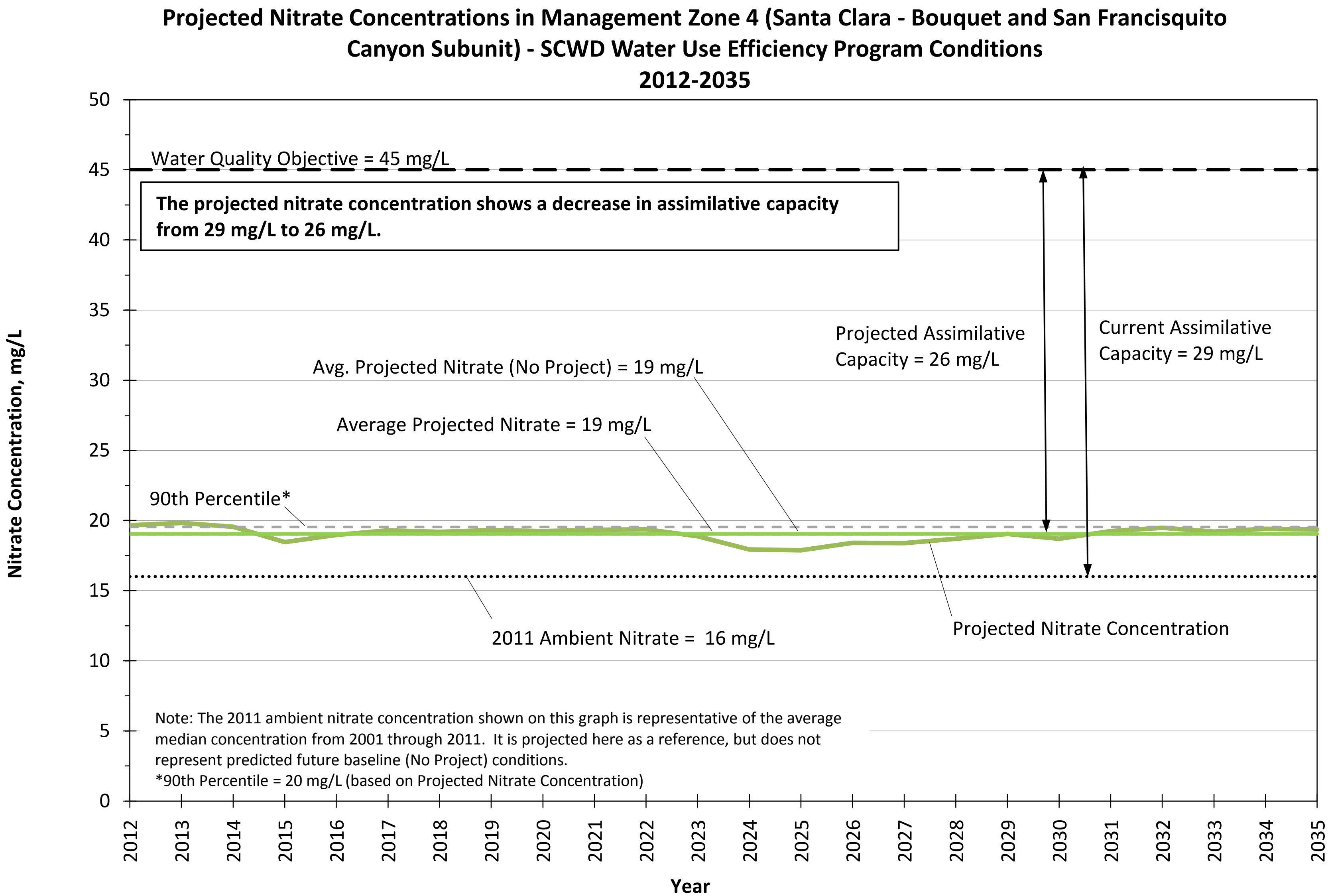

Projected Nitrate Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - SCWD Water Use Efficiency Program Conditions 2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 29 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 29 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Average Projected Nitrate = 19 mg/L
90th Percentile*
2011 Ambient Nitrate = 16 mg/L
Projected Nitrate Concentration
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 20 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 26.3.e

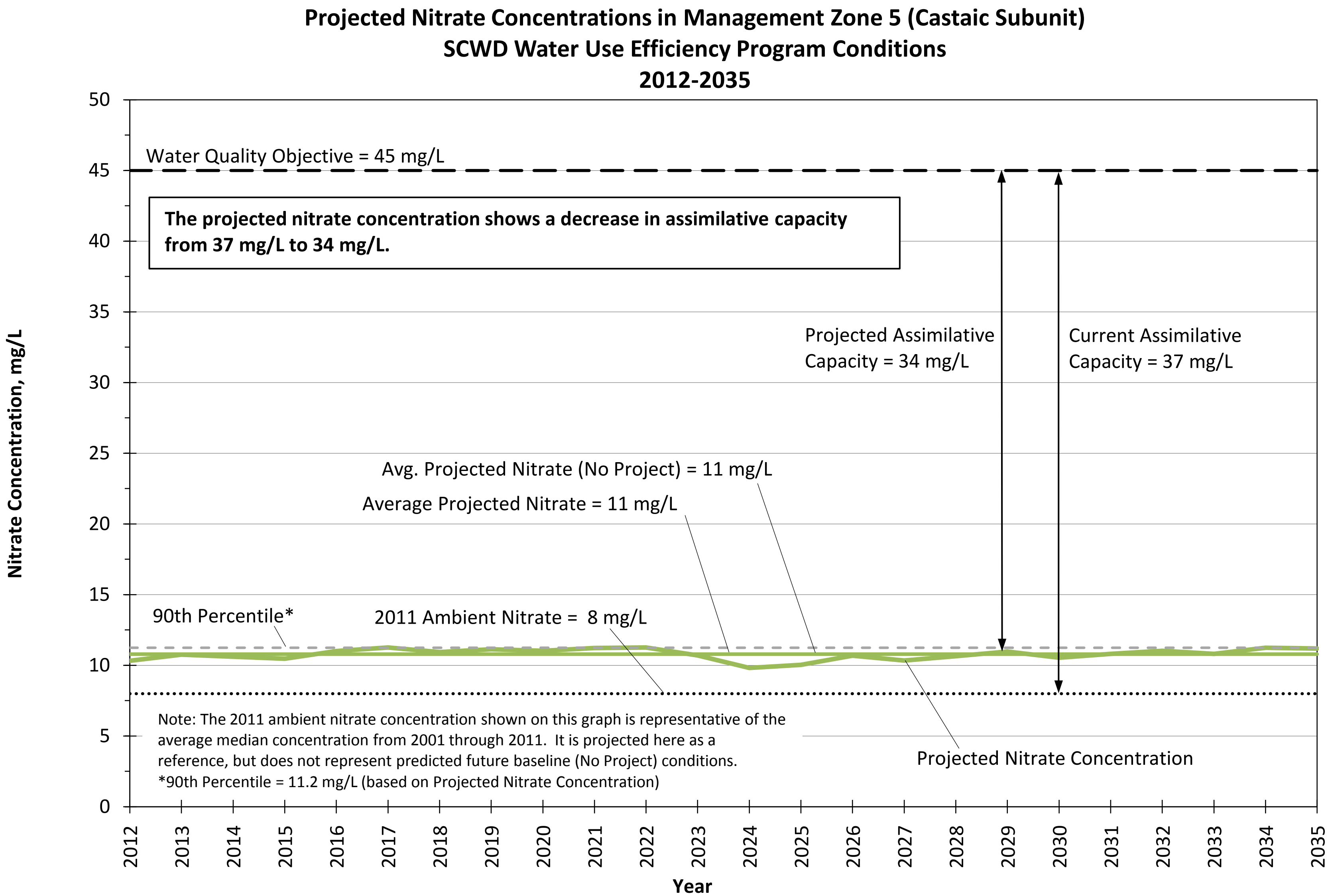
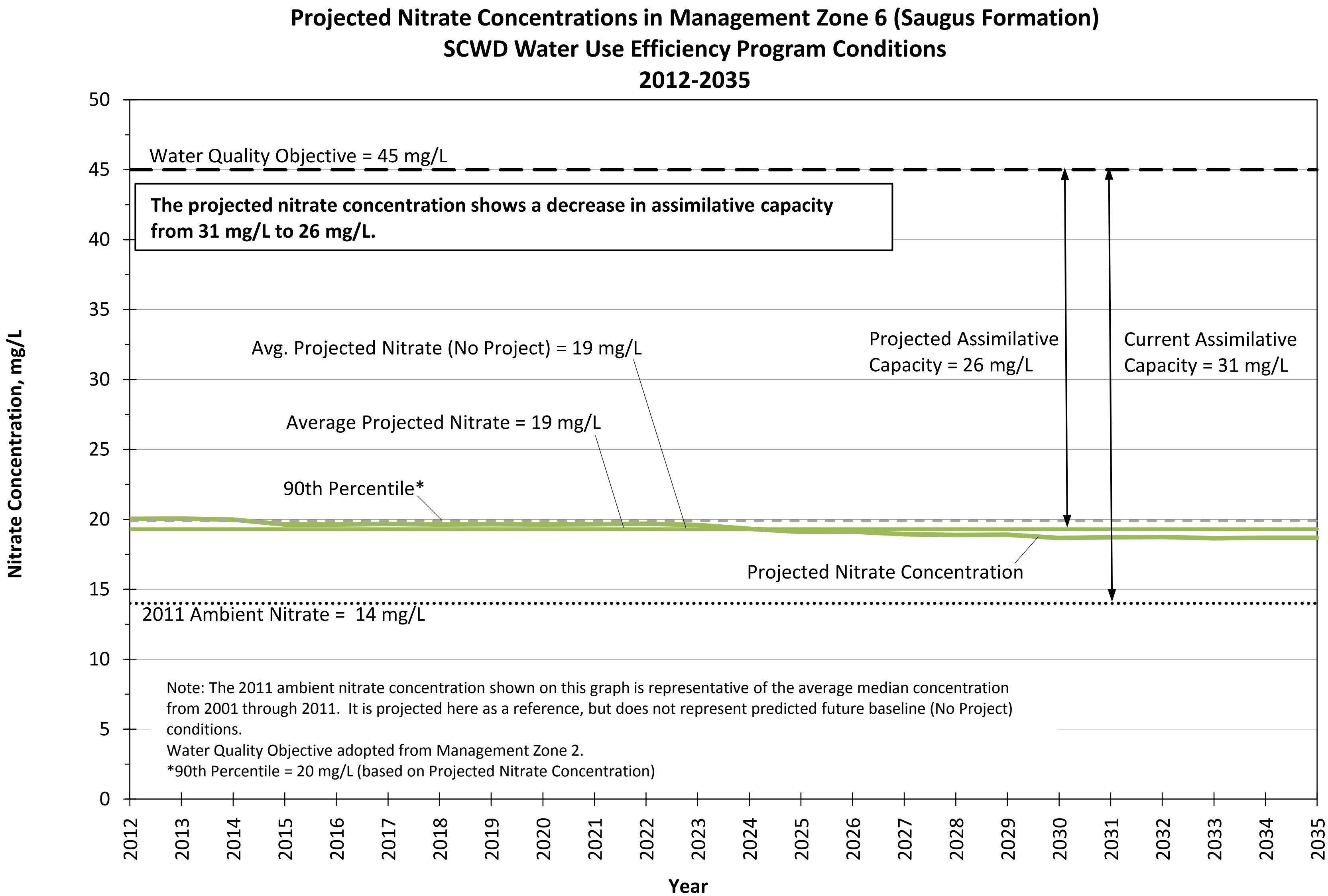

Projected Nitrate Concentrations in Management Zone 5 (Castaic Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 37 mg/L to 34 mg/L.
Projected Assimilative Capacity = 34 mg/L
Current Assimilative Capacity = 37 mg/L
Avg. Projected Nitrate (No Project) = 11 mg/L
Average Projected Nitrate = 11 mg/L
90th Percentile*
2011 Ambient Nitrate = 8 mg/L
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 11.2 mg/L (based on Projected Nitrate Concentration)
Projected Nitrate Concentration
Nitrate Concentration, mg/L
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 26.3.f


Projected Nitrate Concentrations in Management Zone 6 (Saugus Formation)
SCWD Water Use Efficiency Program Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 31 mg/L to 26 mg/L.
Avg. Projected Nitrate (No Project) = 19 mg/L
Average Projected Nitrate = 19 mg/L
90th Percentile*
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 31 mg/L
Projected Nitrate Concentration
2011 Ambient Nitrate = 14 mg/L
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Water Quality Objective adopted from Management Zone 2.
*90th Percentile = 20 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
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2032
2033
2034
2035

Figure 26.3-g

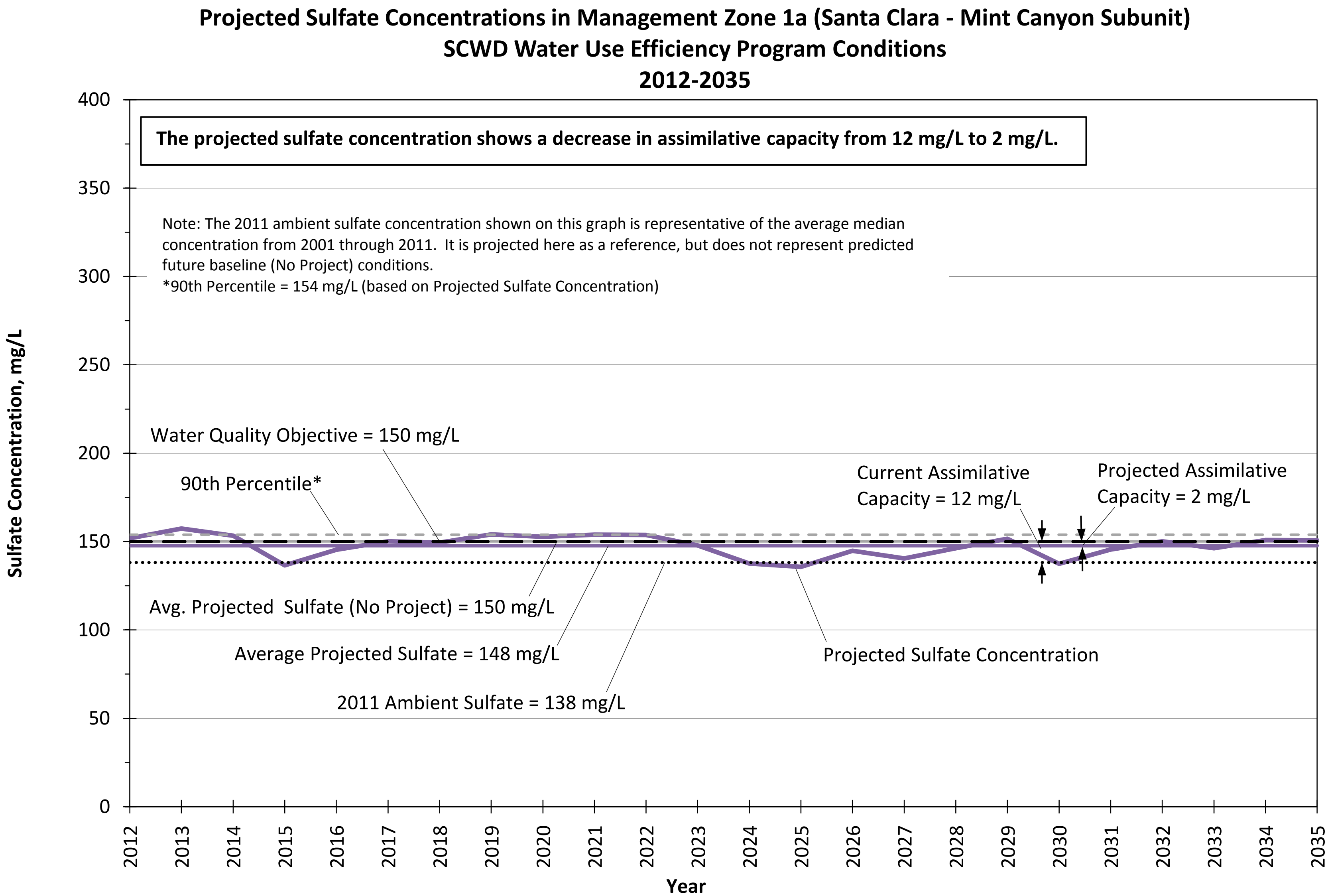

Projected Sulfate Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035
The projected sulfate concentration shows a decrease in assimilative capacity from 12 mg/L to 2 mg/L.
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 154 mg/L (based on Projected Sulfate Concentration)
Water Quality Objective = 150 mg/L
90th Percentile*
Current Assimilative Capacity = 12 mg/L
Projected Assimilative Capacity = 2 mg/L
Avg. Projected Sulfate (No Project) = 150 mg/L
Average Projected Sulfate = 148 mg/L
2011 Ambient Sulfate = 138 mg/L
Projected Sulfate Concentration
Sulfate Concentration, mg/L
400
350
300
250
200
150
100
50
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 26.4.a

Projected Sulfate Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035

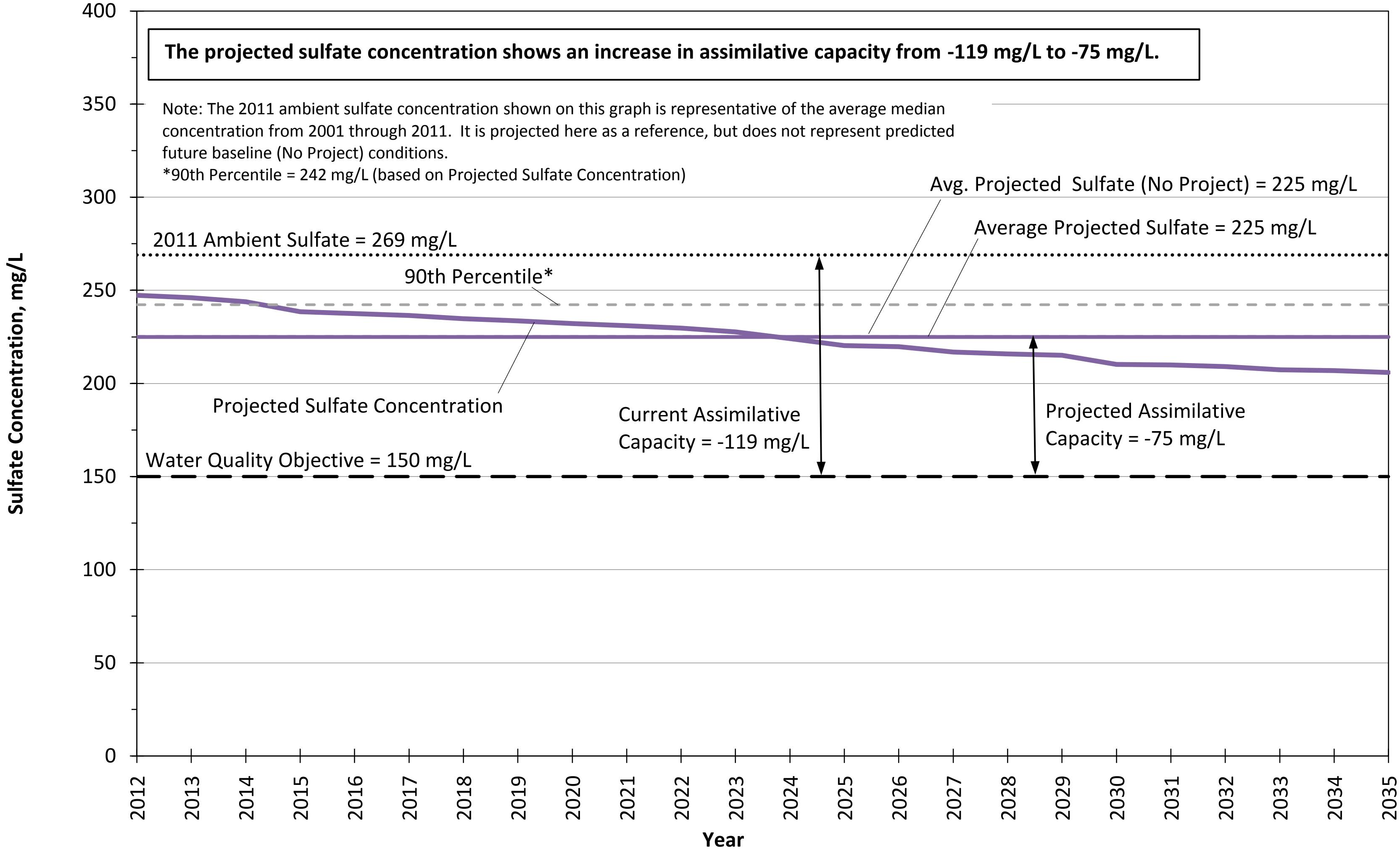


Figure 26.4.b

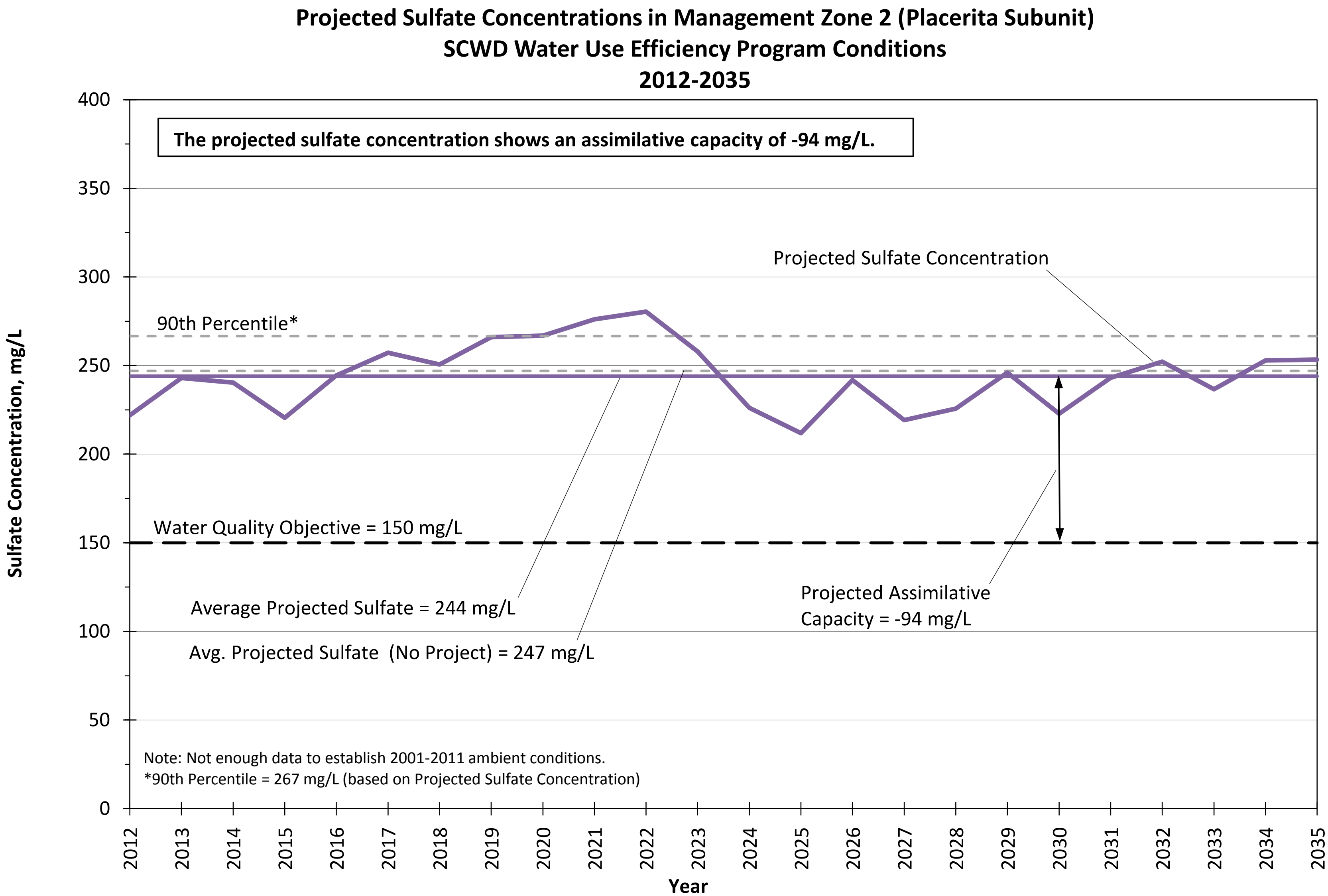

Projected Sulfate Concentrations in Management Zone 2 (Placerita Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035
The projected sulfate concentration shows an assimilative capacity of -94 mg/L.
Projected Sulfate Concentration
90th Percentile*
Water Quality Objective = 150 mg/L
Average Projected Sulfate = 244 mg/L
Avg. Projected Sulfate (No Project) = 247 mg/L
Projected Assimilative Capacity = -94 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 267 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 26.4.c

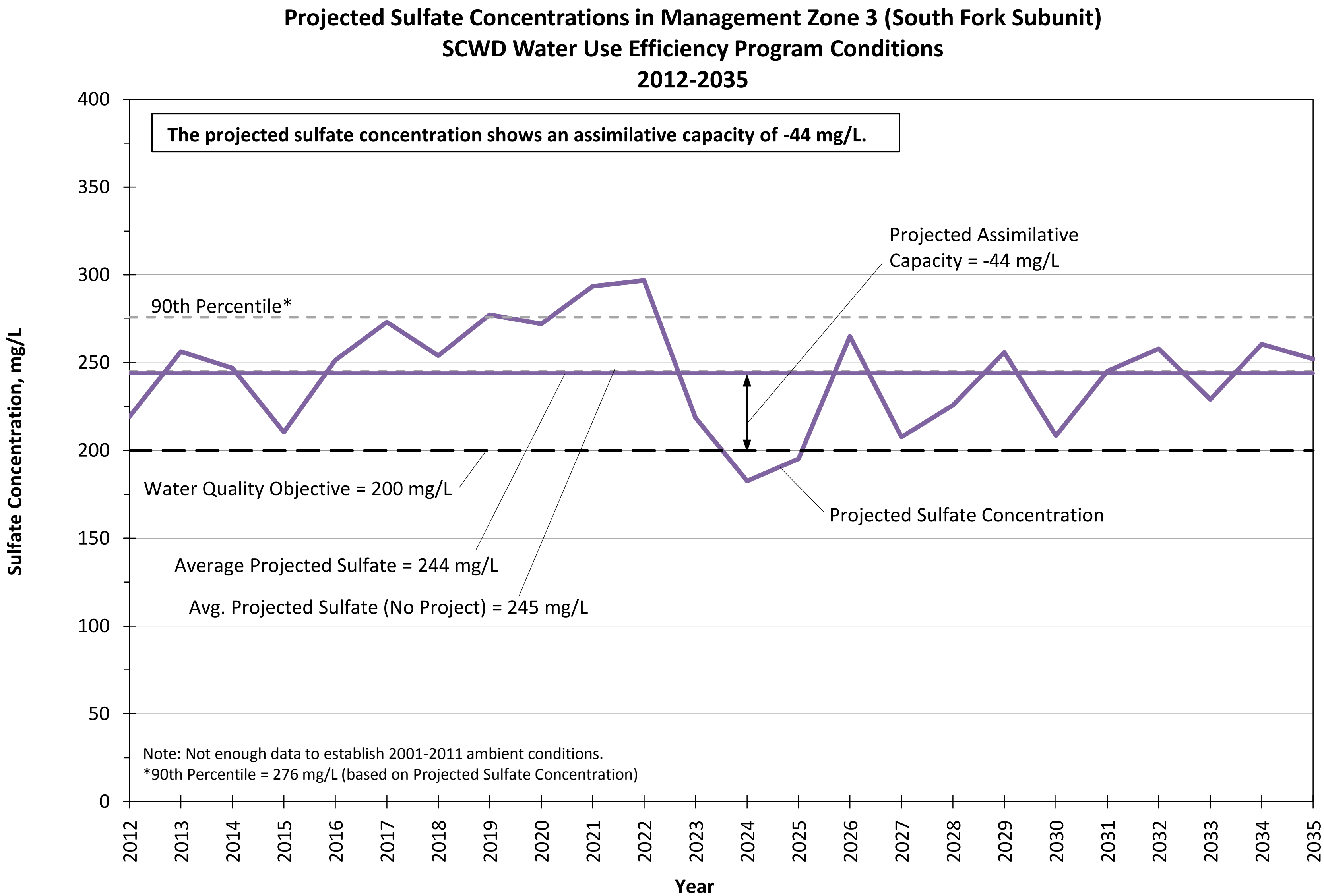

Projected Sulfate Concentrations in Management Zone 3 (South Fork Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035
The projected sulfate concentration shows an assimilative capacity of -44 mg/L.
Sulfate Concentration, mg/L
400
350
300
250
200
150
100
50
0
90th Percentile*
Projected Assimilative Capacity = -44 mg/L
Water Quality Objective = 200 mg/L
Projected Sulfate Concentration
Average Projected Sulfate = 244 mg/L
Avg. Projected Sulfate (No Project) = 245 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 276 mg/L (based on Projected Sulfate Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 26.4.d

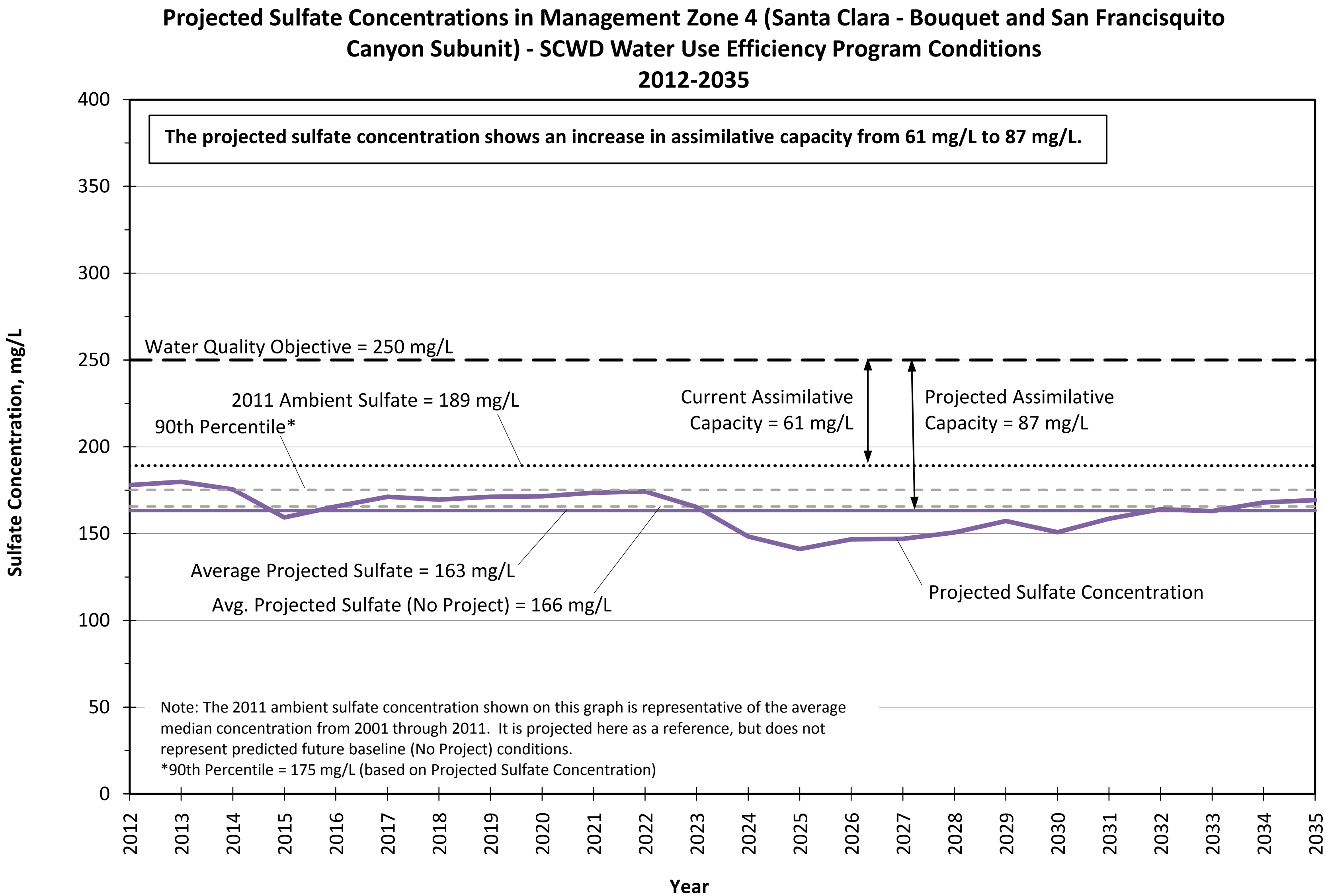

Projected Sulfate Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - SCWD Water Use Efficiency Program Conditions
2012-2035
The projected sulfate concentration shows an increase in assimilative capacity from 61 mg/L to 87 mg/L.
Water Quality Objective = 250 mg/L
2011 Ambient Sulfate = 189 mg/L
90th Percentile*
Current Assimilative Capacity = 61 mg/L
Projected Assimilative Capacity = 87 mg/L
Average Projected Sulfate = 163 mg/L
Avg. Projected Sulfate (No Project) = 166 mg/L
Projected Sulfate Concentration
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 175 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 26.4.e

Projected Sulfate Concentrations in Management Zone 5 (Castaic Subunit)
SCWD Water Use Efficiency Program Conditions
2012-2035

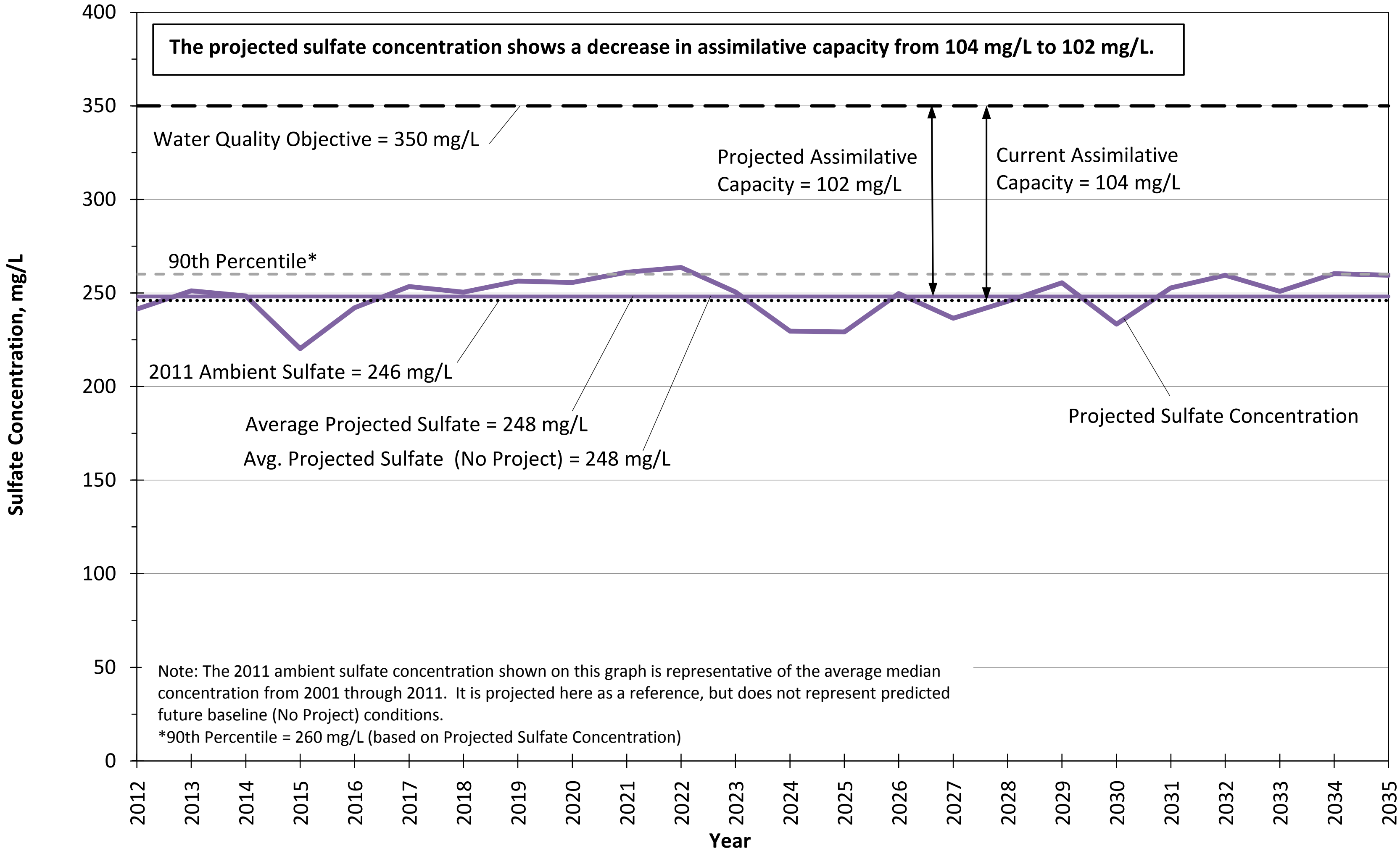


Figure 26.4.f

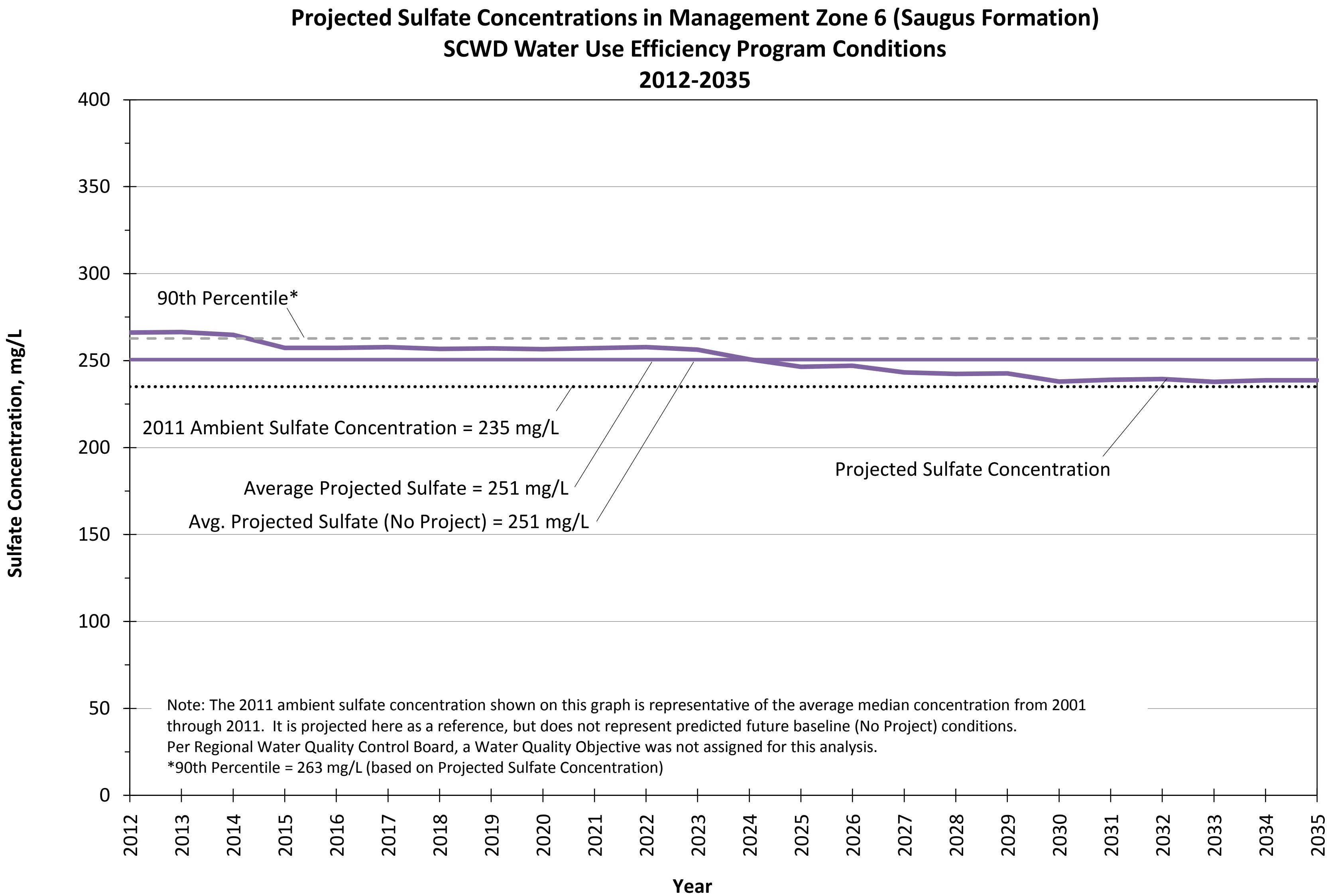
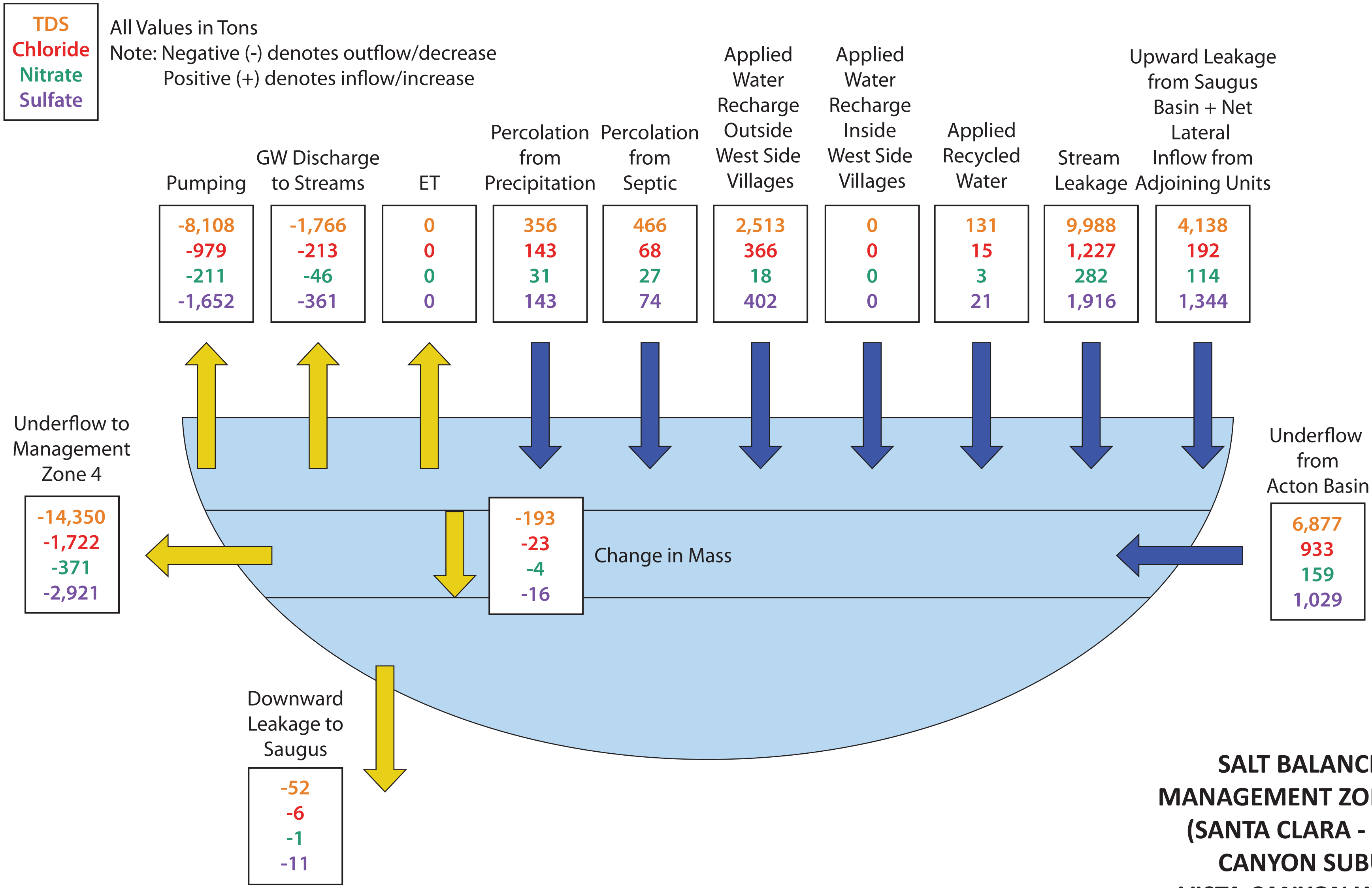

Projected Sulfate Concentrations in Management Zone 6 (Saugus Formation)
SCWD Water Use Efficiency Program Conditions
2012-2035
Sulfate Concentration, mg/L
400
350
300
250
200
150
100
50
0
90th Percentile*
2011 Ambient Sulfate Concentration = 235 mg/L
Average Projected Sulfate = 251 mg/L
Avg. Projected Sulfate (No Project) = 251 mg/L
Projected Sulfate Concentration
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Per Regional Water Quality Control Board, a Water Quality Objective was not assigned for this analysis.
*90th Percentile = 263 mg/L (based on Projected Sulfate Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 26.4.g



SALT BALANCE FOR MANAGEMENT ZONE 1a (SANTA CLARA - MINT CANYON SUBUNIT) VISTA CANYON WATER RECLAMATION PLANT CONDITIONS 2012-2035

8-Dec-16

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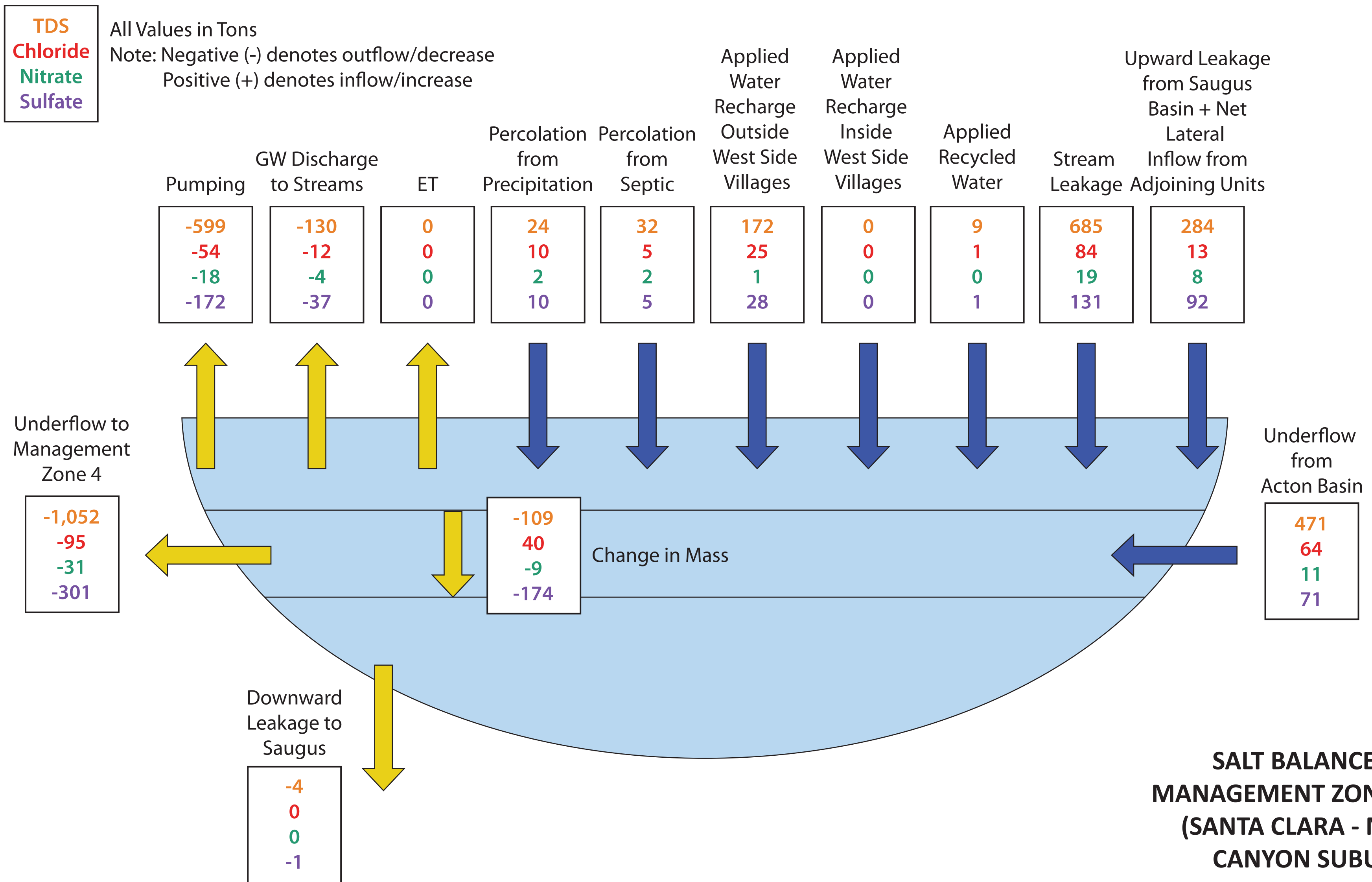
Figure 27a



SALT BALANCE FOR MANAGEMENT ZONE 1b (SANTA CLARA - MINT CANYON SUBUNIT) VISTA CANYON WATER RECLAMATION PLANT CONDITIONS 2012-2035

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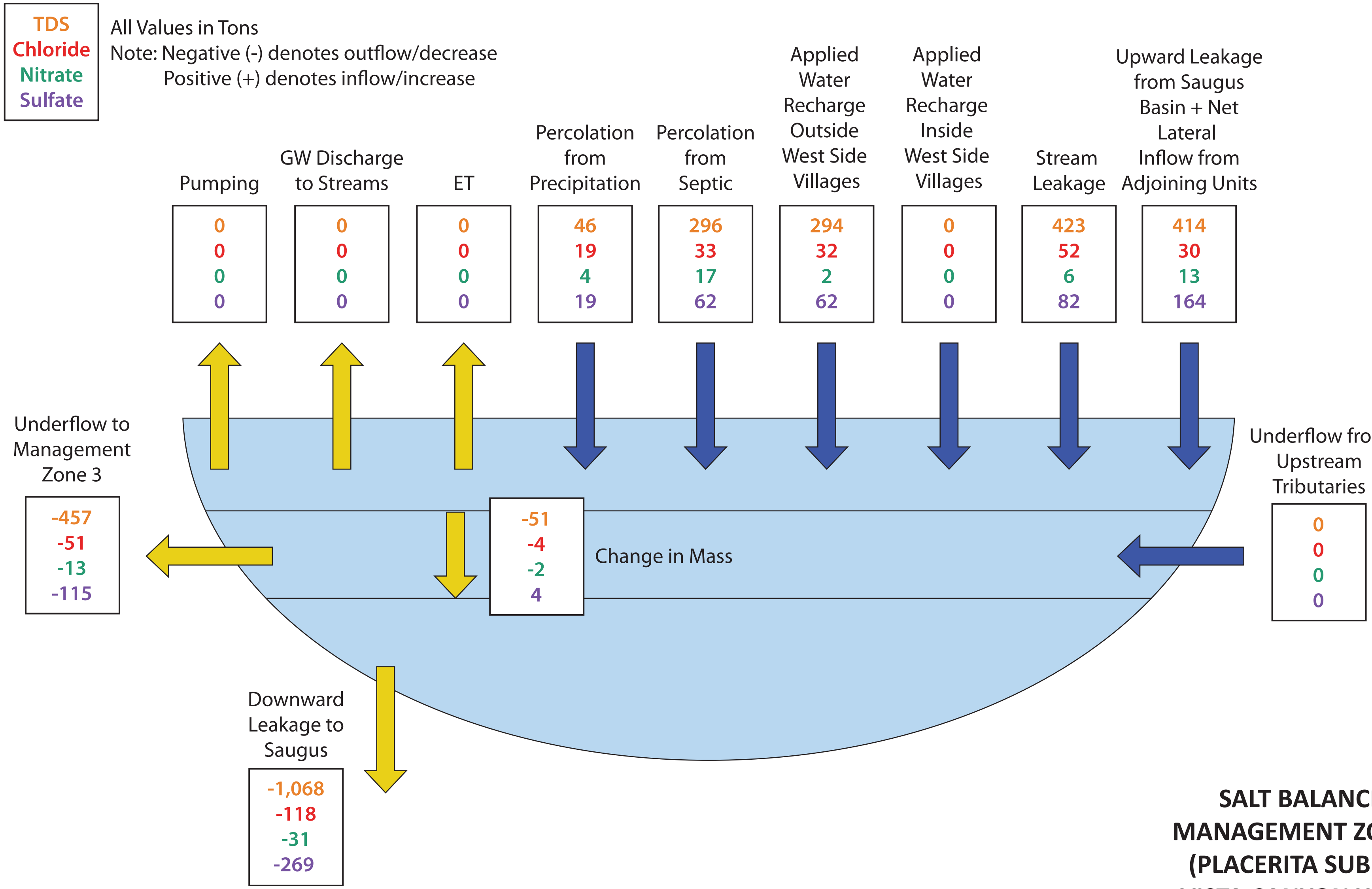
Figure 27b



SALT BALANCE FOR MANAGEMENT ZONE 2 (PLACERITA SUBUNIT) VISTA CANYON WATER RECLAMATION PLANT CONDITIONS 2012-2035

Figure 27c

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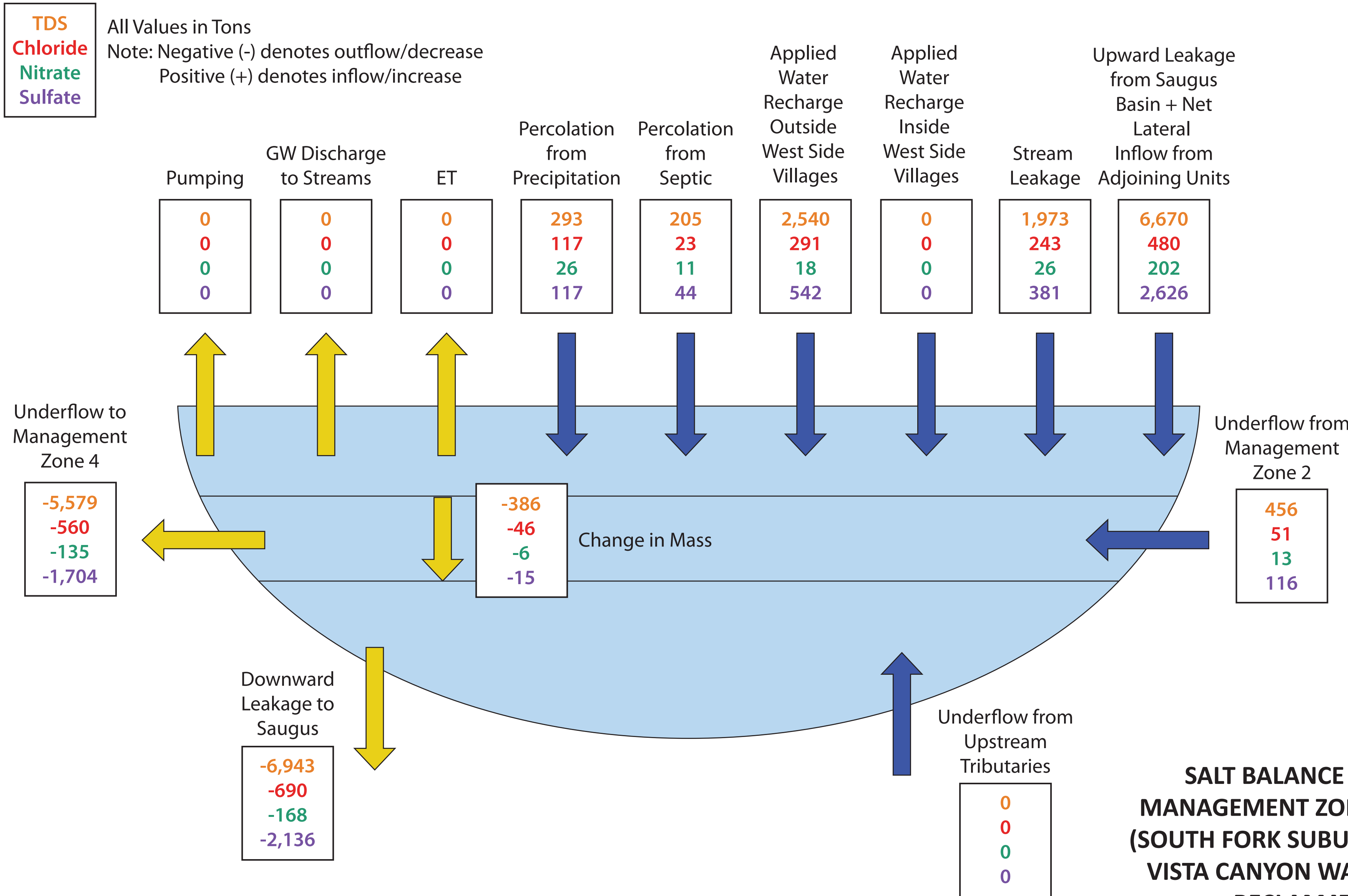
CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 3 (SOUTH FORK SUBUNIT) VISTA CANYON WATER RECLAMATION PLANT CONDITIONS 2012-2035

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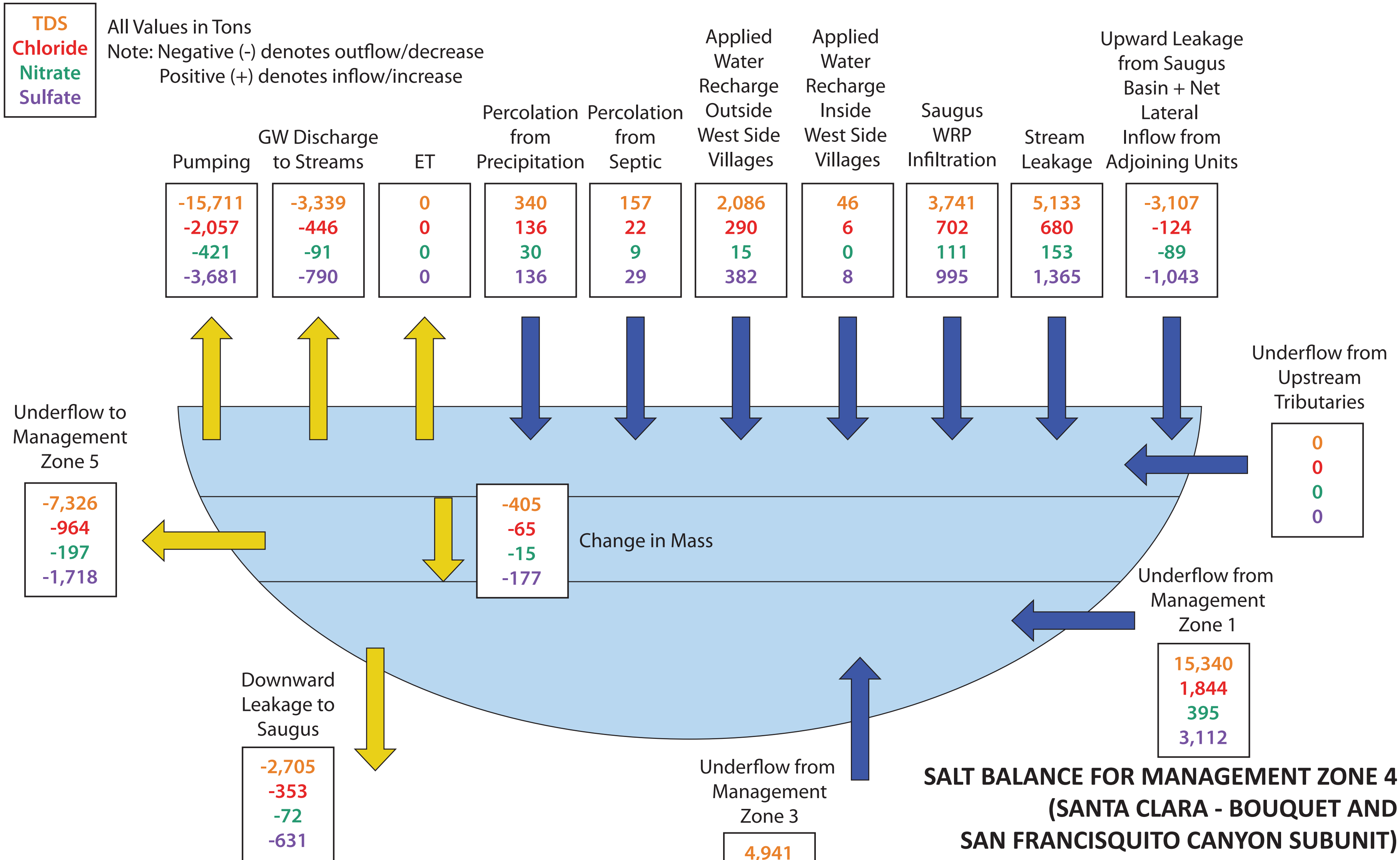
Figure 27d

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 4 (SANTA CLARA - BOUQUET AND SAN FRANCISQUITO CANYON SUBUNIT) VISTA CANYON WATER RECLAMATION PLANT CONDITIONS 2012-2035

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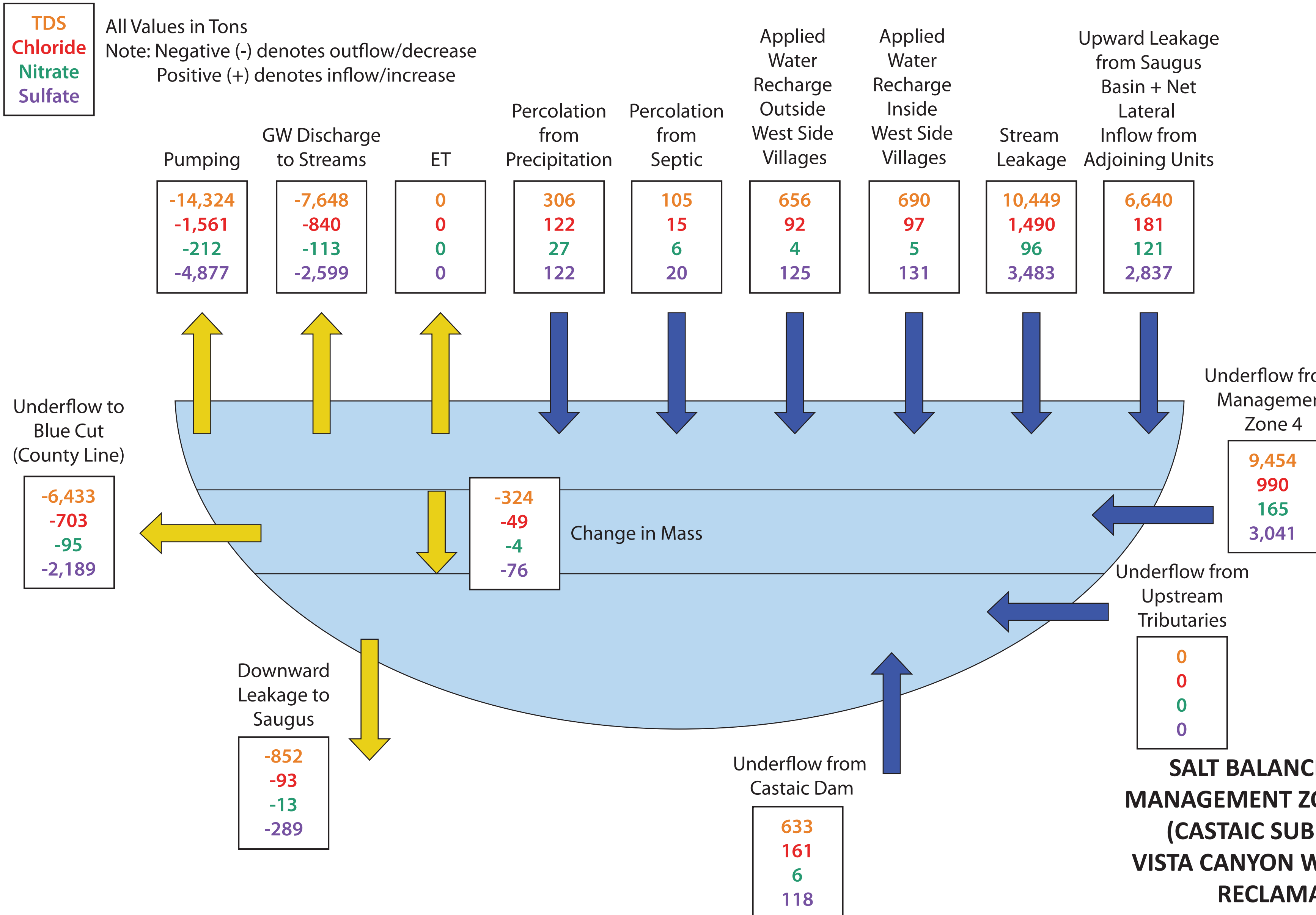
Figure 27e



SALT BALANCE FOR MANAGEMENT ZONE 5 (CASTAIC SUBUNIT) VISTA CANYON WATER RECLAMATION PLANT CONDITIONS 2012-2035

Figure 27f

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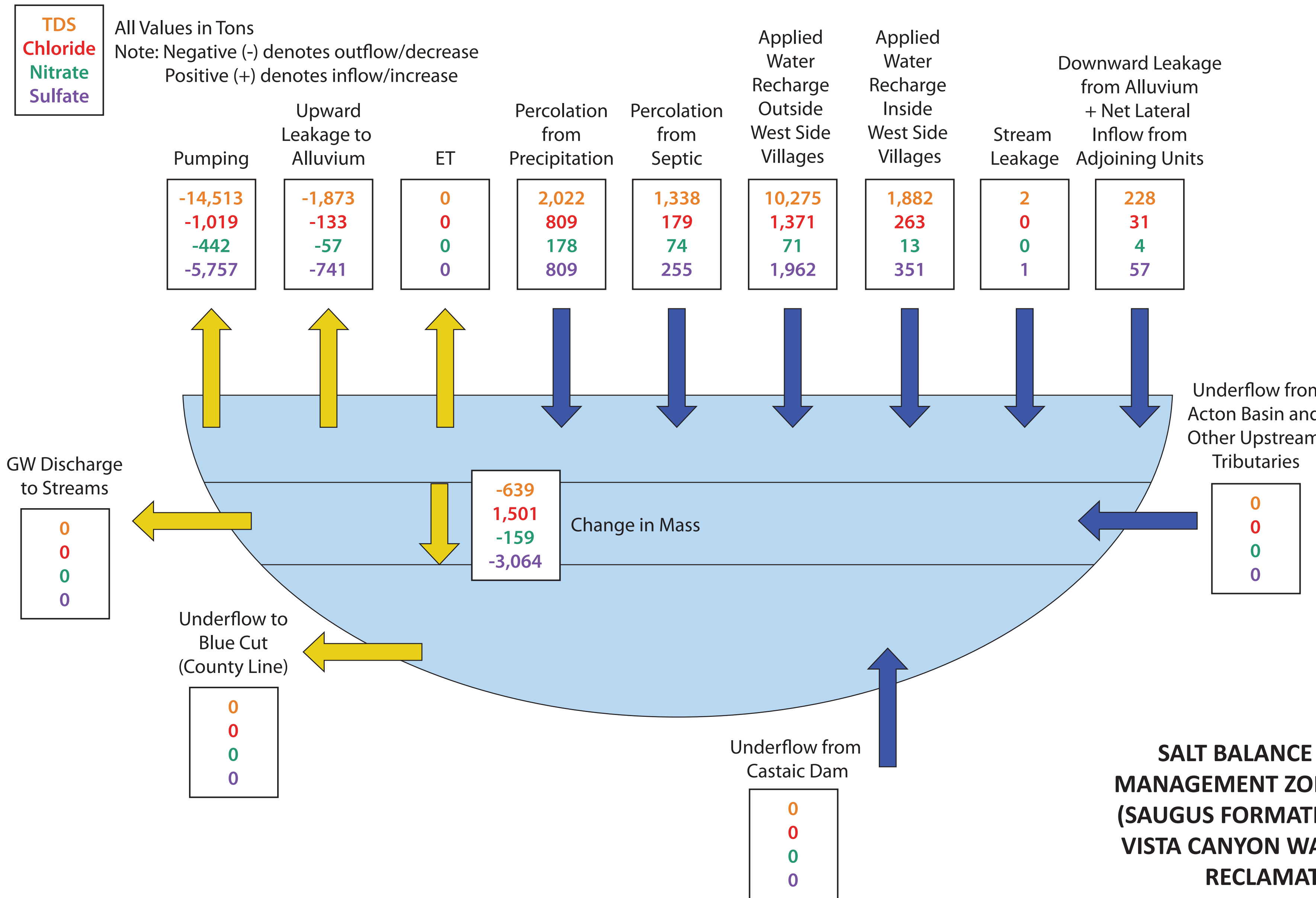

SALT BALANCE FOR MANAGEMENT ZONE 6 (SAUGUS FORMATION) VISTA CANYON WATER RECLAMATION PLANT CONDITIONS 2012-2035

Figure 27g

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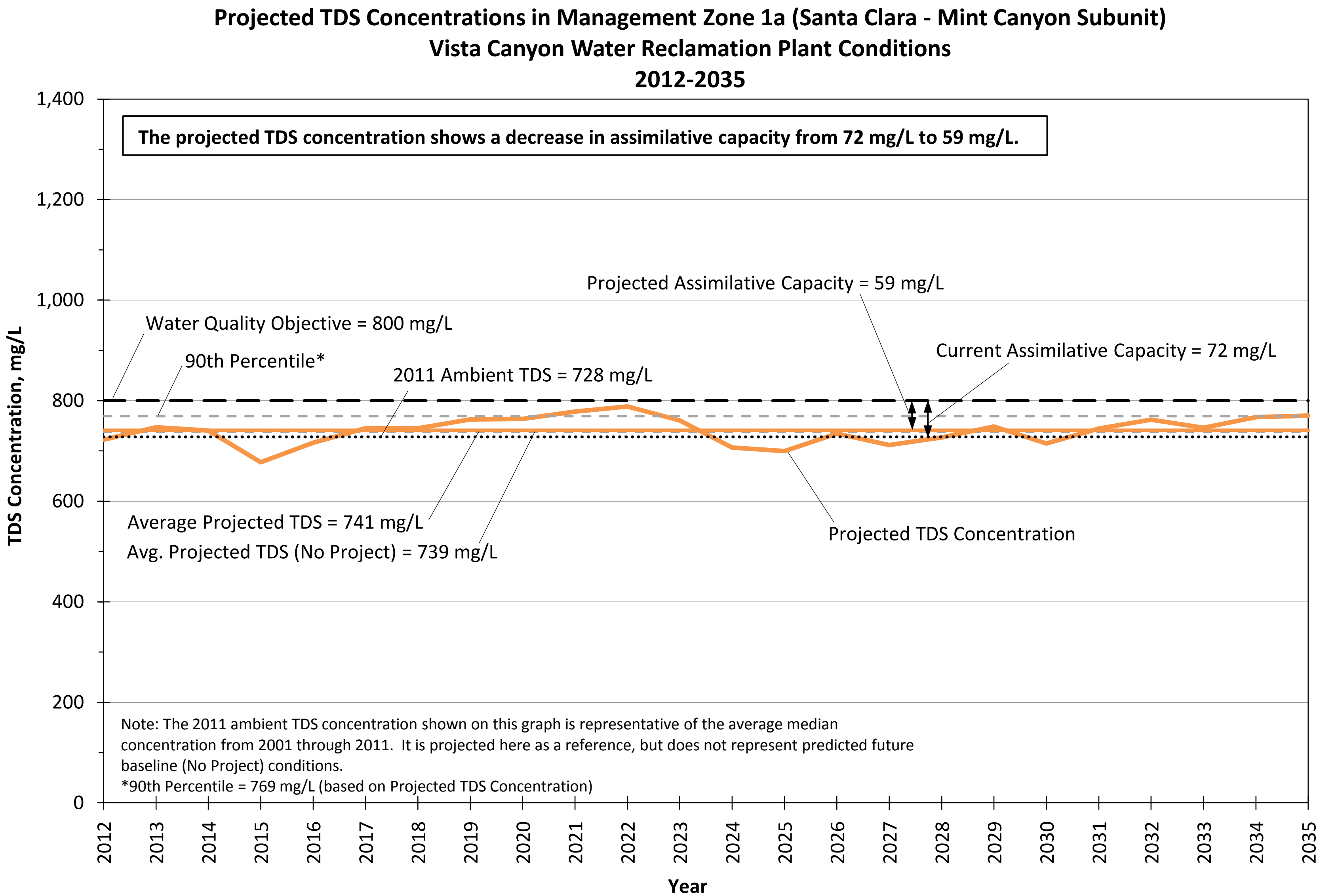

Projected TDS Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
The projected TDS concentration shows a decrease in assimilative capacity from 72 mg/L to 59 mg/L.
Projected Assimilative Capacity = 59 mg/L
Water Quality Objective = 800 mg/L
Current Assimilative Capacity = 72 mg/L
90th Percentile*
2011 Ambient TDS = 728 mg/L
Average Projected TDS = 741 mg/L
Avg. Projected TDS (No Project) = 739 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 769 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 28.1.a

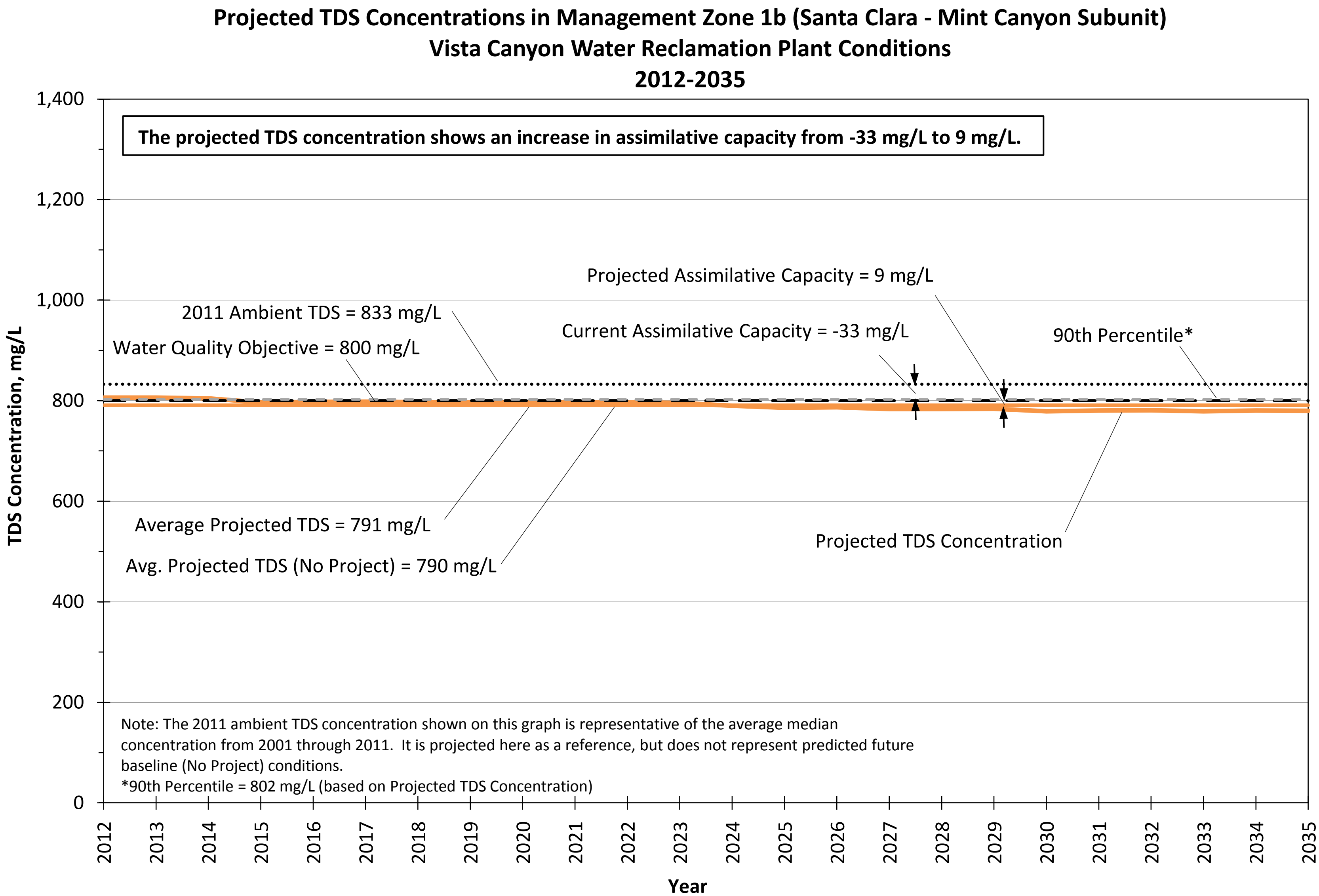
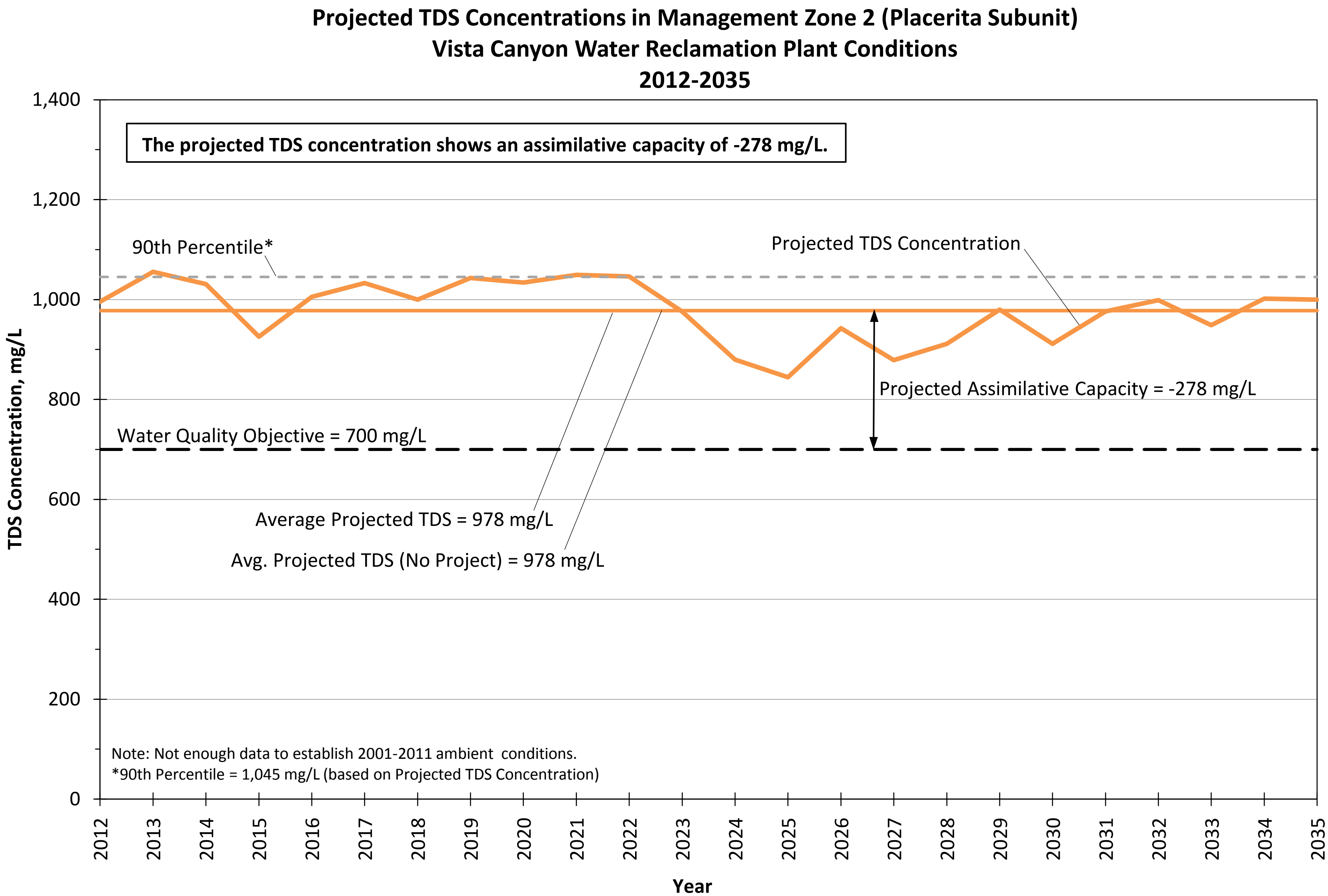

Projected TDS Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
The projected TDS concentration shows an increase in assimilative capacity from -33 mg/L to 9 mg/L.
Projected Assimilative Capacity = 9 mg/L
2011 Ambient TDS = 833 mg/L
Current Assimilative Capacity = -33 mg/L
90th Percentile*
Water Quality Objective = 800 mg/L
Average Projected TDS = 791 mg/L
Avg. Projected TDS (No Project) = 790 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 802 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 28.1.b


Projected TDS Concentrations in Management Zone 2 (Placerita Subunit)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
The projected TDS concentration shows an assimilative capacity of -278 mg/L.
90th Percentile*
Projected TDS Concentration
Projected Assimilative Capacity = -278 mg/L
Water Quality Objective = 700 mg/L
Average Projected TDS = 978 mg/L
Avg. Projected TDS (No Project) = 978 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 1,045 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
Year
0
200
400
600
800
1,000
1,200
1,400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
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2035

Figure 28.1.c

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

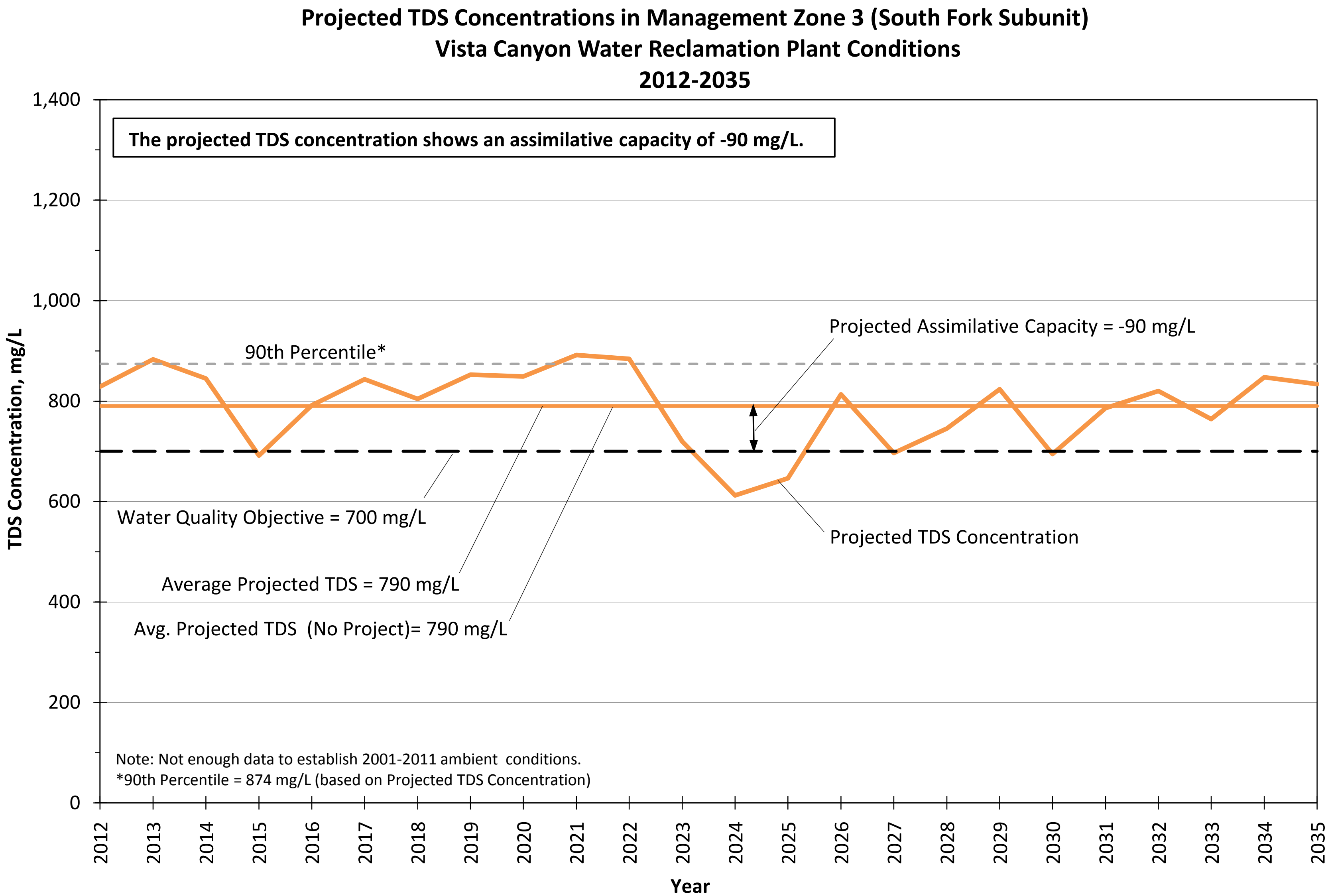

Figure 28.1.d

8-Dec-16

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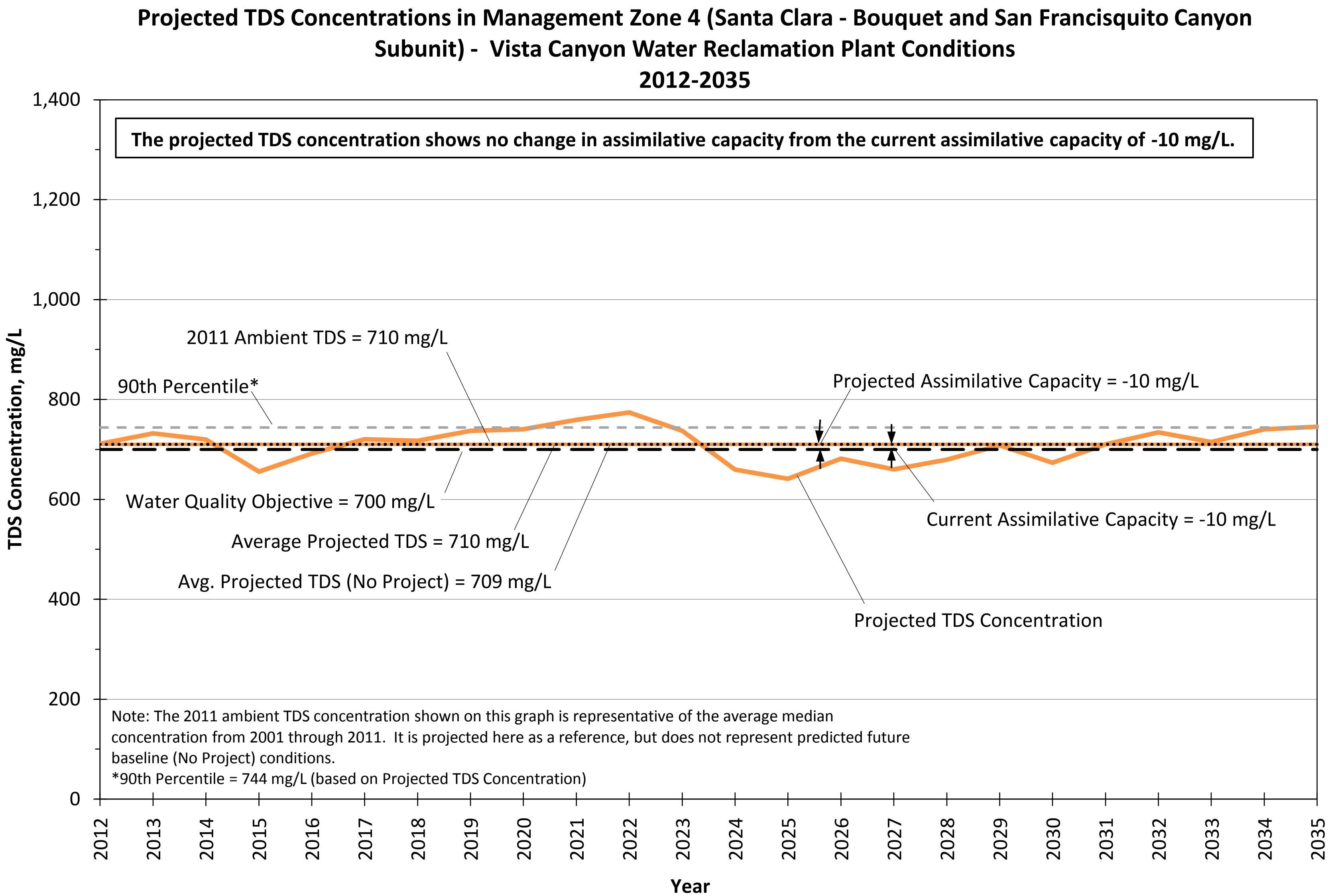

Projected TDS Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - Vista Canyon Water Reclamation Plant Conditions
2012-2035
The projected TDS concentration shows no change in assimilative capacity from the current assimilative capacity of -10 mg/L.
2011 Ambient TDS = 710 mg/L
90th Percentile*
Projected Assimilative Capacity = -10 mg/L
Water Quality Objective = 700 mg/L
Current Assimilative Capacity = -10 mg/L
Average Projected TDS = 710 mg/L
Avg. Projected TDS (No Project) = 709 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 744 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 28.1.e

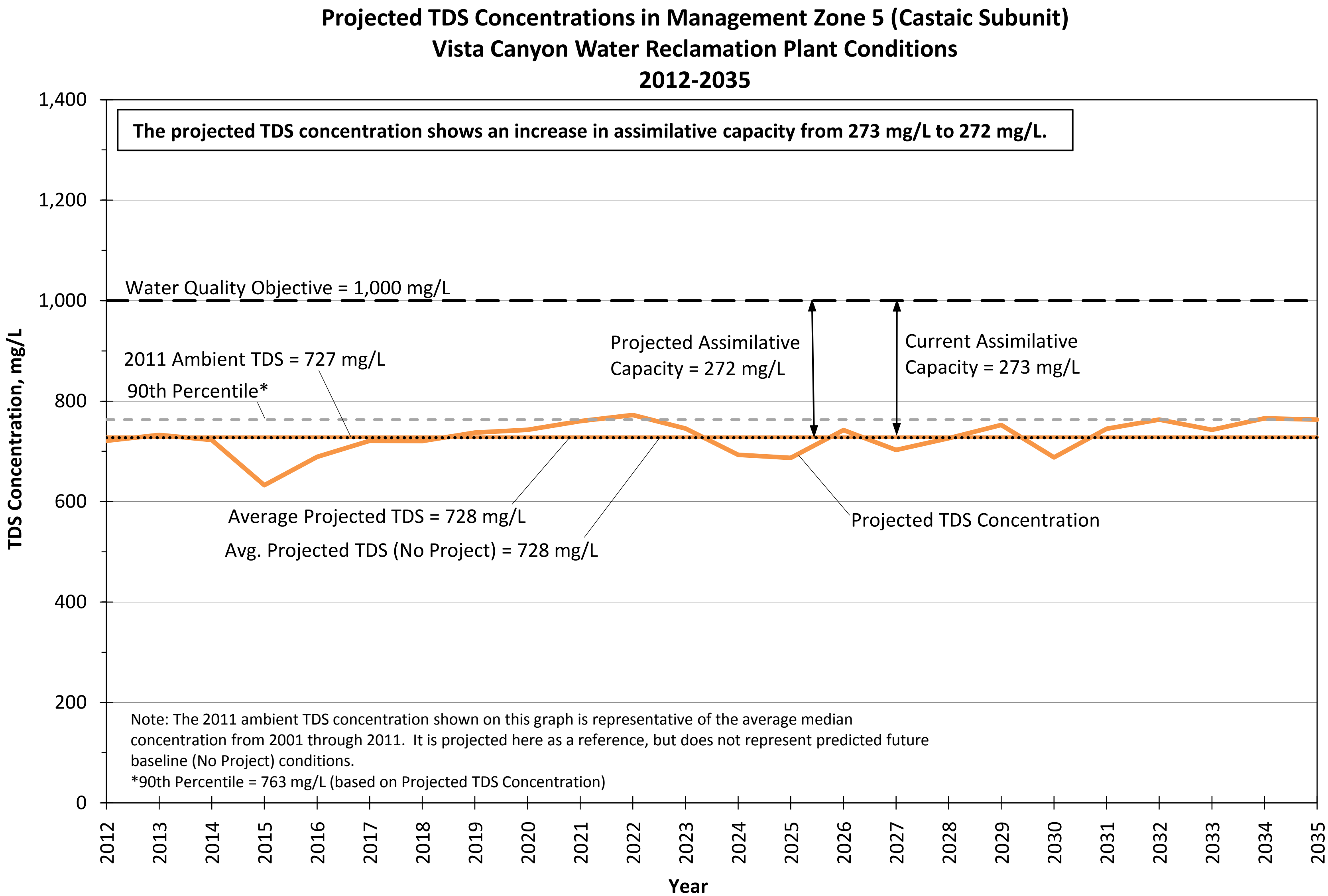

Projected TDS Concentrations in Management Zone 5 (Castaic Subunit)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
The projected TDS concentration shows an increase in assimilative capacity from 273 mg/L to 272 mg/L.
Water Quality Objective = 1,000 mg/L
2011 Ambient TDS = 727 mg/L
90th Percentile*
Projected Assimilative Capacity = 272 mg/L
Current Assimilative Capacity = 273 mg/L
Average Projected TDS = 728 mg/L
Avg. Projected TDS (No Project) = 728 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 763 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
0
200
400
600
800
1,000
1,200
1,400
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 28.1.f

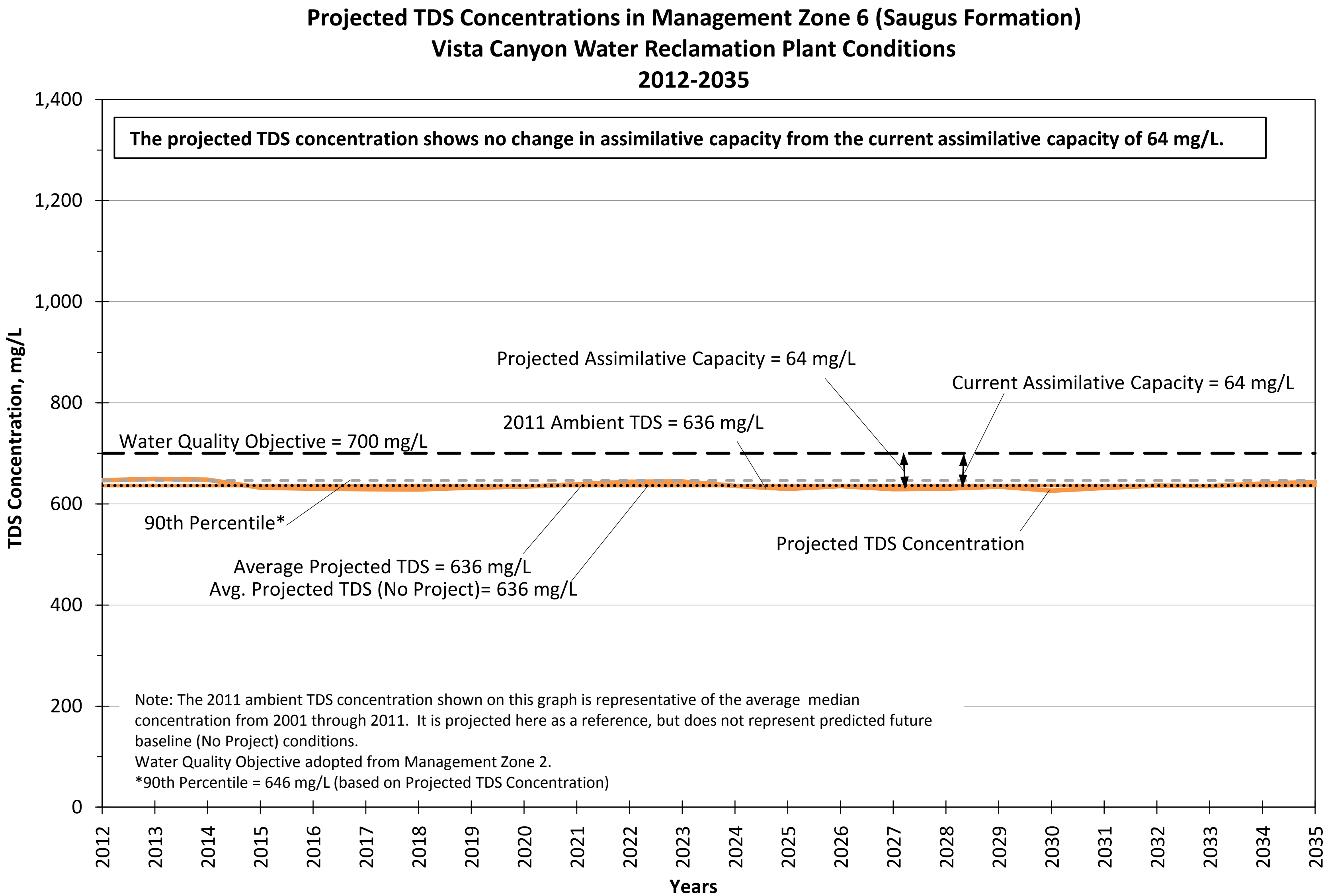

Projected TDS Concentrations in Management Zone 6 (Saugus Formation)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
The projected TDS concentration shows no change in assimilative capacity from the current assimilative capacity of 64 mg/L.
Projected Assimilative Capacity = 64 mg/L
Current Assimilative Capacity = 64 mg/L
2011 Ambient TDS = 636 mg/L
Water Quality Objective = 700 mg/L
90th Percentile*
Projected TDS Concentration
Average Projected TDS = 636 mg/L
Avg. Projected TDS (No Project)= 636 mg/L
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Water Quality Objective adopted from Management Zone 2.
*90th Percentile = 646 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
0
200
400
600
800
1,000
1,200
1,400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Years

Figure 28.1.g

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

Projected Chloride Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
Vista Canyon Water Reclamation Plant Conditions
2012-2035

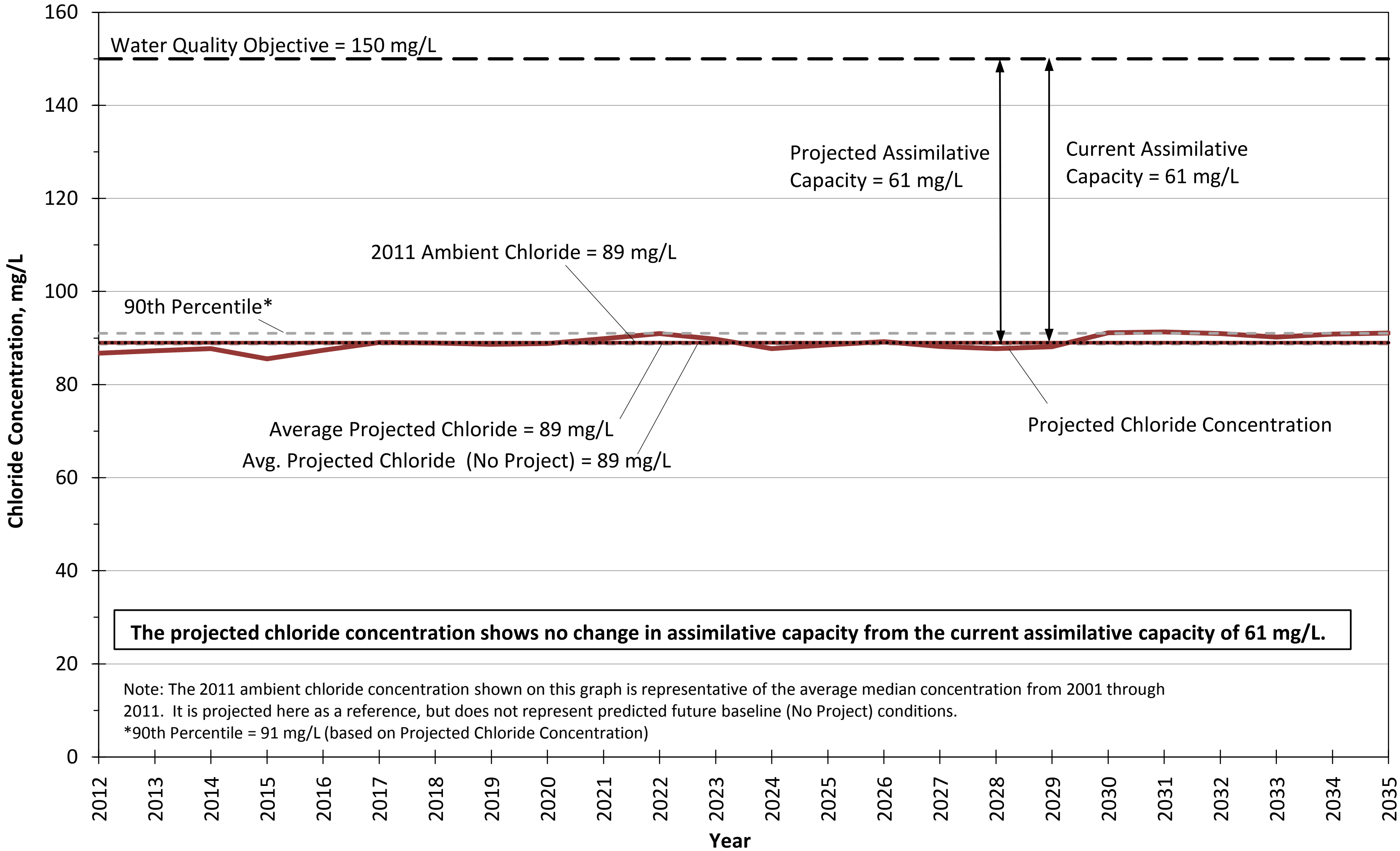


Figure 28.2.a

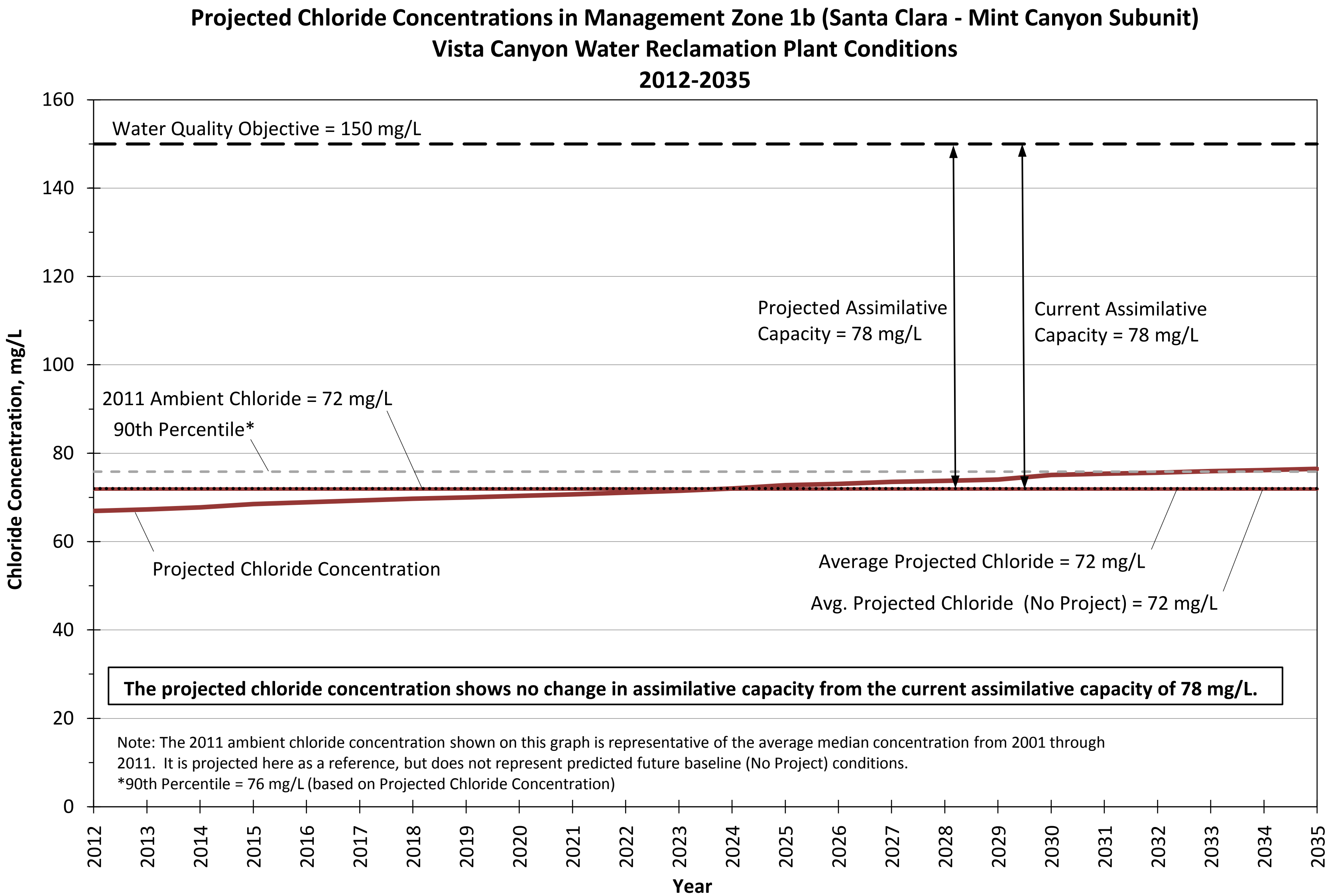

Projected Chloride Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
Water Quality Objective = 150 mg/L
Projected Assimilative Capacity = 78 mg/L
Current Assimilative Capacity = 78 mg/L
2011 Ambient Chloride = 72 mg/L
90th Percentile*
Projected Chloride Concentration
Average Projected Chloride = 72 mg/L
Avg. Projected Chloride (No Project) = 72 mg/L
The projected chloride concentration shows no change in assimilative capacity from the current assimilative capacity of 78 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 76 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
0
20
40
60
80
100
120
140
160
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 28.2.b

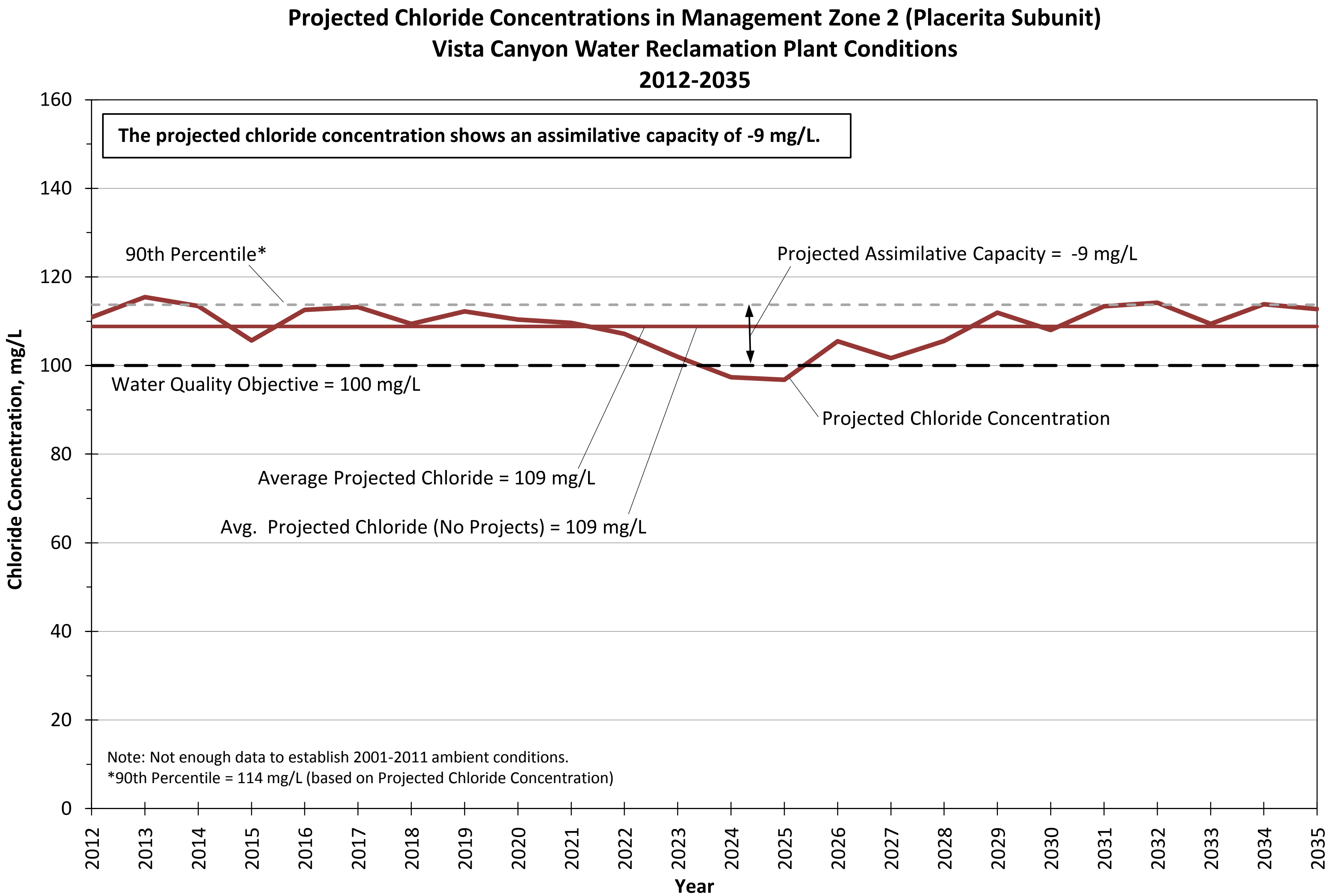

Projected Chloride Concentrations in Management Zone 2 (Placerita Subunit)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
The projected chloride concentration shows an assimilative capacity of -9 mg/L.
90th Percentile*
Projected Assimilative Capacity = -9 mg/L
Water Quality Objective = 100 mg/L
Projected Chloride Concentration
Average Projected Chloride = 109 mg/L
Avg. Projected Chloride (No Projects) = 109 mg/L
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 114 mg/L (based on Projected Chloride Concentration)

Figure 28.2.c

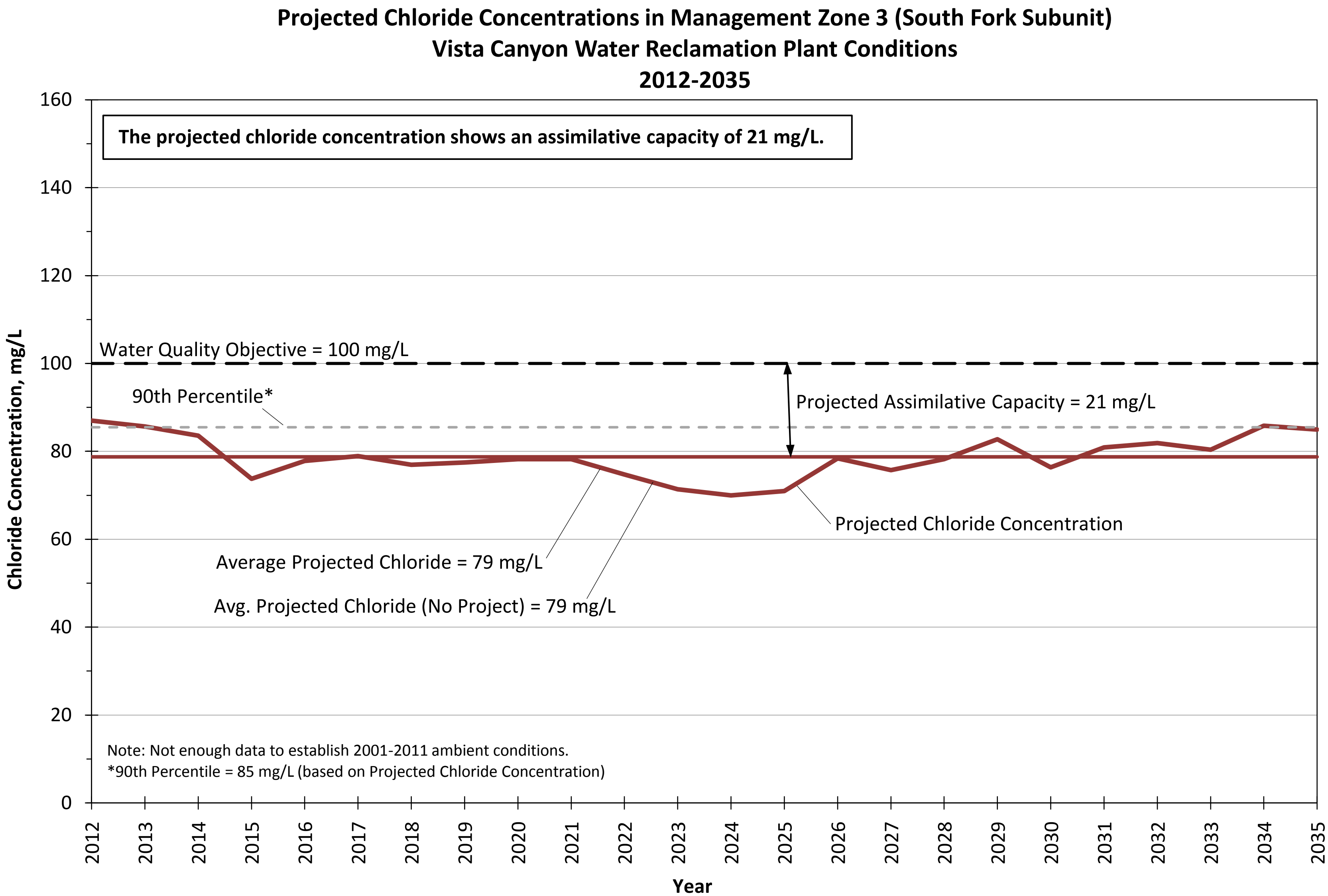
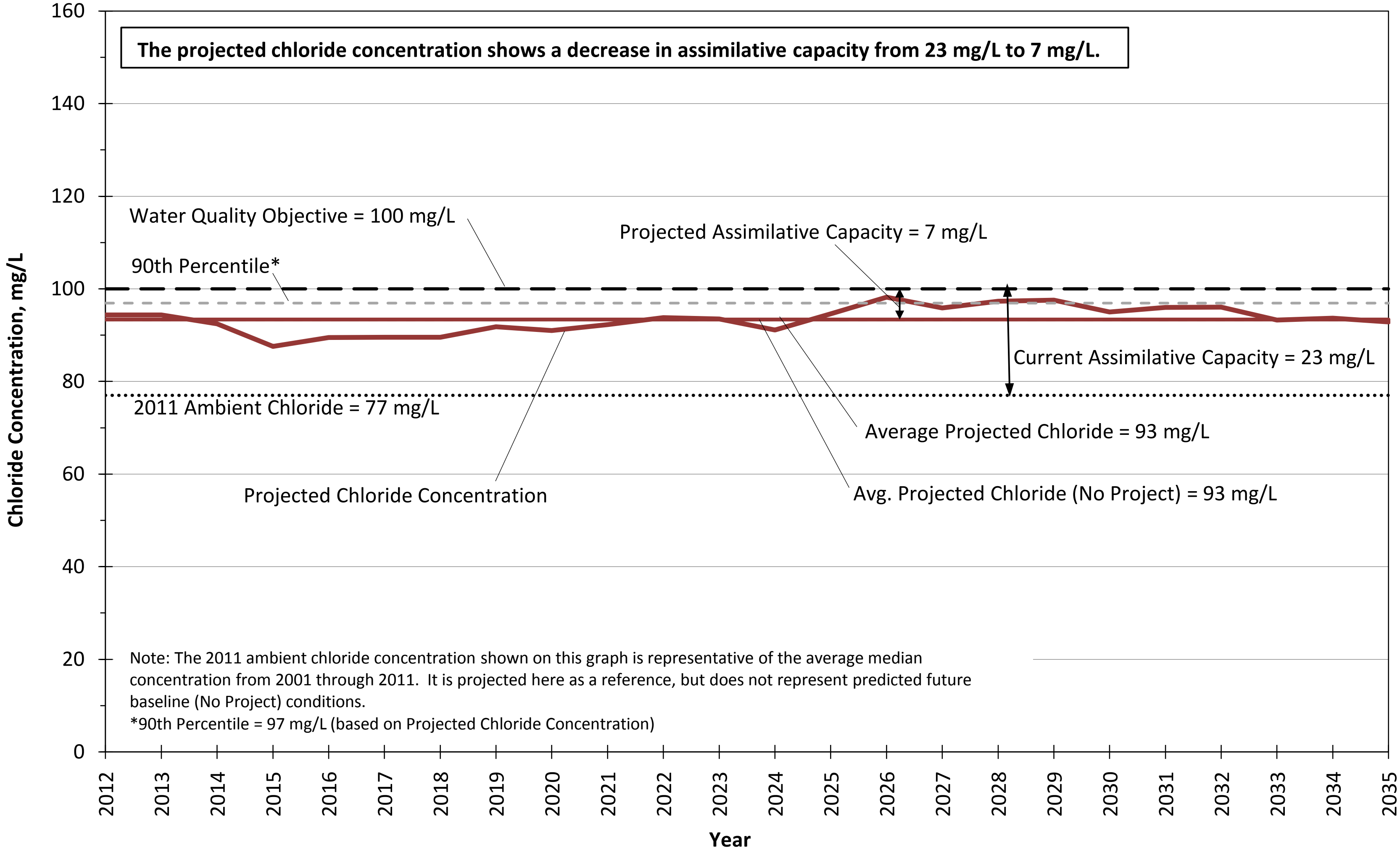

Projected Chloride Concentrations in Management Zone 3 (South Fork Subunit)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
The projected chloride concentration shows an assimilative capacity of 21 mg/L.
Water Quality Objective = 100 mg/L
90th Percentile*
Projected Assimilative Capacity = 21 mg/L
Projected Chloride Concentration
Average Projected Chloride = 79 mg/L
Avg. Projected Chloride (No Project) = 79 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 85 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 28.2.d

Projected Chloride Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - Vista Canyon Water Reclamation Plant Conditions 2012-2035



Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 97 mg/L (based on Projected Chloride Concentration)

Figure 28.2.e

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

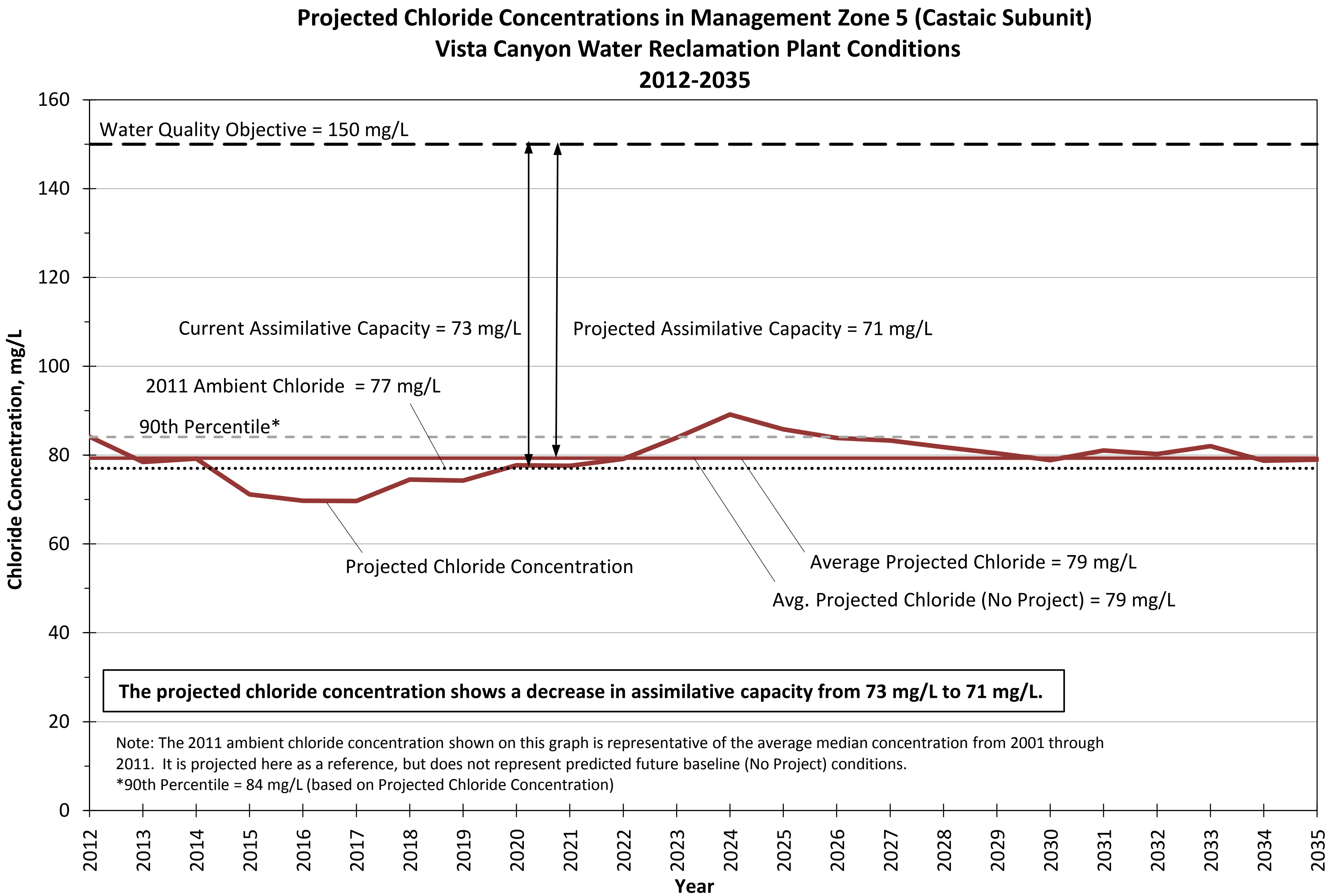


Figure 28.2.f

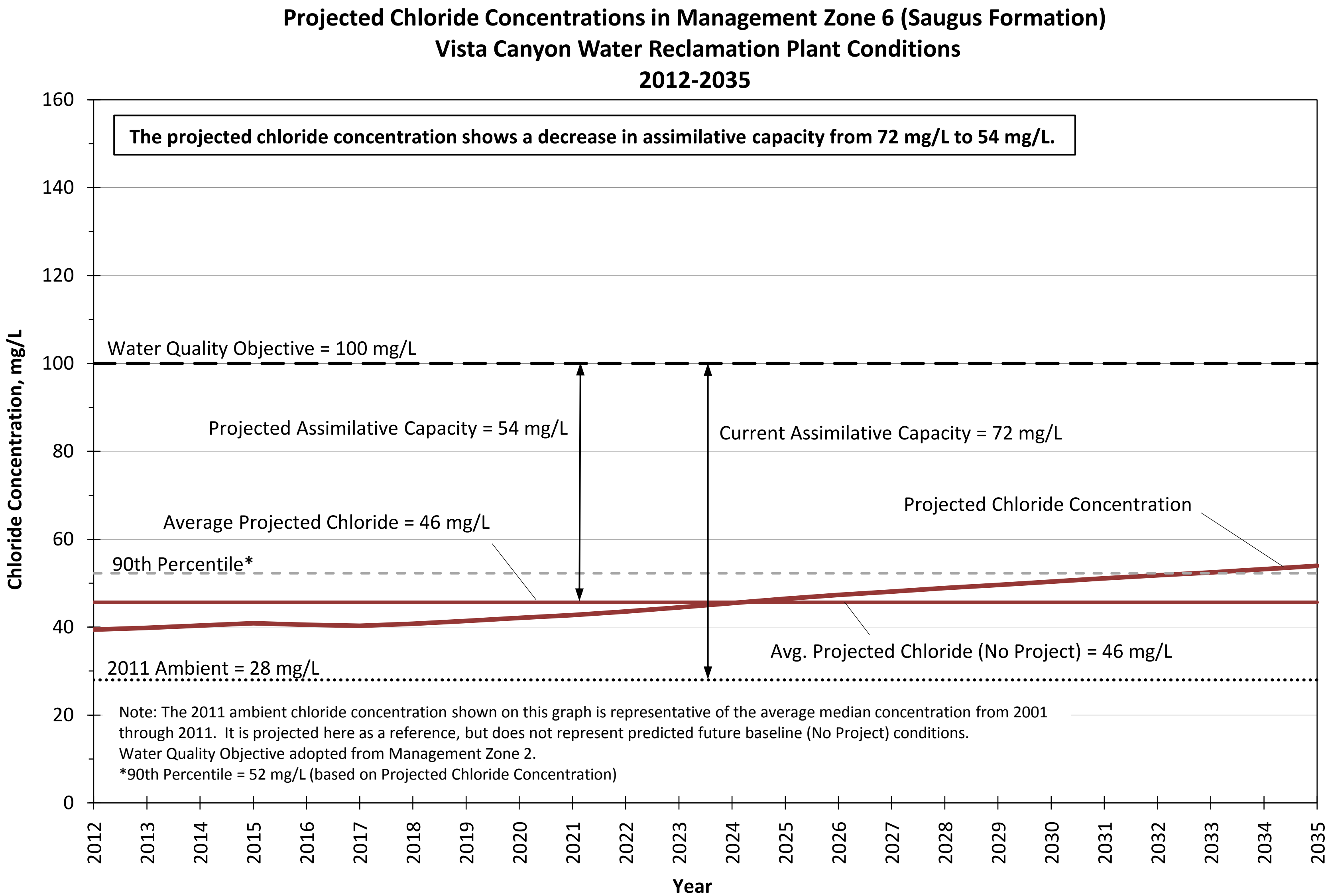
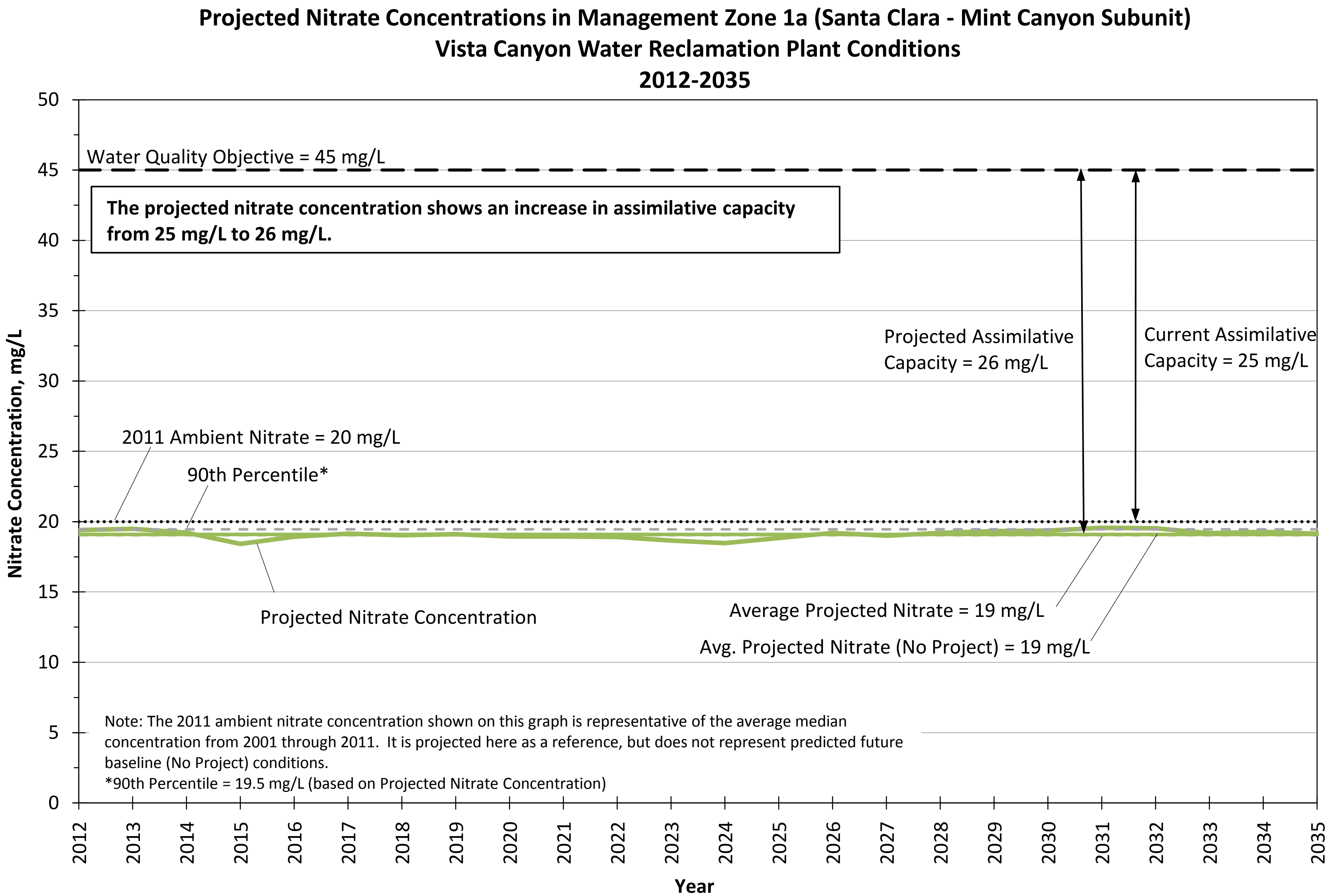

Projected Chloride Concentrations in Management Zone 6 (Saugus Formation)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
The projected chloride concentration shows a decrease in assimilative capacity from 72 mg/L to 54 mg/L.
Water Quality Objective = 100 mg/L
Projected Assimilative Capacity = 54 mg/L
Current Assimilative Capacity = 72 mg/L
Projected Chloride Concentration
Average Projected Chloride = 46 mg/L
90th Percentile*
Avg. Projected Chloride (No Project) = 46 mg/L
2011 Ambient = 28 mg/L
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Water Quality Objective adopted from Management Zone 2.
*90th Percentile = 52 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 28.2.g


Projected Nitrate Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an increase in assimilative capacity from 25 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 25 mg/L
2011 Ambient Nitrate = 20 mg/L
90th Percentile*
Projected Nitrate Concentration
Average Projected Nitrate = 19 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 19.5 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
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2026
2027
2028
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2030
2031
2032
2033
2034
2035

Figure 28.3.a

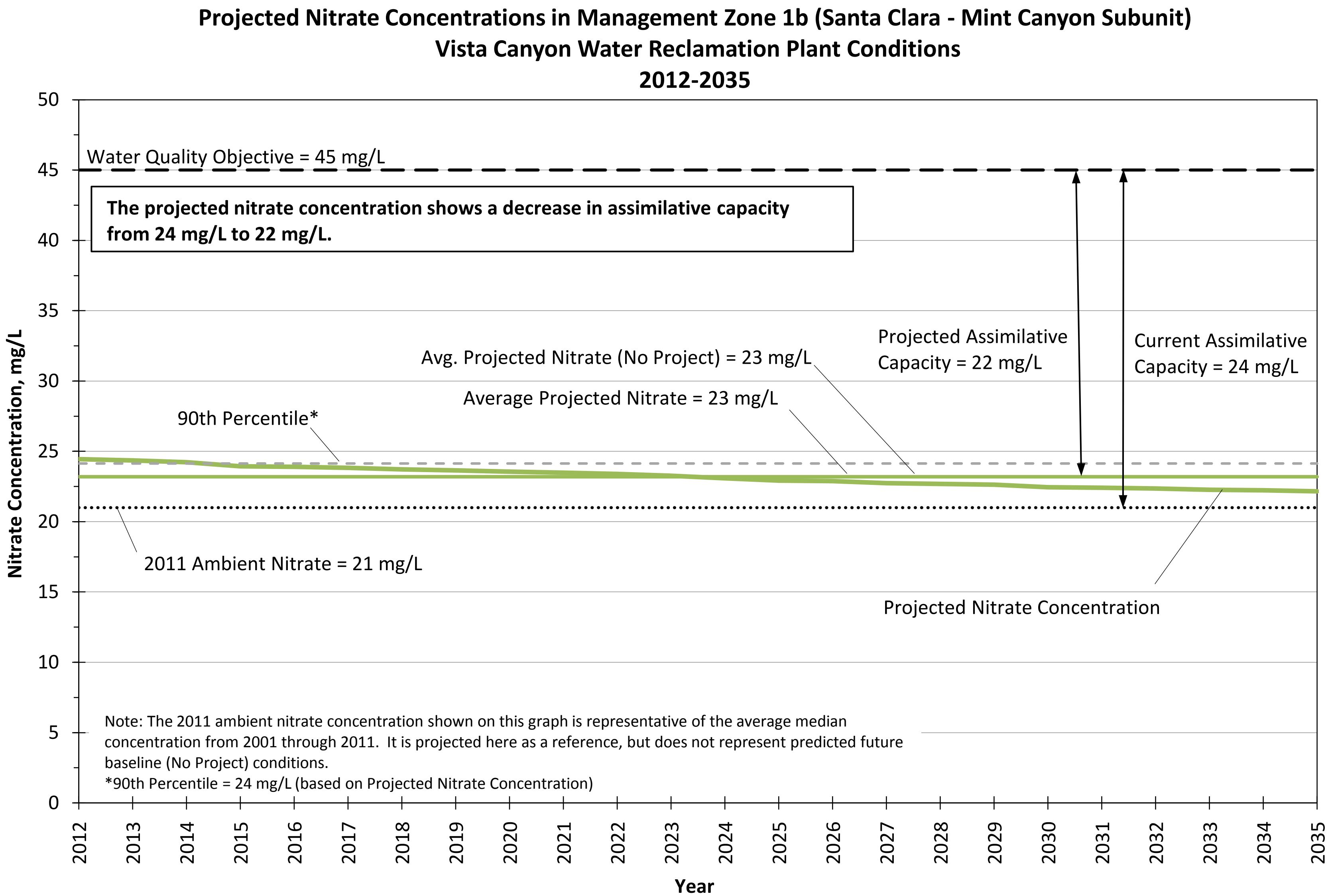

Projected Nitrate Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 24 mg/L to 22 mg/L.
Avg. Projected Nitrate (No Project) = 23 mg/L
Projected Assimilative Capacity = 22 mg/L
Current Assimilative Capacity = 24 mg/L
Average Projected Nitrate = 23 mg/L
90th Percentile*
2011 Ambient Nitrate = 21 mg/L
Projected Nitrate Concentration
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 24 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
0
5
10
15
20
25
30
35
40
45
50
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 28.3.b

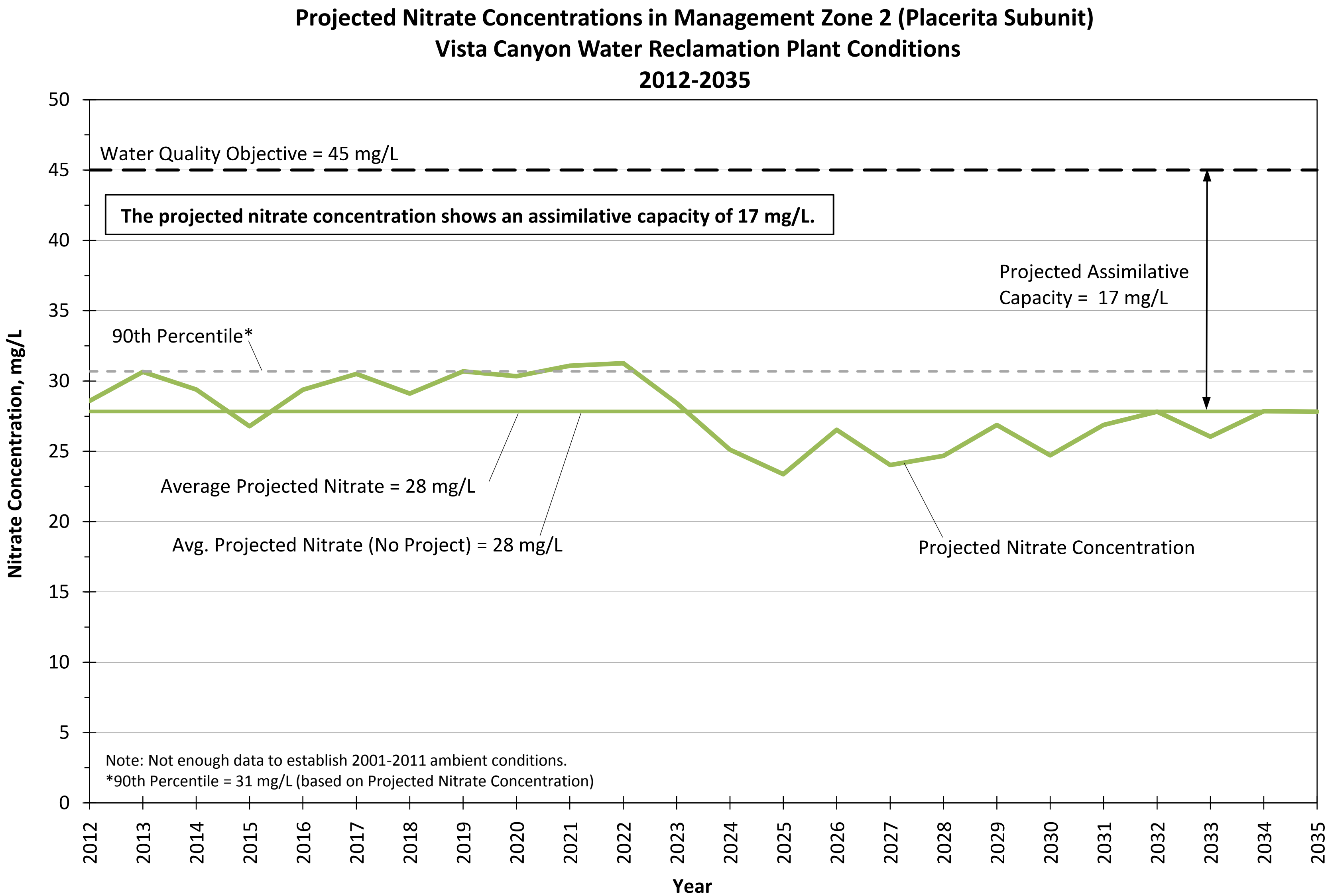

Projected Nitrate Concentrations in Management Zone 2 (Placerita Subunit)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an assimilative capacity of 17 mg/L.
Projected Assimilative Capacity = 17 mg/L
90th Percentile*
Average Projected Nitrate = 28 mg/L
Avg. Projected Nitrate (No Project) = 28 mg/L
Projected Nitrate Concentration
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 31 mg/L (based on Projected Nitrate Concentration)

Figure 28.3.c

Projected Nitrate Concentrations in Management Zone 3 (South Fork Subunit)
Vista Canyon Water Reclamation Plant Conditions
2012-2035

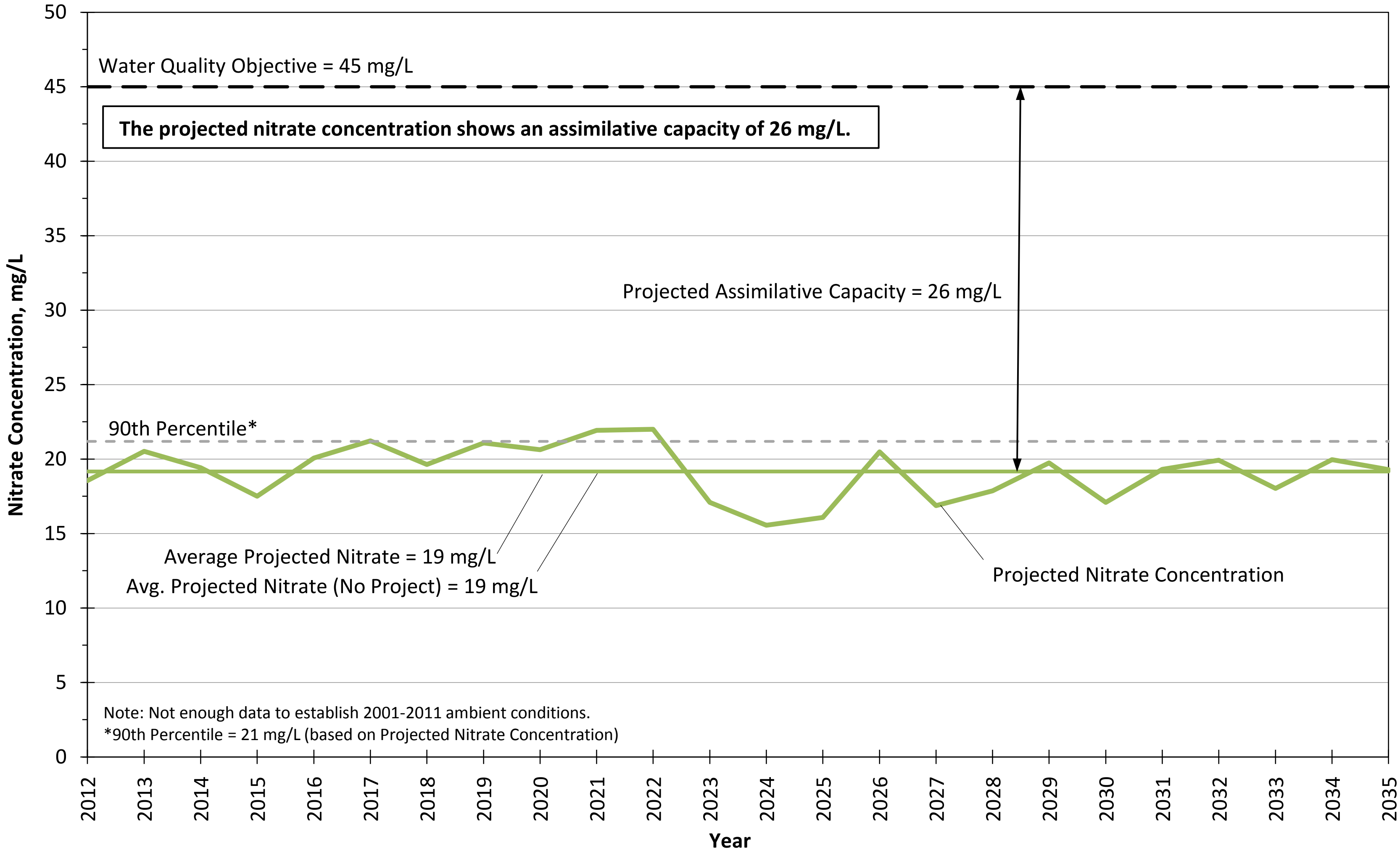


Figure 28.3.d

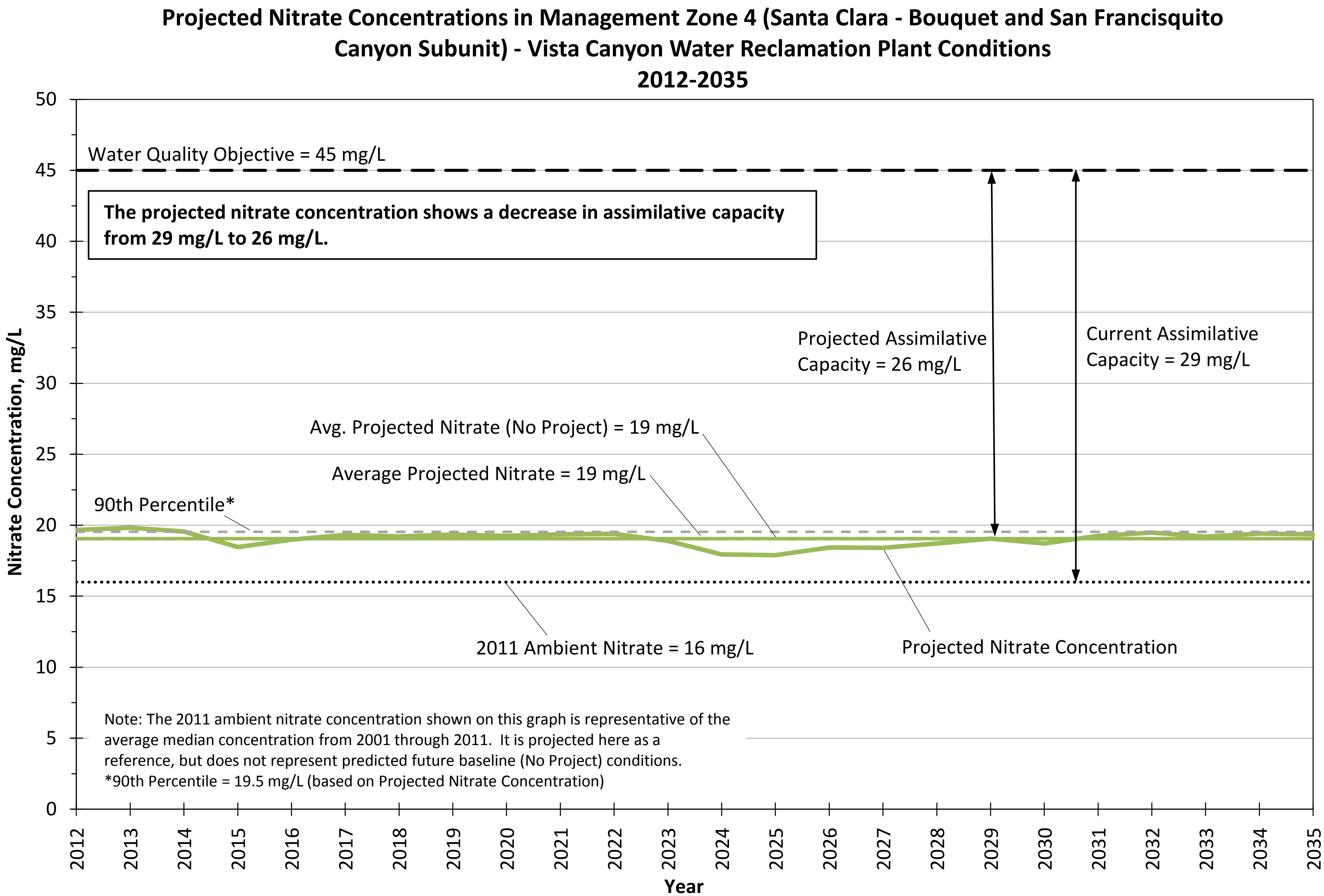

Projected Nitrate Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - Vista Canyon Water Reclamation Plant Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 29 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 29 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Average Projected Nitrate = 19 mg/L
90th Percentile*
2011 Ambient Nitrate = 16 mg/L
Projected Nitrate Concentration
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 19.5 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 28.3.e

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

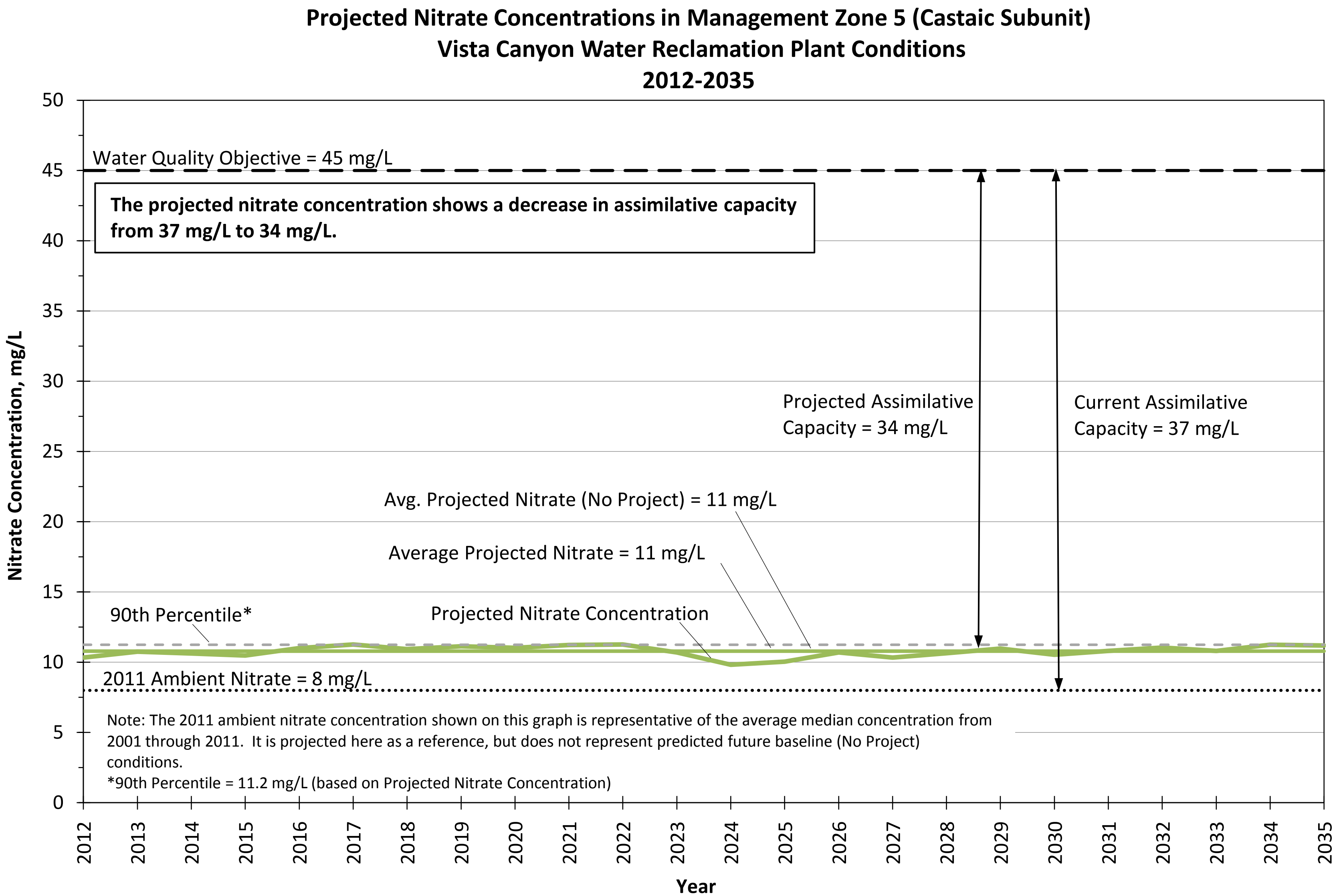
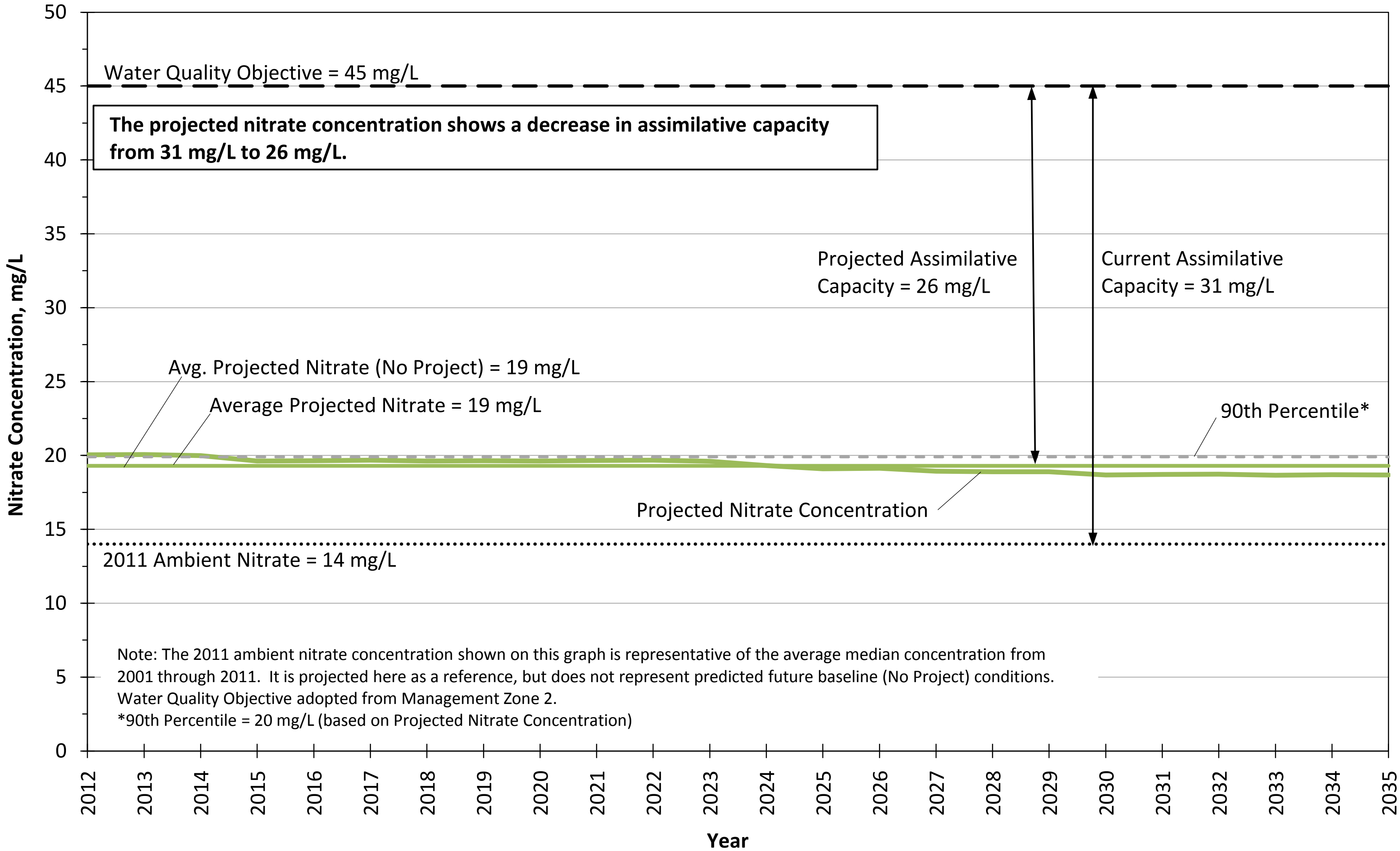


Figure 28.3.f

Projected Nitrate Concentrations in Management Zone 6 (Saugus Formation)
Vista Canyon Water Reclamation Plant Conditions
2012-2035



Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Water Quality Objective adopted from Management Zone 2.
*90th Percentile = 20 mg/L (based on Projected Nitrate Concentration)

Figure 28.3.g

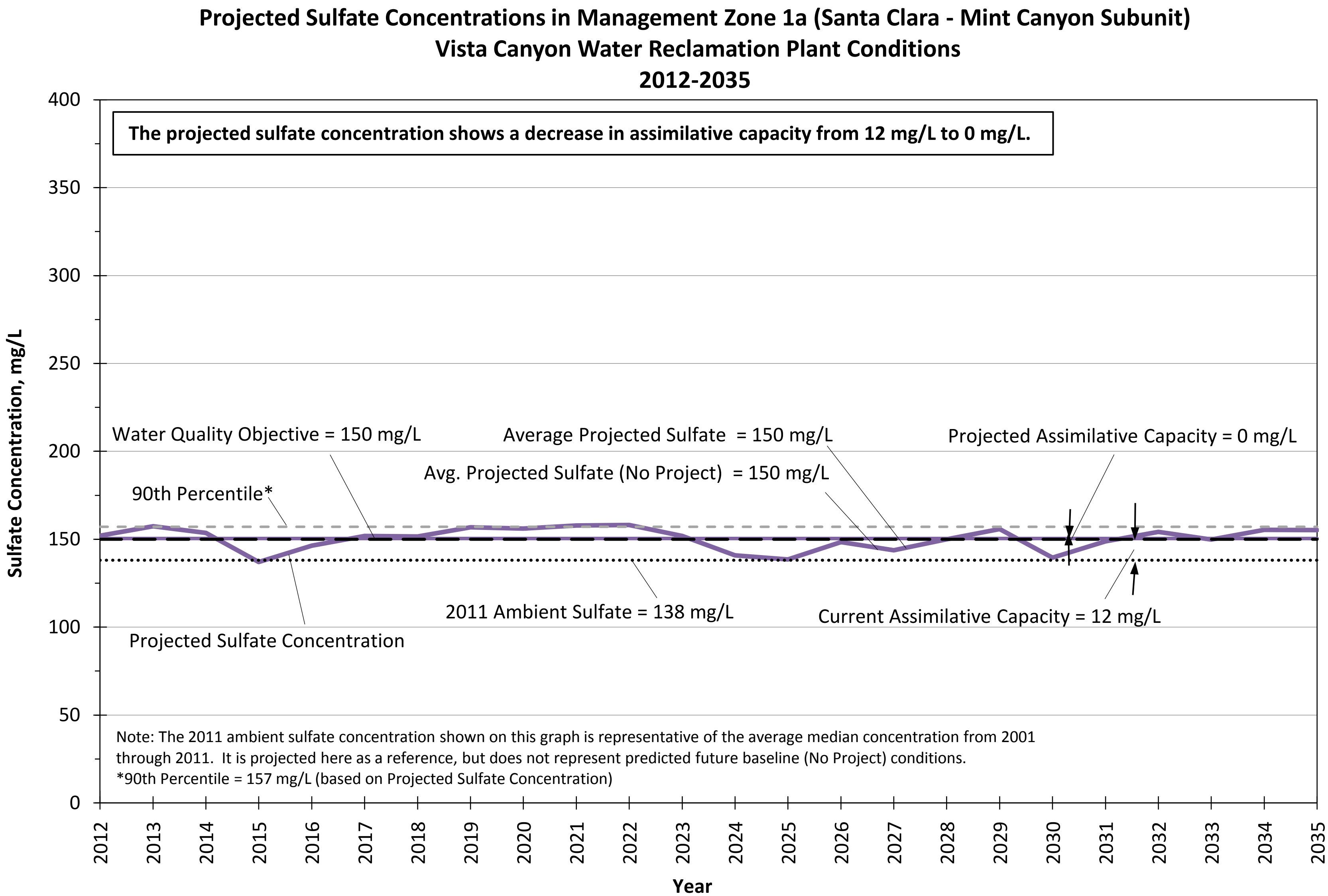

Projected Sulfate Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
The projected sulfate concentration shows a decrease in assimilative capacity from 12 mg/L to 0 mg/L.
Sulfate Concentration, mg/L
Year
Water Quality Objective = 150 mg/L
Average Projected Sulfate = 150 mg/L
Projected Assimilative Capacity = 0 mg/L
Avg. Projected Sulfate (No Project) = 150 mg/L
90th Percentile*
2011 Ambient Sulfate = 138 mg/L
Current Assimilative Capacity = 12 mg/L
Projected Sulfate Concentration
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 157 mg/L (based on Projected Sulfate Concentration)

Figure 28.4.a

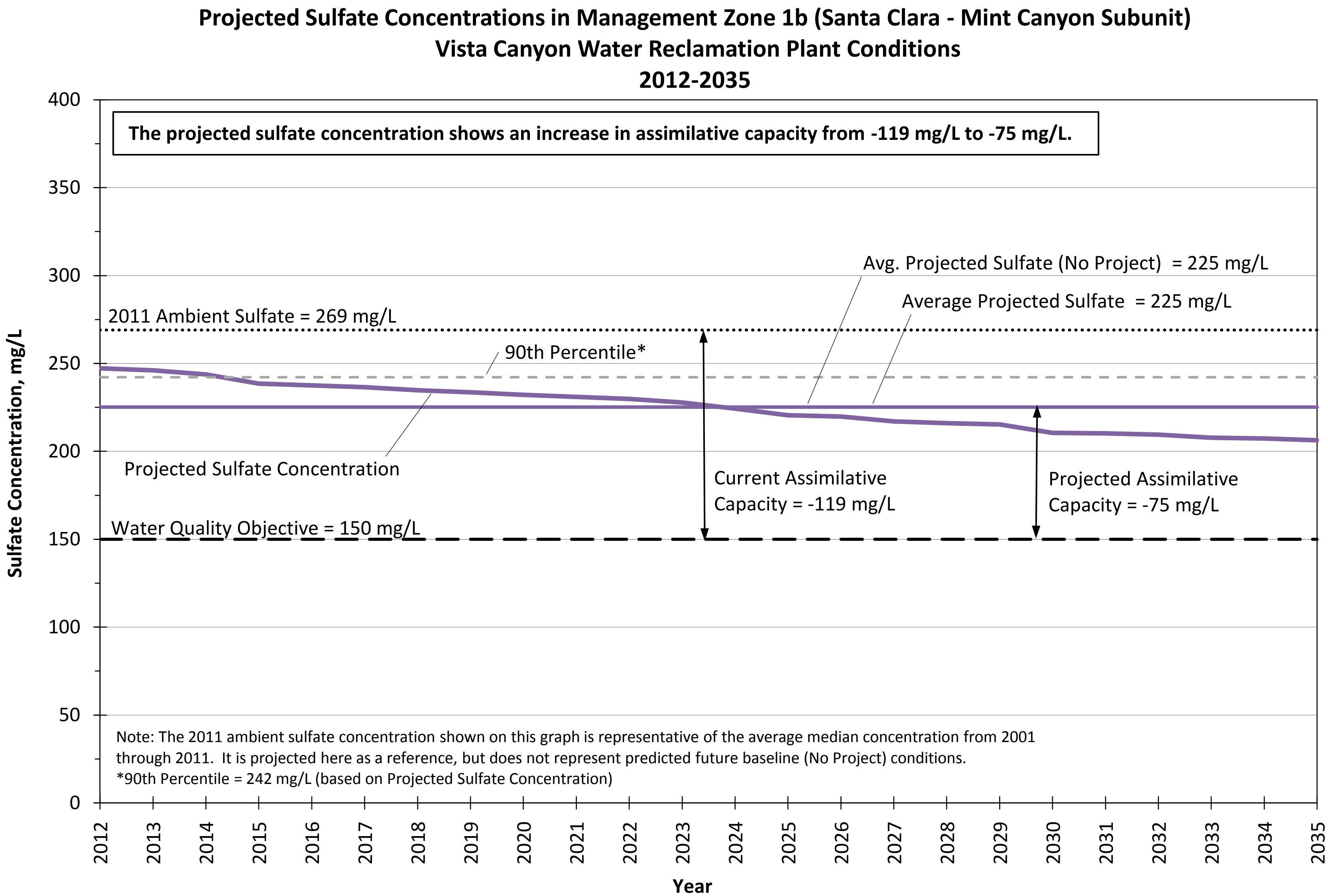

Projected Sulfate Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
The projected sulfate concentration shows an increase in assimilative capacity from -119 mg/L to -75 mg/L.
Avg. Projected Sulfate (No Project) = 225 mg/L
Average Projected Sulfate = 225 mg/L
2011 Ambient Sulfate = 269 mg/L
90th Percentile*
Projected Sulfate Concentration
Current Assimilative Capacity = -119 mg/L
Projected Assimilative Capacity = -75 mg/L
Water Quality Objective = 150 mg/L
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 242 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 28.4.b

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

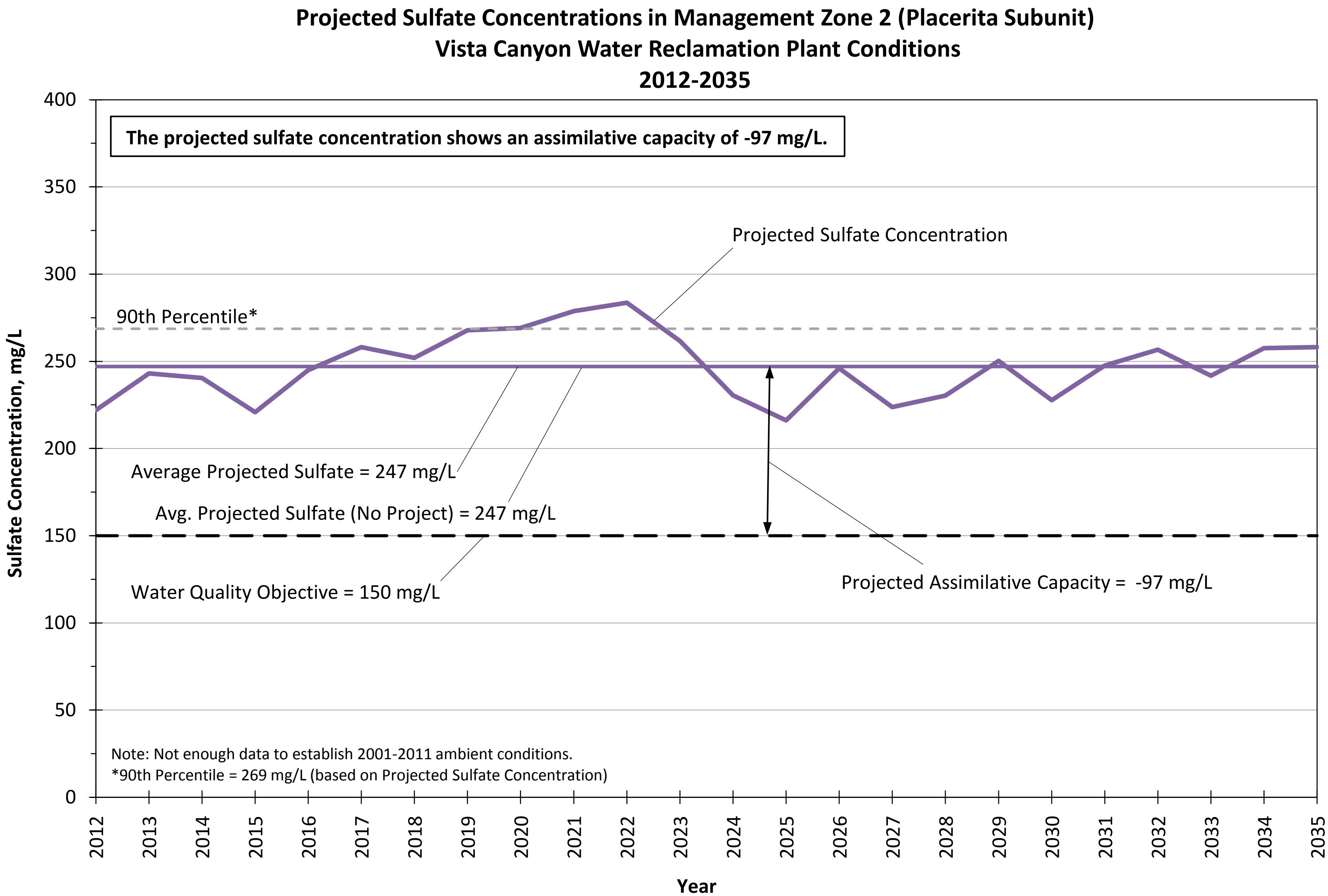


Figure 28.4.c

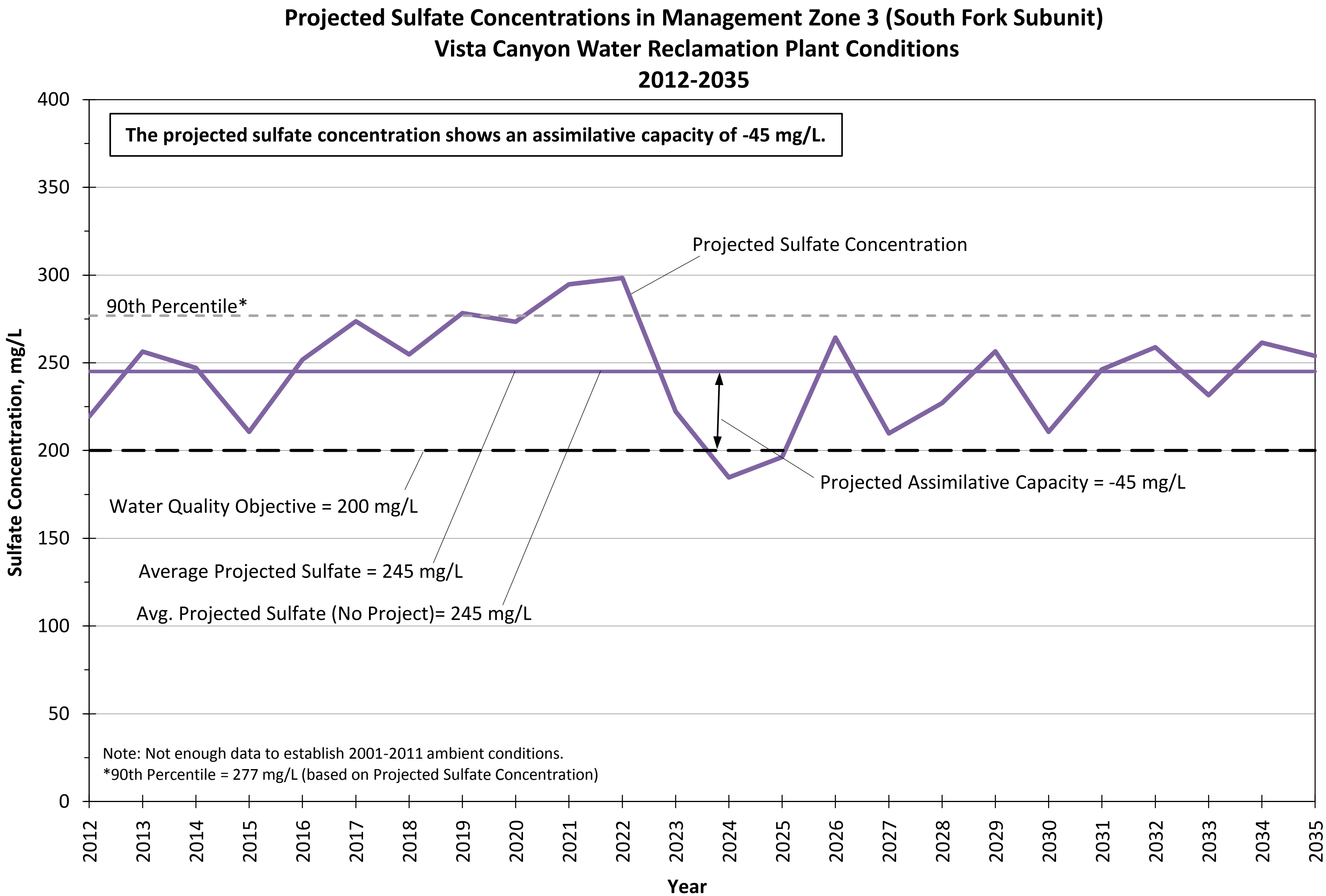

Projected Sulfate Concentrations in Management Zone 3 (South Fork Subunit)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
The projected sulfate concentration shows an assimilative capacity of -45 mg/L.
Projected Sulfate Concentration
90th Percentile*
Projected Assimilative Capacity = -45 mg/L
Water Quality Objective = 200 mg/L
Average Projected Sulfate = 245 mg/L
Avg. Projected Sulfate (No Project)= 245 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 277 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 28.4.d

Projected Sulfate Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - Vista Canyon Water Reclamation Plant Conditions 2012-2035

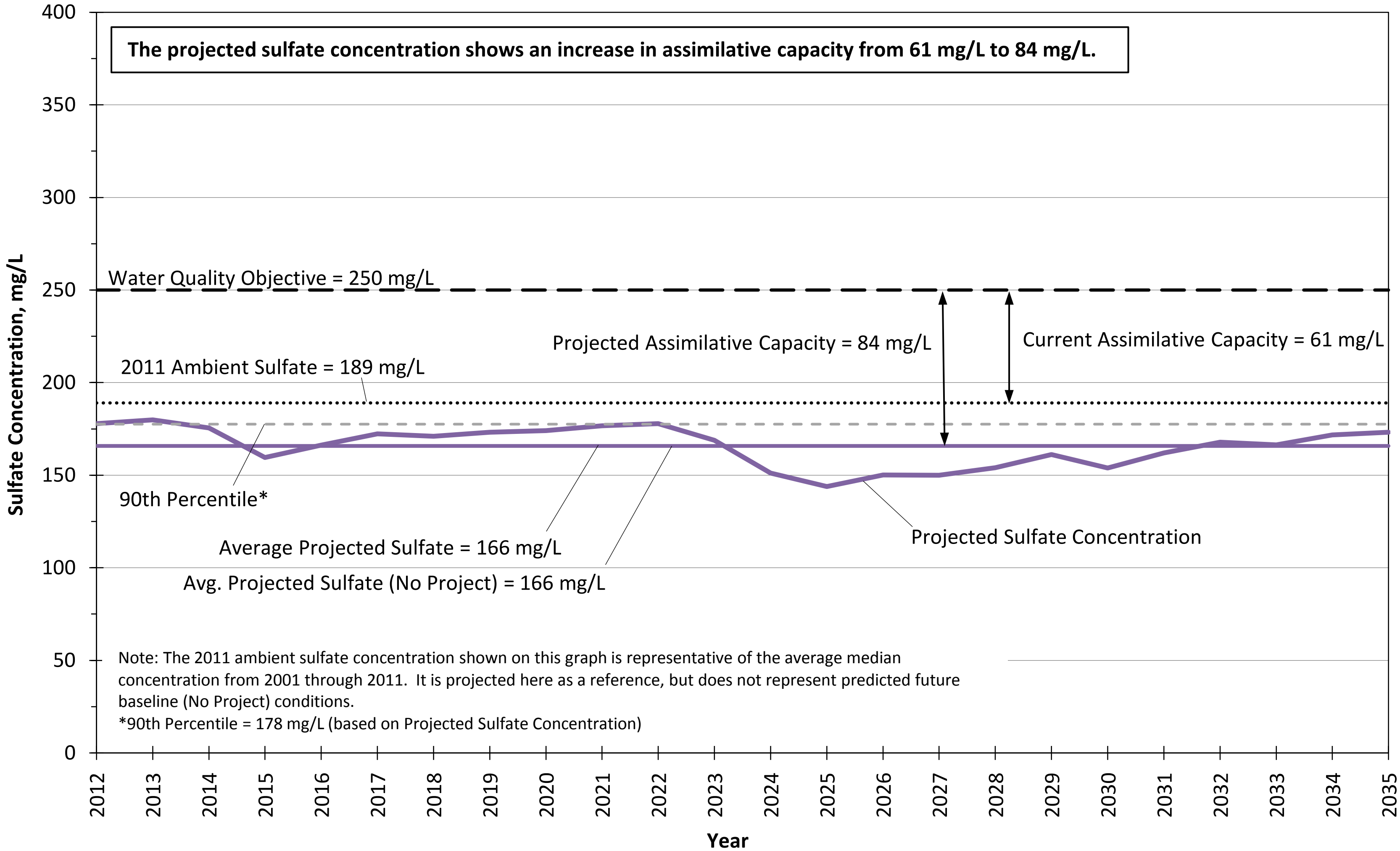
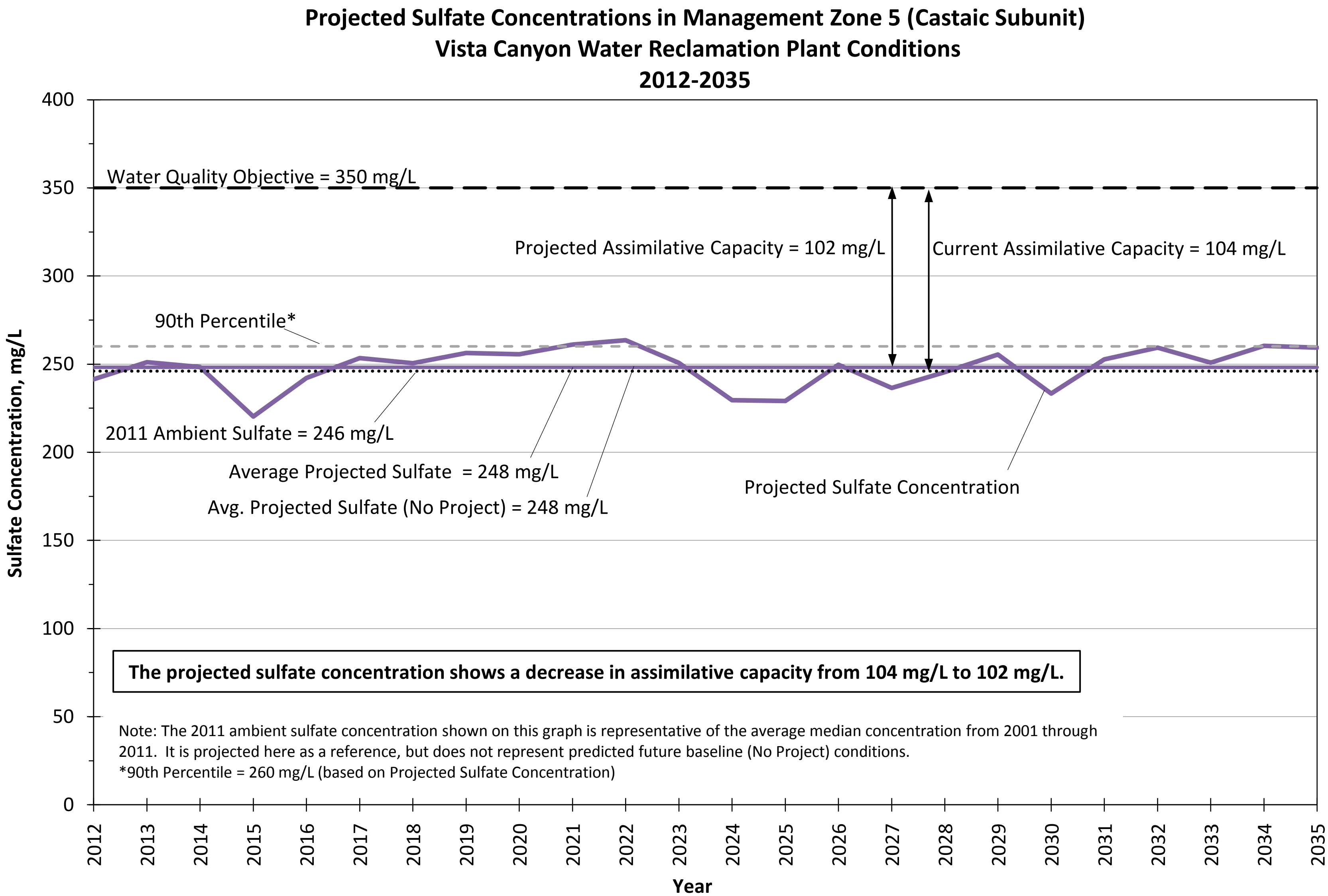


Figure 28.4.e


Projected Sulfate Concentrations in Management Zone 5 (Castaic Subunit)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
Water Quality Objective = 350 mg/L
Projected Assimilative Capacity = 102 mg/L
Current Assimilative Capacity = 104 mg/L
90th Percentile*
2011 Ambient Sulfate = 246 mg/L
Average Projected Sulfate = 248 mg/L
Avg. Projected Sulfate (No Project) = 248 mg/L
Projected Sulfate Concentration
The projected sulfate concentration shows a decrease in assimilative capacity from 104 mg/L to 102 mg/L.
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 260 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
400
350
300
250
200
150
100
50
0
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
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2034
2035

Figure 28.4.f

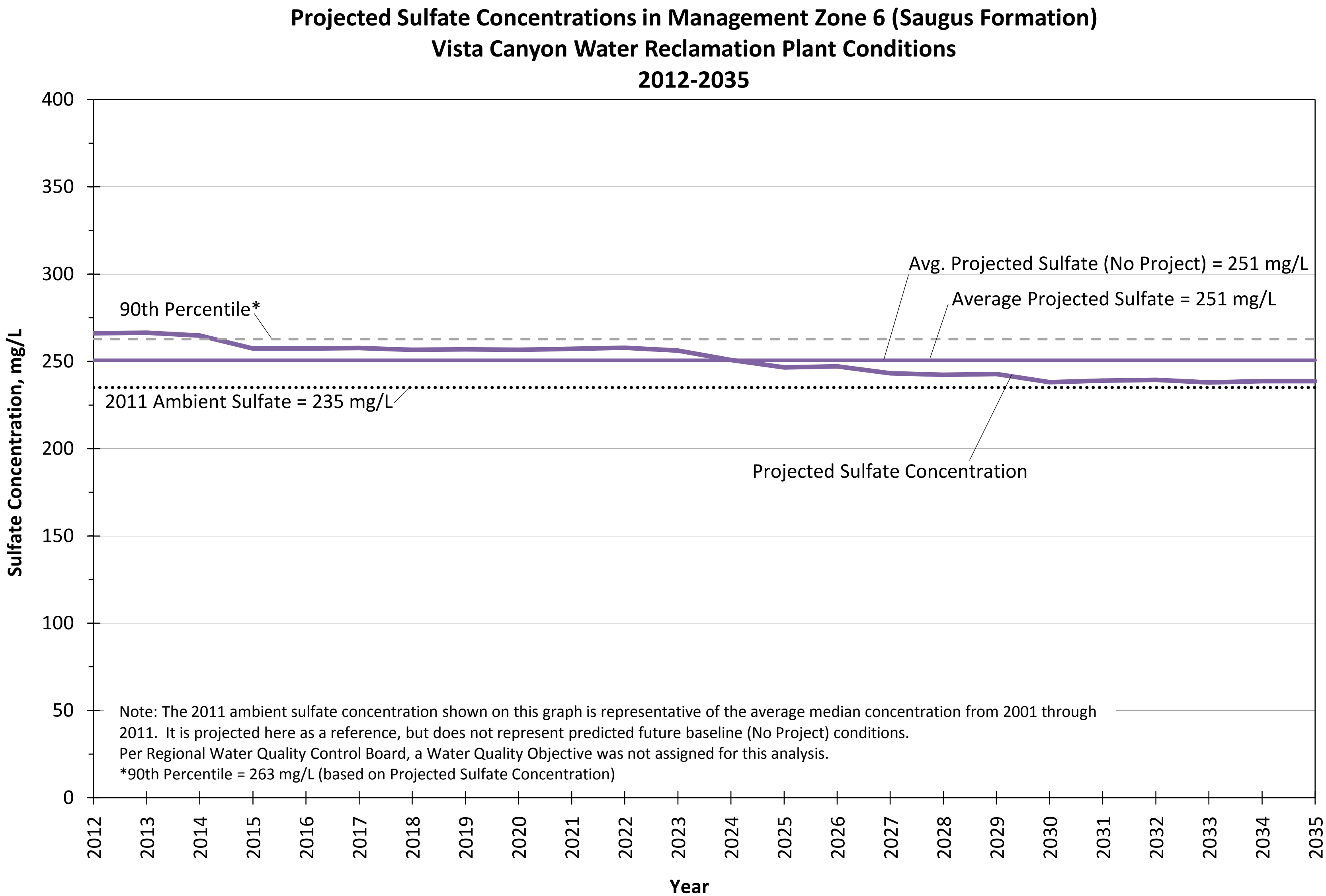
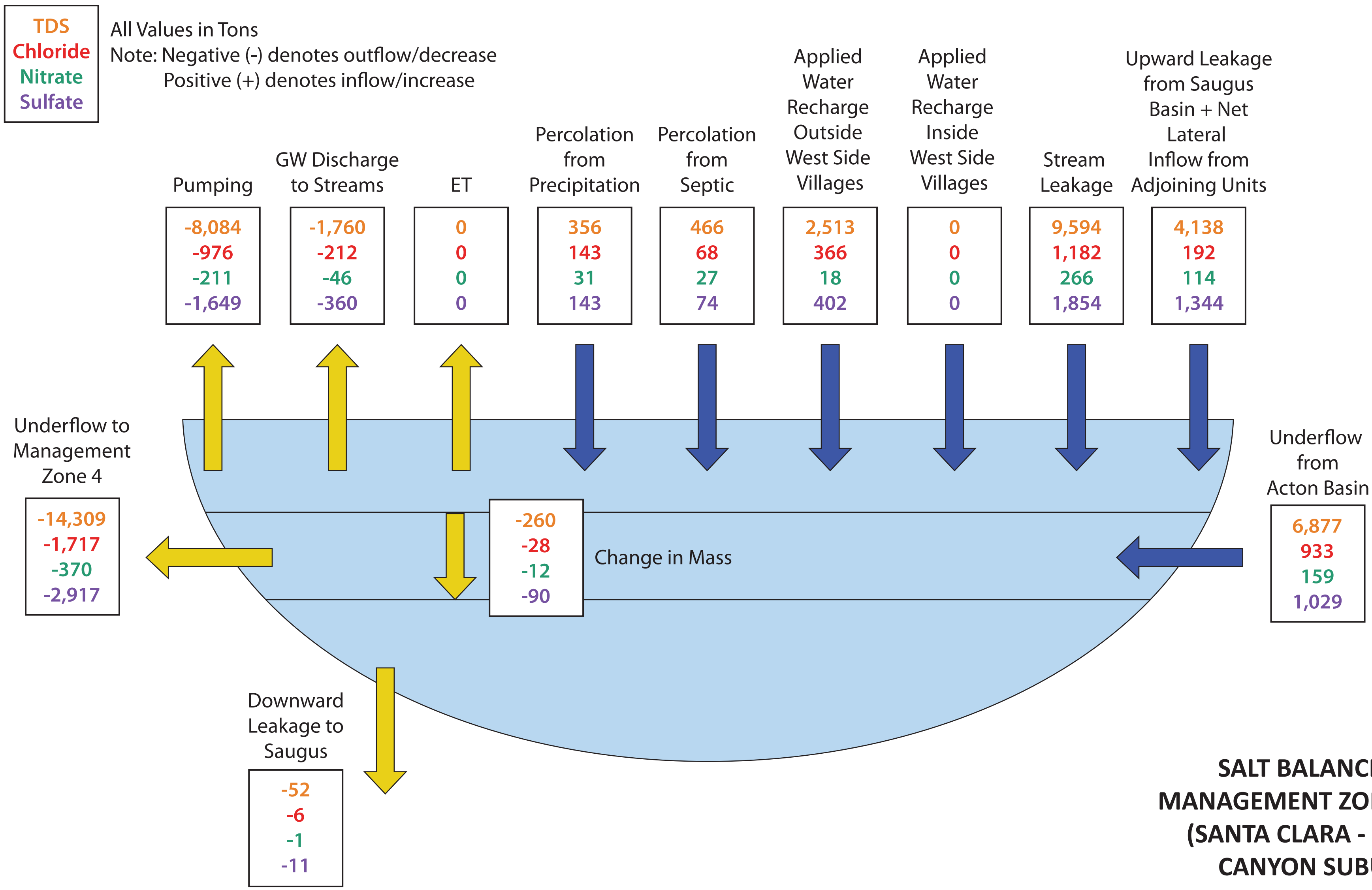

Projected Sulfate Concentrations in Management Zone 6 (Saugus Formation)
Vista Canyon Water Reclamation Plant Conditions
2012-2035
Sulfate Concentration, mg/L
400
350
300
250
200
150
100
50
0
Avg. Projected Sulfate (No Project) = 251 mg/L
Average Projected Sulfate = 251 mg/L
90th Percentile*
2011 Ambient Sulfate = 235 mg/L
Projected Sulfate Concentration
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Per Regional Water Quality Control Board, a Water Quality Objective was not assigned for this analysis.
*90th Percentile = 263 mg/L (based on Projected Sulfate Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 28.4.g



SALT BALANCE FOR MANAGEMENT ZONE 1a (SANTA CLARA - MINT CANYON SUBUNIT) CLWA RECYCLED WATER MASTER PLAN CONDITIONS 2012-2035

Figure 29a

8-Dec-16

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P.O. Box 220, Claremont, CA 91711
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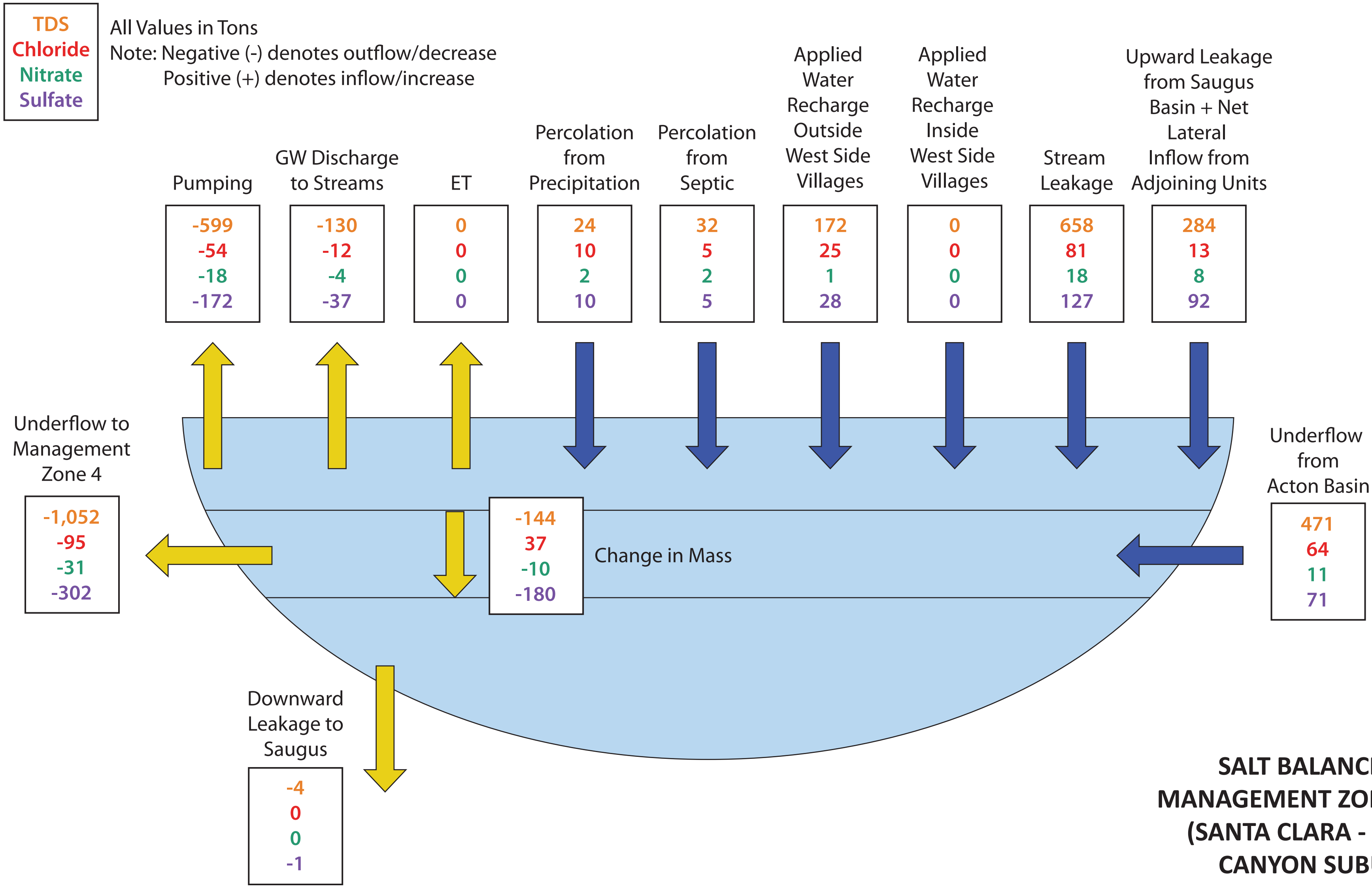

SALT BALANCE FOR MANAGEMENT ZONE 1b (SANTA CLARA - MINT CANYON SUBUNIT) CLWA RECYCLED WATER MASTER PLAN CONDITIONS 2012-2035

Figure 29b

8-Dec-16

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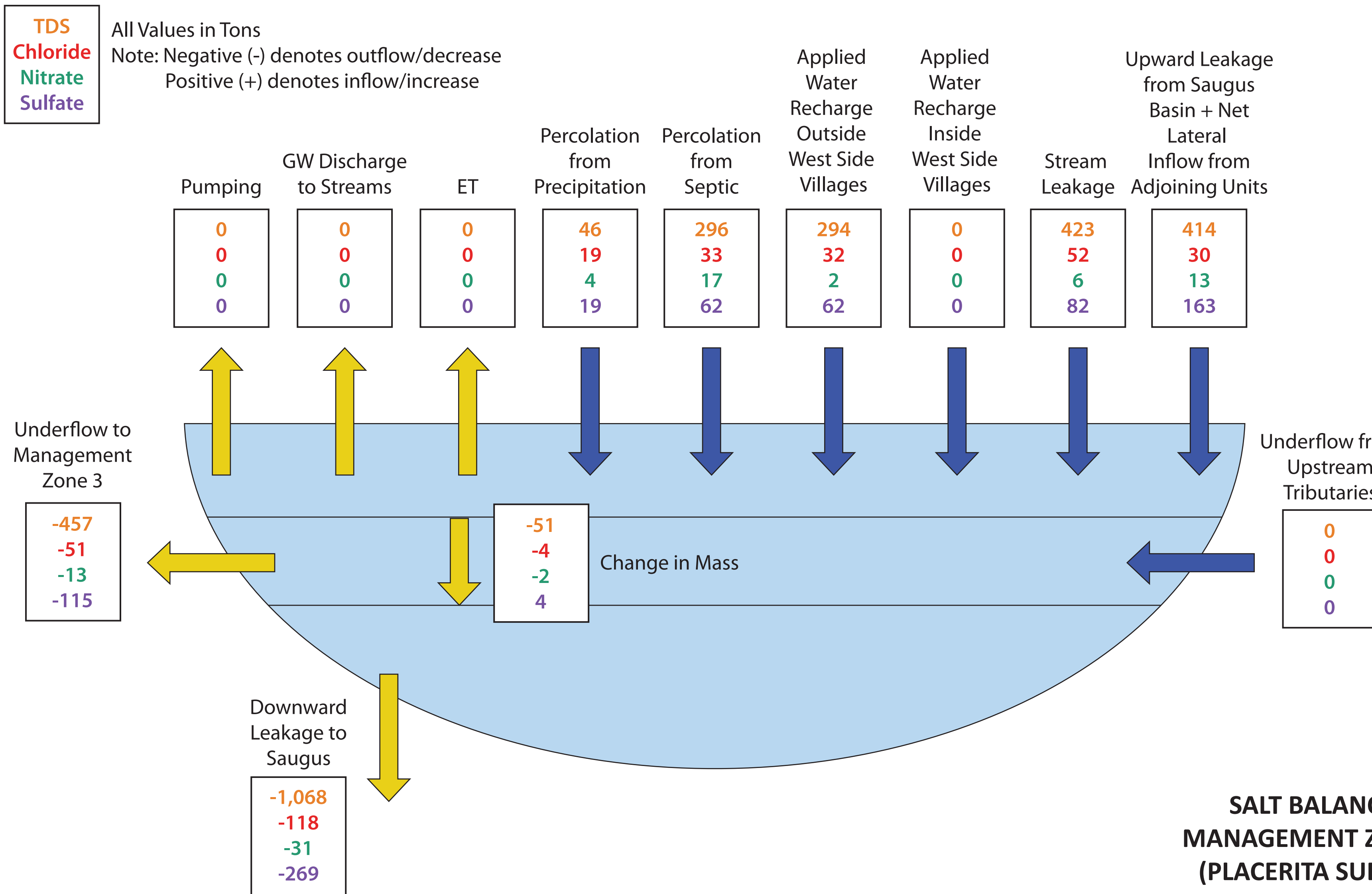
CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 2 (PLACERITA SUBUNIT) CLWA RECYCLED WATER MASTER PLAN CONDITIONS 2012-2035

8-Dec-16

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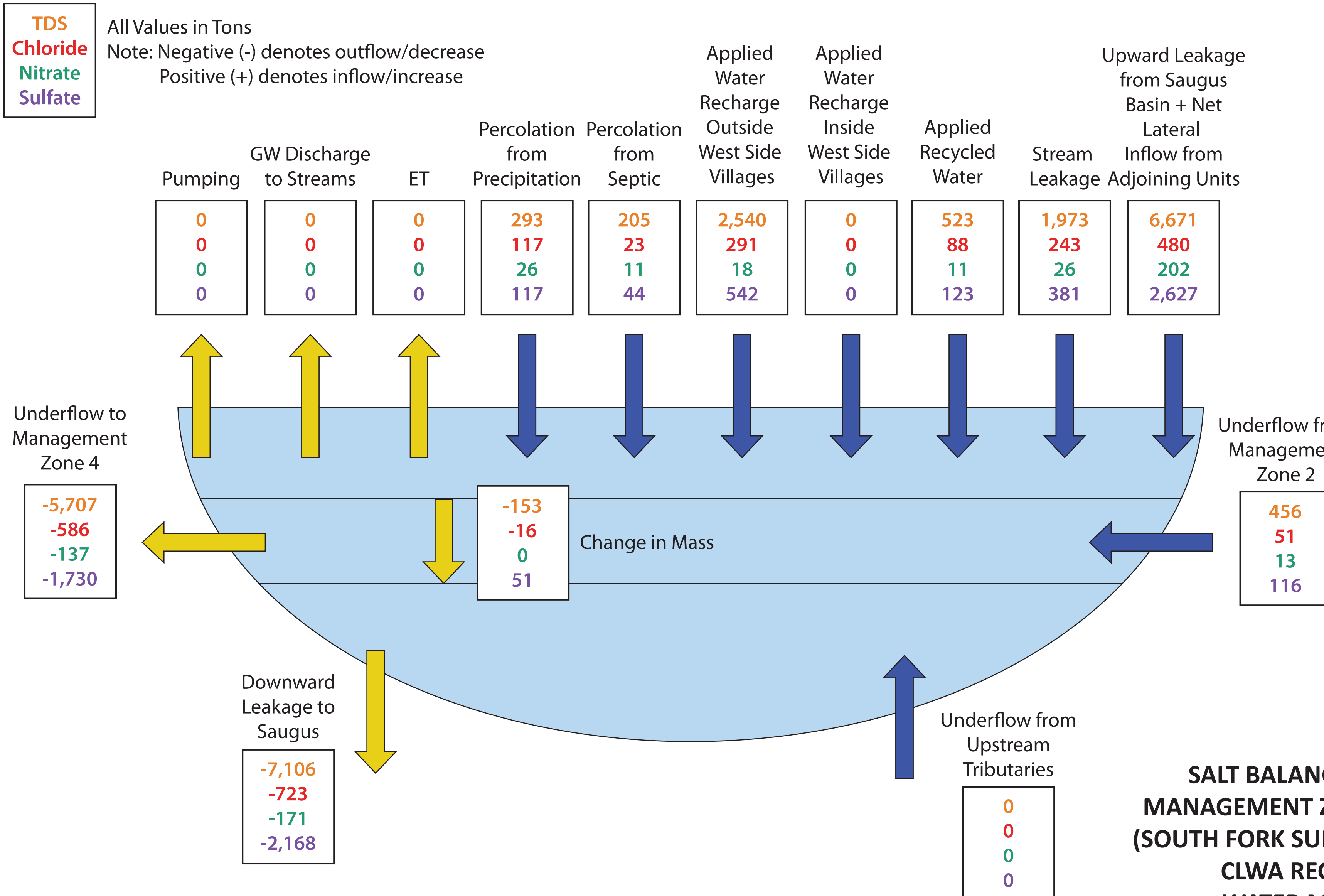
Figure 29c



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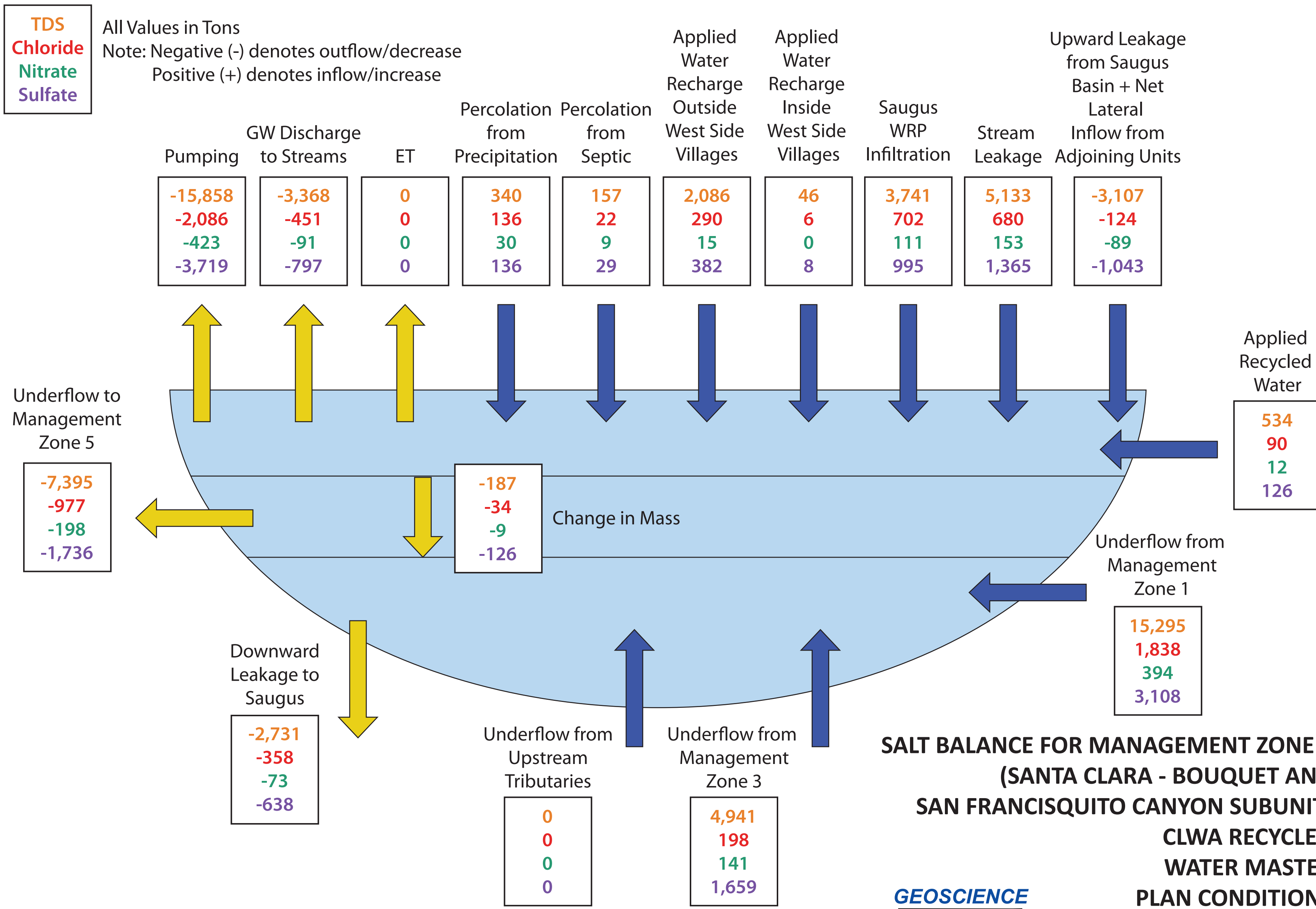
SALT BALANCE FOR MANAGEMENT ZONE 3 (SOUTH FORK SUBUNIT) CLWA RECYCLED WATER MASTER PLAN CONDITIONS 2012-2035

Figure 29d

8-Dec-16



SALT BALANCE FOR MANAGEMENT ZONE 4 (SANTA CLARA - BOUQUET AND SAN FRANCISQUITO CANYON SUBUNIT) CLWA RECYCLED WATER MASTER PLAN CONDITIONS 2012-2035

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Figure 29e

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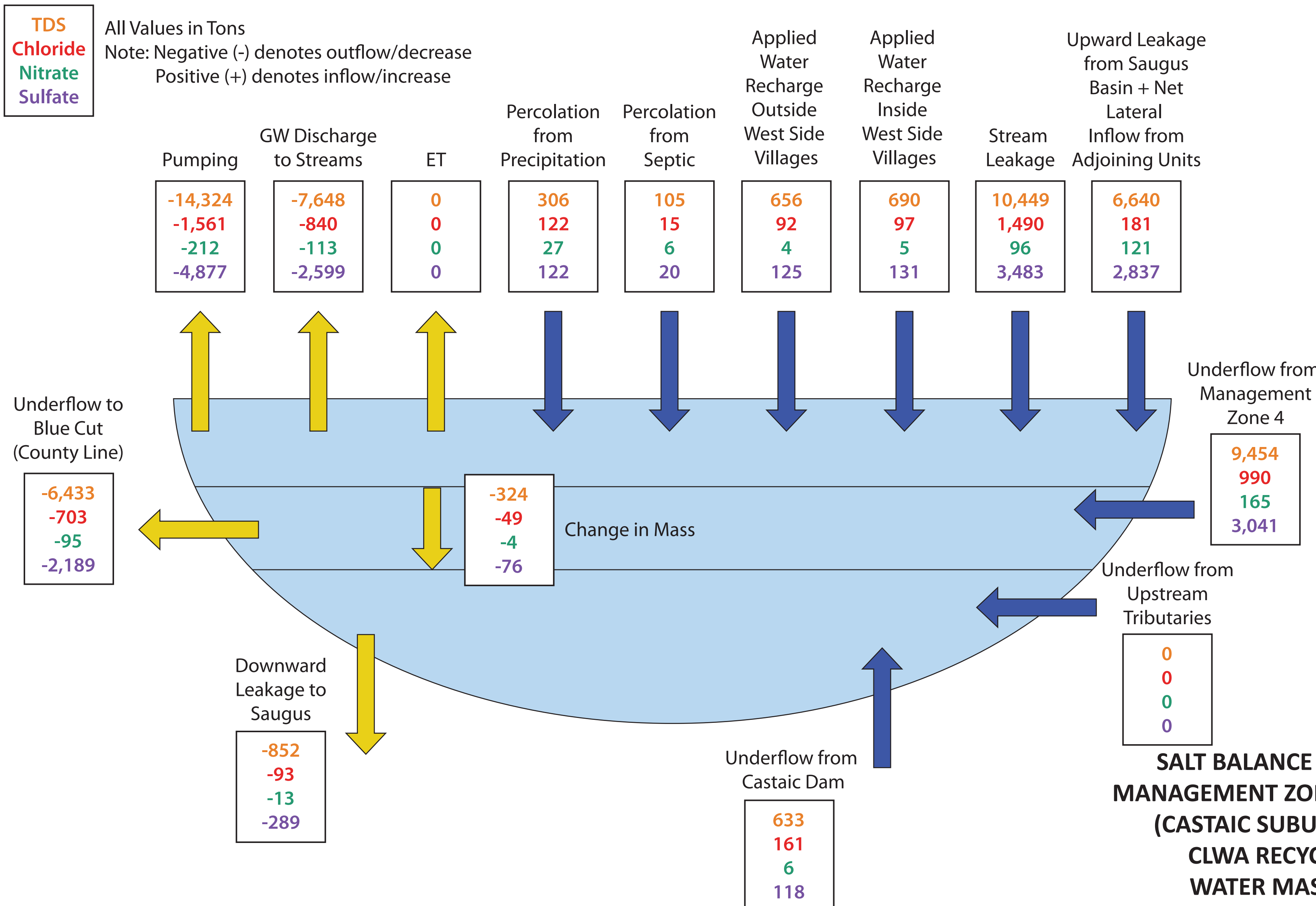
CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 5 (CASTAIC SUBUNIT) CLWA RECYCLED WATER MASTER PLAN CONDITIONS 2012-2035

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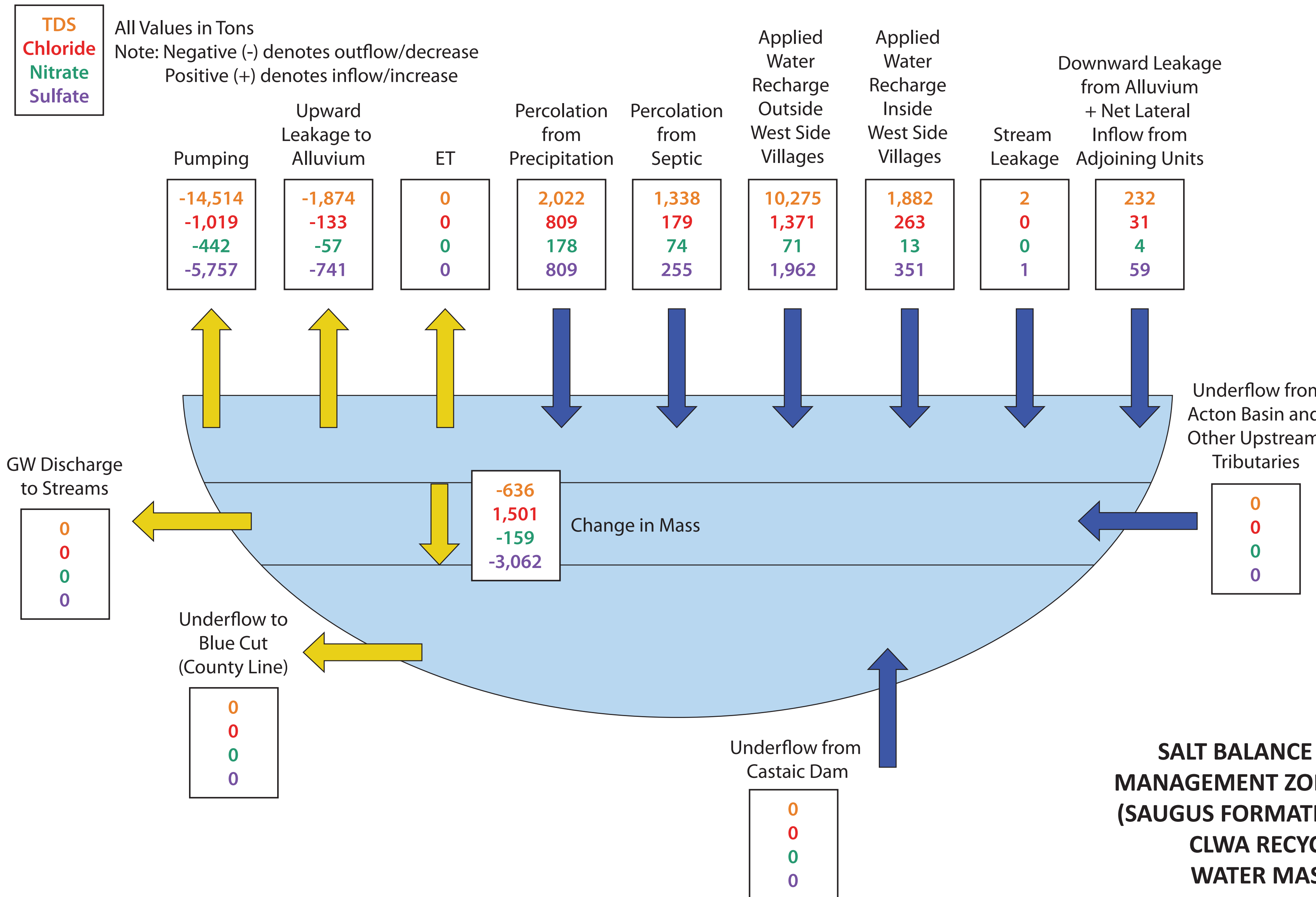
Figure 29f

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 6 (SAUGUS FORMATION) CLWA RECYCLED WATER MASTER PLAN CONDITIONS 2012-2035

Figure 29g

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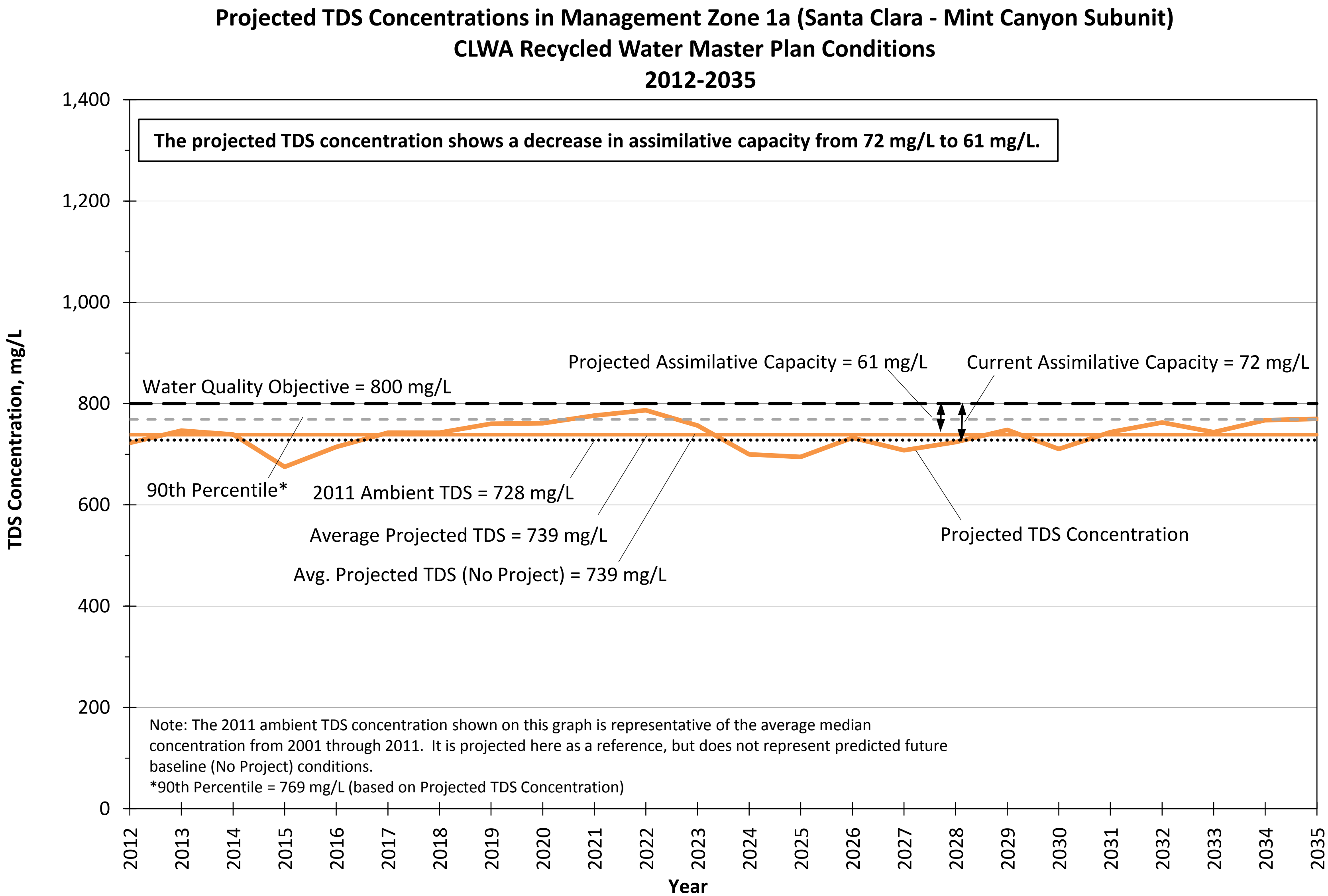
Projected TDS Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035
The projected TDS concentration shows a decrease in assimilative capacity from 72 mg/L to 61 mg/L.
Projected Assimilative Capacity = 61 mg/L
Current Assimilative Capacity = 72 mg/L
Water Quality Objective = 800 mg/L
90th Percentile*
2011 Ambient TDS = 728 mg/L
Average Projected TDS = 739 mg/L
Avg. Projected TDS (No Project) = 739 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 769 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 30.1.a

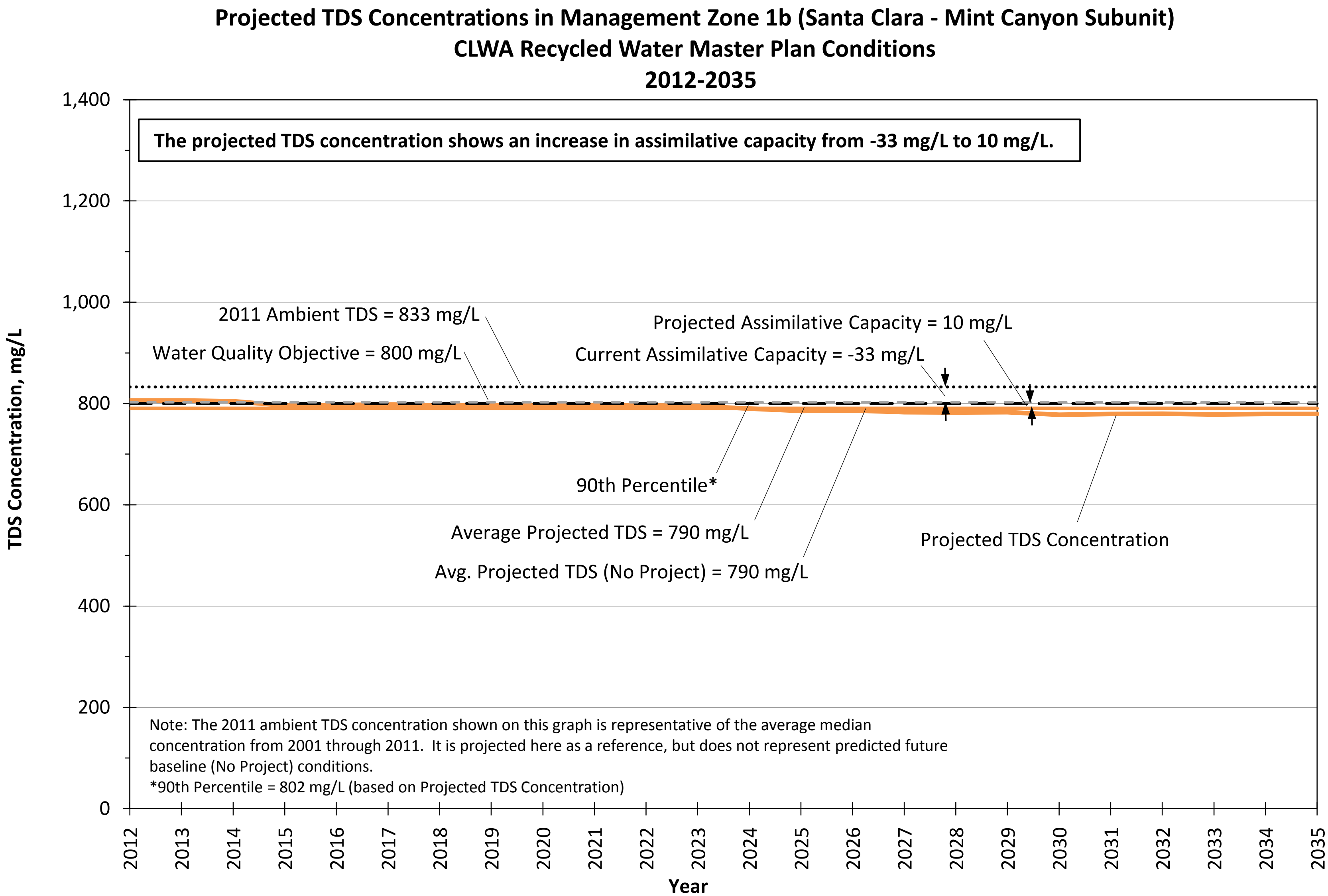
Projected TDS Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035
The projected TDS concentration shows an increase in assimilative capacity from -33 mg/L to 10 mg/L.
2011 Ambient TDS = 833 mg/L
Water Quality Objective = 800 mg/L
Projected Assimilative Capacity = 10 mg/L
Current Assimilative Capacity = -33 mg/L
90th Percentile*
Average Projected TDS = 790 mg/L
Avg. Projected TDS (No Project) = 790 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 802 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 30.1.b

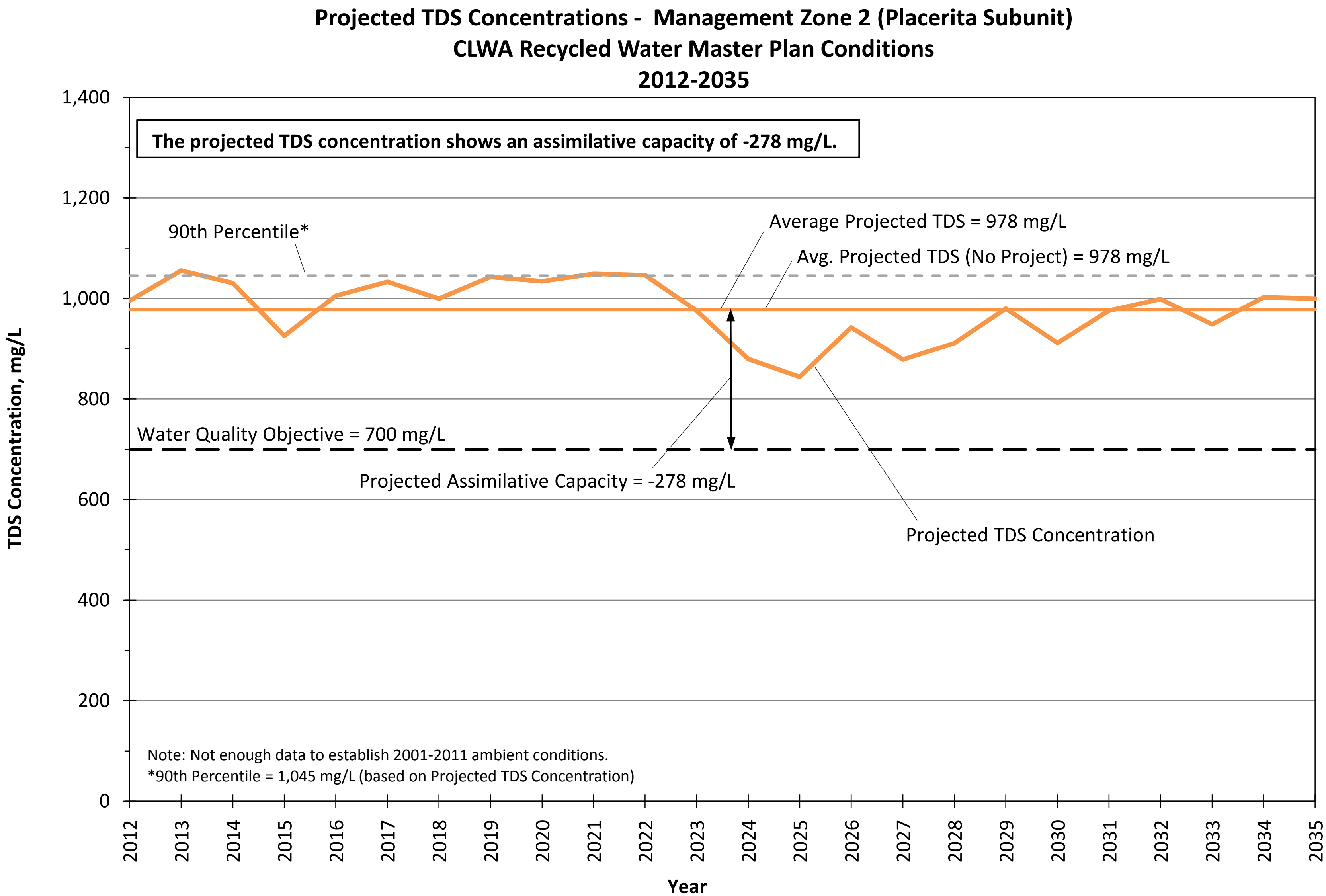
Projected TDS Concentrations - Management Zone 2 (Placerita Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035
The projected TDS concentration shows an assimilative capacity of -278 mg/L.
90th Percentile*
Average Projected TDS = 978 mg/L
Avg. Projected TDS (No Project) = 978 mg/L
Water Quality Objective = 700 mg/L
Projected Assimilative Capacity = -278 mg/L
Projected TDS Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 1,045 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
Year
1,400
1,200
1,000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 30.1.c

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

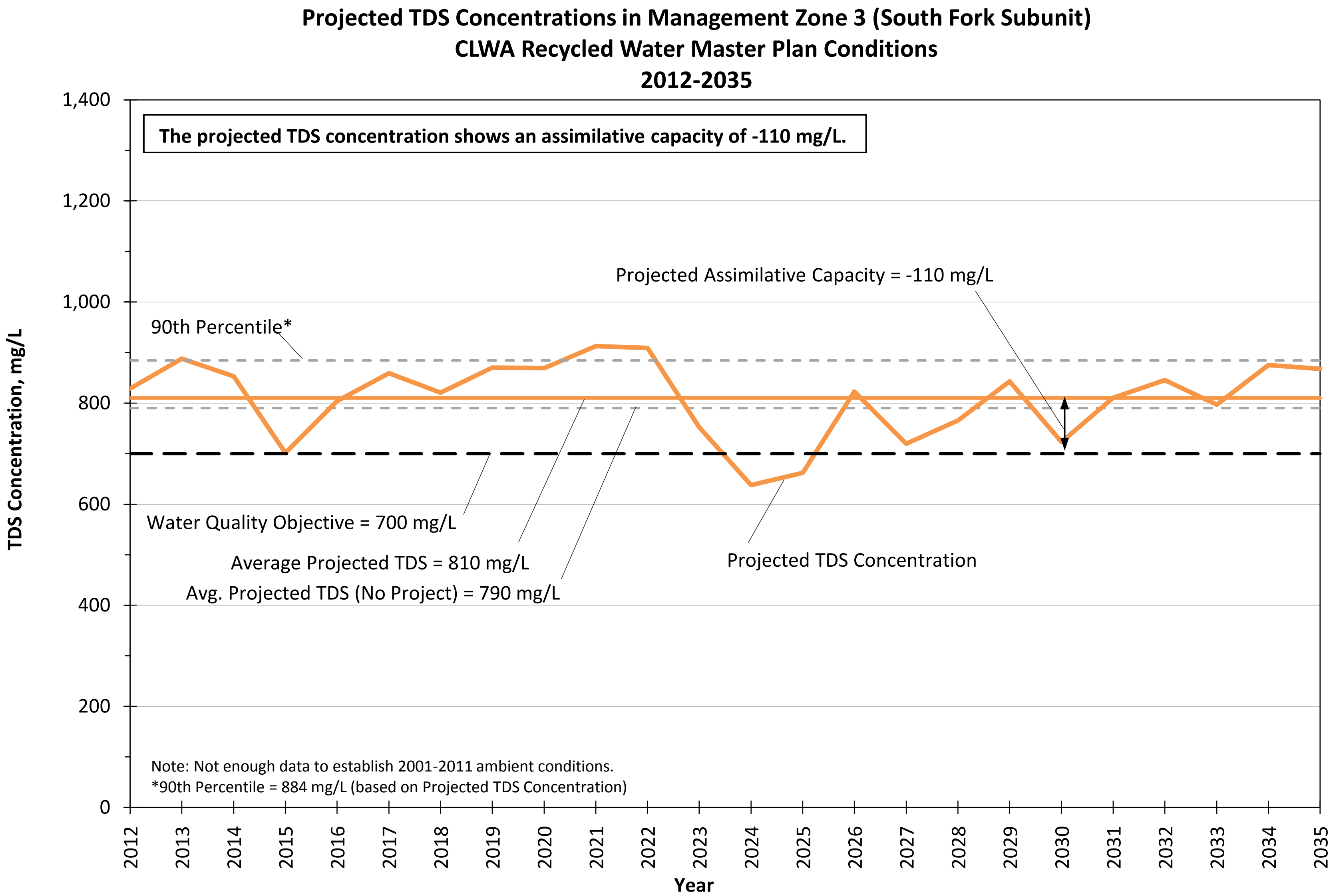

Figure 30.1.d

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Projected TDS Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - CLWA Recycled Water Master Plan Conditions 2012-2035

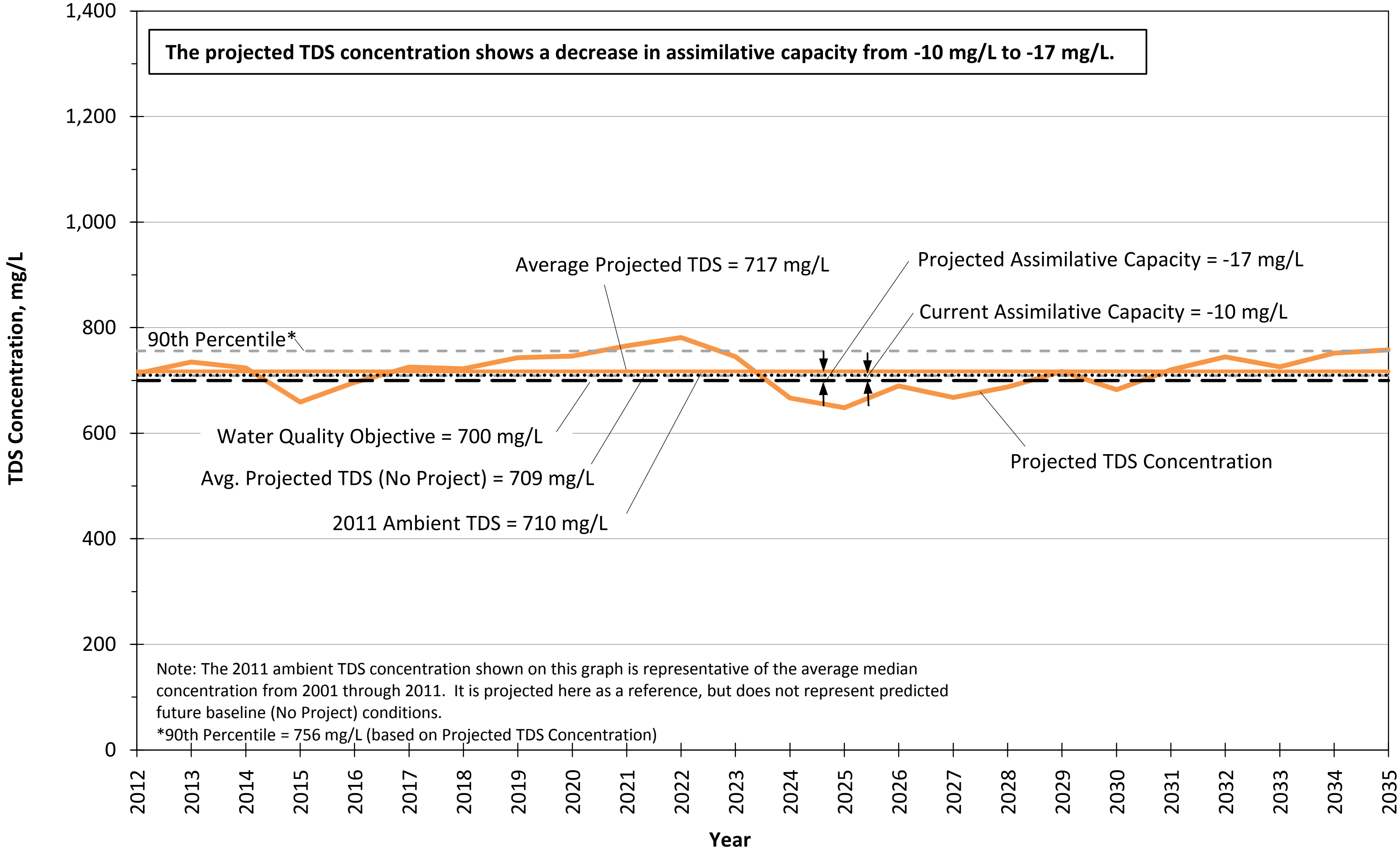

Figure 30.1.e

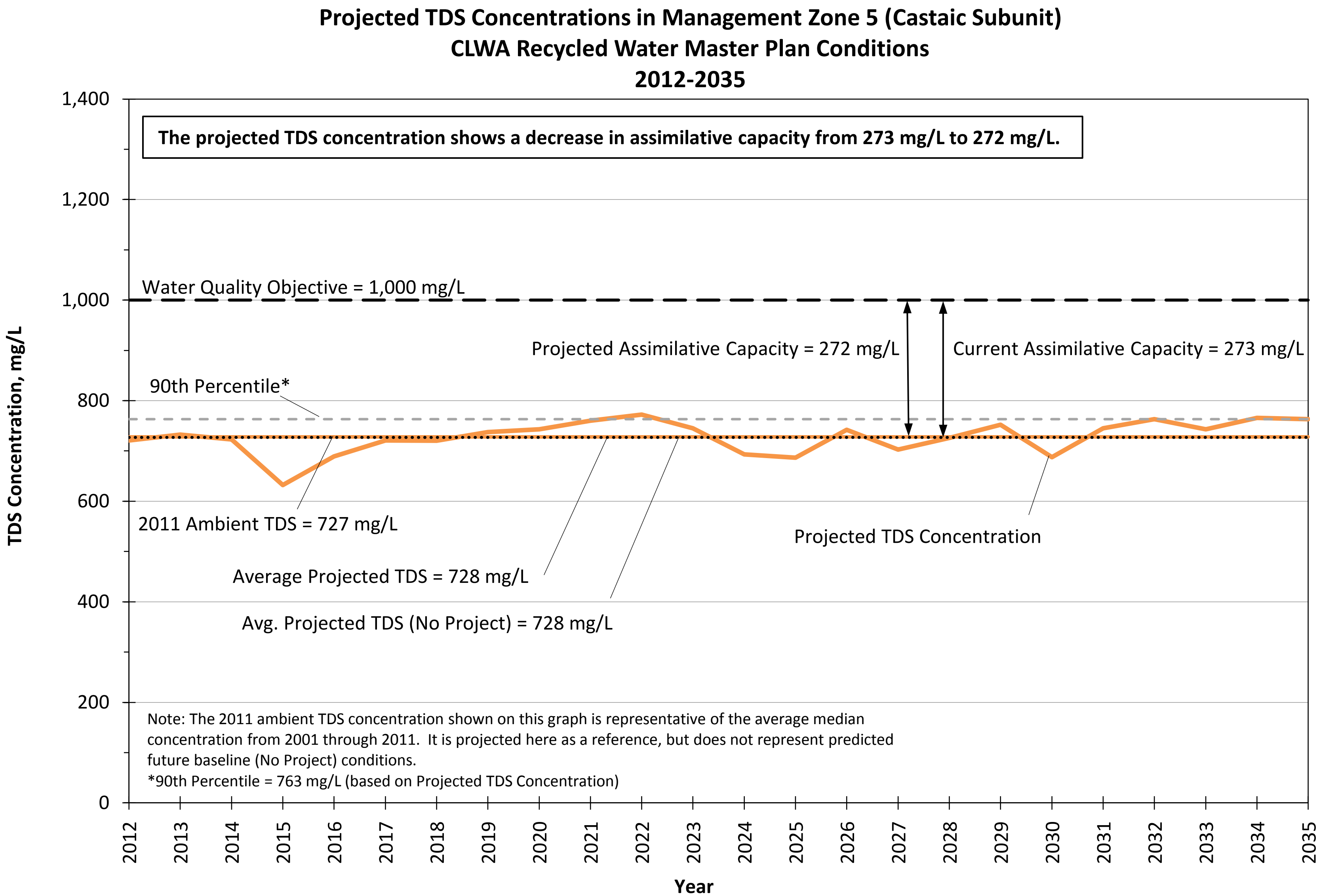
Projected TDS Concentrations in Management Zone 5 (Castaic Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035
The projected TDS concentration shows a decrease in assimilative capacity from 273 mg/L to 272 mg/L.
Water Quality Objective = 1,000 mg/L
Projected Assimilative Capacity = 272 mg/L
Current Assimilative Capacity = 273 mg/L
90th Percentile*
2011 Ambient TDS = 727 mg/L
Average Projected TDS = 728 mg/L
Avg. Projected TDS (No Project) = 728 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 763 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 30.1.f

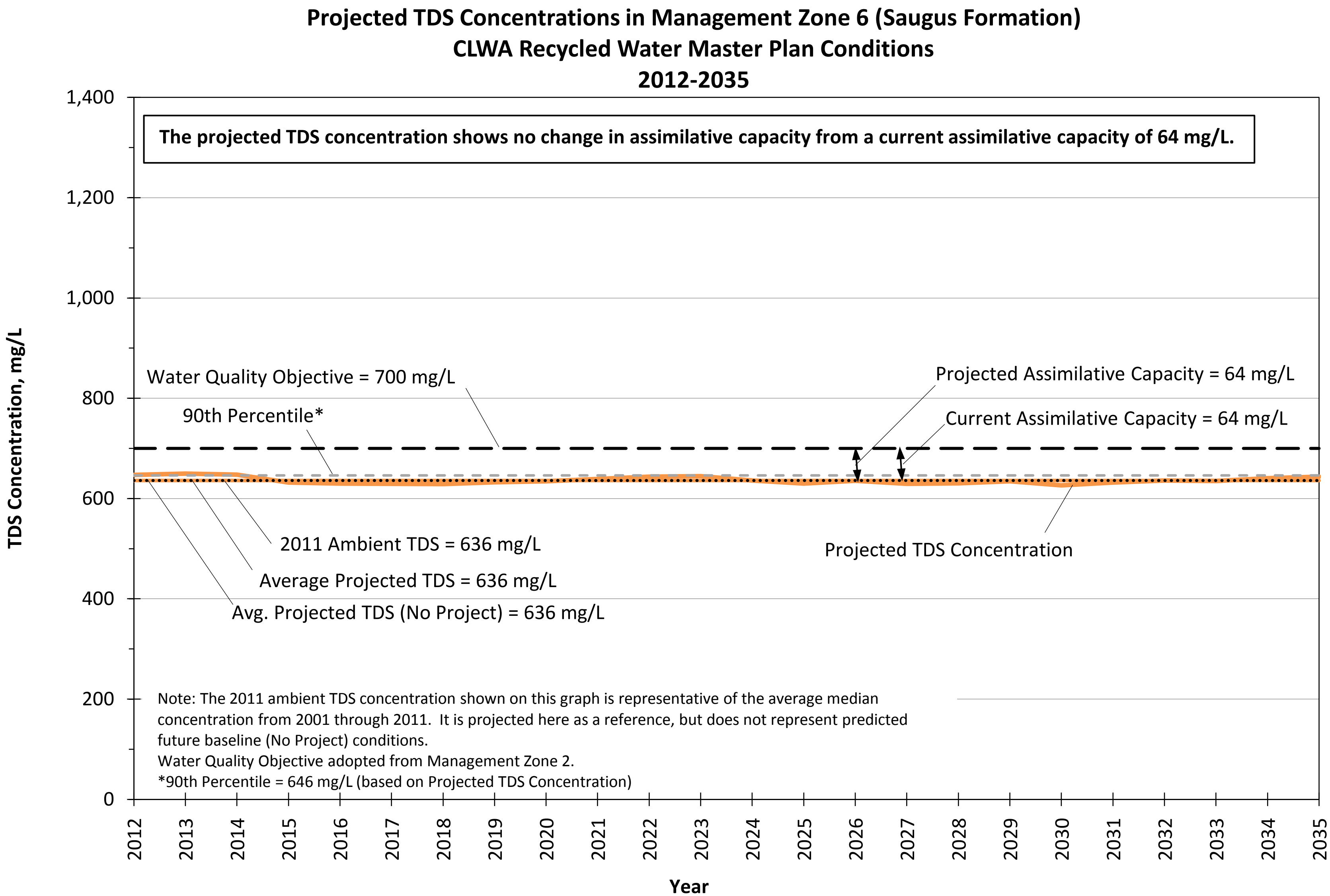
Projected TDS Concentrations in Management Zone 6 (Saugus Formation)
CLWA Recycled Water Master Plan Conditions
2012-2035
The projected TDS concentration shows no change in assimilative capacity from a current assimilative capacity of 64 mg/L.
1,400
1,200
1,000
800
600
400
200
0
TDS Concentration, mg/L
Water Quality Objective = 700 mg/L
90th Percentile*
Projected Assimilative Capacity = 64 mg/L
Current Assimilative Capacity = 64 mg/L
2011 Ambient TDS = 636 mg/L
Average Projected TDS = 636 mg/L
Avg. Projected TDS (No Project) = 636 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Water Quality Objective adopted from Management Zone 2.
*90th Percentile = 646 mg/L (based on Projected TDS Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 30.1.g

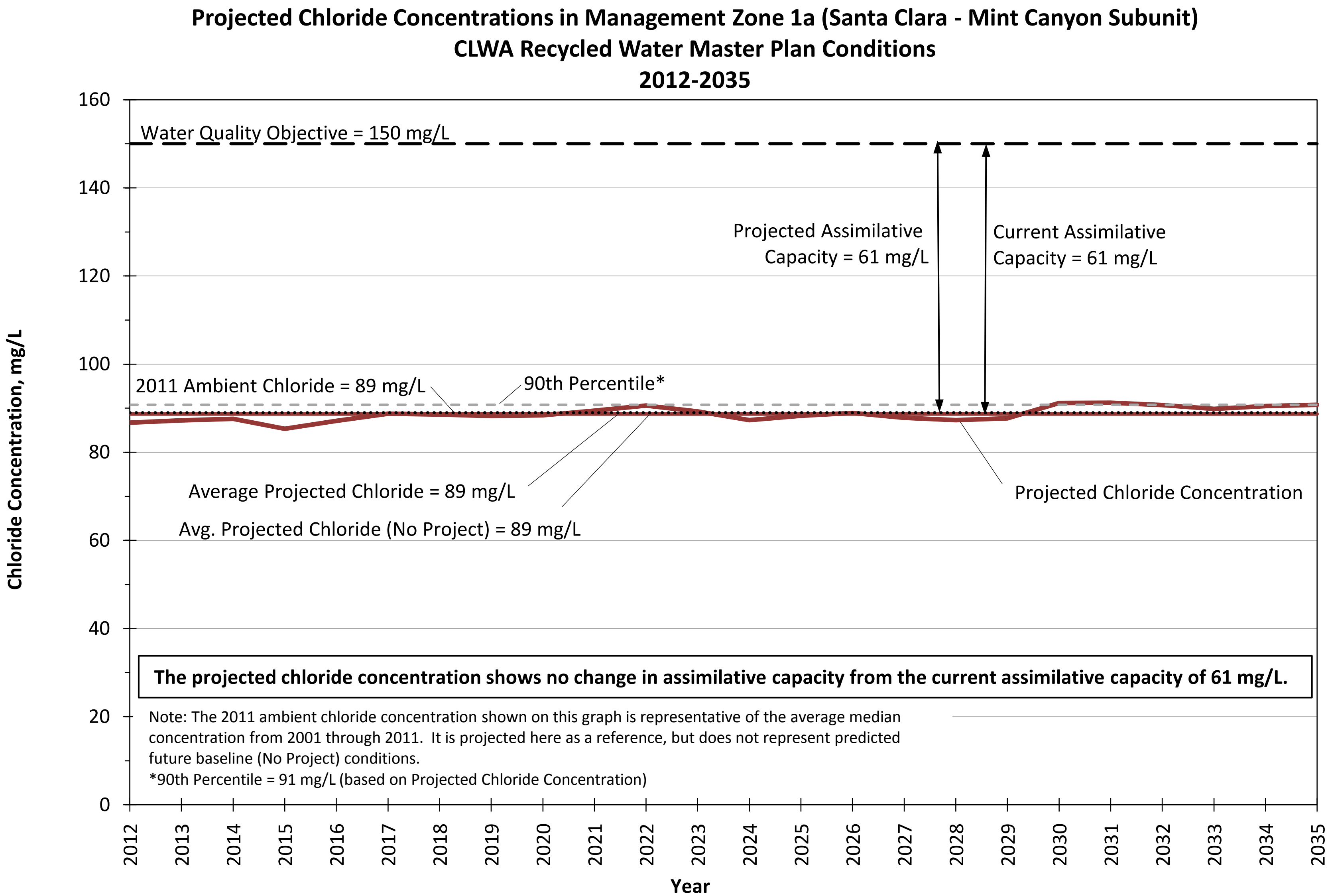
Projected Chloride Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035
Water Quality Objective = 150 mg/L
Projected Assimilative Capacity = 61 mg/L
Current Assimilative Capacity = 61 mg/L
2011 Ambient Chloride = 89 mg/L
90th Percentile*
Average Projected Chloride = 89 mg/L
Avg. Projected Chloride (No Project) = 89 mg/L
Projected Chloride Concentration
The projected chloride concentration shows no change in assimilative capacity from the current assimilative capacity of 61 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 91 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 30.2.a

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

Projected Chloride Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035

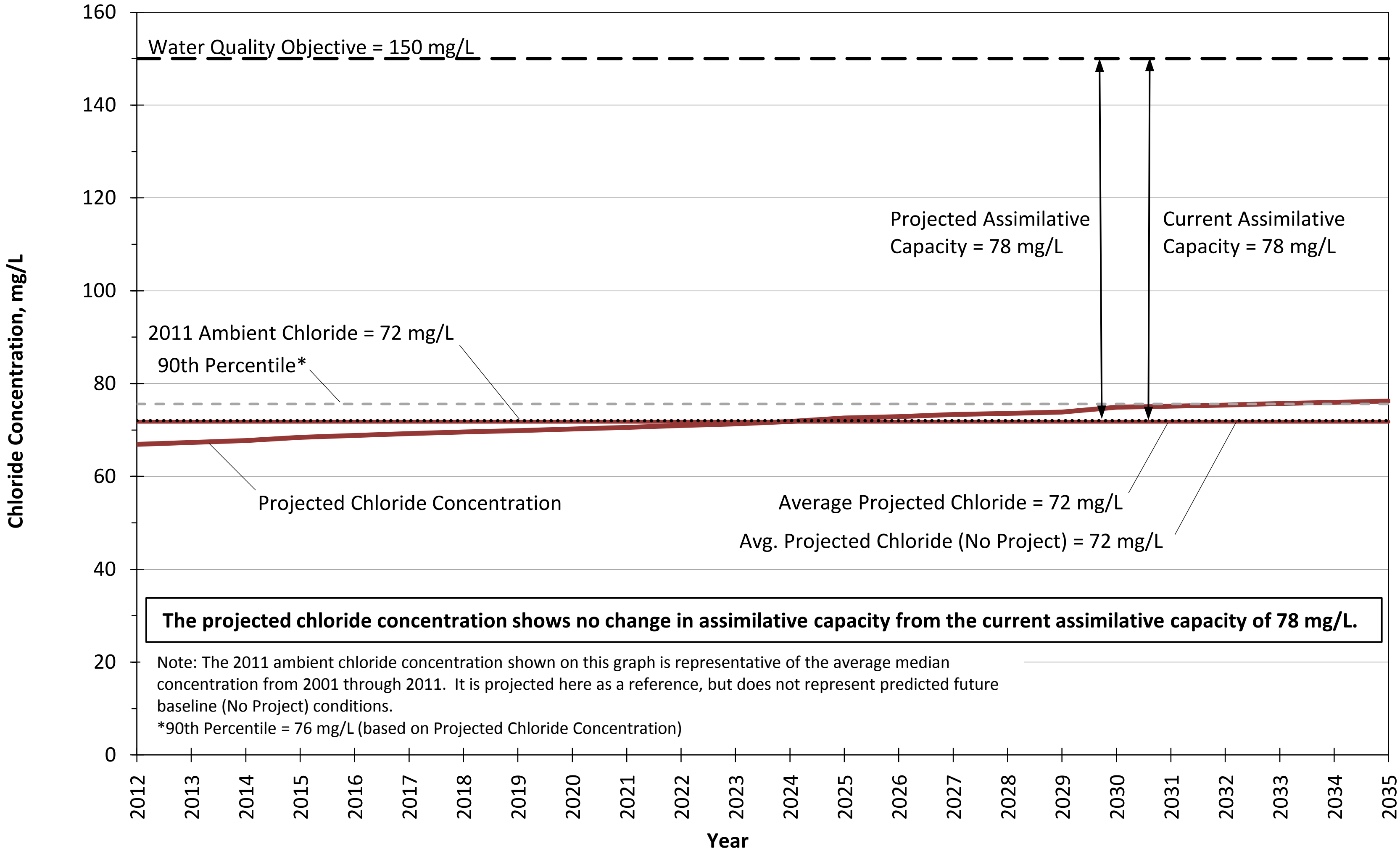

Figure 30.2.b

Projected Chloride Concentrations in Management Zone 2 (Placerita Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035

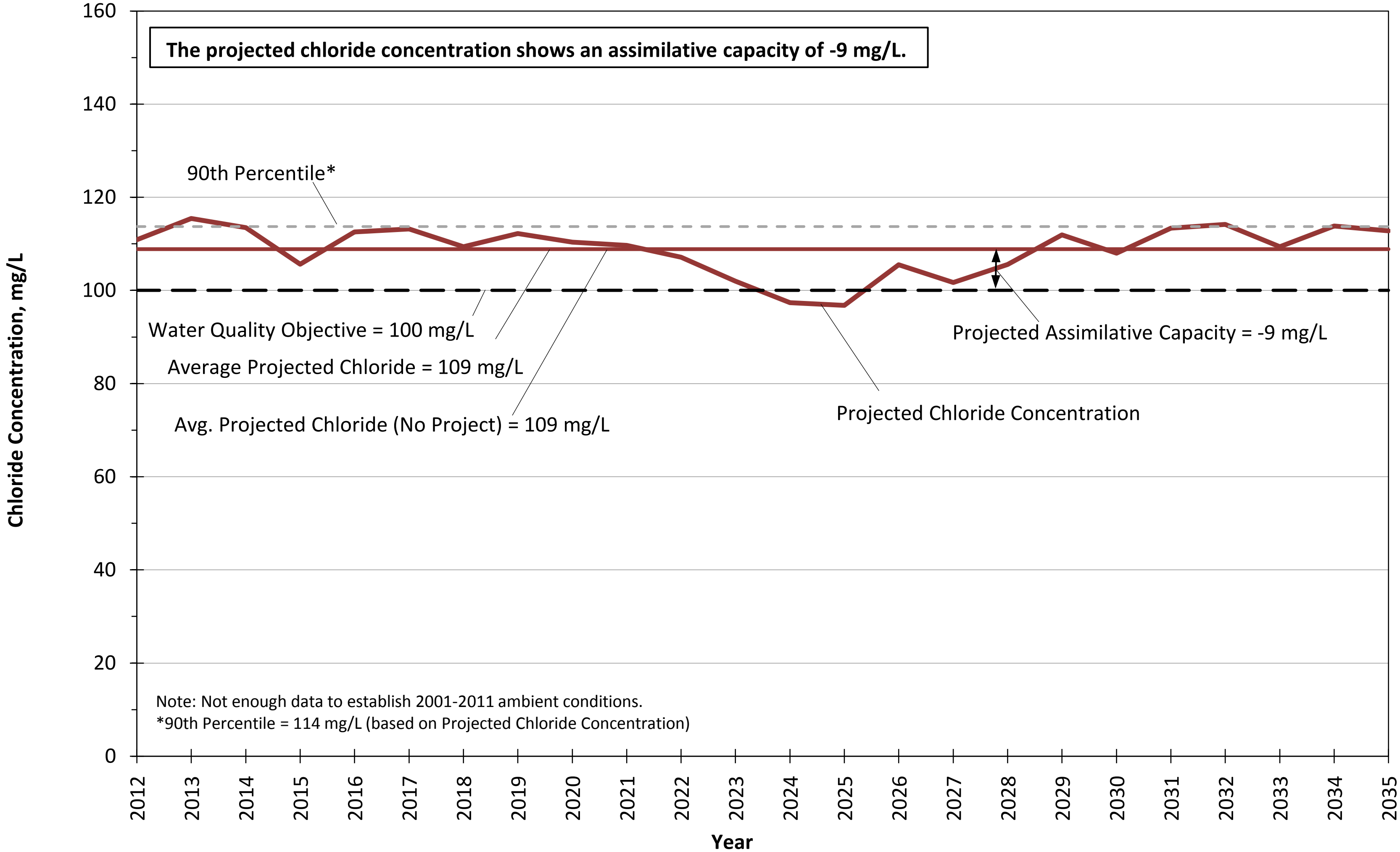

Figure 30.2.c

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

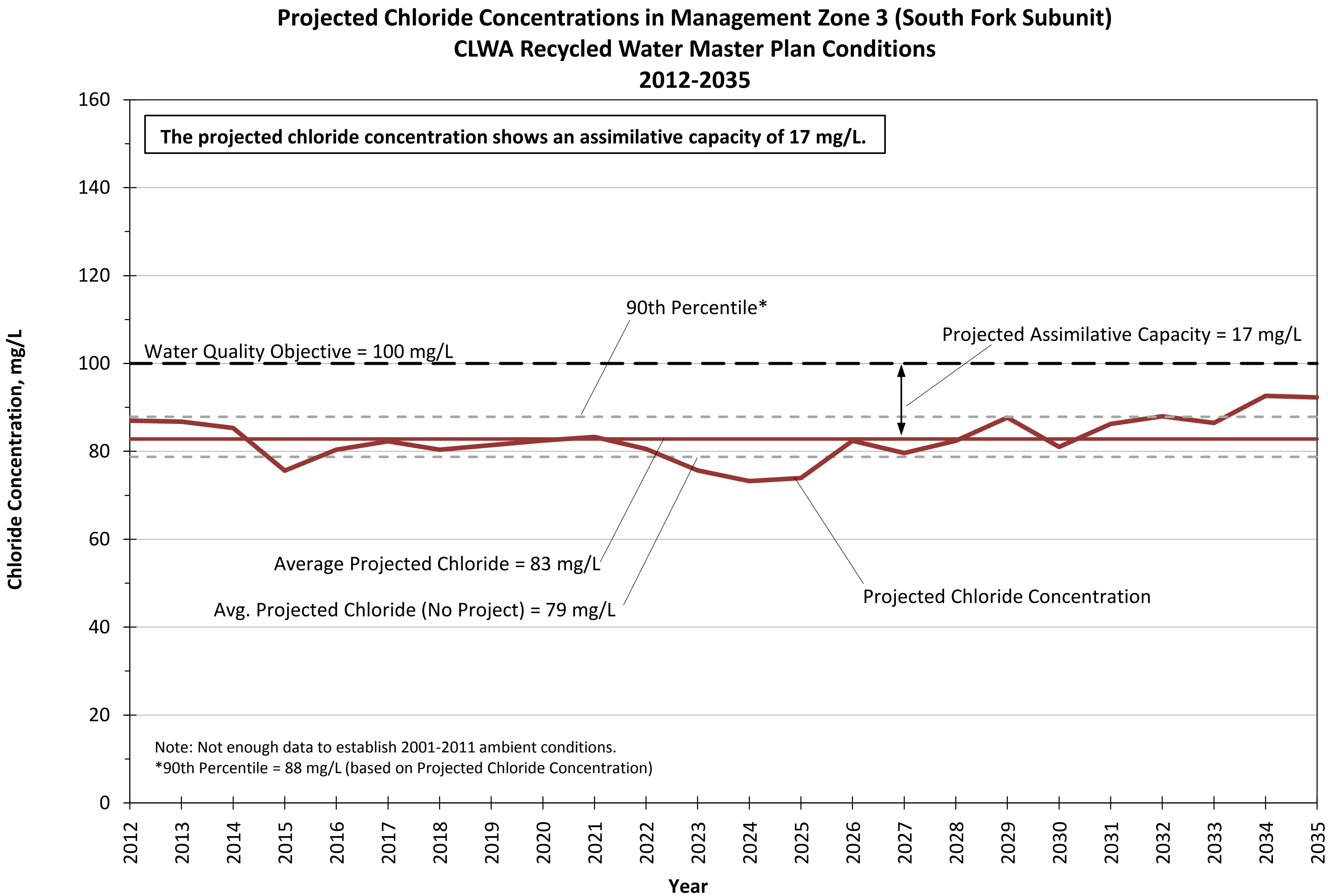

Figure 30.2.d

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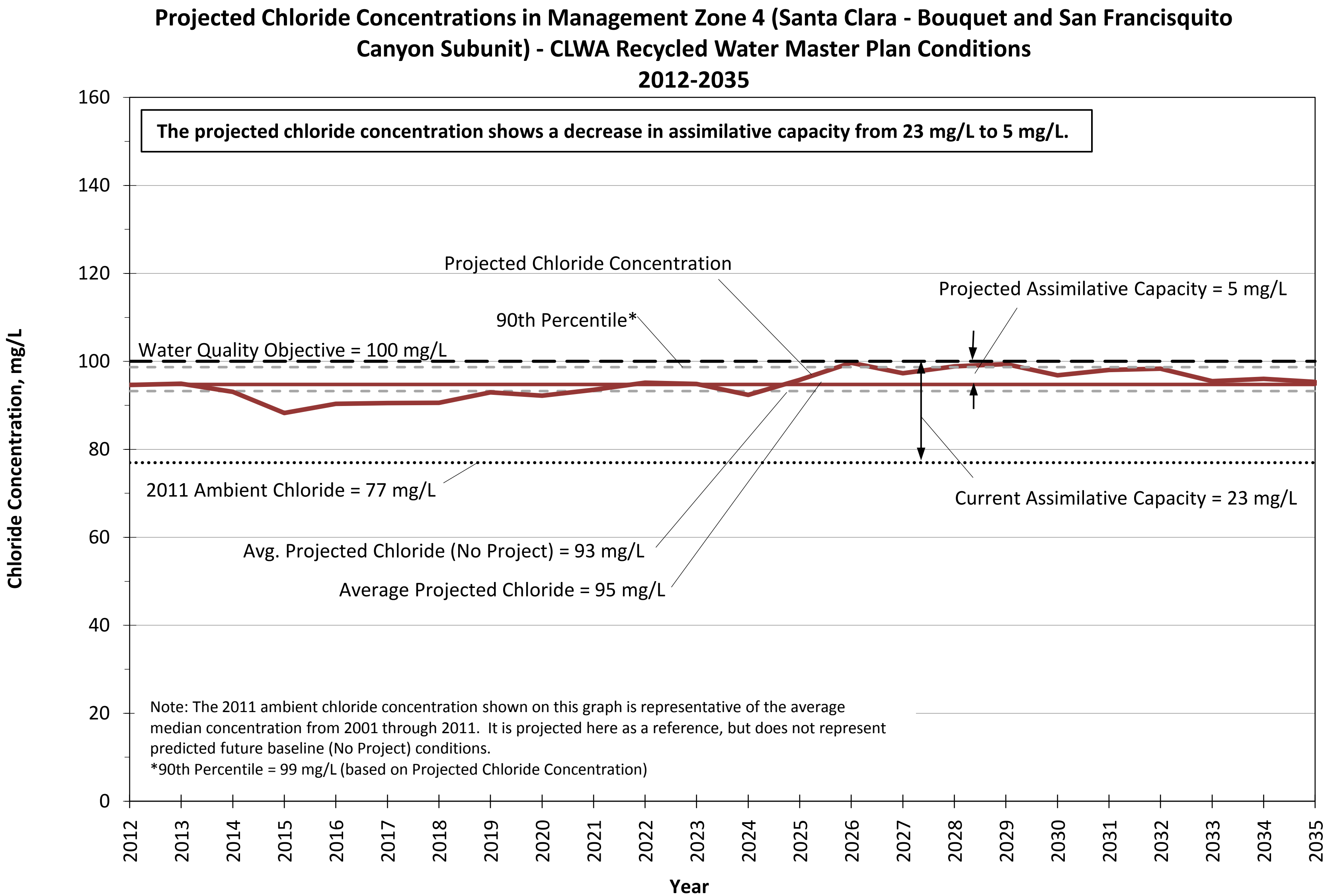

Projected Chloride Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - CLWA Recycled Water Master Plan Conditions
2012-2035
The projected chloride concentration shows a decrease in assimilative capacity from 23 mg/L to 5 mg/L.
Projected Chloride Concentration
Projected Assimilative Capacity = 5 mg/L
90th Percentile*
Water Quality Objective = 100 mg/L
2011 Ambient Chloride = 77 mg/L
Current Assimilative Capacity = 23 mg/L
Avg. Projected Chloride (No Project) = 93 mg/L
Average Projected Chloride = 95 mg/L
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 99 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 30.2.e

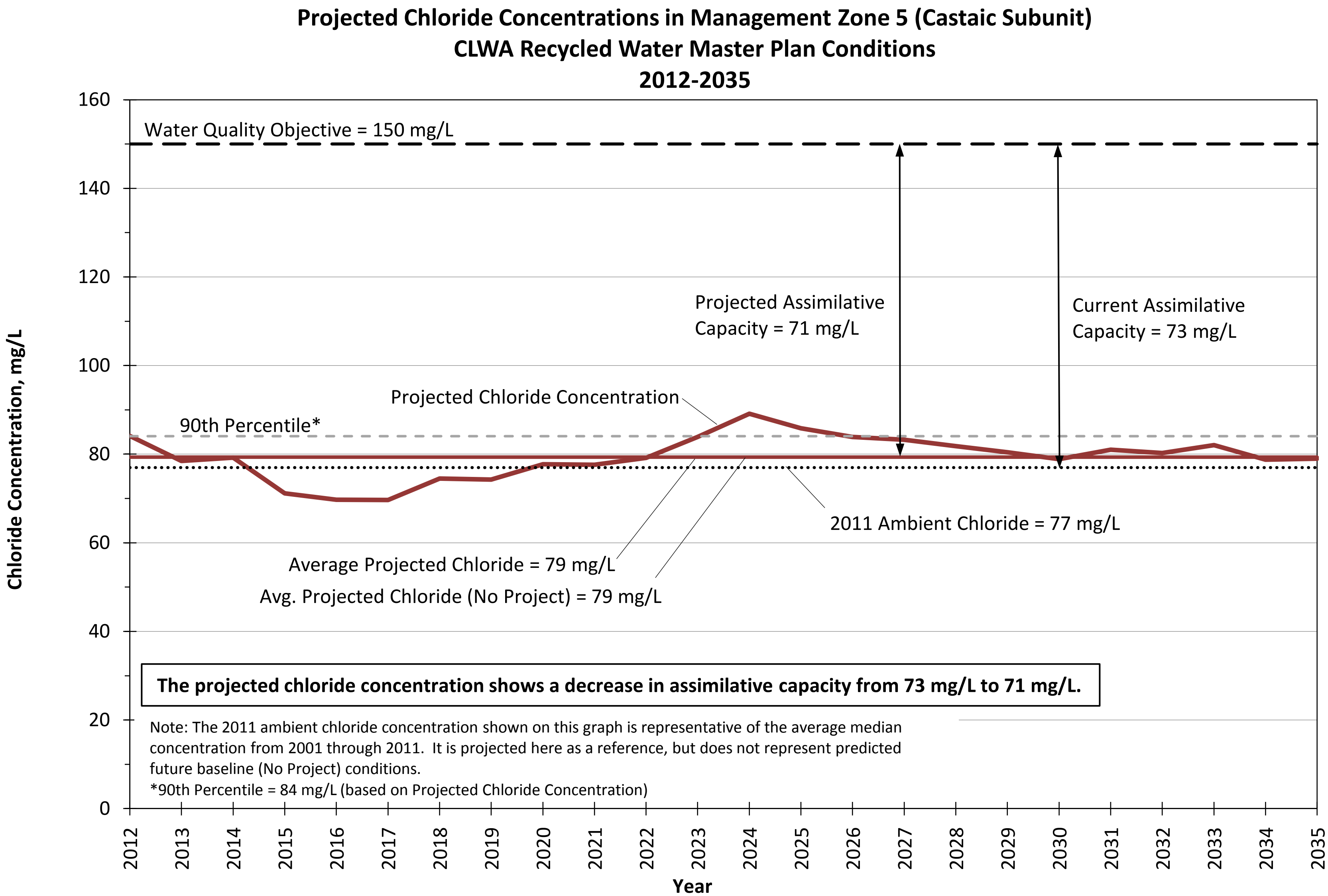

Projected Chloride Concentrations in Management Zone 5 (Castaic Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035
Water Quality Objective = 150 mg/L
Projected Assimilative Capacity = 71 mg/L
Current Assimilative Capacity = 73 mg/L
Projected Chloride Concentration
90th Percentile*
2011 Ambient Chloride = 77 mg/L
Average Projected Chloride = 79 mg/L
Avg. Projected Chloride (No Project) = 79 mg/L
The projected chloride concentration shows a decrease in assimilative capacity from 73 mg/L to 71 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 84 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
0
20
40
60
80
100
120
140
160
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 30.2.f

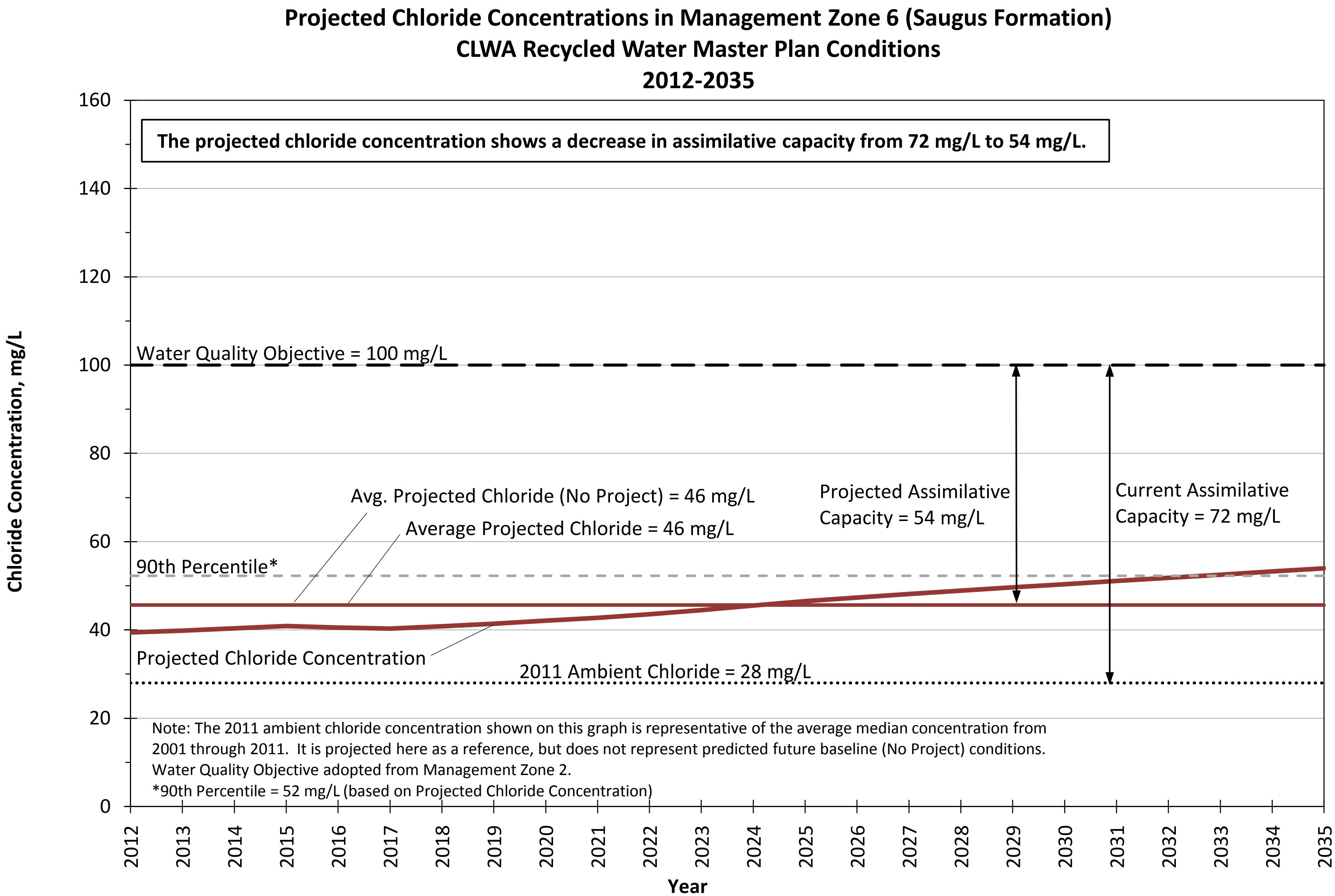

Projected Chloride Concentrations in Management Zone 6 (Saugus Formation)
CLWA Recycled Water Master Plan Conditions
2012-2035
The projected chloride concentration shows a decrease in assimilative capacity from 72 mg/L to 54 mg/L.
Chloride Concentration, mg/L
160
140
120
100
80
60
40
20
0
Water Quality Objective = 100 mg/L
Avg. Projected Chloride (No Project) = 46 mg/L
Average Projected Chloride = 46 mg/L
Projected Assimilative Capacity = 54 mg/L
Current Assimilative Capacity = 72 mg/L
90th Percentile*
Projected Chloride Concentration
2011 Ambient Chloride = 28 mg/L
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Water Quality Objective adopted from Management Zone 2.
*90th Percentile = 52 mg/L (based on Projected Chloride Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 30.2.g

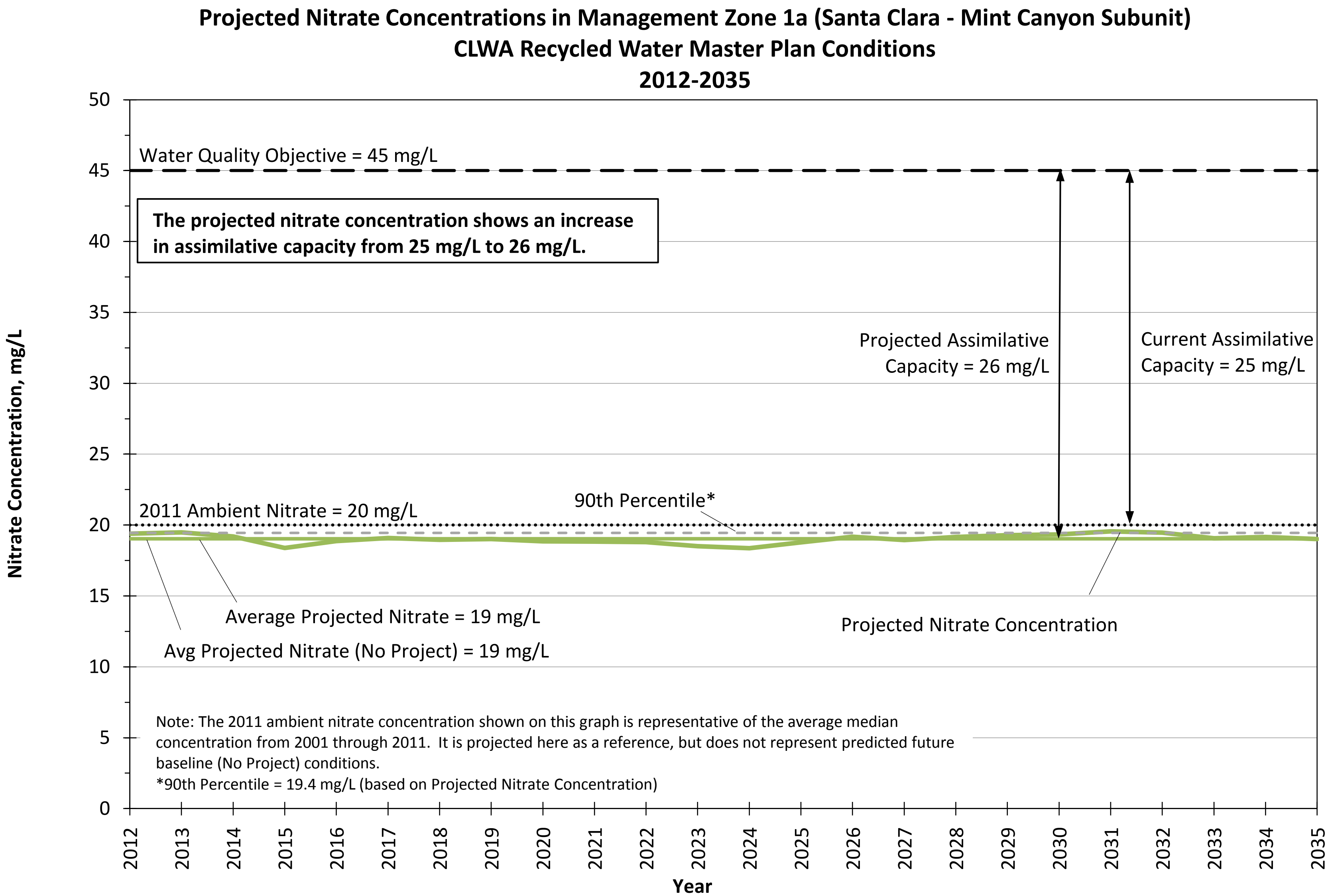

Projected Nitrate Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an increase in assimilative capacity from 25 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 25 mg/L
2011 Ambient Nitrate = 20 mg/L
90th Percentile*
Average Projected Nitrate = 19 mg/L
Avg Projected Nitrate (No Project) = 19 mg/L
Projected Nitrate Concentration
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 19.4 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 30.3.a

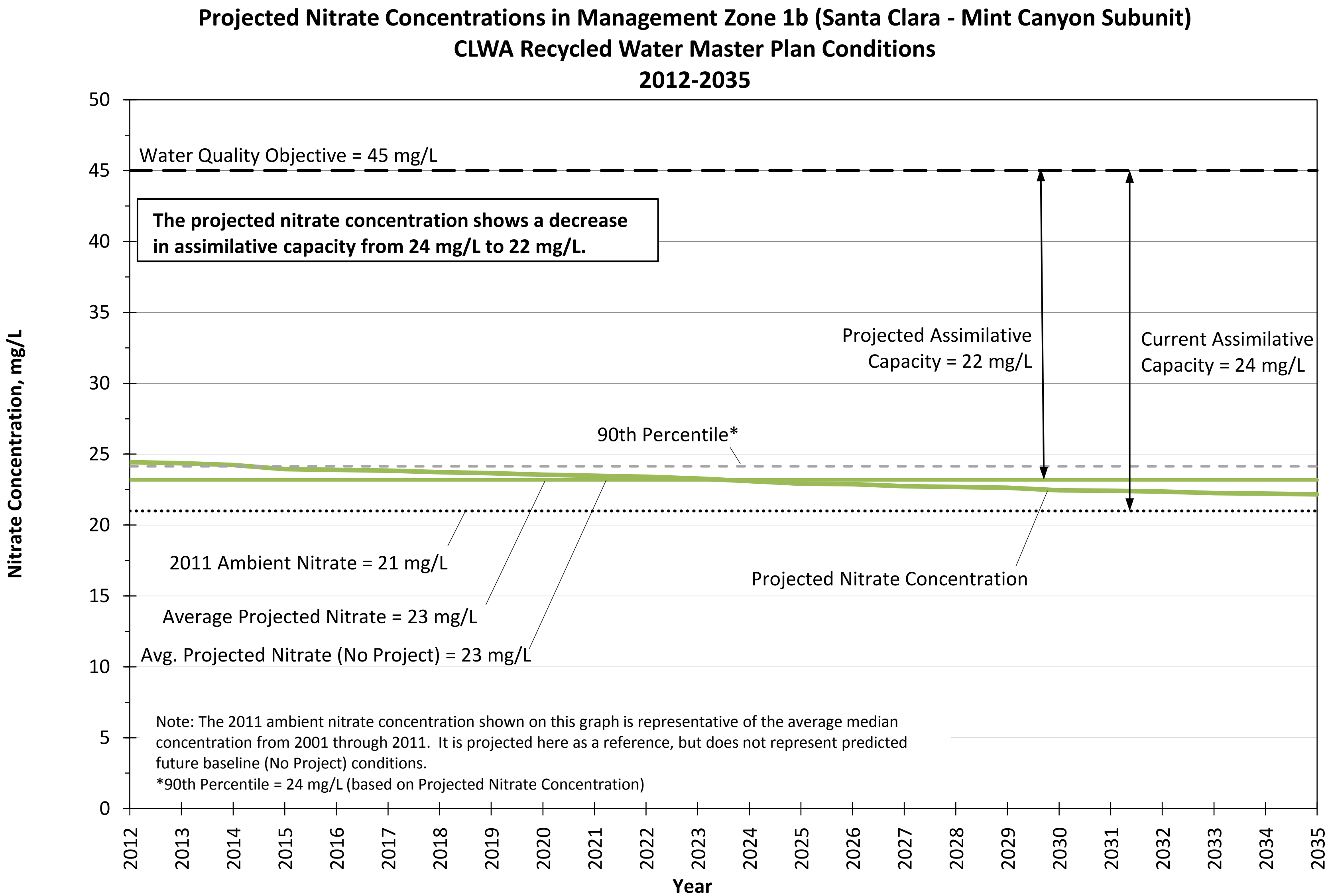

Projected Nitrate Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 24 mg/L to 22 mg/L.
Projected Assimilative Capacity = 22 mg/L
Current Assimilative Capacity = 24 mg/L
90th Percentile*
2011 Ambient Nitrate = 21 mg/L
Average Projected Nitrate = 23 mg/L
Avg. Projected Nitrate (No Project) = 23 mg/L
Projected Nitrate Concentration
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 24 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 30.3.b

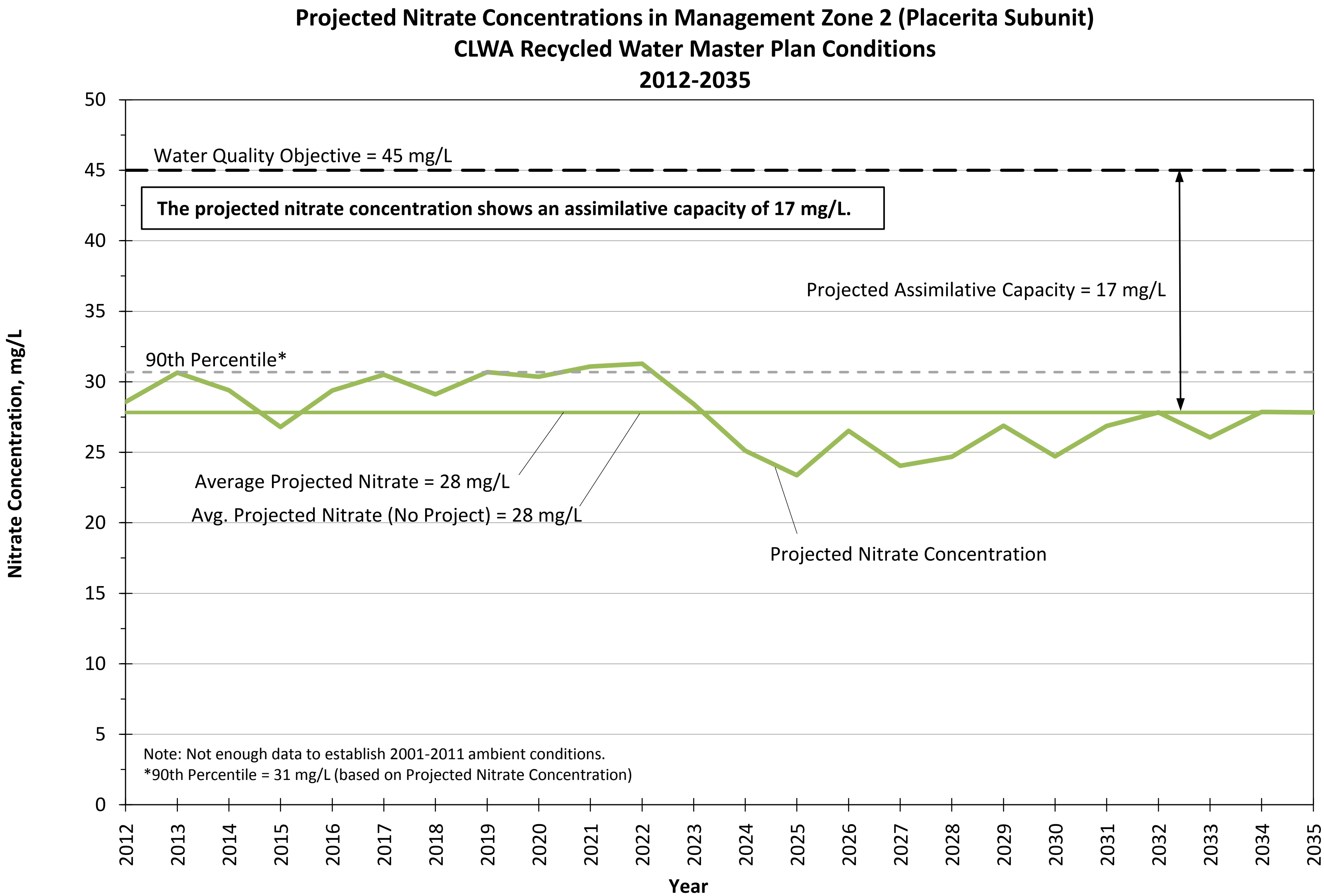

Projected Nitrate Concentrations in Management Zone 2 (Placerita Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an assimilative capacity of 17 mg/L.
Projected Assimilative Capacity = 17 mg/L
90th Percentile*
Average Projected Nitrate = 28 mg/L
Avg. Projected Nitrate (No Project) = 28 mg/L
Projected Nitrate Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 31 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 30.3.c

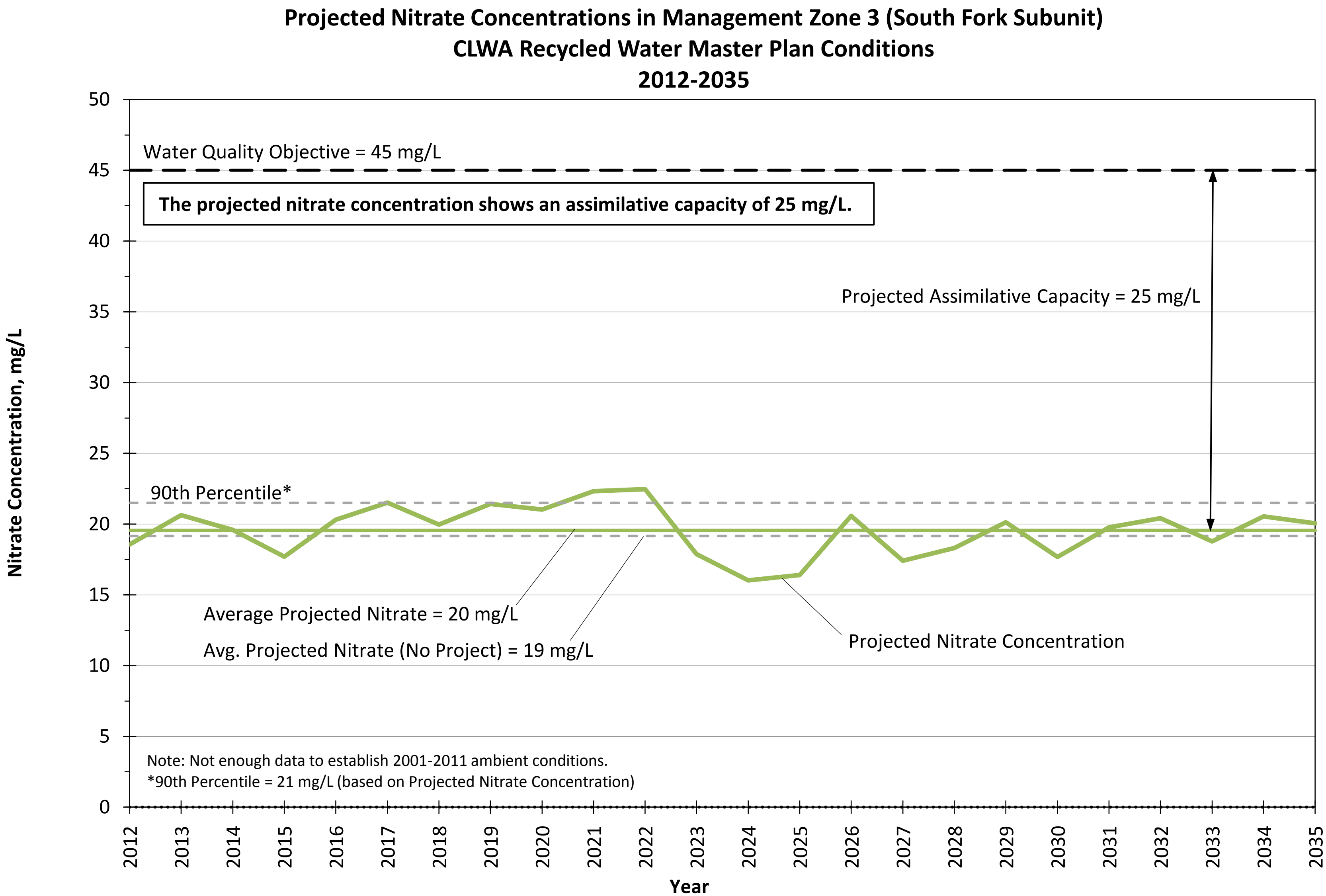
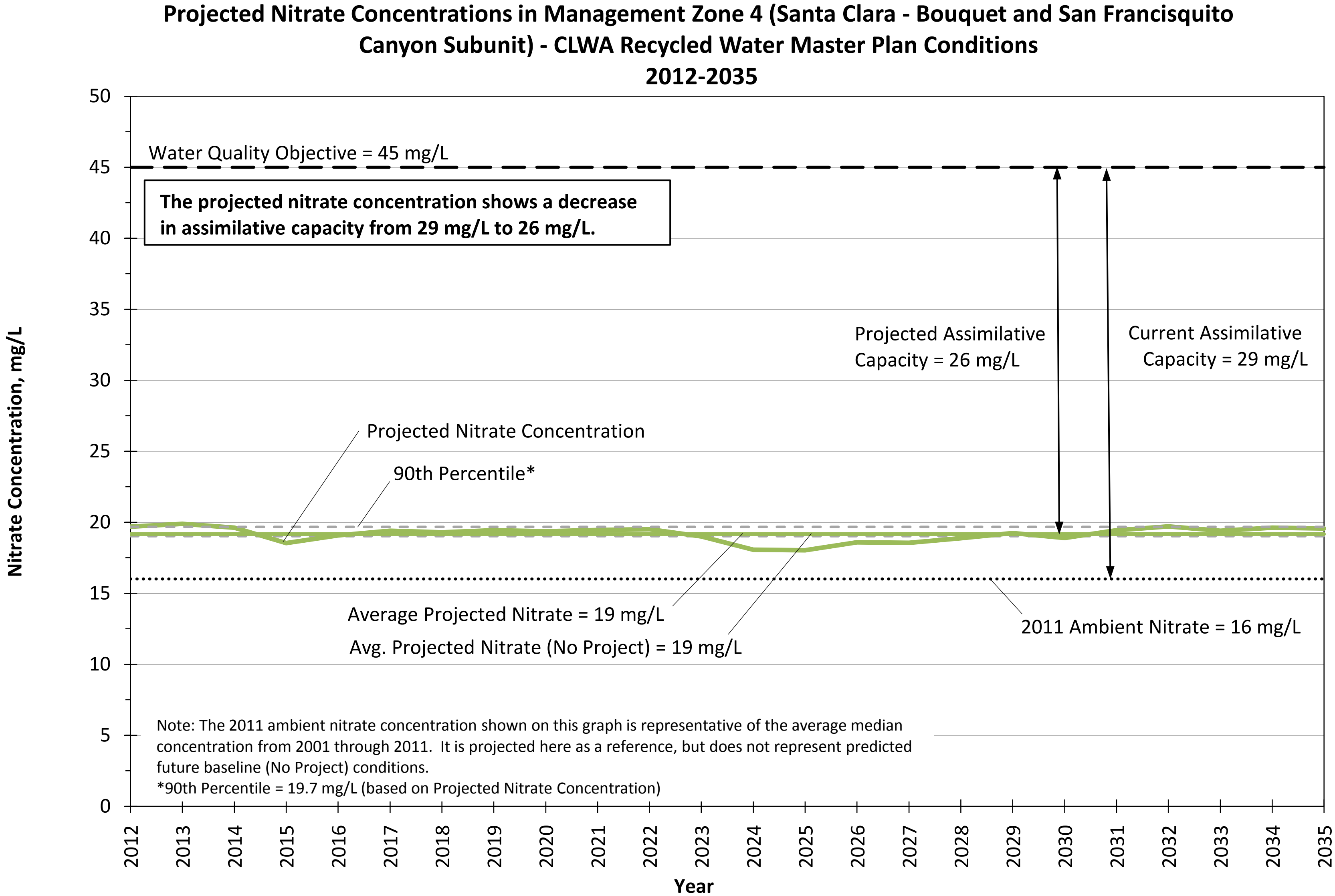

Projected Nitrate Concentrations in Management Zone 3 (South Fork Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an assimilative capacity of 25 mg/L.
Projected Assimilative Capacity = 25 mg/L
90th Percentile*
Average Projected Nitrate = 20 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Projected Nitrate Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 21 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 30.3.d


Projected Nitrate Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - CLWA Recycled Water Master Plan Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 29 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 29 mg/L
Projected Nitrate Concentration
90th Percentile*
Average Projected Nitrate = 19 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
2011 Ambient Nitrate = 16 mg/L
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 19.7 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
0
5
10
15
20
25
30
35
40
45
50
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
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2026
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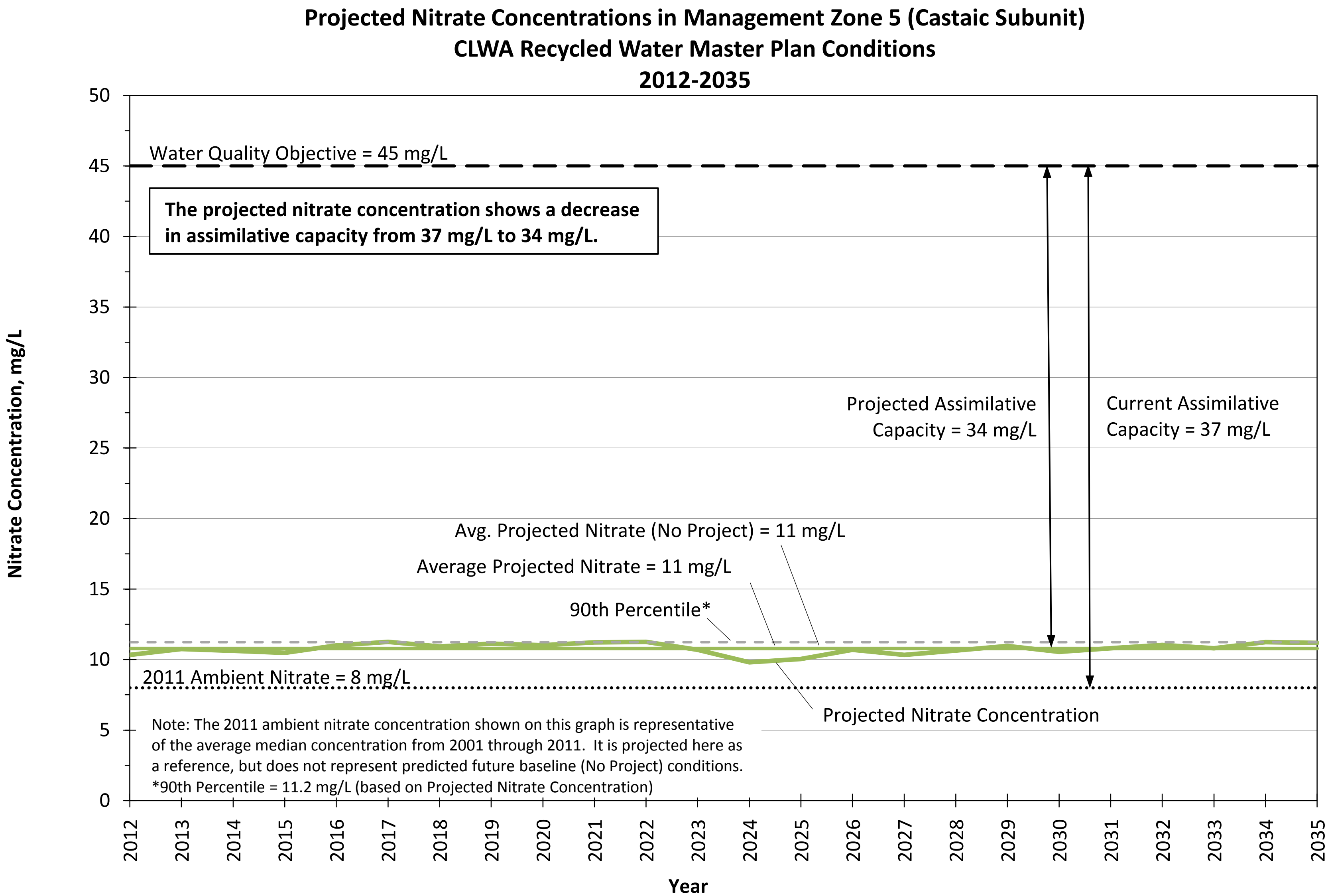
2028
2029
2030
2031
2032
2033
2034
2035

Figure 30.3.e


Projected Nitrate Concentrations in Management Zone 5 (Castaic Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 37 mg/L to 34 mg/L.
Projected Assimilative Capacity = 34 mg/L
Current Assimilative Capacity = 37 mg/L
Avg. Projected Nitrate (No Project) = 11 mg/L
Average Projected Nitrate = 11 mg/L
90th Percentile*
2011 Ambient Nitrate = 8 mg/L
Projected Nitrate Concentration
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 11.2 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
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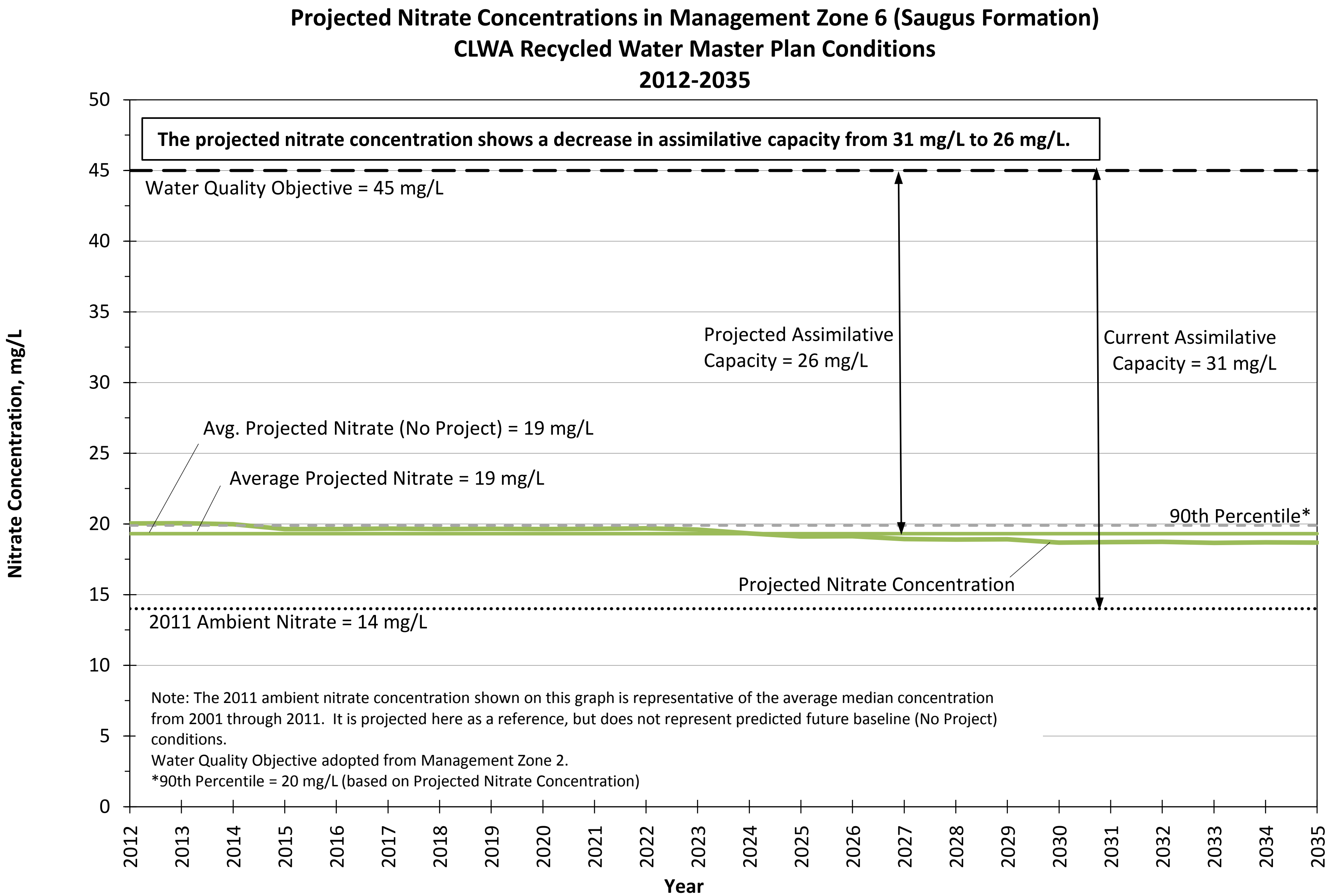
2035

Figure 30.3.f


Projected Nitrate Concentrations in Management Zone 6 (Saugus Formation)
CLWA Recycled Water Master Plan Conditions
2012-2035
The projected nitrate concentration shows a decrease in assimilative capacity from 31 mg/L to 26 mg/L.
Water Quality Objective = 45 mg/L
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 31 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Average Projected Nitrate = 19 mg/L
90th Percentile*
Projected Nitrate Concentration
2011 Ambient Nitrate = 14 mg/L
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Water Quality Objective adopted from Management Zone 2.
*90th Percentile = 20 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
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2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 30.3.g

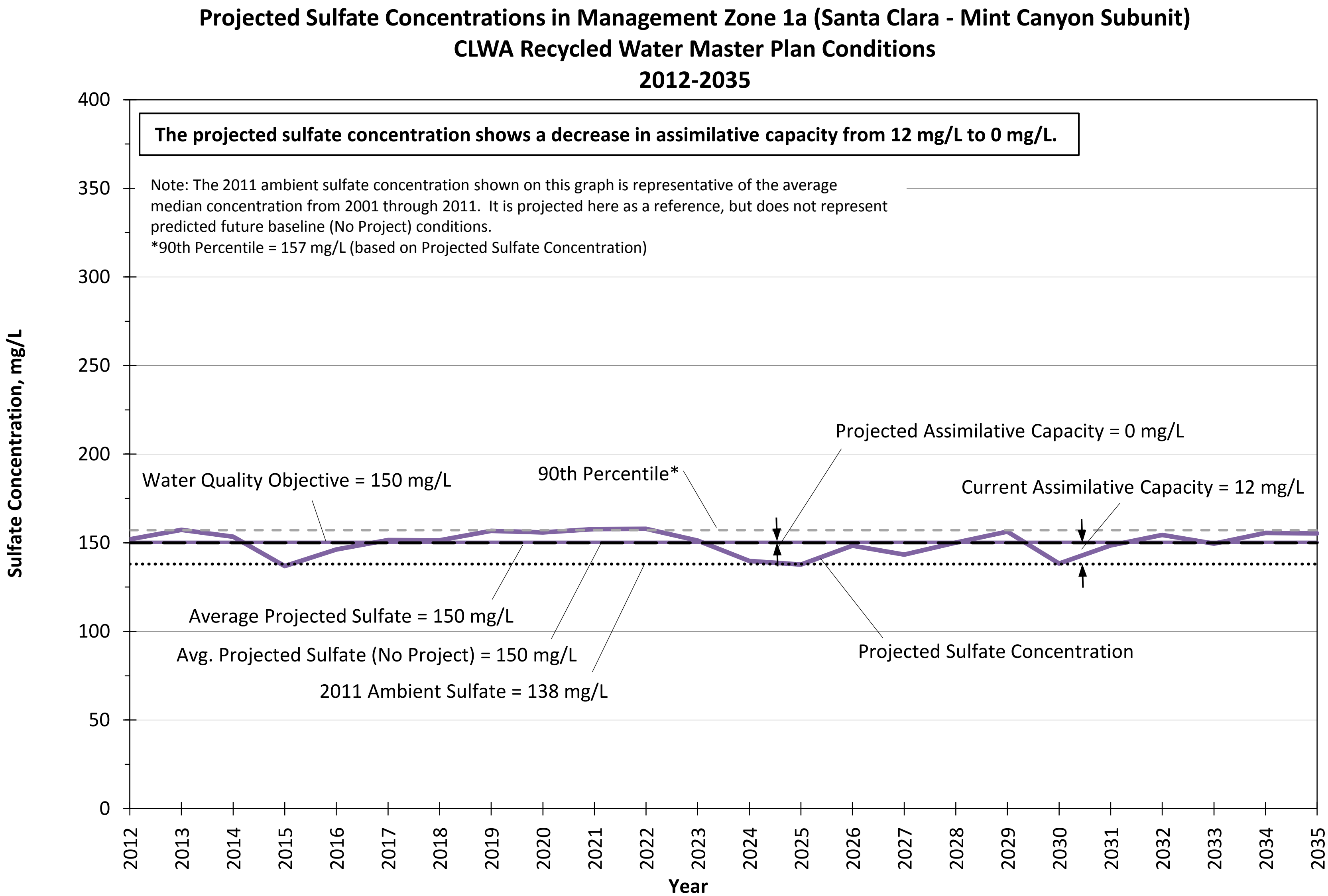
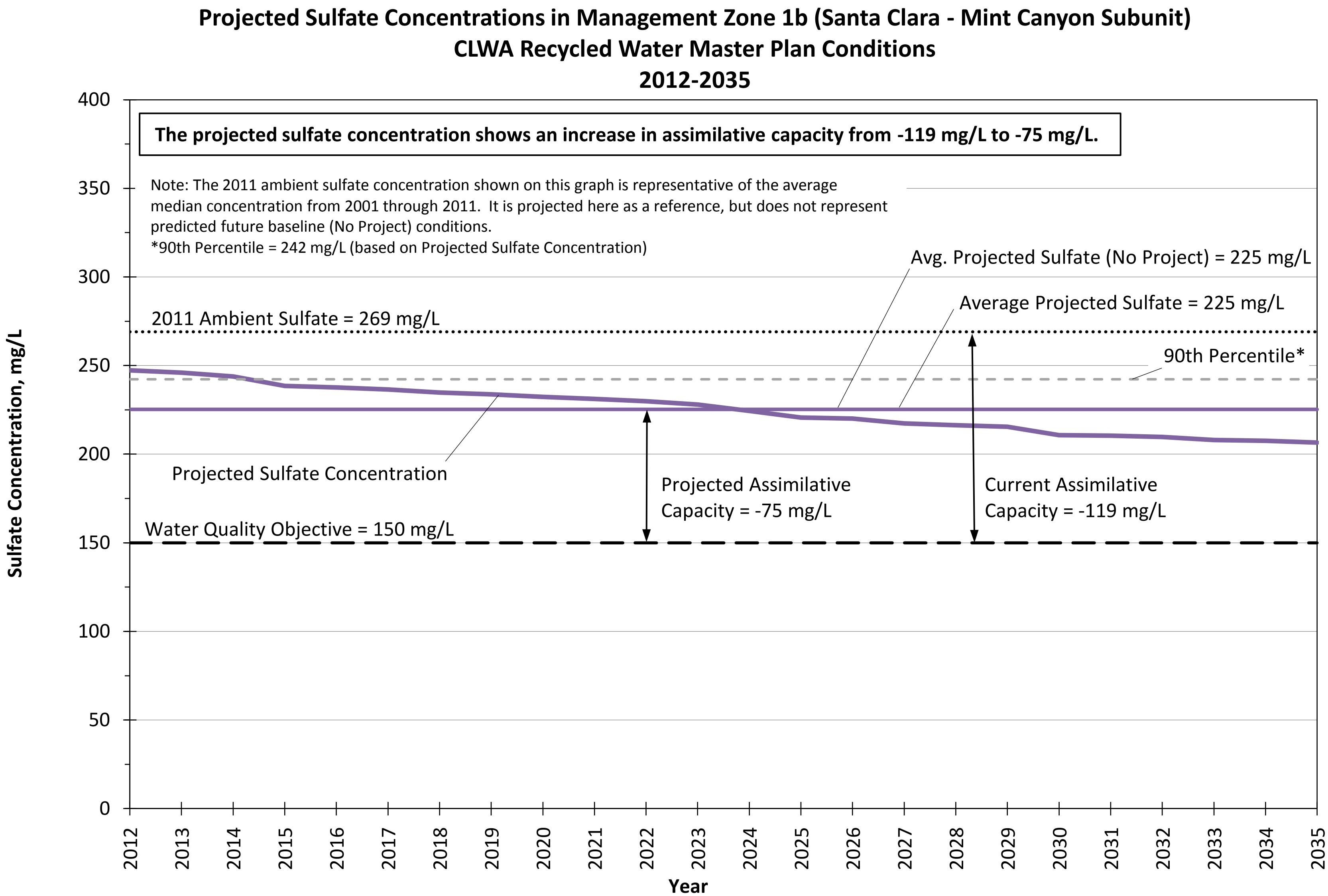

Projected Sulfate Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035
The projected sulfate concentration shows a decrease in assimilative capacity from 12 mg/L to 0 mg/L.
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 157 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
Year
Water Quality Objective = 150 mg/L
90th Percentile*
Projected Assimilative Capacity = 0 mg/L
Current Assimilative Capacity = 12 mg/L
Average Projected Sulfate = 150 mg/L
Avg. Projected Sulfate (No Project) = 150 mg/L
2011 Ambient Sulfate = 138 mg/L
Projected Sulfate Concentration
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 30.4.a


Projected Sulfate Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035
The projected sulfate concentration shows an increase in assimilative capacity from -119 mg/L to -75 mg/L.
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 242 mg/L (based on Projected Sulfate Concentration)
Avg. Projected Sulfate (No Project) = 225 mg/L
Average Projected Sulfate = 225 mg/L
2011 Ambient Sulfate = 269 mg/L
90th Percentile*
Projected Sulfate Concentration
Projected Assimilative Capacity = -75 mg/L
Current Assimilative Capacity = -119 mg/L
Water Quality Objective = 150 mg/L
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
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2032
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2034
2035

Figure 30.4.b

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

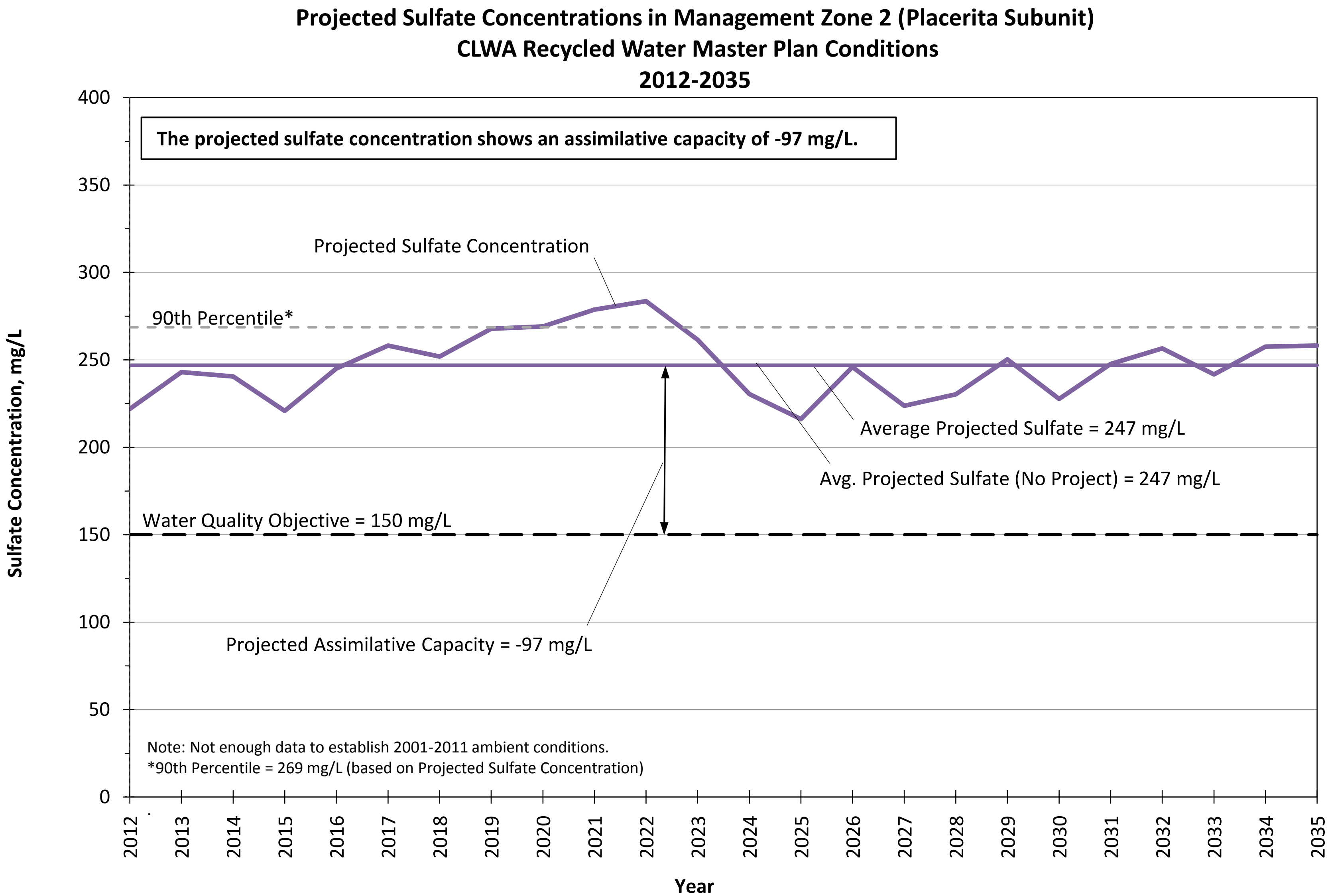

Figure 30.4.c

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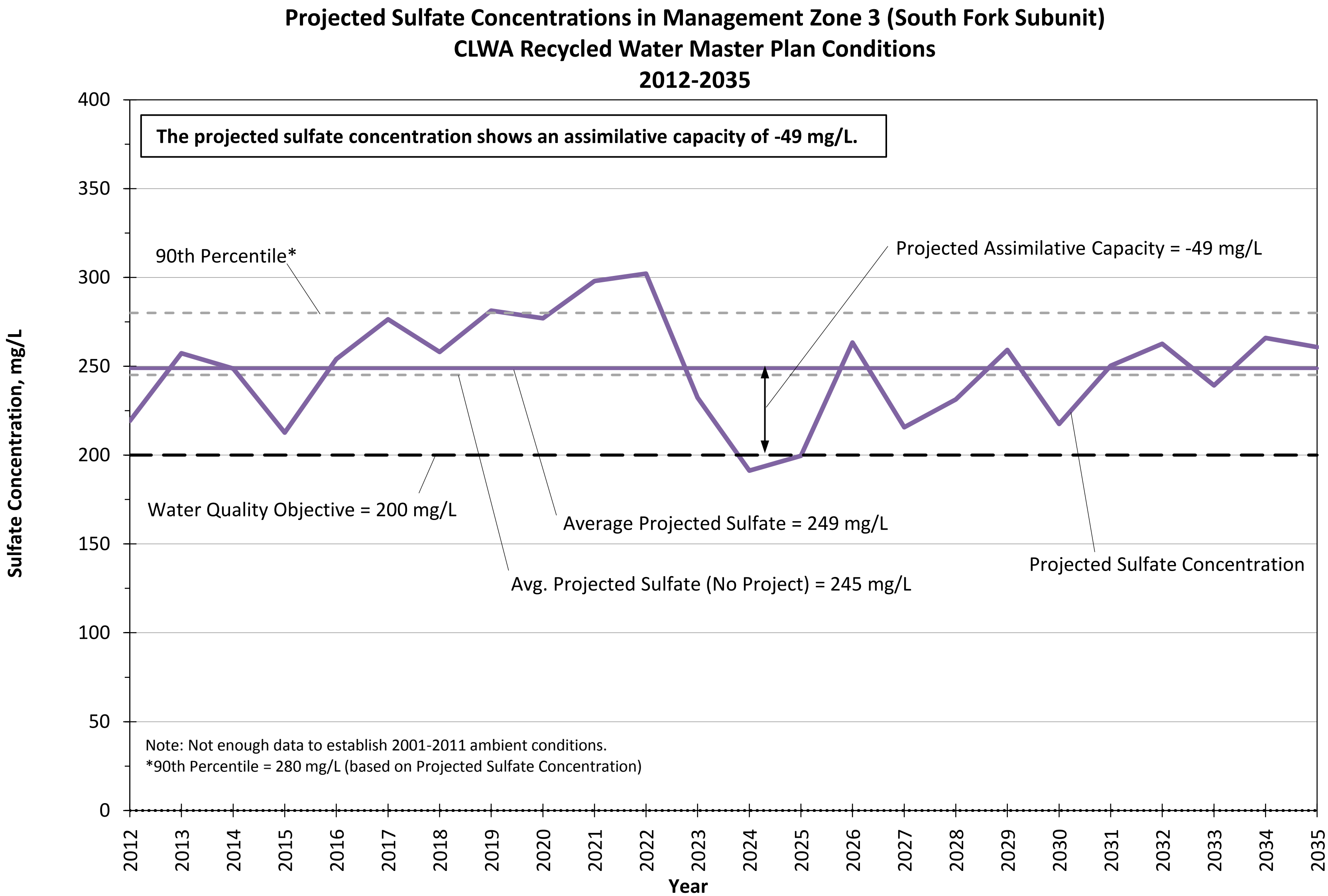

Projected Sulfate Concentrations in Management Zone 3 (South Fork Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035
The projected sulfate concentration shows an assimilative capacity of -49 mg/L.
90th Percentile*
Projected Assimilative Capacity = -49 mg/L
Water Quality Objective = 200 mg/L
Average Projected Sulfate = 249 mg/L
Avg. Projected Sulfate (No Project) = 245 mg/L
Projected Sulfate Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 280 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 30.4.d

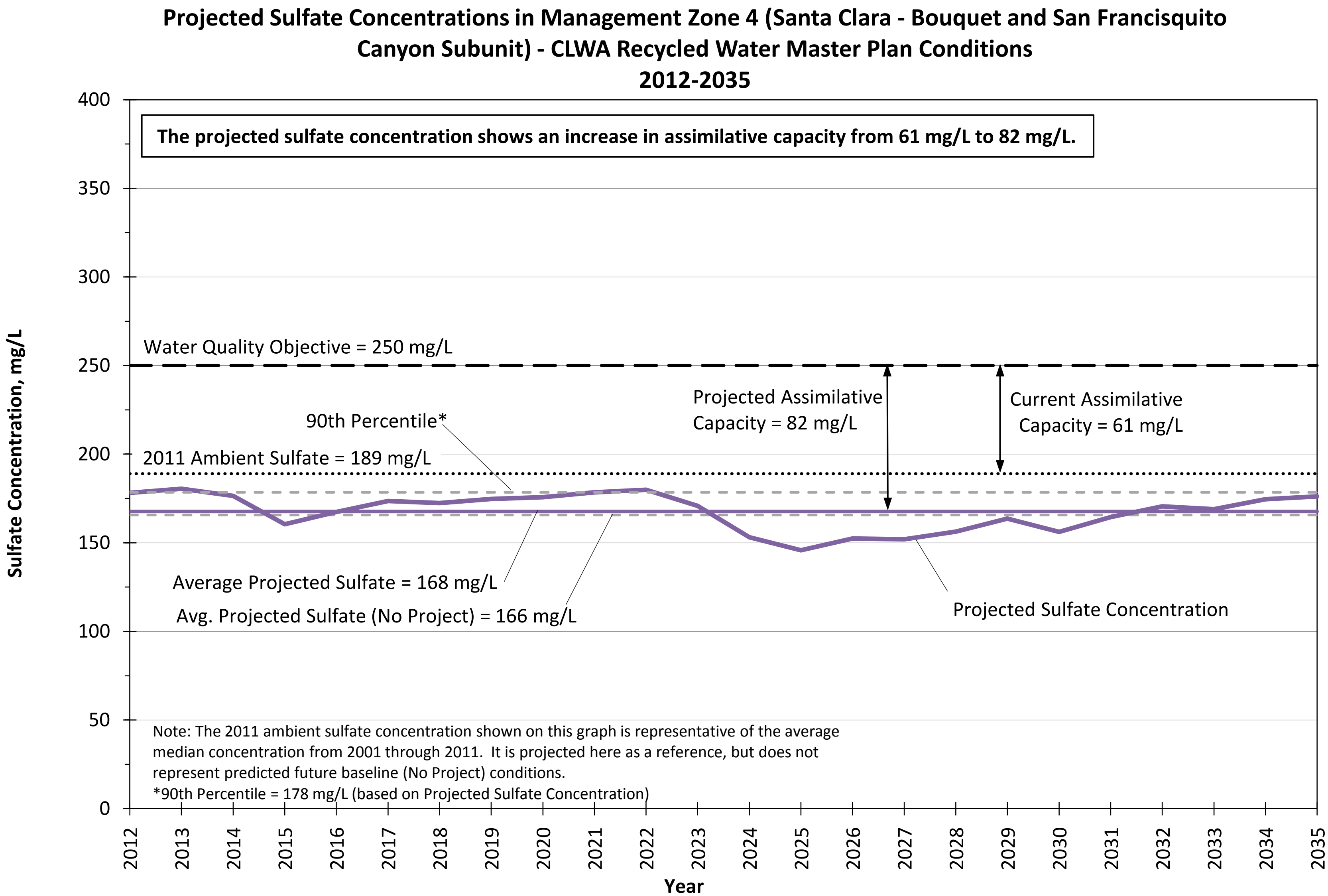

Projected Sulfate Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - CLWA Recycled Water Master Plan Conditions
2012-2035
The projected sulfate concentration shows an increase in assimilative capacity from 61 mg/L to 82 mg/L.
Water Quality Objective = 250 mg/L
Projected Assimilative Capacity = 82 mg/L
Current Assimilative Capacity = 61 mg/L
90th Percentile*
2011 Ambient Sulfate = 189 mg/L
Average Projected Sulfate = 168 mg/L
Avg. Projected Sulfate (No Project) = 166 mg/L
Projected Sulfate Concentration
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 178 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
0
50
100
150
200
250
300
350
400
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 30.4.e

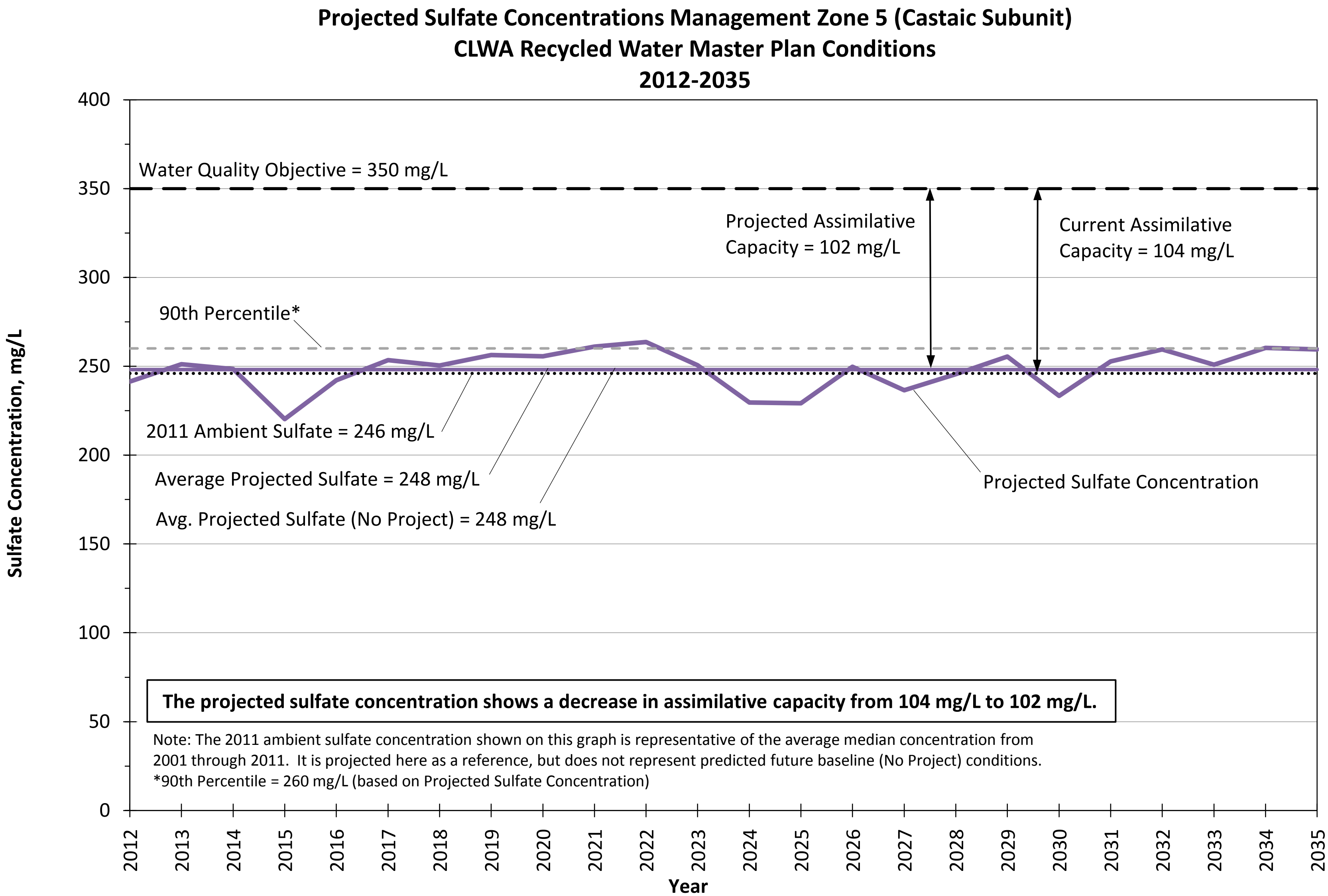

Projected Sulfate Concentrations Management Zone 5 (Castaic Subunit)
CLWA Recycled Water Master Plan Conditions
2012-2035
Sulfate Concentration, mg/L
Year
Water Quality Objective = 350 mg/L
Projected Assimilative Capacity = 102 mg/L
Current Assimilative Capacity = 104 mg/L
90th Percentile*
2011 Ambient Sulfate = 246 mg/L
Average Projected Sulfate = 248 mg/L
Avg. Projected Sulfate (No Project) = 248 mg/L
Projected Sulfate Concentration
The projected sulfate concentration shows a decrease in assimilative capacity from 104 mg/L to 102 mg/L.
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 260 mg/L (based on Projected Sulfate Concentration)
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 30.4.f

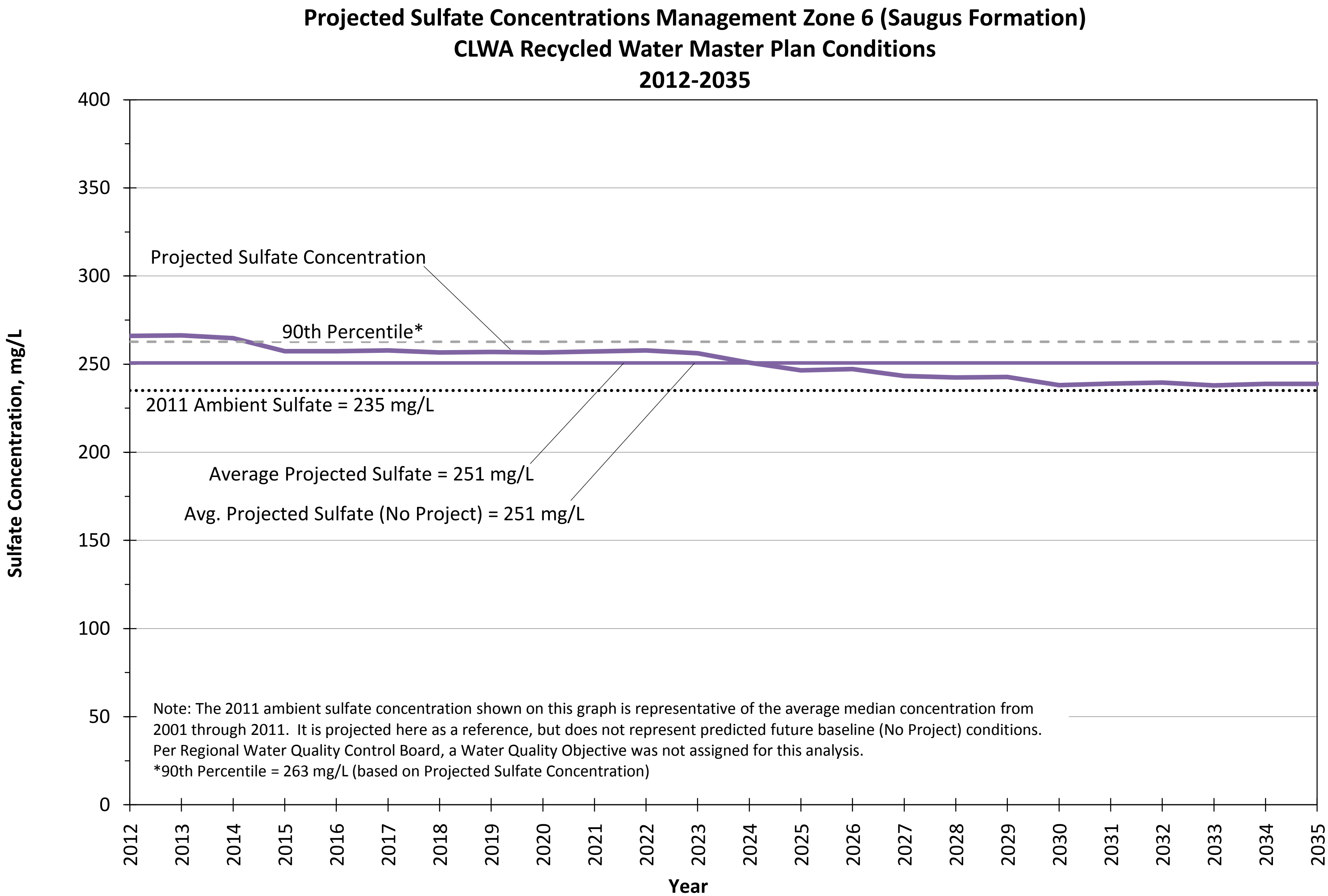
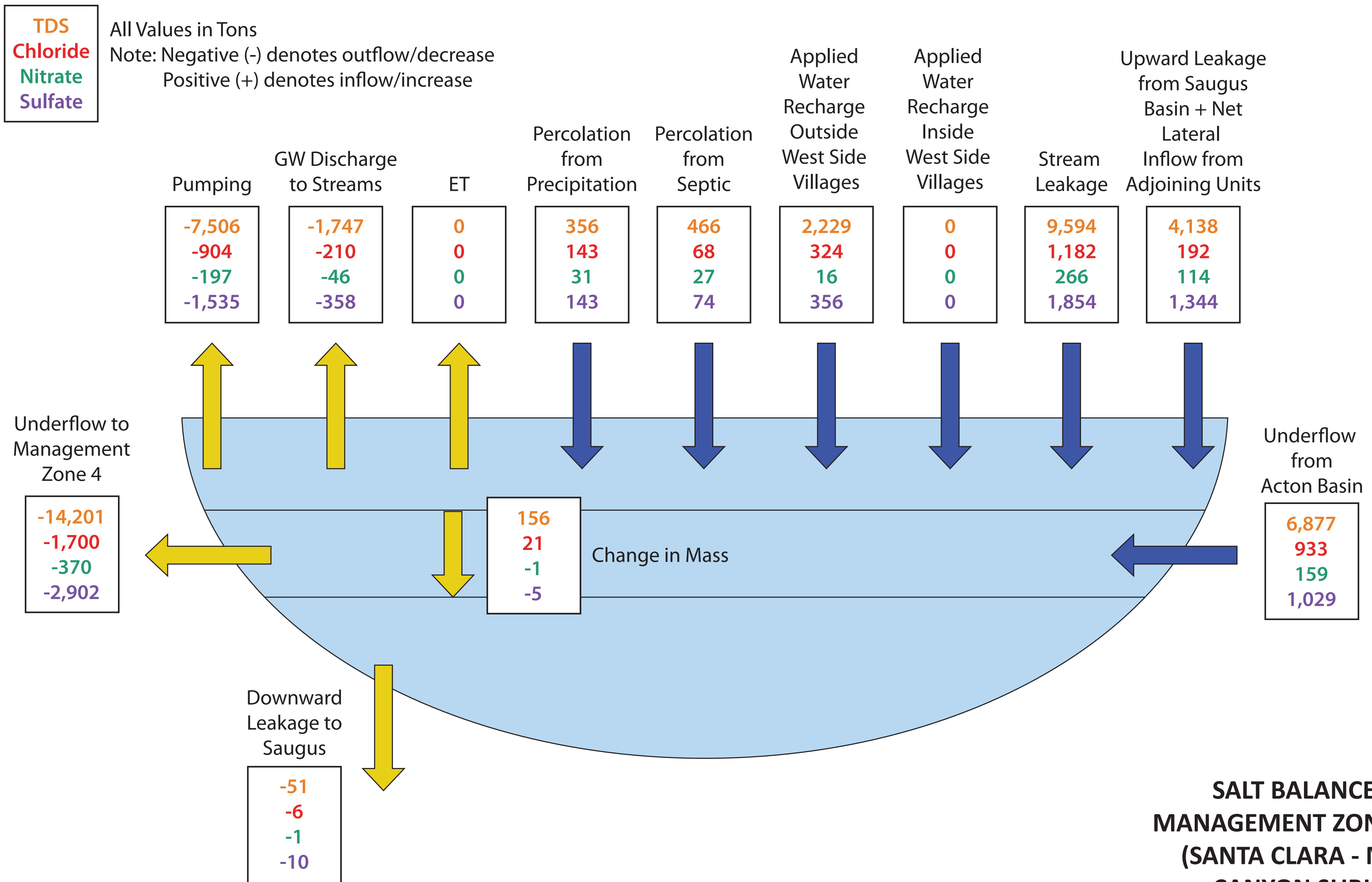

Projected Sulfate Concentrations Management Zone 6 (Saugus Formation)
CLWA Recycled Water Master Plan Conditions
2012-2035
Sulfate Concentration, mg/L
400
350
300
250
200
150
100
50
0
Projected Sulfate Concentration
90th Percentile*
2011 Ambient Sulfate = 235 mg/L
Average Projected Sulfate = 251 mg/L
Avg. Projected Sulfate (No Project) = 251 mg/L
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions. Per Regional Water Quality Control Board, a Water Quality Objective was not assigned for this analysis.
*90th Percentile = 263 mg/L (based on Projected Sulfate Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 30.4.8

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN - SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 1a (SANTA CLARA - MINT CANYON SUBUNIT) CLWA SCV WUE SP CONDITIONS 2012-2035

8-Dec-16

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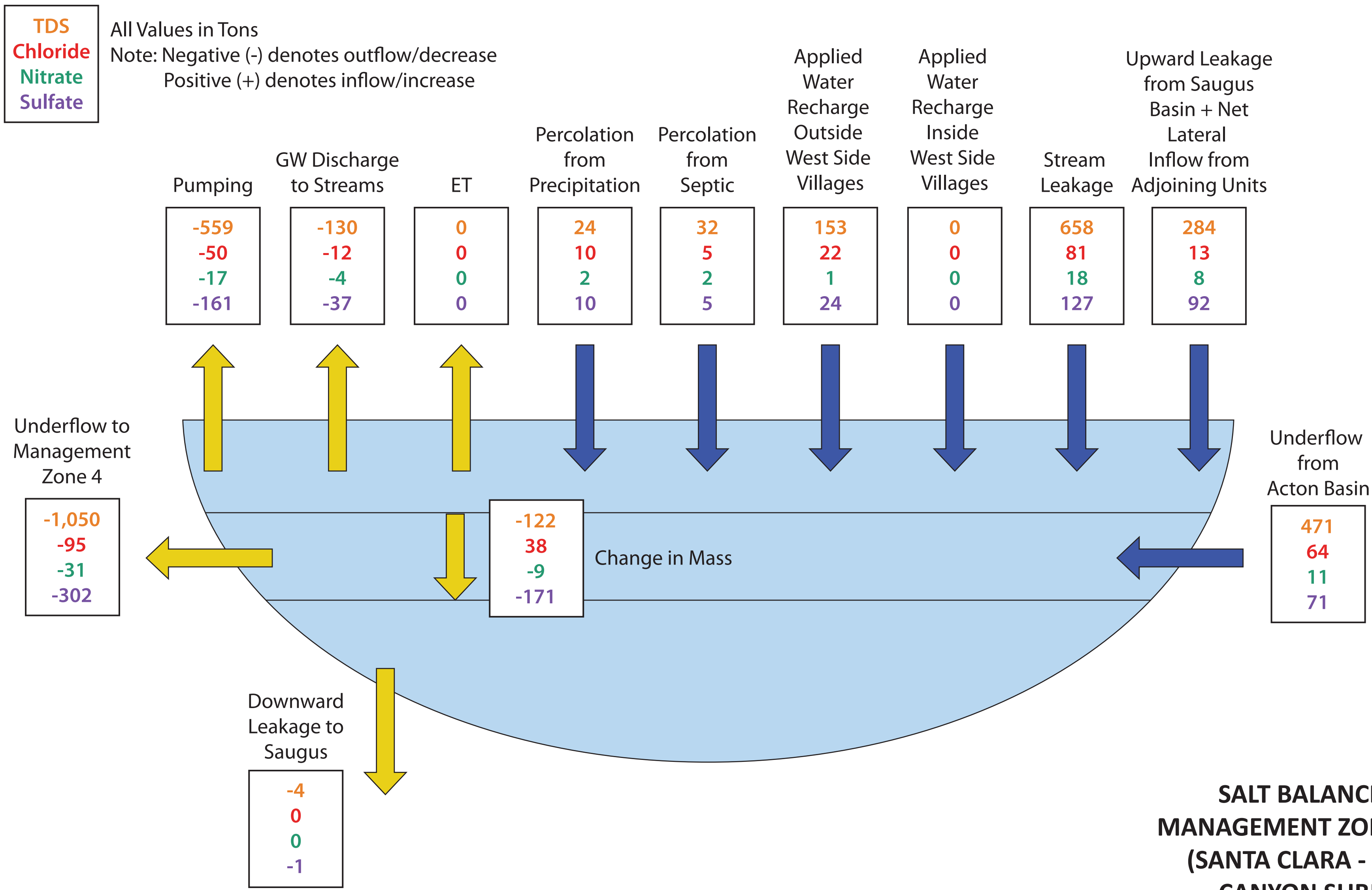
www.gssiwater.com

Figure 31a



SALT BALANCE FOR MANAGEMENT ZONE 1b (SANTA CLARA - MINT CANYON SUBUNIT) CLWA SCV WUE SP CONDITIONS 2012-2035

8-Dec-16

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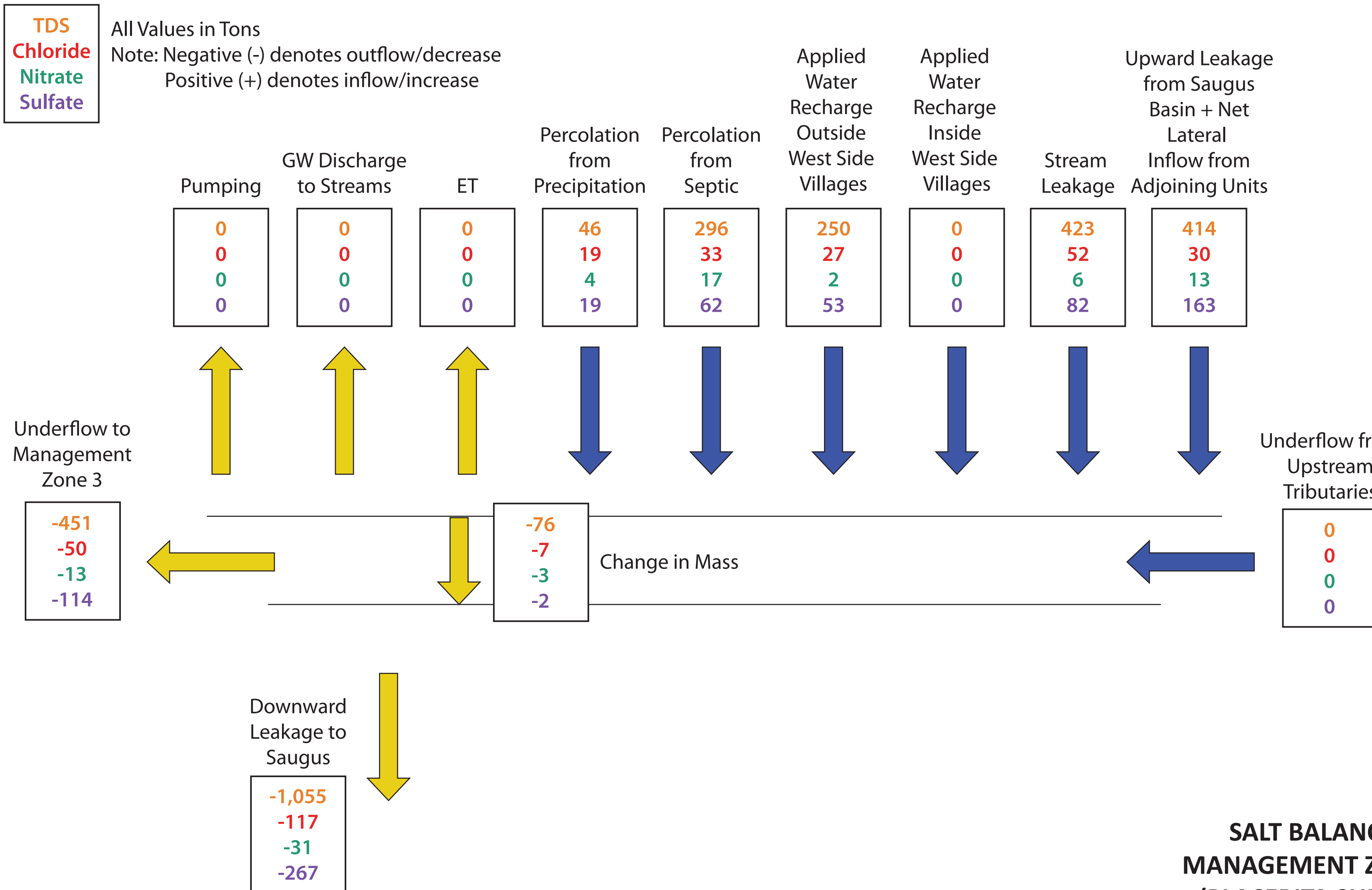
Figure 31b



SALT BALANCE FOR MANAGEMENT ZONE 2 (PLACERITA SUBUNIT) CLWA SCV WUE SP CONDITIONS 2012-2035

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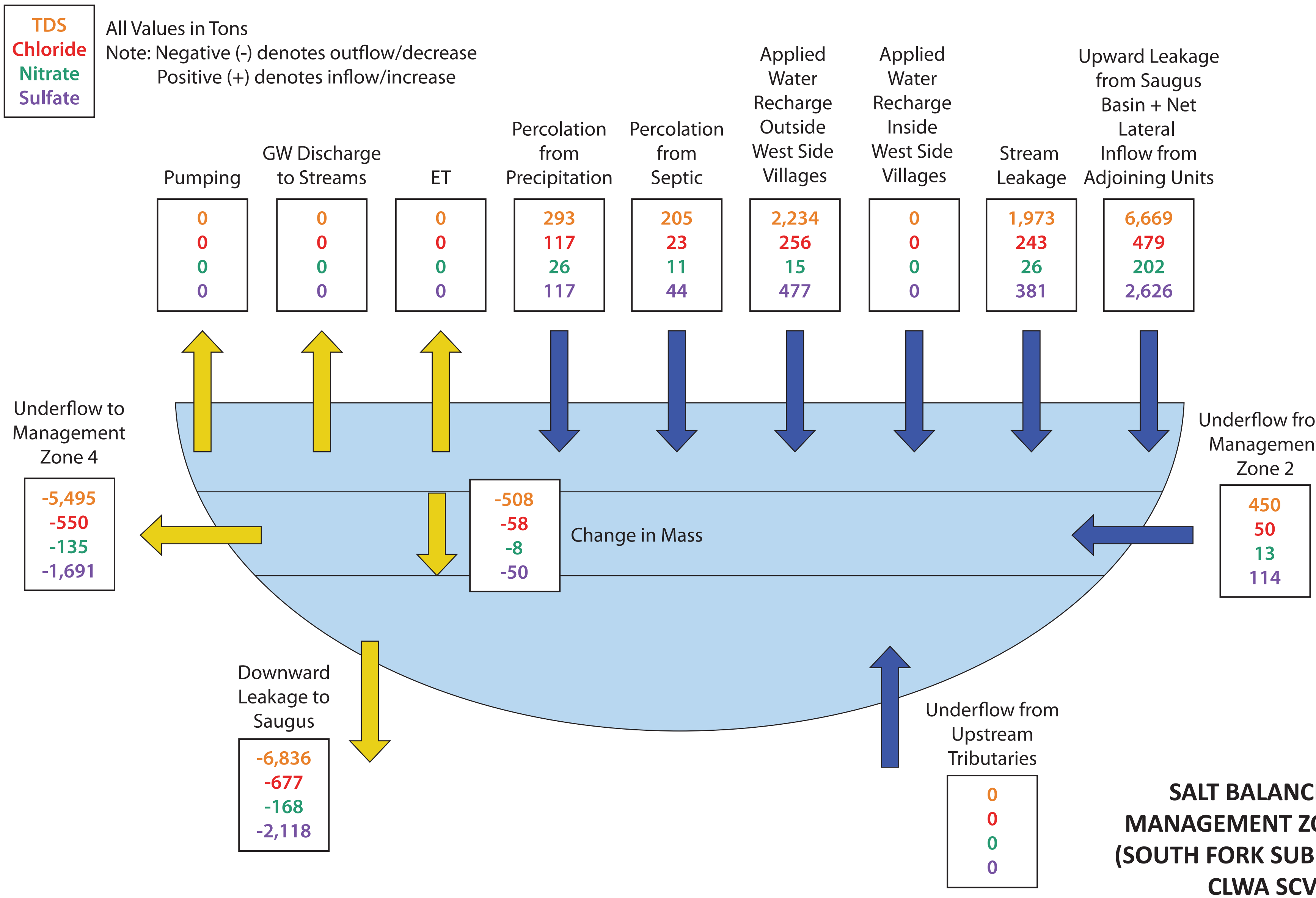
Figure 31c



SALT BALANCE FOR MANAGEMENT ZONE 3 (SOUTH FORK SUBUNIT) CLWA SCV WUE SP CONDITIONS 2012-2035

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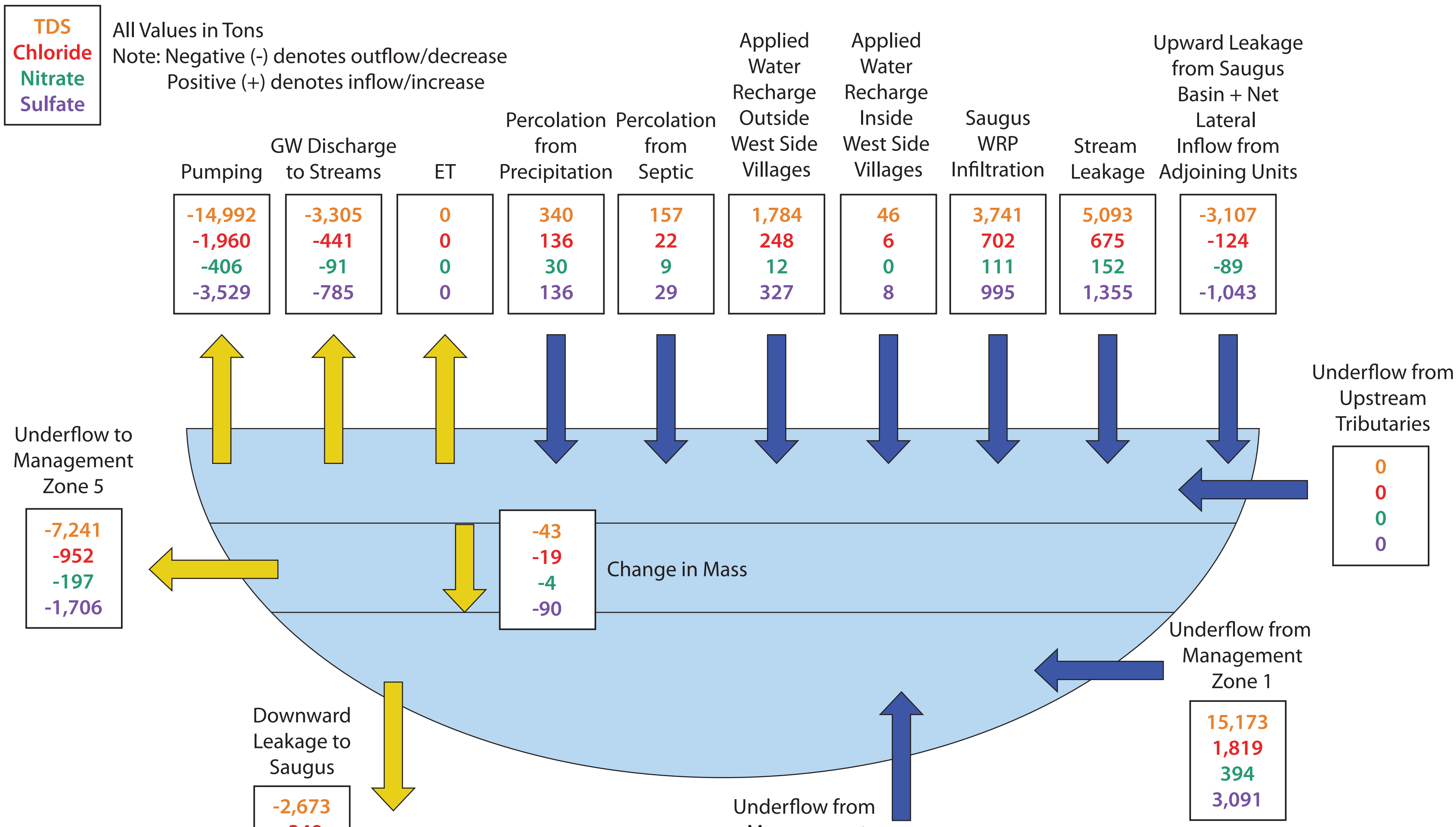
Figure 31d



SALT BALANCE FOR MANAGEMENT ZONE 4
(SANTA CLARA - BOUQUET AND SAN FRANCISQUITO CANYON SUBUNIT)
CLWA SCV WUE
SP CONDITIONS
2012-2035

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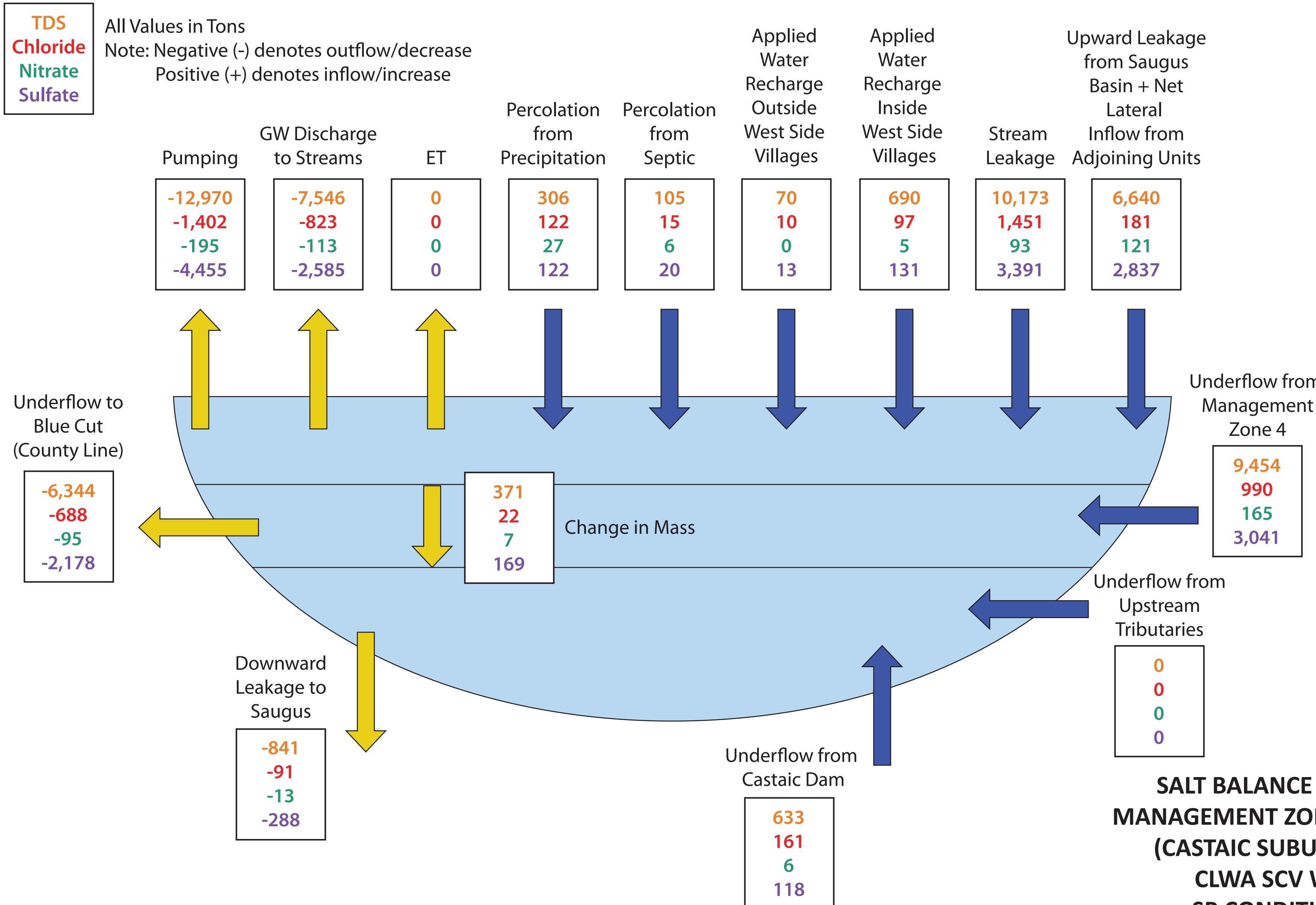
Figure 31e



SALT BALANCE FOR MANAGEMENT ZONE 5 (CASTAIC SUBUNIT) CLWA SCV WUE SP CONDITIONS 2012-2035

Figure 31f

8-Dec-16

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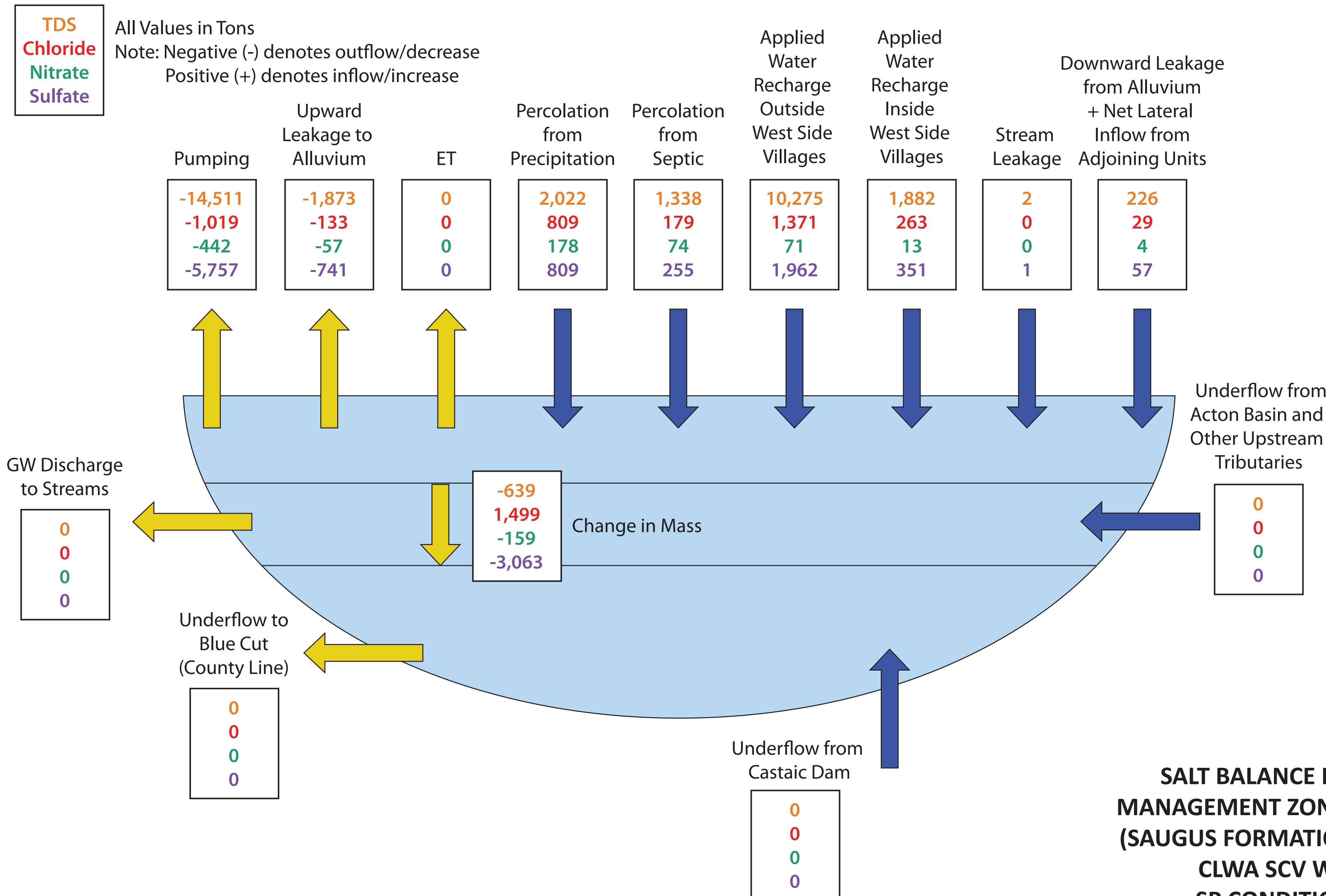

SALT BALANCE FOR MANAGEMENT ZONE 6 (SAUGUS FORMATION) CLWA SCV WUE SP CONDITIONS 2012-2035

Figure 31g

8-Dec-16

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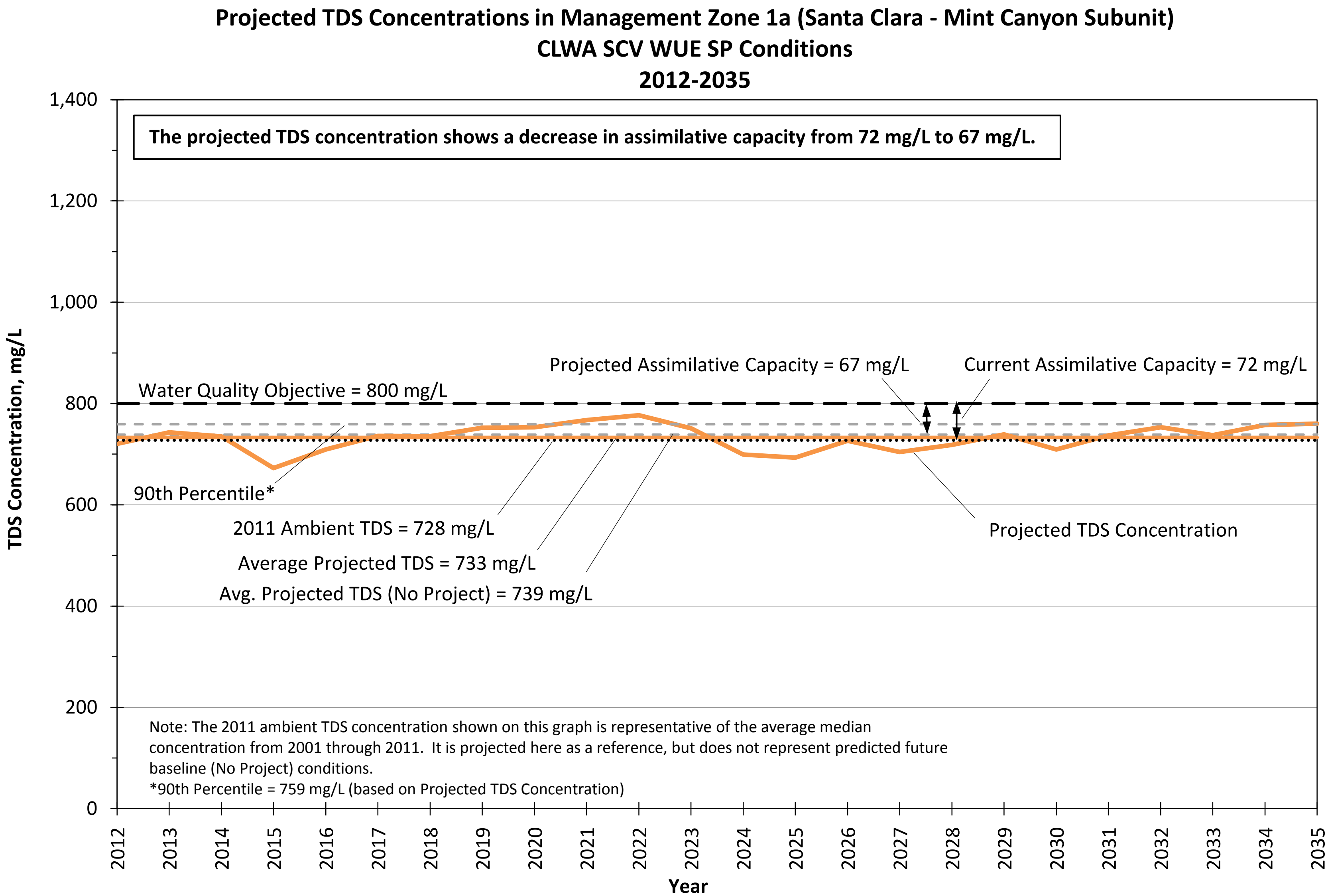

Projected TDS Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
CLWA SCV WUE SP Conditions
2012-2035
The projected TDS concentration shows a decrease in assimilative capacity from 72 mg/L to 67 mg/L.
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
Water Quality Objective = 800 mg/L
Projected Assimilative Capacity = 67 mg/L
Current Assimilative Capacity = 72 mg/L
90th Percentile*
2011 Ambient TDS = 728 mg/L
Average Projected TDS = 733 mg/L
Avg. Projected TDS (No Project) = 739 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 759 mg/L (based on Projected TDS Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 32.1.a

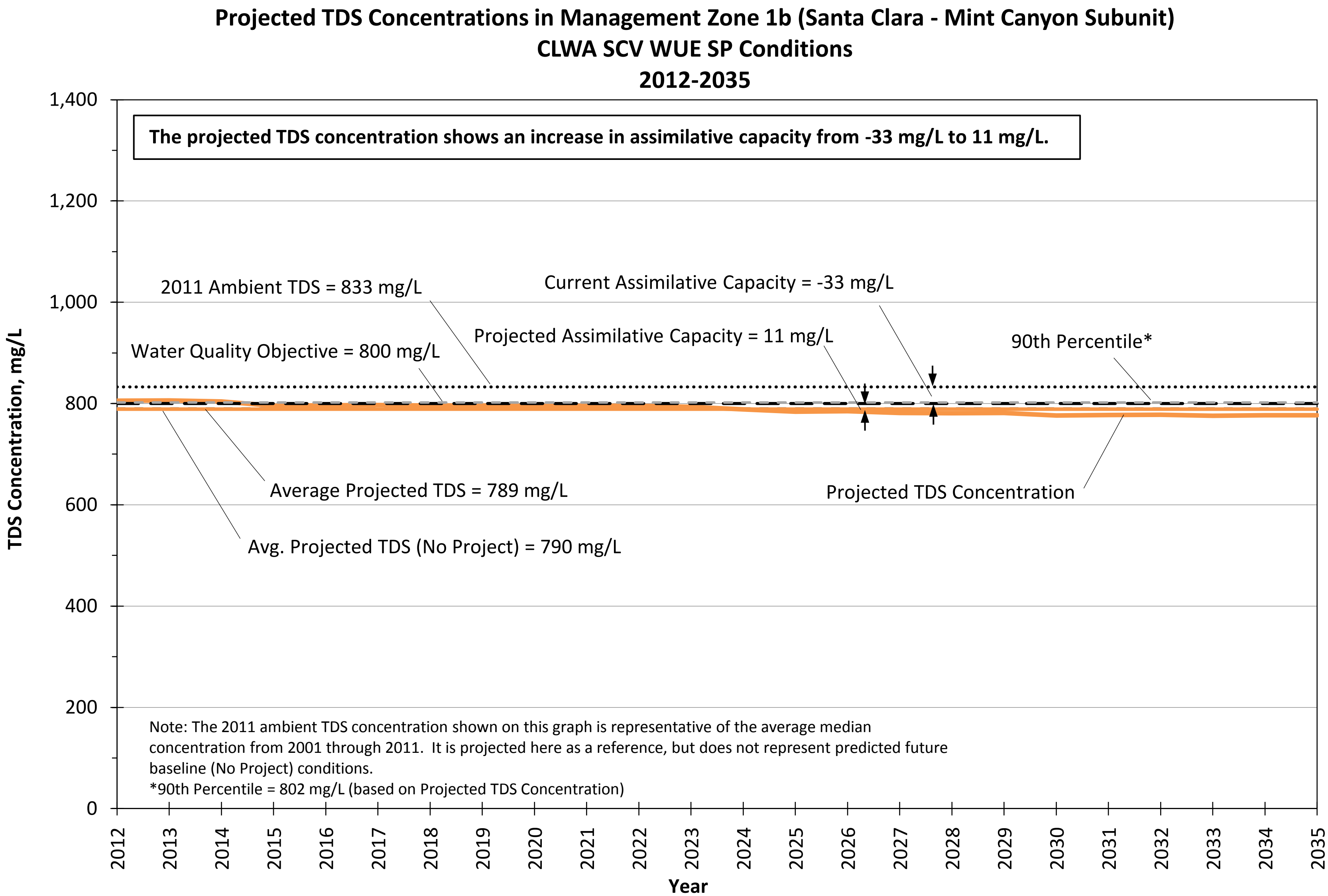

Projected TDS Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
CLWA SCV WUE SP Conditions
2012-2035
The projected TDS concentration shows an increase in assimilative capacity from -33 mg/L to 11 mg/L.
2011 Ambient TDS = 833 mg/L
Current Assimilative Capacity = -33 mg/L
Water Quality Objective = 800 mg/L
Projected Assimilative Capacity = 11 mg/L
90th Percentile*
Average Projected TDS = 789 mg/L
Projected TDS Concentration
Avg. Projected TDS (No Project) = 790 mg/L
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 802 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
Year
0
200
400
600
800
1,000
1,200
1,400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 32.1.b

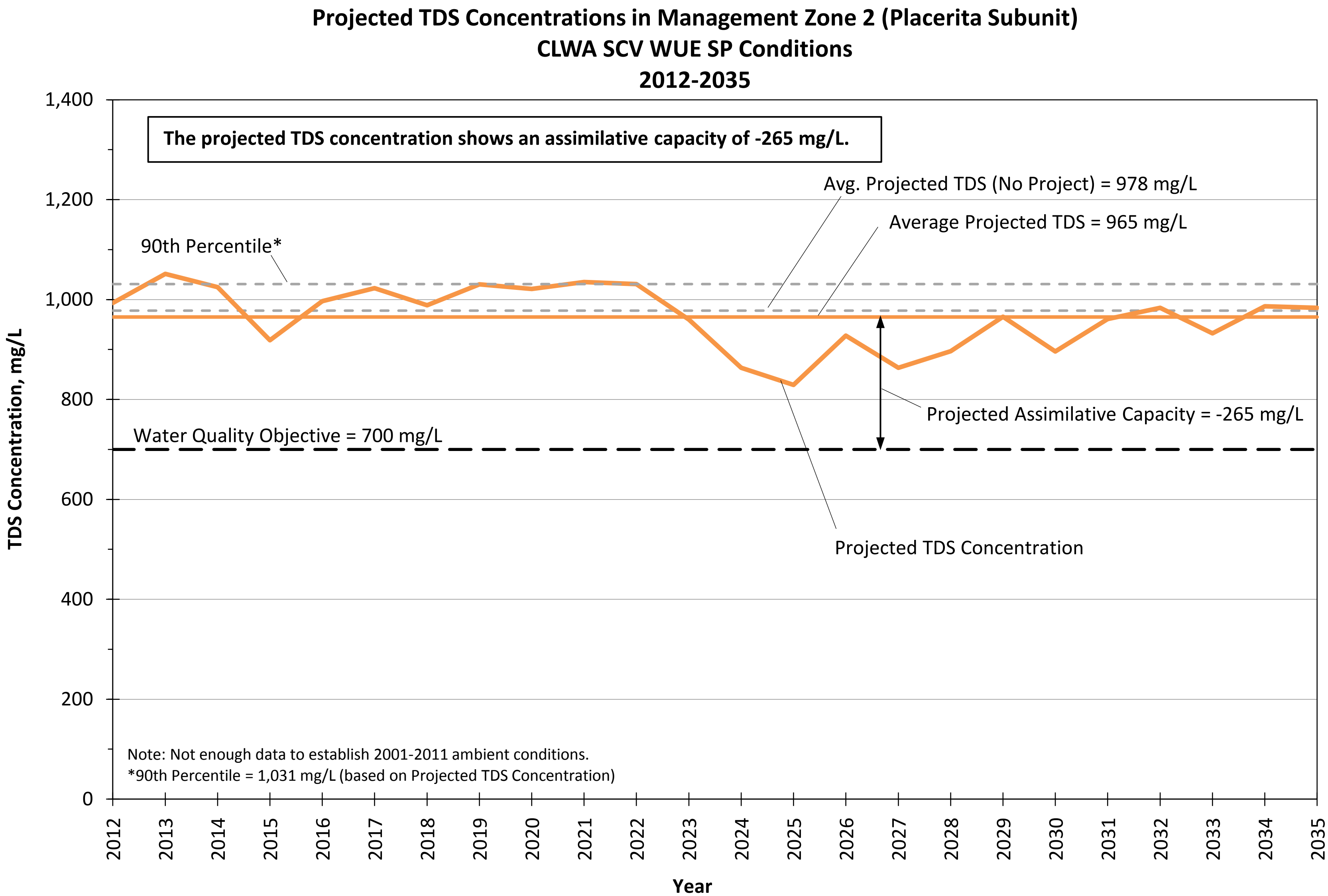

Projected TDS Concentrations in Management Zone 2 (Placerita Subunit)
CLWA SCV WUE SP Conditions
2012-2035
The projected TDS concentration shows an assimilative capacity of -265 mg/L.
Avg. Projected TDS (No Project) = 978 mg/L
Average Projected TDS = 965 mg/L
90th Percentile*
Projected Assimilative Capacity = -265 mg/L
Water Quality Objective = 700 mg/L
Projected TDS Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 1,031 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 32.1.c

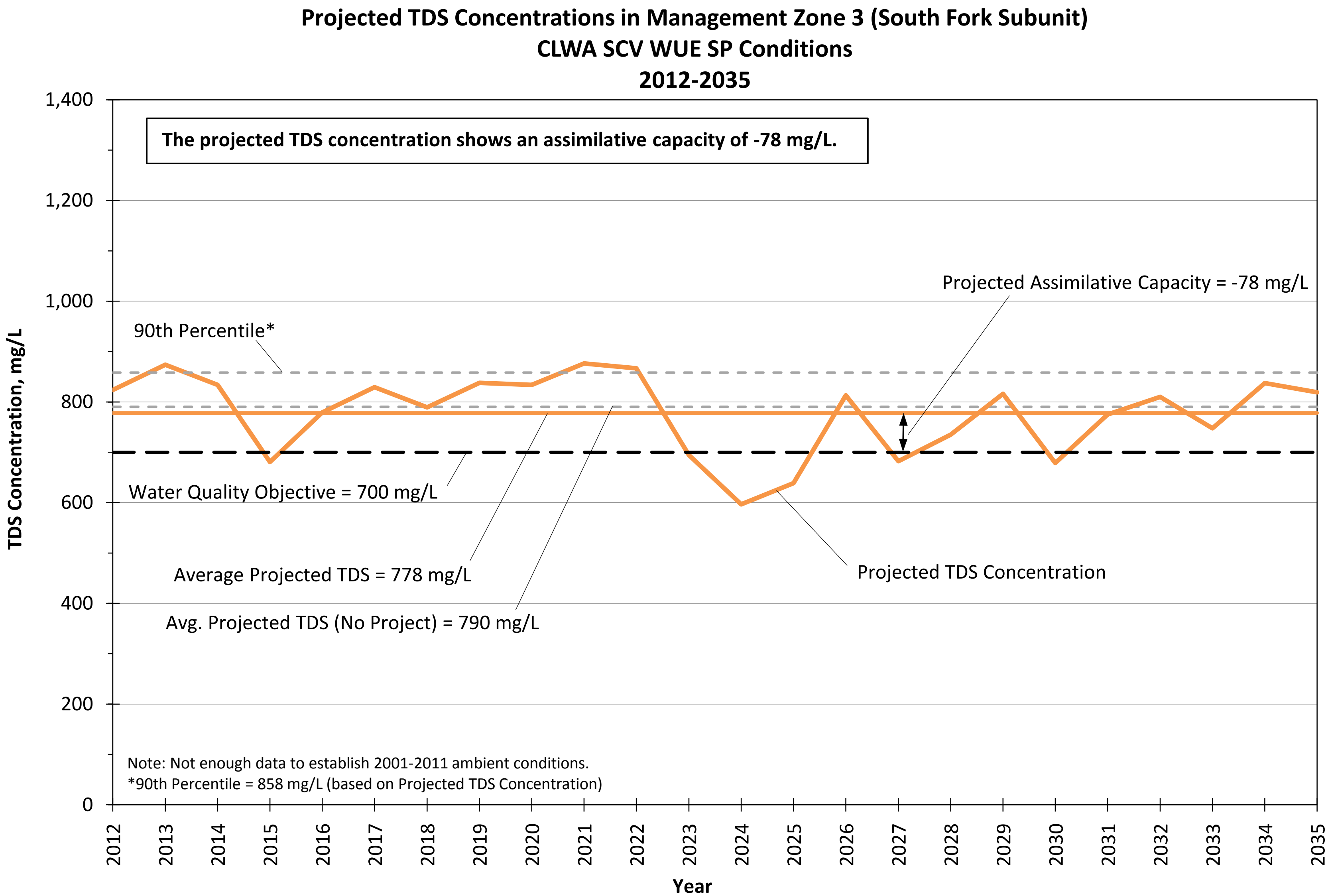

Projected TDS Concentrations in Management Zone 3 (South Fork Subunit)
CLWA SCV WUE SP Conditions
2012-2035
The projected TDS concentration shows an assimilative capacity of -78 mg/L.
Projected Assimilative Capacity = -78 mg/L
90th Percentile*
Water Quality Objective = 700 mg/L
Average Projected TDS = 778 mg/L
Avg. Projected TDS (No Project) = 790 mg/L
Projected TDS Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 858 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 32.1.d

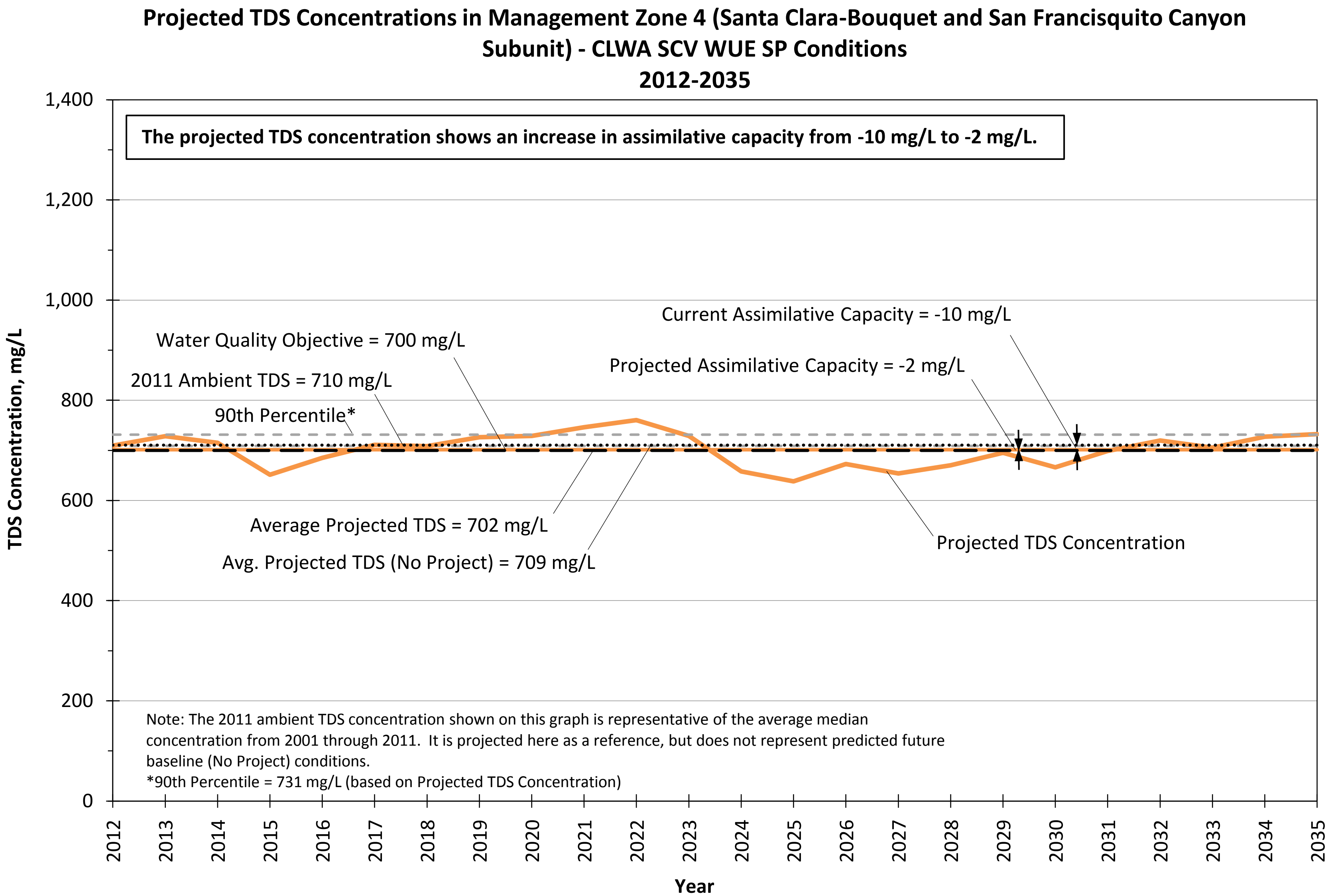

Projected TDS Concentrations in Management Zone 4 (Santa Clara-Bouquet and San Francisquito Canyon Subunit) - CLWA SCV WUE SP Conditions
2012-2035
The projected TDS concentration shows an increase in assimilative capacity from -10 mg/L to -2 mg/L.
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
Water Quality Objective = 700 mg/L
2011 Ambient TDS = 710 mg/L
90th Percentile*
Current Assimilative Capacity = -10 mg/L
Projected Assimilative Capacity = -2 mg/L
Average Projected TDS = 702 mg/L
Avg. Projected TDS (No Project) = 709 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 731 mg/L (based on Projected TDS Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 32.1.e

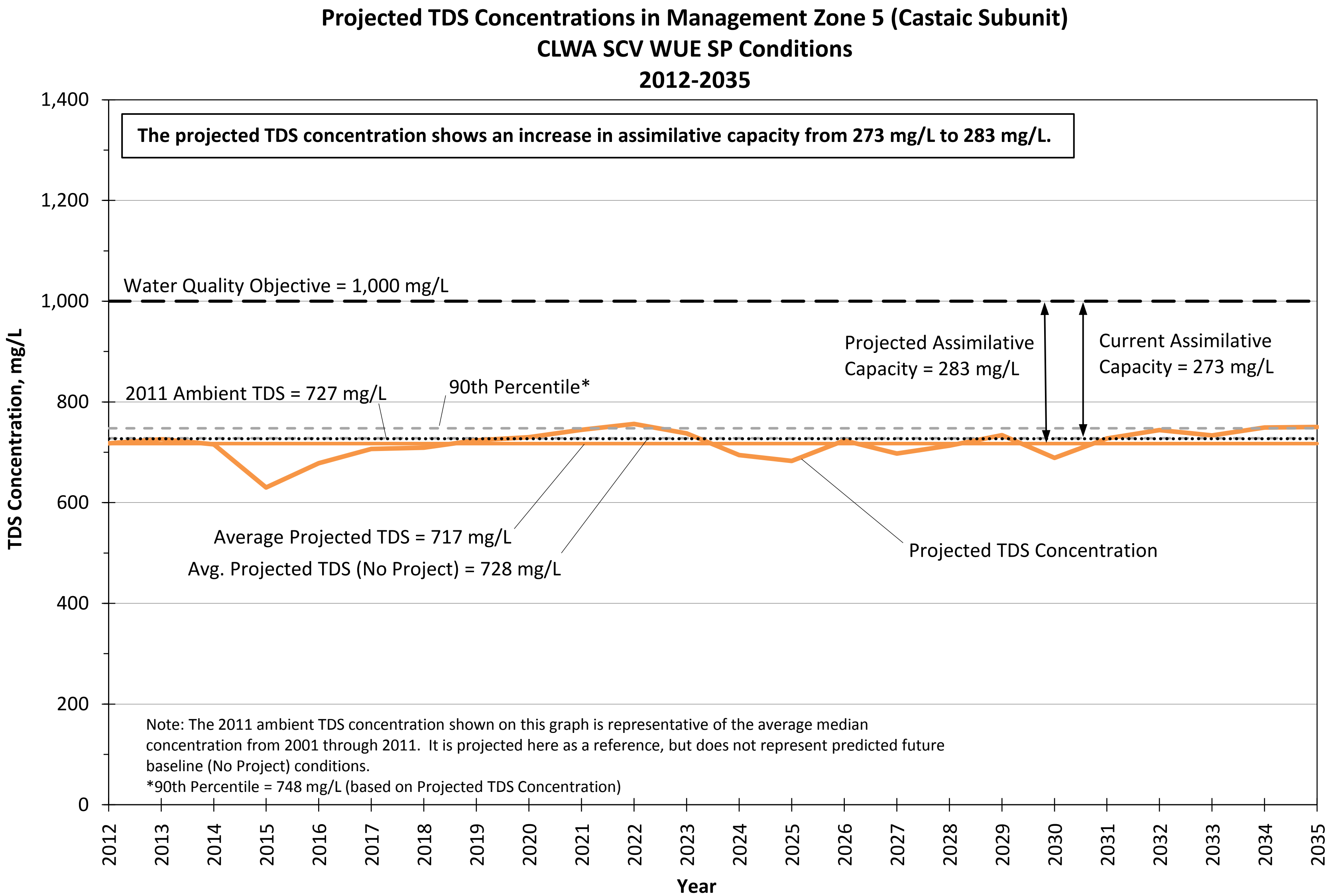

Projected TDS Concentrations in Management Zone 5 (Castaic Subunit)
CLWA SCV WUE SP Conditions
2012-2035
The projected TDS concentration shows an increase in assimilative capacity from 273 mg/L to 283 mg/L.
Water Quality Objective = 1,000 mg/L
Projected Assimilative Capacity = 283 mg/L
Current Assimilative Capacity = 273 mg/L
2011 Ambient TDS = 727 mg/L
90th Percentile*
Average Projected TDS = 717 mg/L
Avg. Projected TDS (No Project) = 728 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 748 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 32.1.f

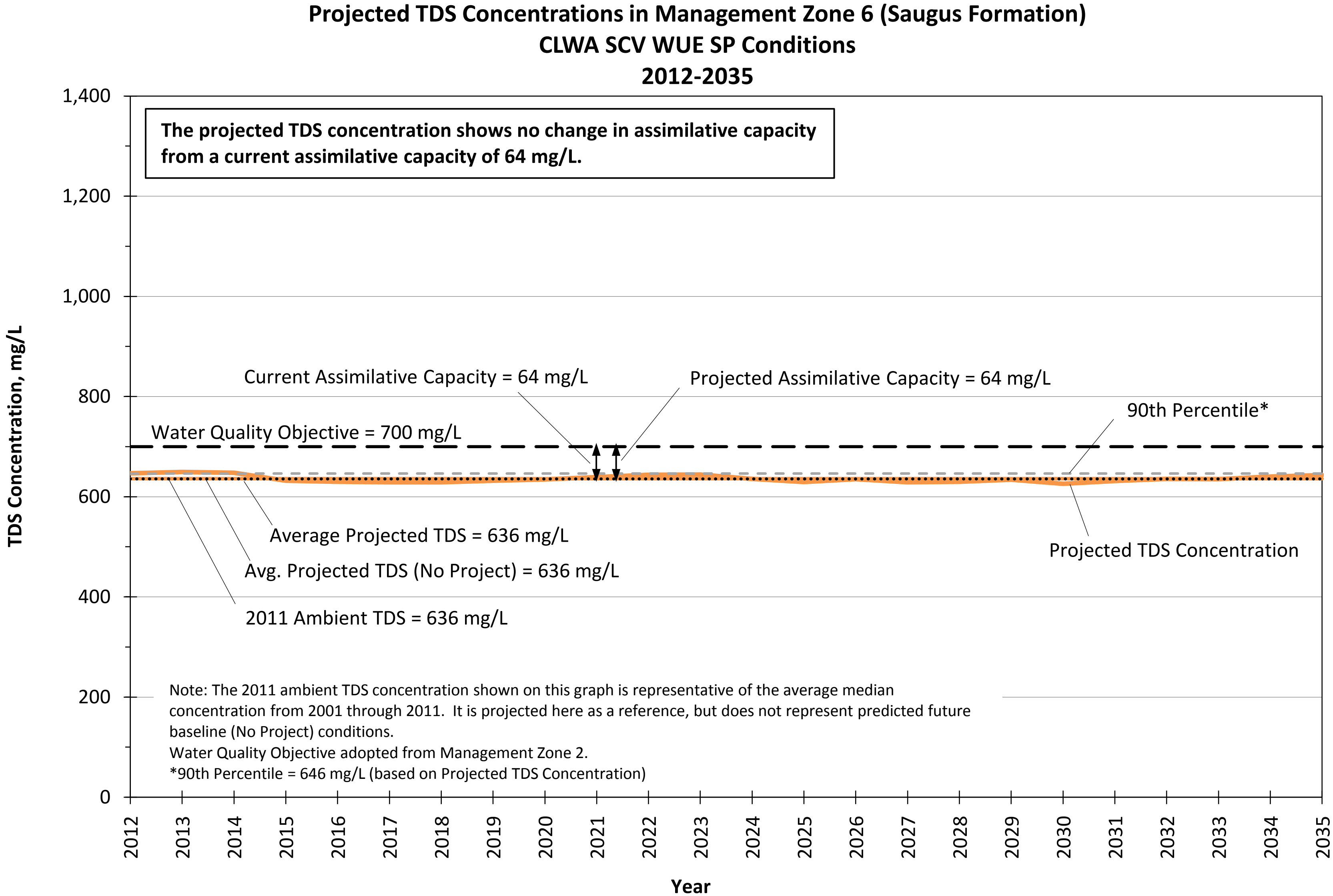

Projected TDS Concentrations in Management Zone 6 (Saugus Formation)
CLWA SCV WUE SP Conditions
2012-2035
The projected TDS concentration shows no change in assimilative capacity from a current assimilative capacity of 64 mg/L.
Current Assimilative Capacity = 64 mg/L
Projected Assimilative Capacity = 64 mg/L
90th Percentile*
Water Quality Objective = 700 mg/L
Average Projected TDS = 636 mg/L
Projected TDS Concentration
Avg. Projected TDS (No Project) = 636 mg/L
2011 Ambient TDS = 636 mg/L
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Water Quality Objective adopted from Management Zone 2.
*90th Percentile = 646 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 32.1.g

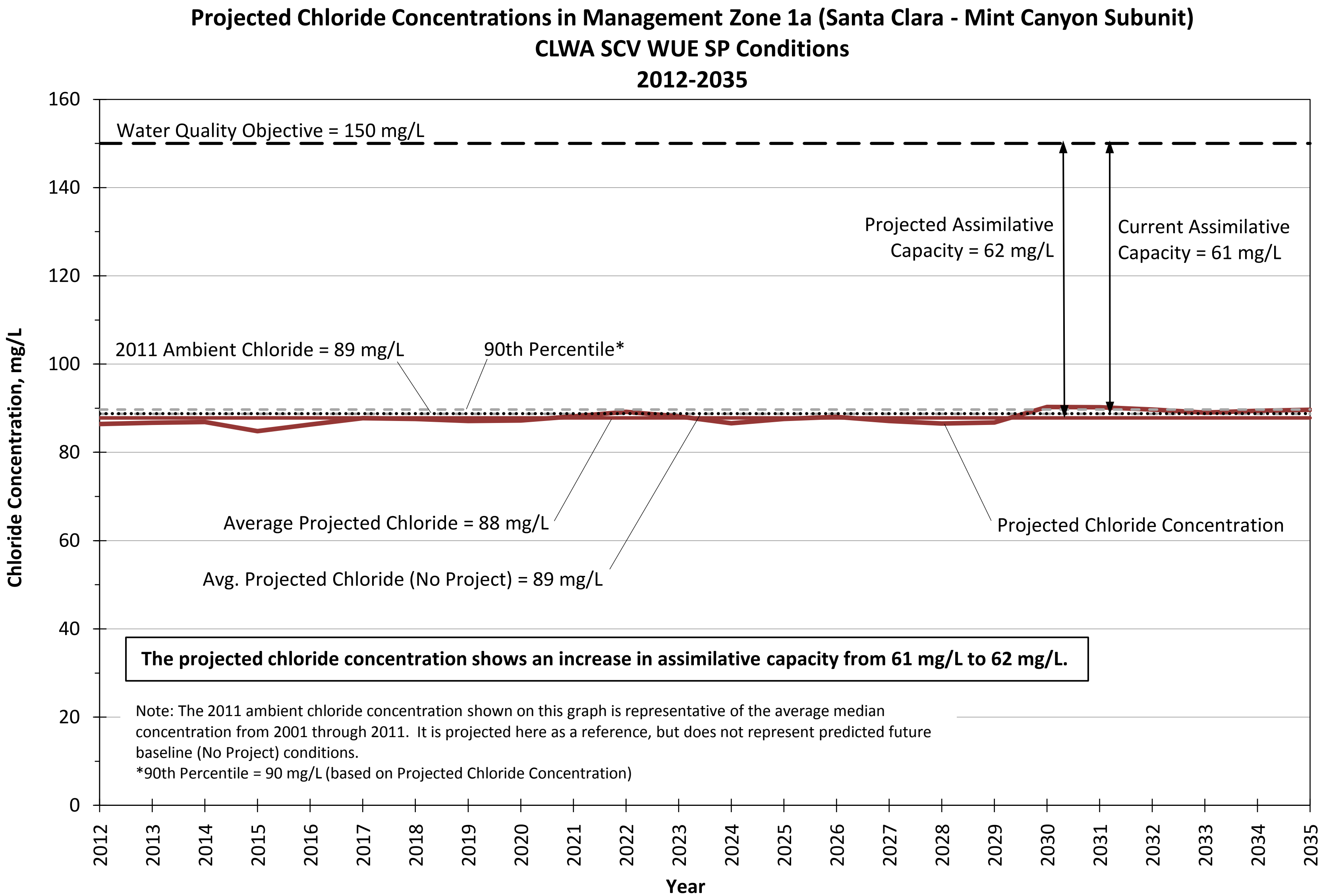

Projected Chloride Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
CLWA SCV WUE SP Conditions
2012-2035
Water Quality Objective = 150 mg/L
Projected Assimilative Capacity = 62 mg/L
Current Assimilative Capacity = 61 mg/L
2011 Ambient Chloride = 89 mg/L
90th Percentile*
Average Projected Chloride = 88 mg/L
Projected Chloride Concentration
Avg. Projected Chloride (No Project) = 89 mg/L
The projected chloride concentration shows an increase in assimilative capacity from 61 mg/L to 62 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 90 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 32.2.a

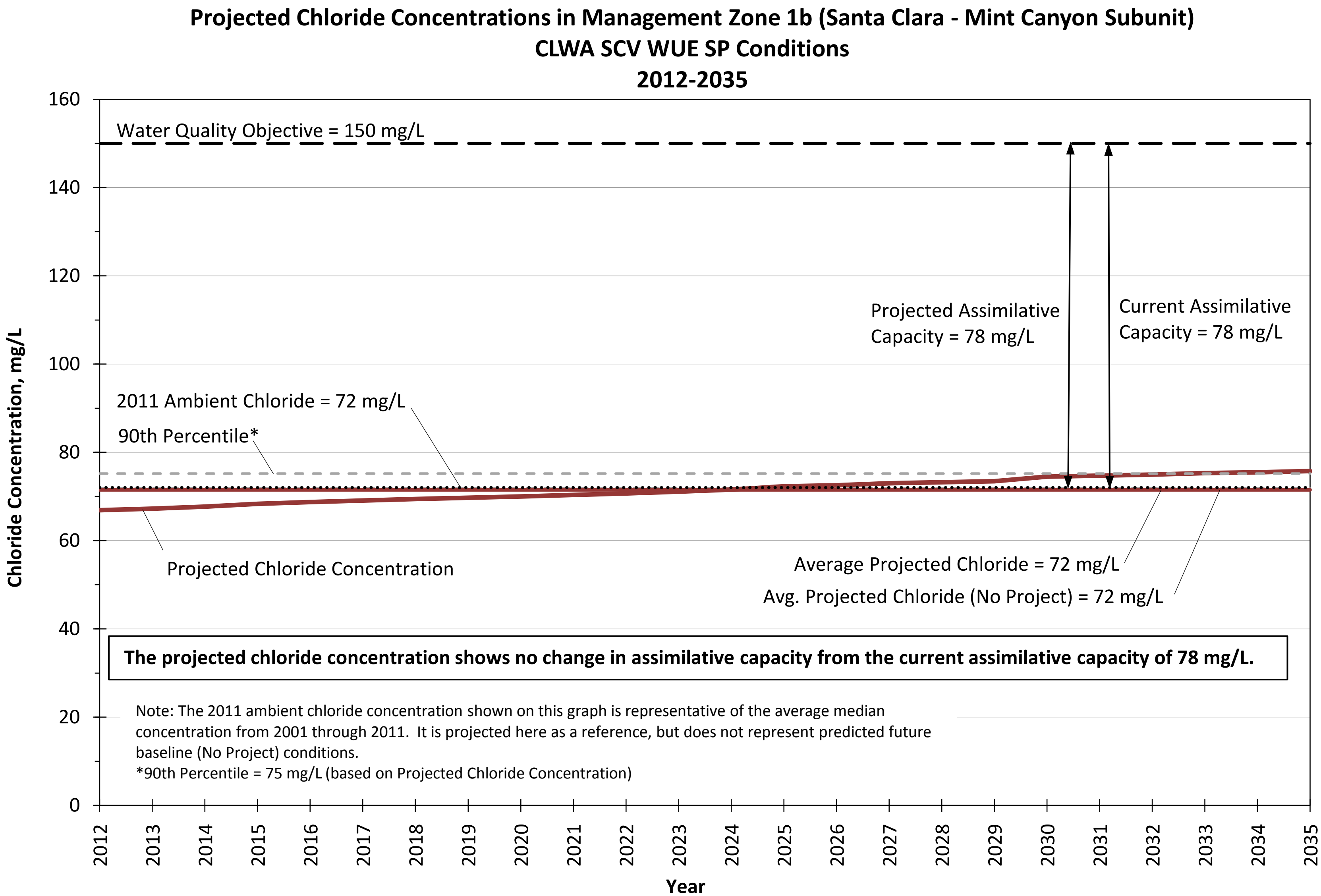

Projected Chloride Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
CLWA SCV WUE SP Conditions
2012-2035
Water Quality Objective = 150 mg/L
Projected Assimilative Capacity = 78 mg/L
Current Assimilative Capacity = 78 mg/L
2011 Ambient Chloride = 72 mg/L
90th Percentile*
Projected Chloride Concentration
Average Projected Chloride = 72 mg/L
Avg. Projected Chloride (No Project) = 72 mg/L
The projected chloride concentration shows no change in assimilative capacity from the current assimilative capacity of 78 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 75 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 32.2.b

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

Projected Chloride Concentrations in Management Zone 2 (Placerita Subunit)
CLWA SCV WUE SP Conditions
2012-2035

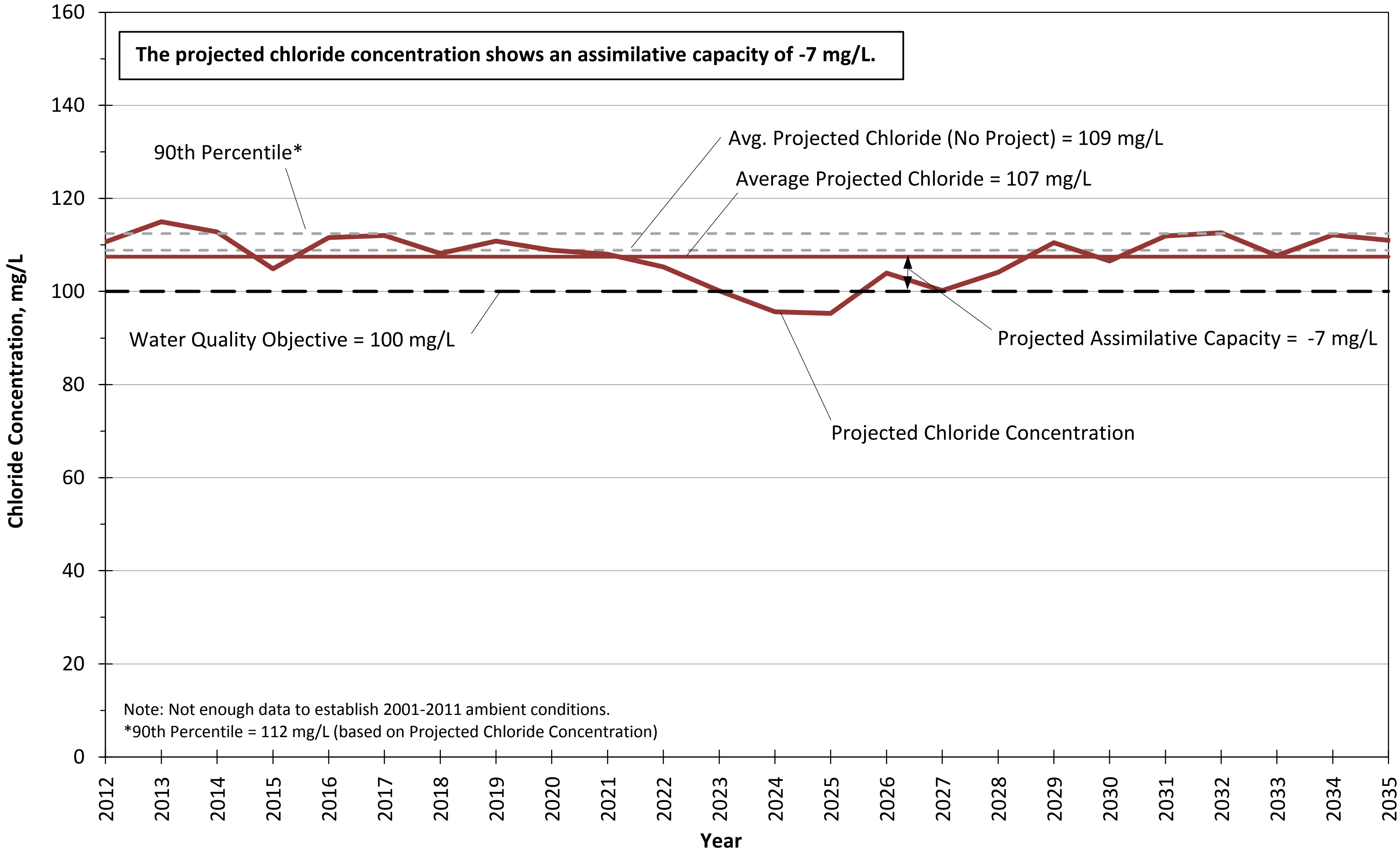


Figure 32.2.c

8-Dec-16

GEOSCIENCE Support Services, Inc.

Projected Chloride Concentrations in Management Zone 3 (South Fork Subunit)
CLWA SCV WUE SP Conditions
2012-2035

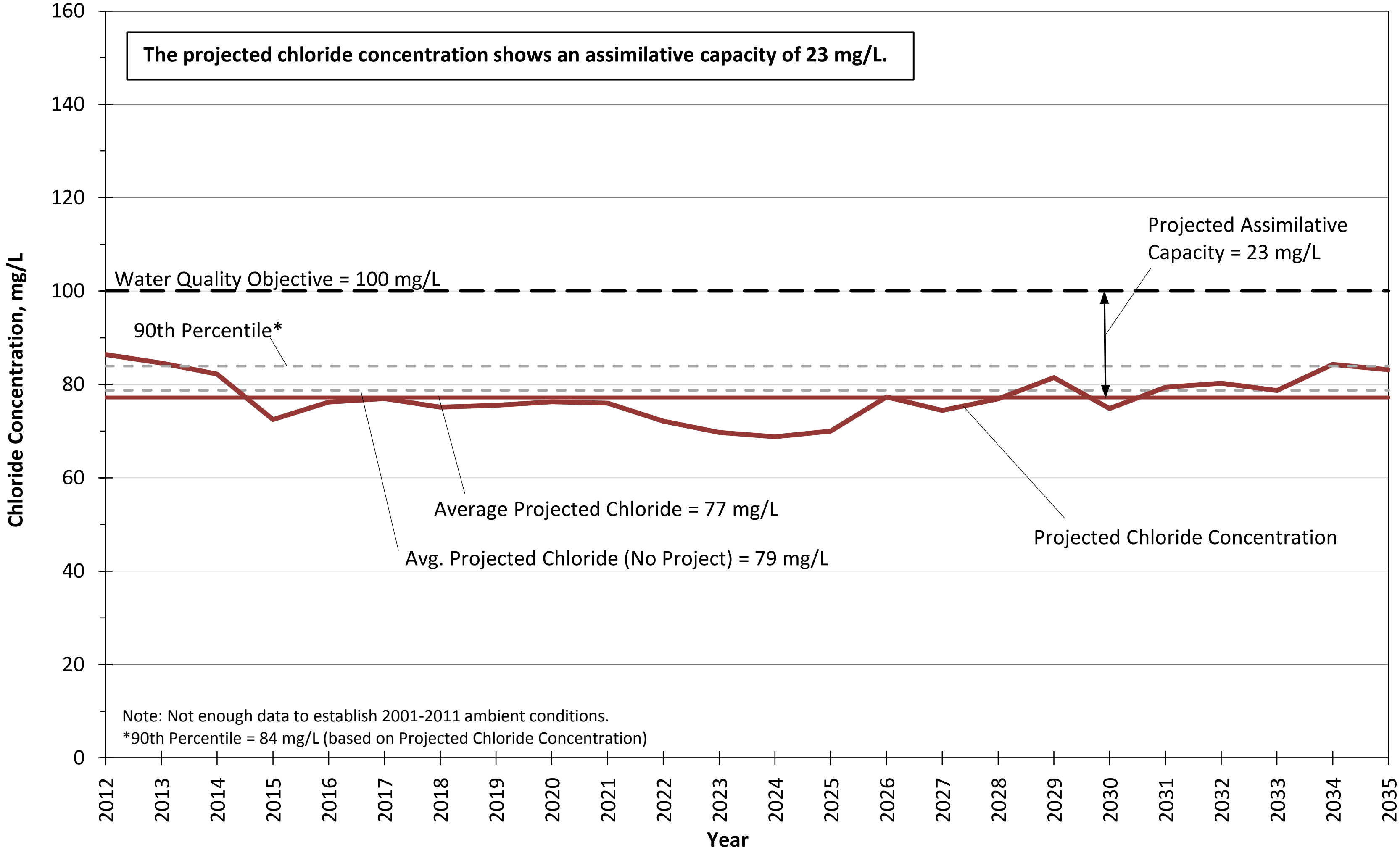
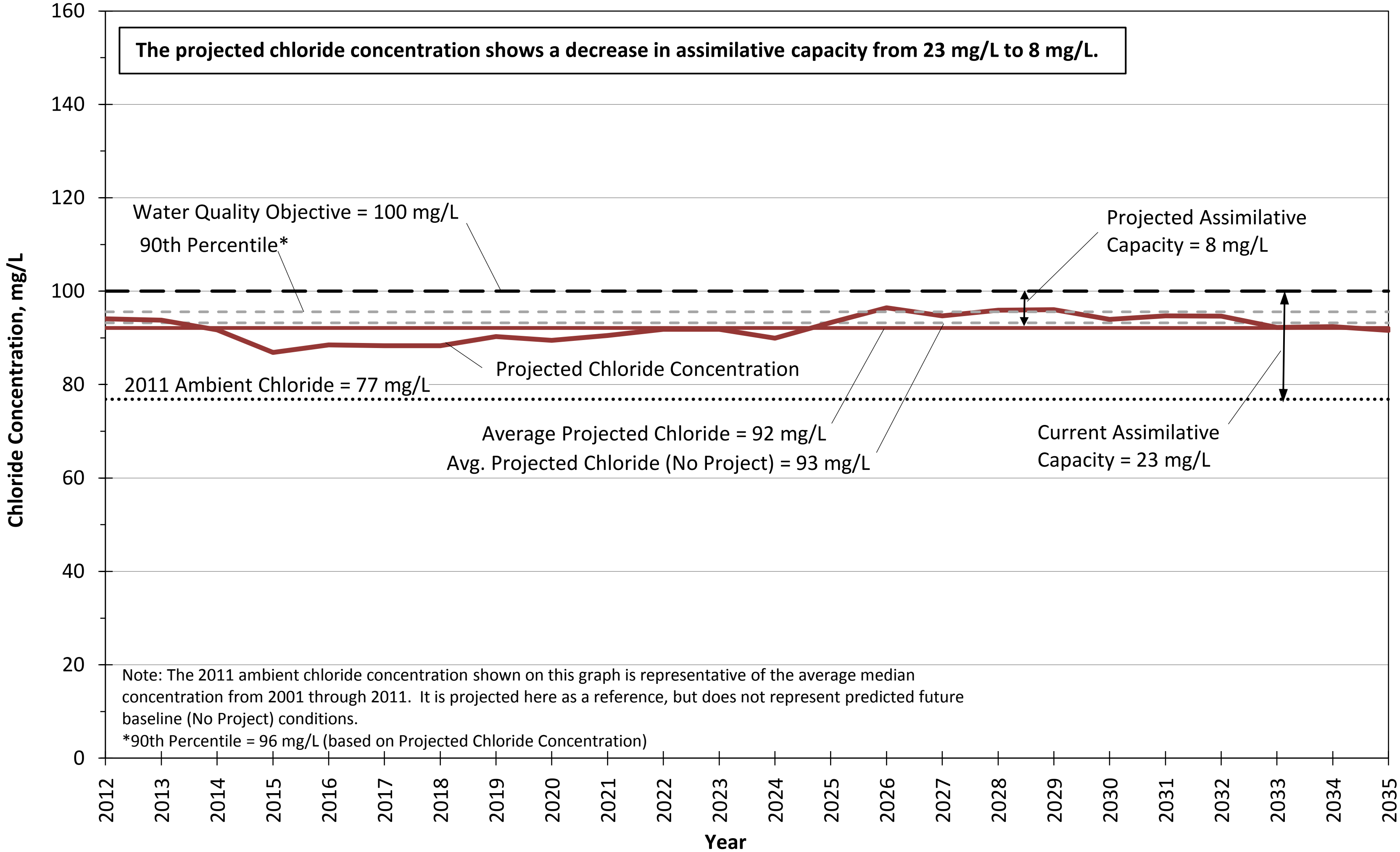


Figure 32.2.d

Projected Chloride Concentrations in Management Zone 4 (Santa Clara-Bouquet and San Francisquito Canyon Subunit) - CLWA SCV WUE SP Conditions 2012-2035



Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 96 mg/L (based on Projected Chloride Concentration)

Figure 32.2.e

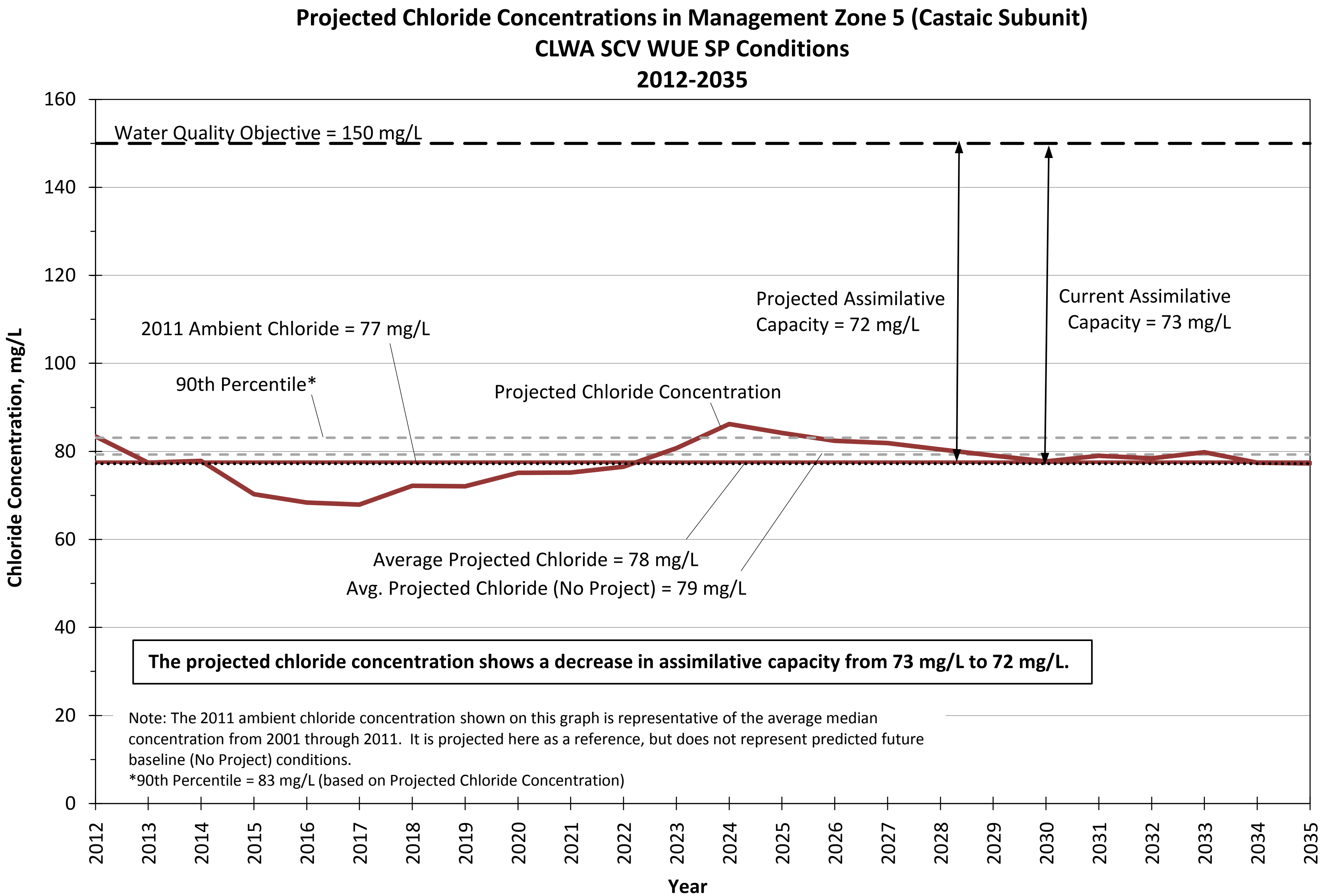

Projected Chloride Concentrations in Management Zone 5 (Castaic Subunit)
CLWA SCV WUE SP Conditions
2012-2035
Water Quality Objective = 150 mg/L
2011 Ambient Chloride = 77 mg/L
90th Percentile*
Projected Chloride Concentration
Projected Assimilative Capacity = 72 mg/L
Current Assimilative Capacity = 73 mg/L
Average Projected Chloride = 78 mg/L
Avg. Projected Chloride (No Project) = 79 mg/L
The projected chloride concentration shows a decrease in assimilative capacity from 73 mg/L to 72 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 83 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
0
20
40
60
80
100
120
140
160
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 32.2.f

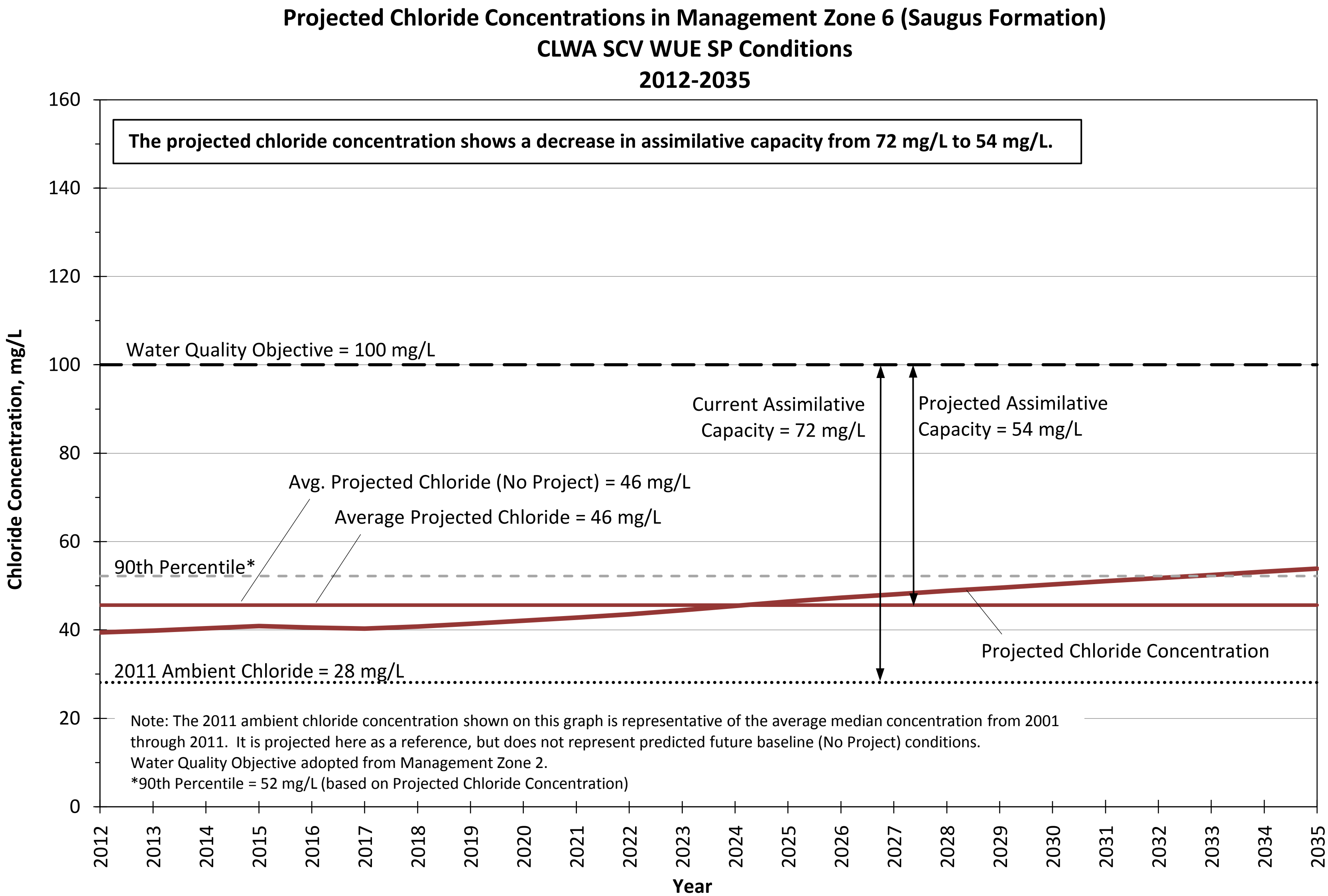

Projected Chloride Concentrations in Management Zone 6 (Saugus Formation)
CLWA SCV WUE SP Conditions
2012-2035
The projected chloride concentration shows a decrease in assimilative capacity from 72 mg/L to 54 mg/L.
Water Quality Objective = 100 mg/L
Current Assimilative Capacity = 72 mg/L
Projected Assimilative Capacity = 54 mg/L
Avg. Projected Chloride (No Project) = 46 mg/L
Average Projected Chloride = 46 mg/L
90th Percentile*
Projected Chloride Concentration
2011 Ambient Chloride = 28 mg/L
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Water Quality Objective adopted from Management Zone 2.
*90th Percentile = 52 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 32.2.g

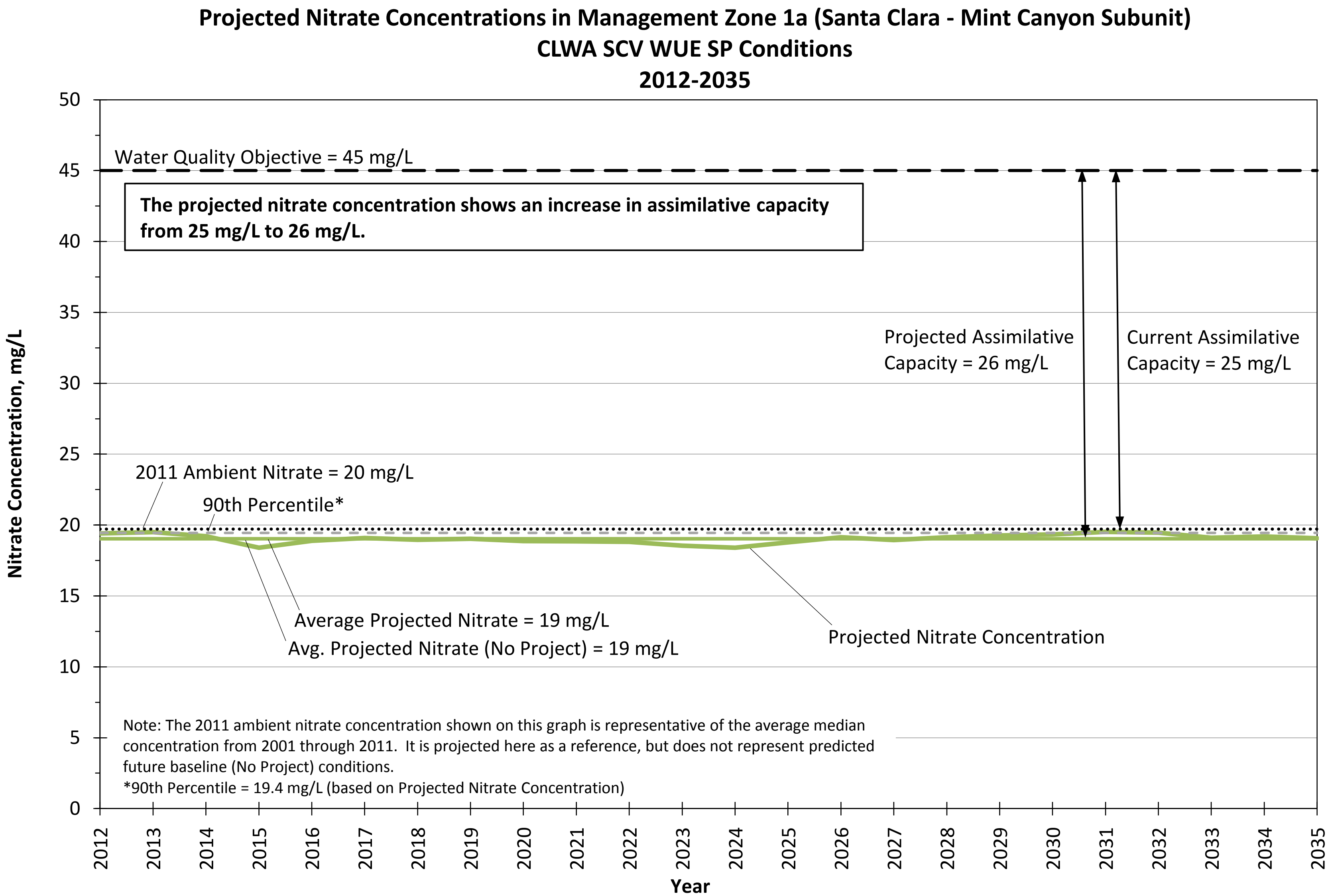

Projected Nitrate Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
CLWA SCV WUE SP Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an increase in assimilative capacity from 25 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 25 mg/L
2011 Ambient Nitrate = 20 mg/L
90th Percentile*
Average Projected Nitrate = 19 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Projected Nitrate Concentration
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 19.4 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 32.3.a

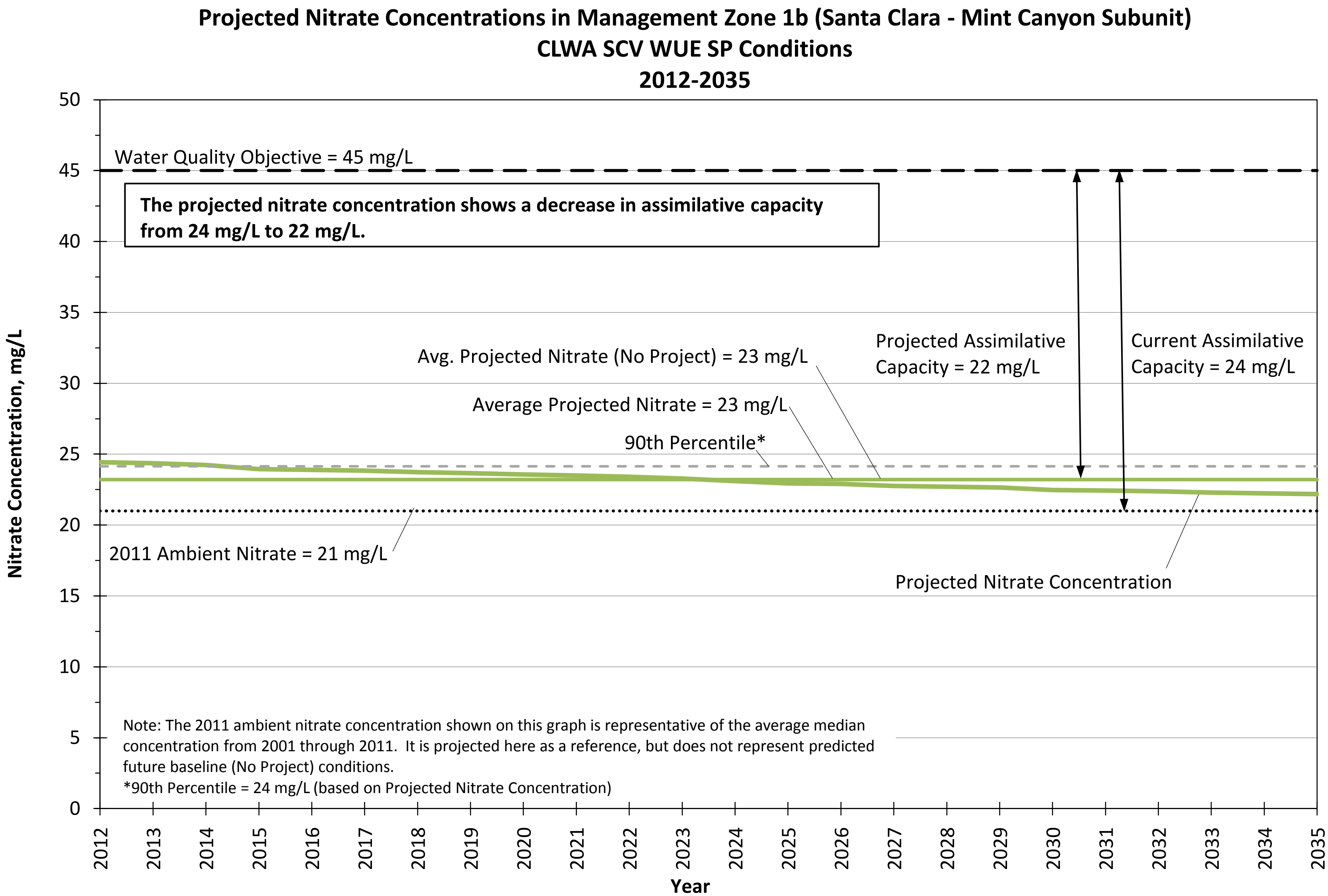

Projected Nitrate Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
CLWA SCV WUE SP Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 24 mg/L to 22 mg/L.
Avg. Projected Nitrate (No Project) = 23 mg/L
Average Projected Nitrate = 23 mg/L
90th Percentile*
Projected Assimilative Capacity = 22 mg/L
Current Assimilative Capacity = 24 mg/L
2011 Ambient Nitrate = 21 mg/L
Projected Nitrate Concentration
Nitrate Concentration, mg/L
Year
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 24 mg/L (based on Projected Nitrate Concentration)

Figure 32.3.b

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

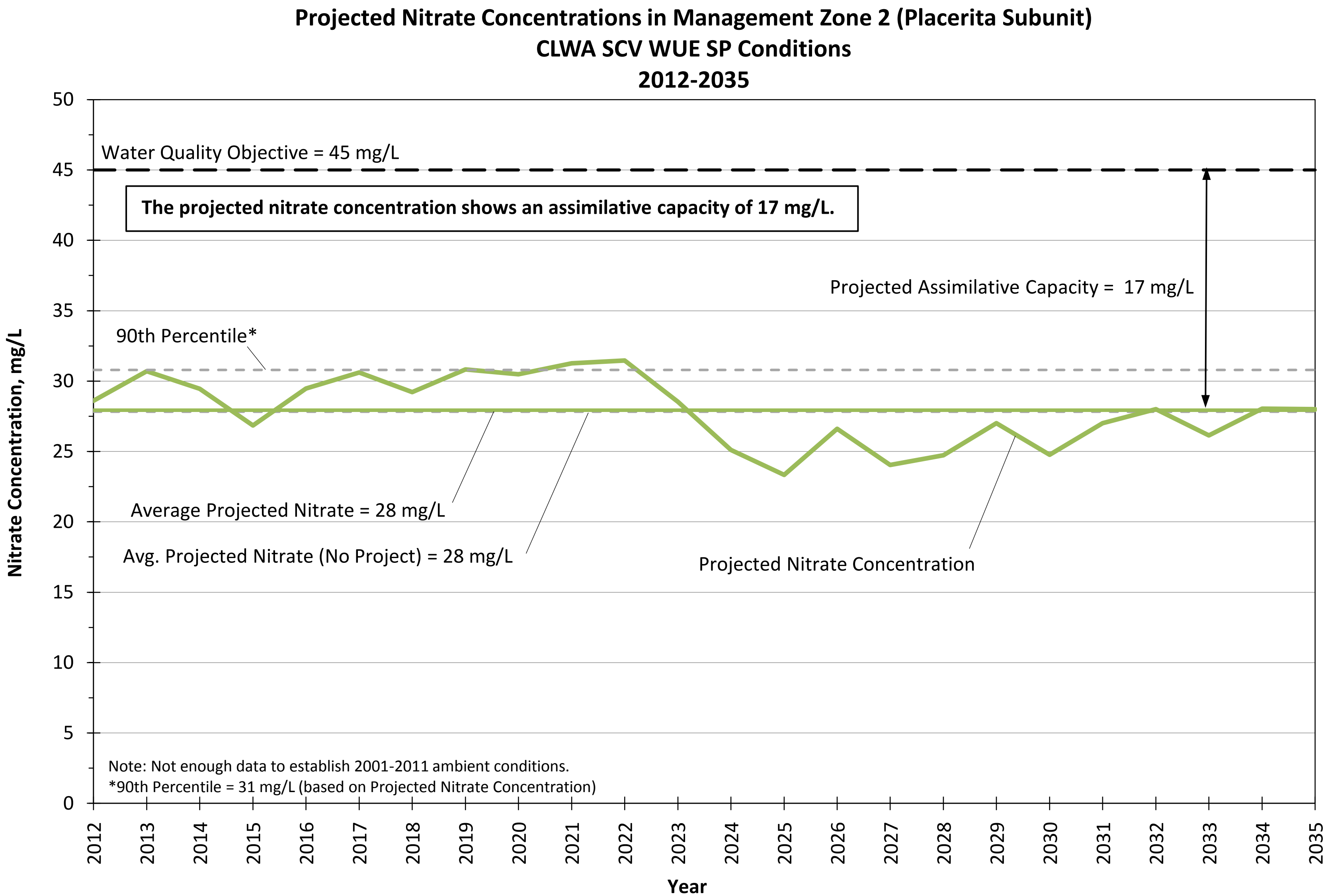
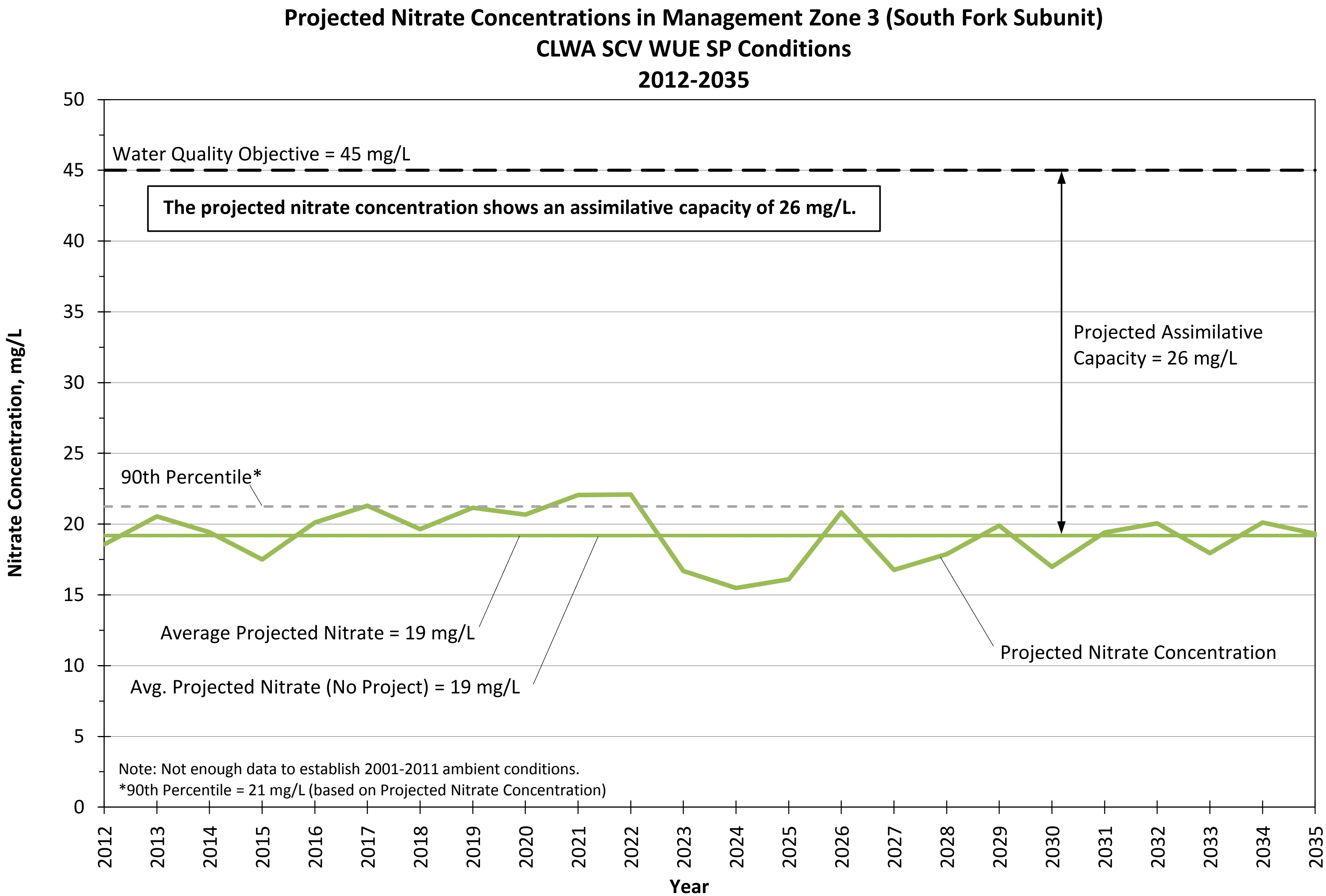


Figure 32.3.c


Projected Nitrate Concentrations in Management Zone 3 (South Fork Subunit)
CLWA SCV WUE SP Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an assimilative capacity of 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
90th Percentile*
Average Projected Nitrate = 19 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Projected Nitrate Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 21 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
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2032
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2034
2035

Figure 32.3.d

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

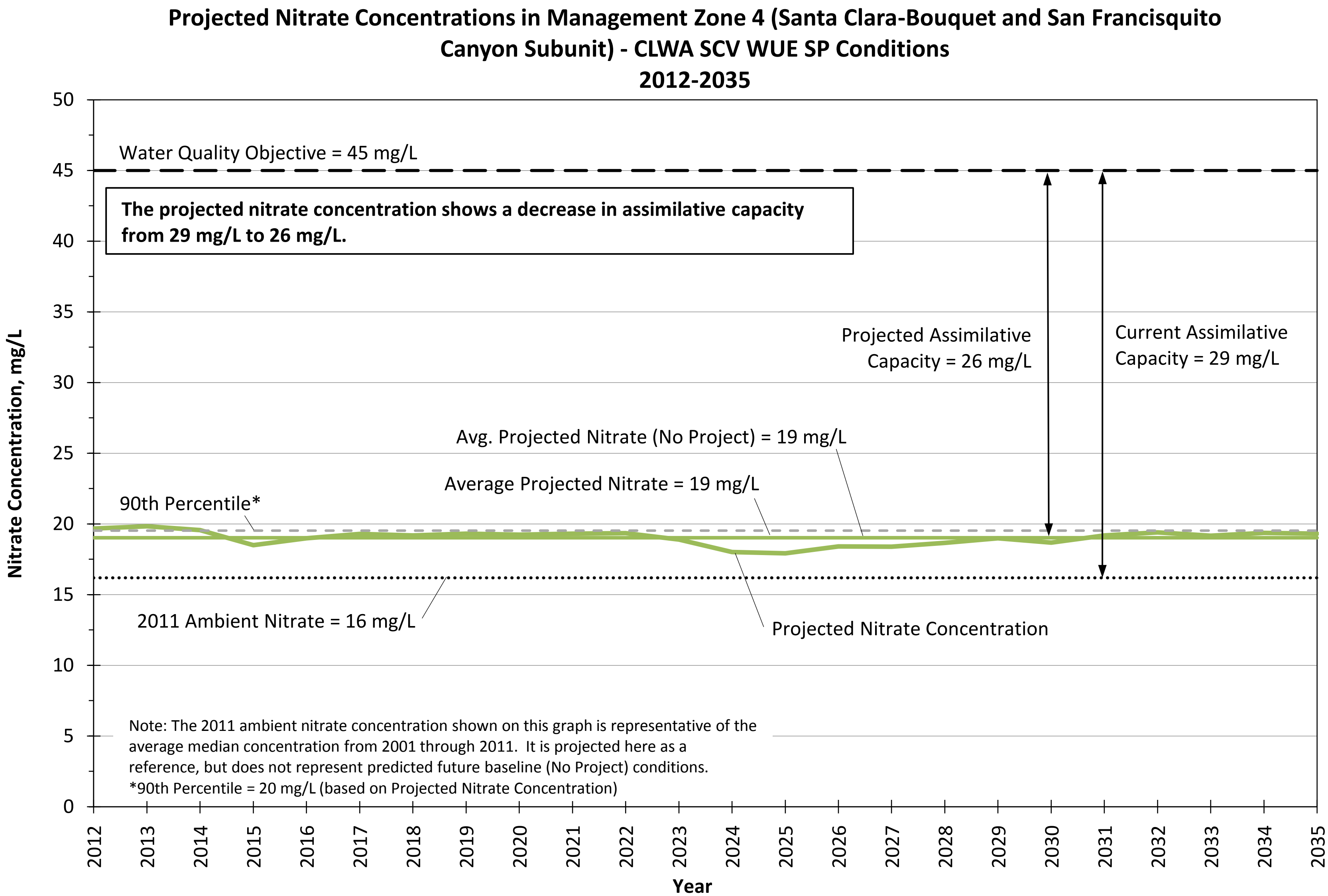

Figure 32.3.e

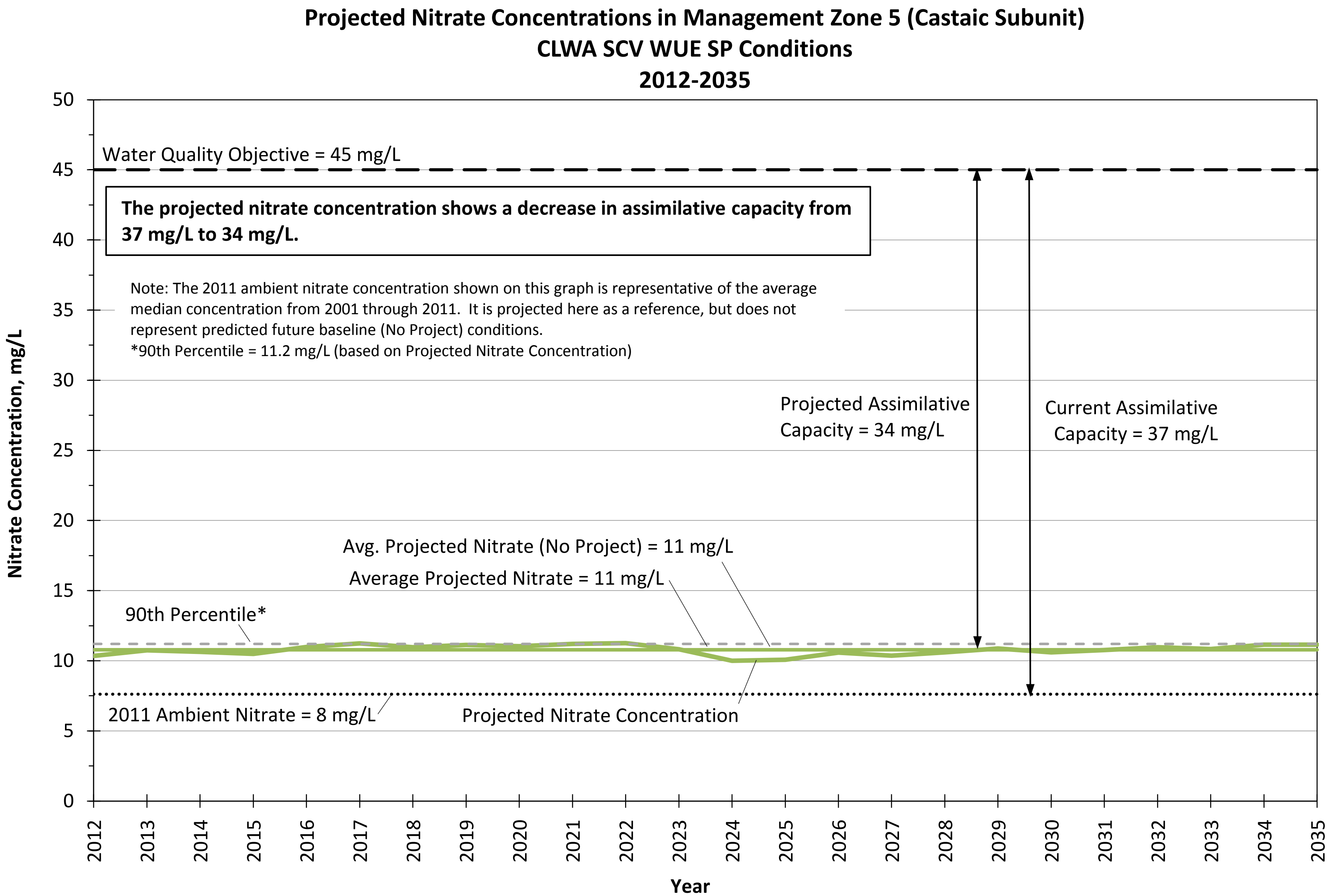
Projected Nitrate Concentrations in Management Zone 5 (Castaic Subunit)
CLWA SCV WUE SP Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 37 mg/L to 34 mg/L.
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 11.2 mg/L (based on Projected Nitrate Concentration)
Projected Assimilative Capacity = 34 mg/L
Current Assimilative Capacity = 37 mg/L
Avg. Projected Nitrate (No Project) = 11 mg/L
Average Projected Nitrate = 11 mg/L
90th Percentile*
2011 Ambient Nitrate = 8 mg/L
Projected Nitrate Concentration
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
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Figure 32.3.f

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

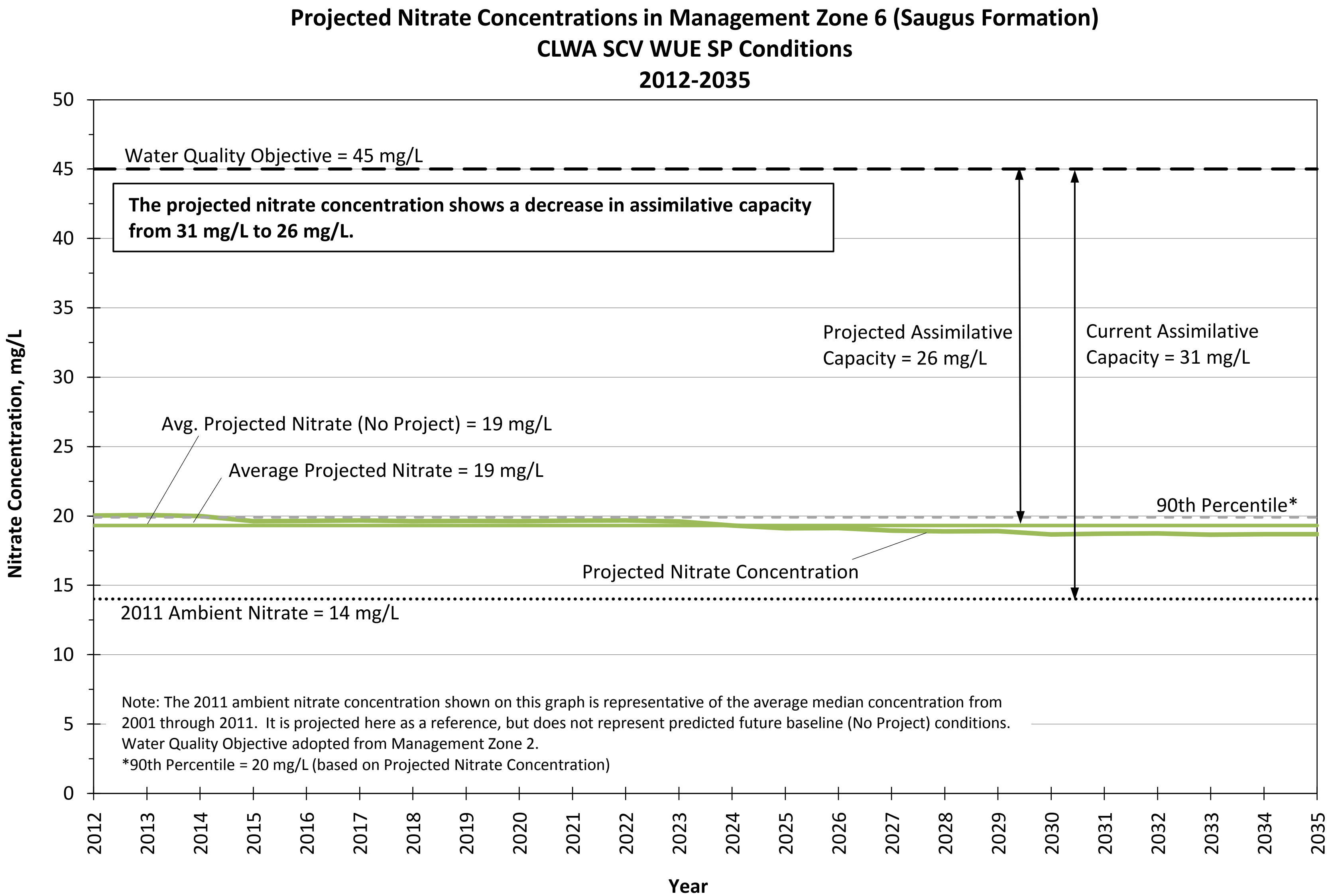


Figure 32.3.g

Projected Sulfate Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
CLWA SCV WUE SP Conditions
2012-2035

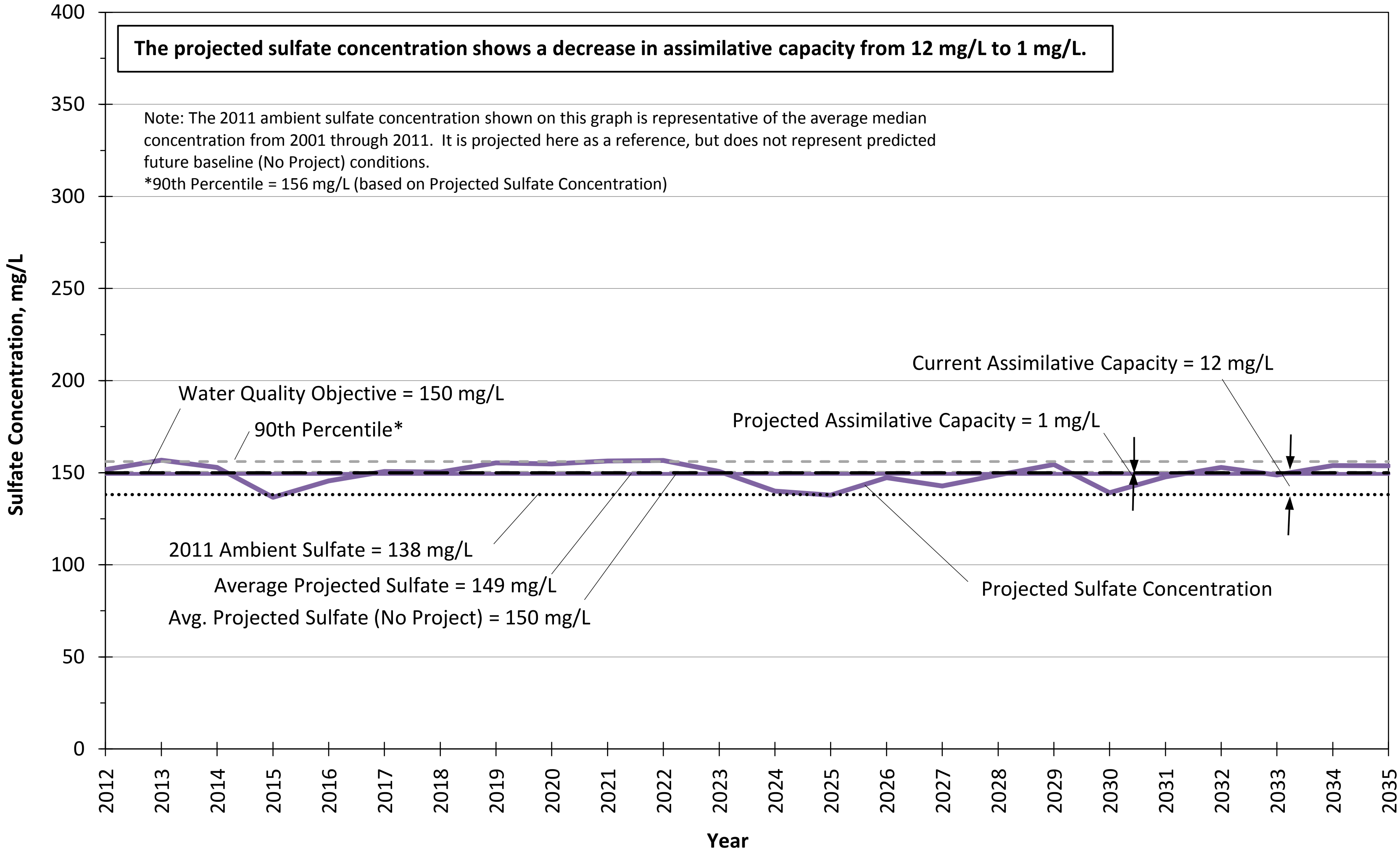


Figure 32.4.a

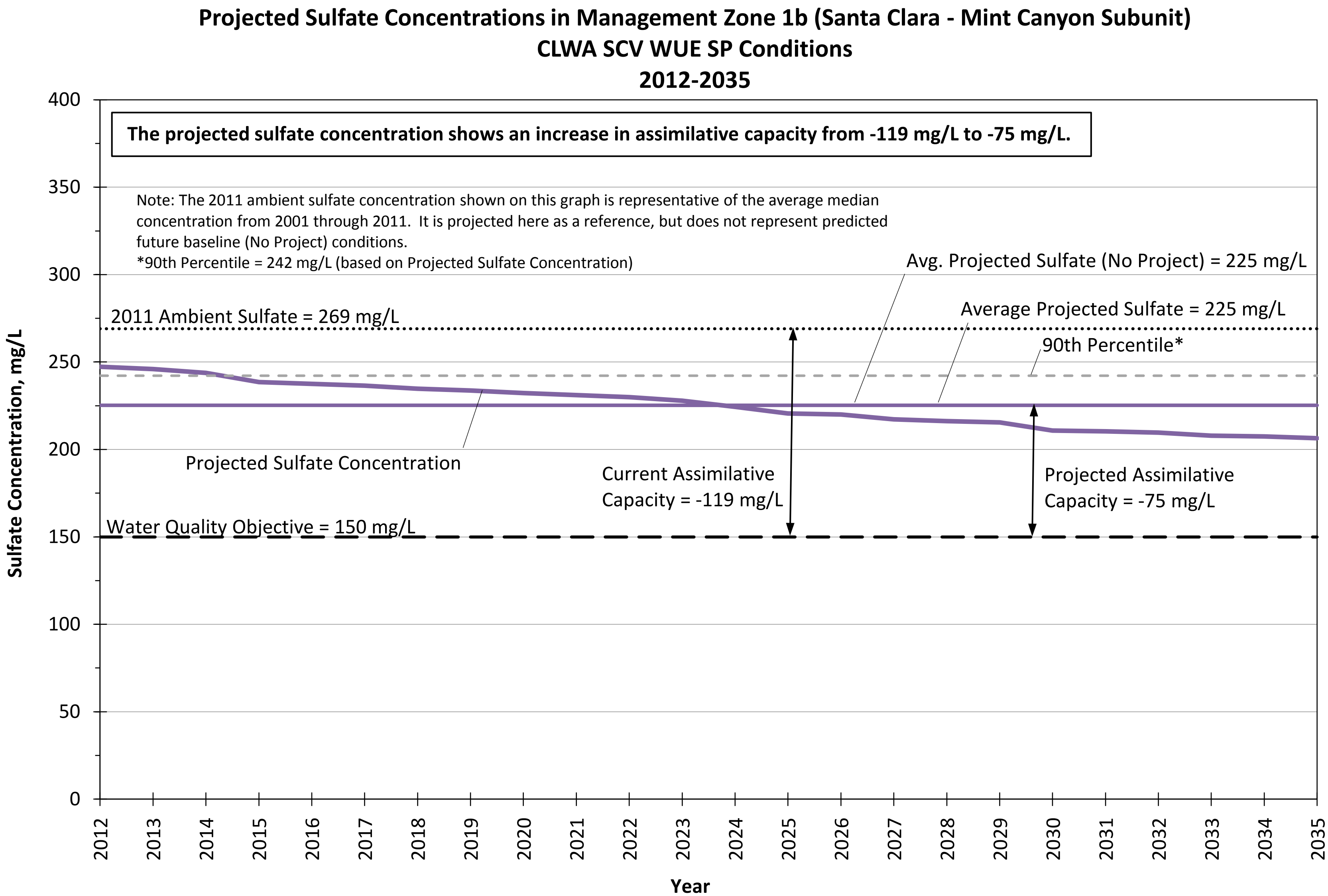

Projected Sulfate Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
CLWA SCV WUE SP Conditions
2012-2035
The projected sulfate concentration shows an increase in assimilative capacity from -119 mg/L to -75 mg/L.
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 242 mg/L (based on Projected Sulfate Concentration)
Avg. Projected Sulfate (No Project) = 225 mg/L
Average Projected Sulfate = 225 mg/L
90th Percentile*
2011 Ambient Sulfate = 269 mg/L
Projected Sulfate Concentration
Current Assimilative Capacity = -119 mg/L
Projected Assimilative Capacity = -75 mg/L
Water Quality Objective = 150 mg/L
Sulfate Concentration, mg/L
400
350
300
250
200
150
100
50
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 32.4.b

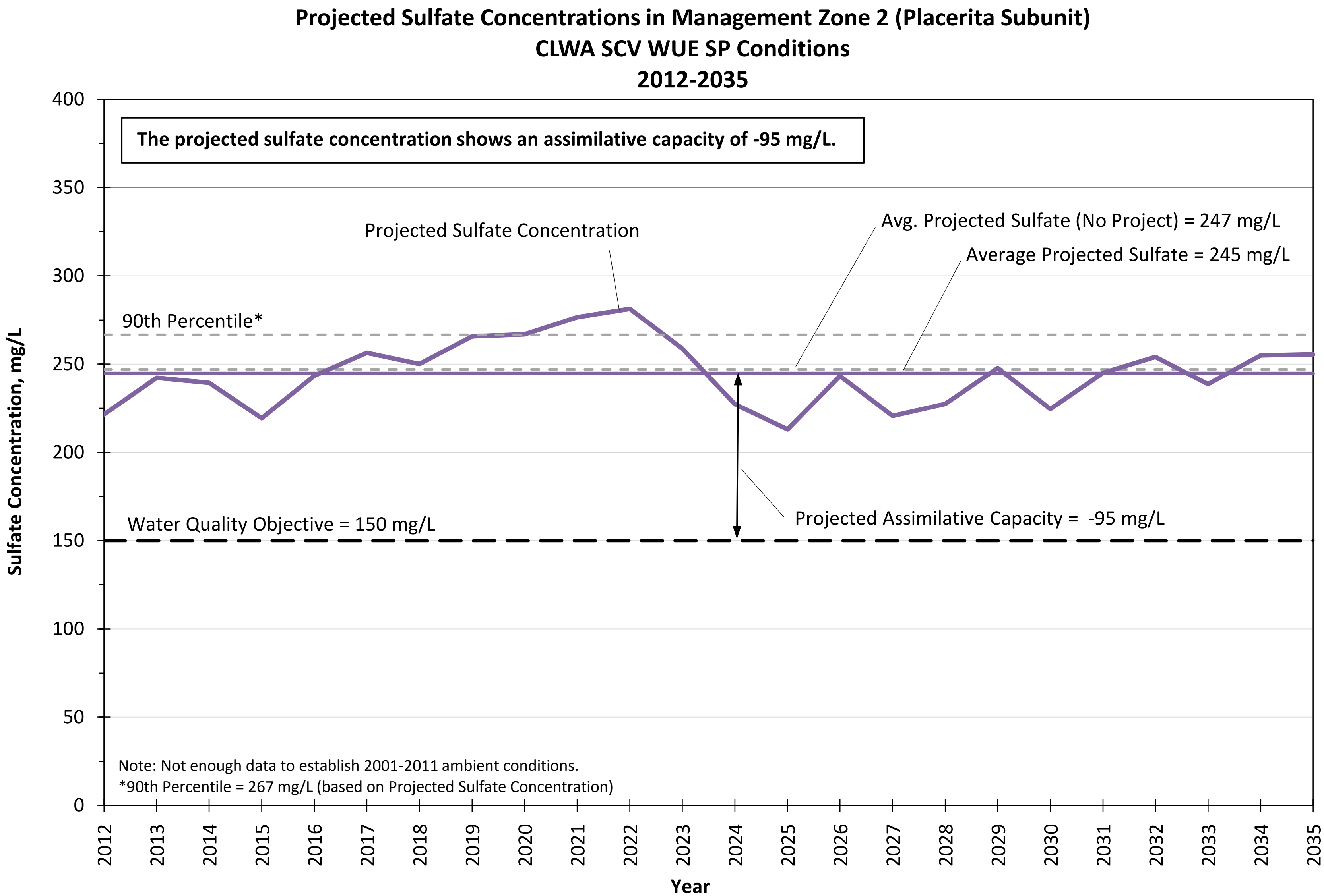

Projected Sulfate Concentrations in Management Zone 2 (Placerita Subunit)
CLWA SCV WUE SP Conditions
2012-2035
The projected sulfate concentration shows an assimilative capacity of -95 mg/L.
Projected Sulfate Concentration
Avg. Projected Sulfate (No Project) = 247 mg/L
Average Projected Sulfate = 245 mg/L
90th Percentile*
Projected Assimilative Capacity = -95 mg/L
Water Quality Objective = 150 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 267 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 32.4.c

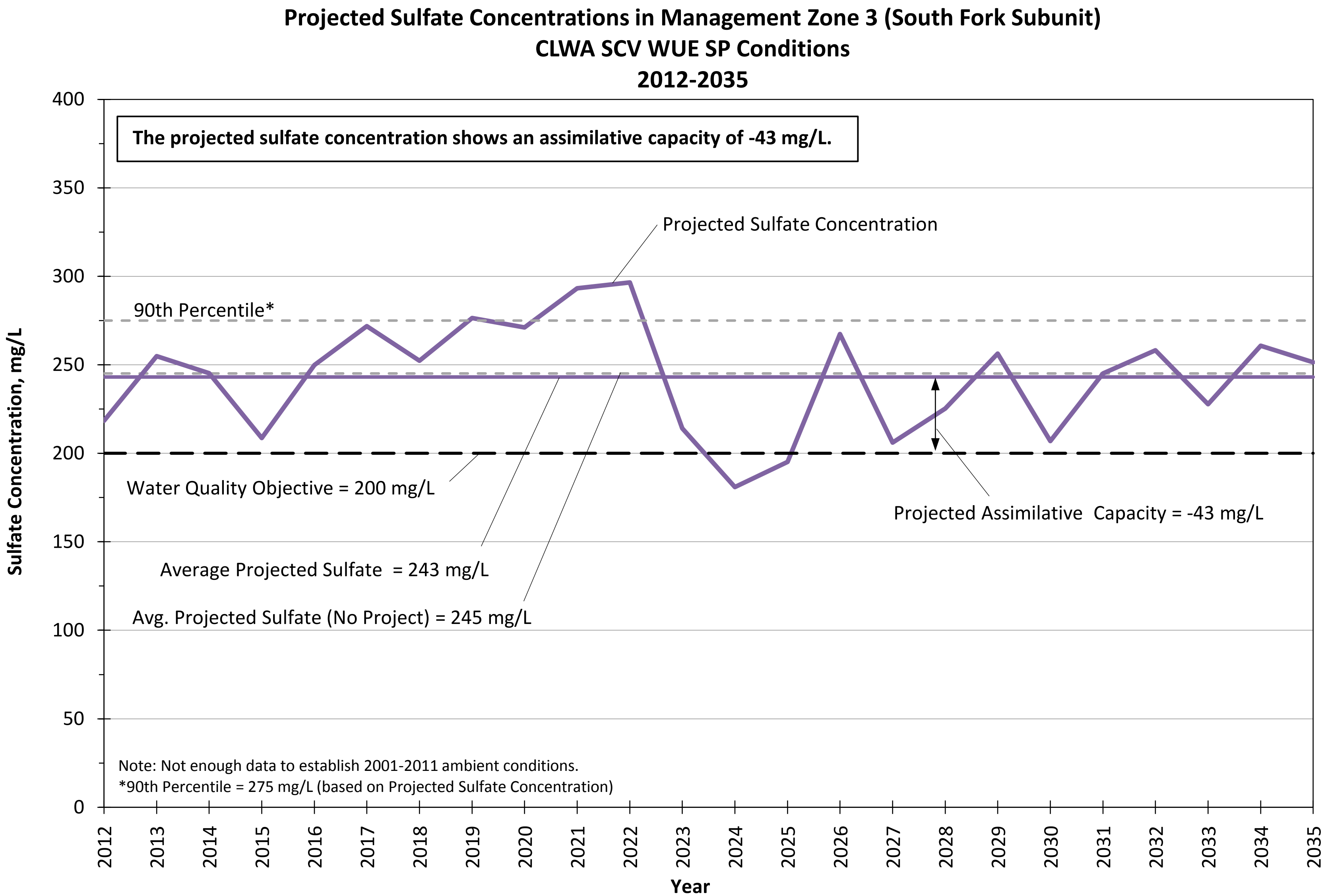

Projected Sulfate Concentrations in Management Zone 3 (South Fork Subunit)
CLWA SCV WUE SP Conditions
2012-2035
The projected sulfate concentration shows an assimilative capacity of -43 mg/L.
Projected Sulfate Concentration
90th Percentile*
Water Quality Objective = 200 mg/L
Projected Assimilative Capacity = -43 mg/L
Average Projected Sulfate = 243 mg/L
Avg. Projected Sulfate (No Project) = 245 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 275 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 32.4.d

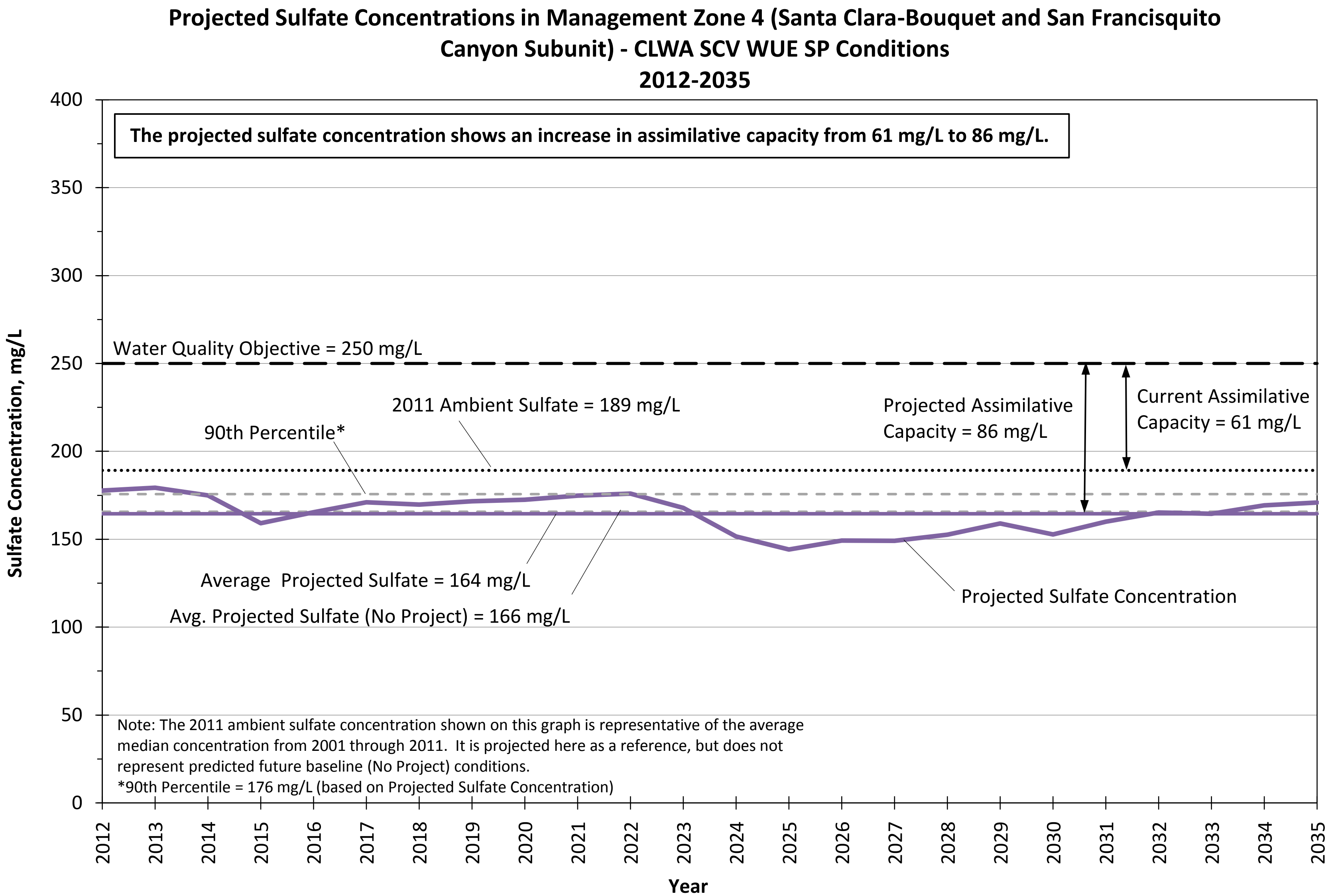

Projected Sulfate Concentrations in Management Zone 4 (Santa Clara-Bouquet and San Francisquito Canyon Subunit) - CLWA SCV WUE SP Conditions
2012-2035
The projected sulfate concentration shows an increase in assimilative capacity from 61 mg/L to 86 mg/L.
Water Quality Objective = 250 mg/L
2011 Ambient Sulfate = 189 mg/L
90th Percentile*
Projected Assimilative Capacity = 86 mg/L
Current Assimilative Capacity = 61 mg/L
Average Projected Sulfate = 164 mg/L
Avg. Projected Sulfate (No Project) = 166 mg/L
Projected Sulfate Concentration
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 176 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 32.4.e

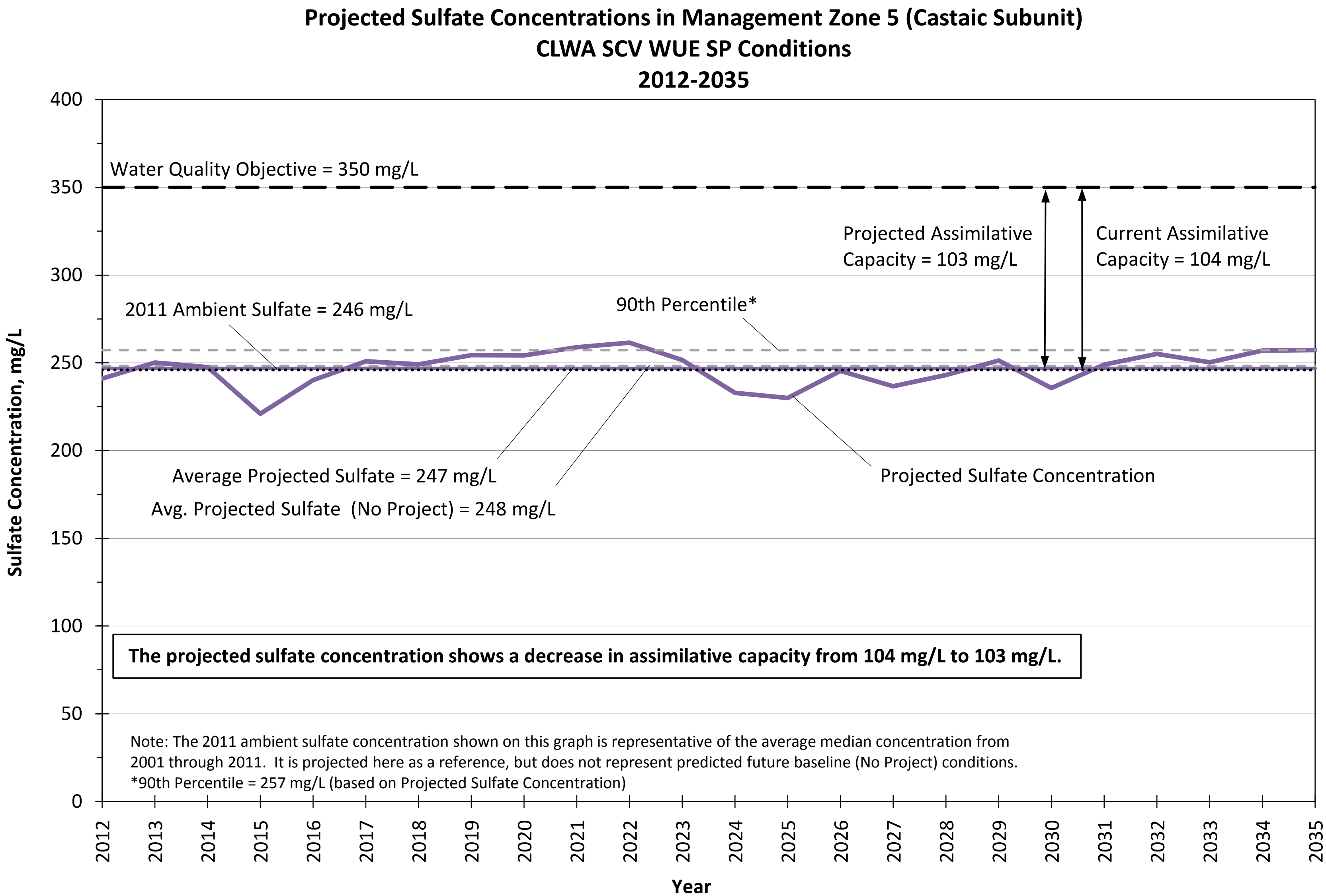

Projected Sulfate Concentrations in Management Zone 5 (Castaic Subunit)
CLWA SCV WUE SP Conditions
2012-2035
Water Quality Objective = 350 mg/L
Projected Assimilative Capacity = 103 mg/L
Current Assimilative Capacity = 104 mg/L
2011 Ambient Sulfate = 246 mg/L
90th Percentile*
Average Projected Sulfate = 247 mg/L
Avg. Projected Sulfate (No Project) = 248 mg/L
Projected Sulfate Concentration
The projected sulfate concentration shows a decrease in assimilative capacity from 104 mg/L to 103 mg/L.
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 257 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 32.4.f

Projected Sulfate Concentrations in Management Zone 6 (Saugus Formation)
CLWA SCV WUE SP Conditions
2012-2035

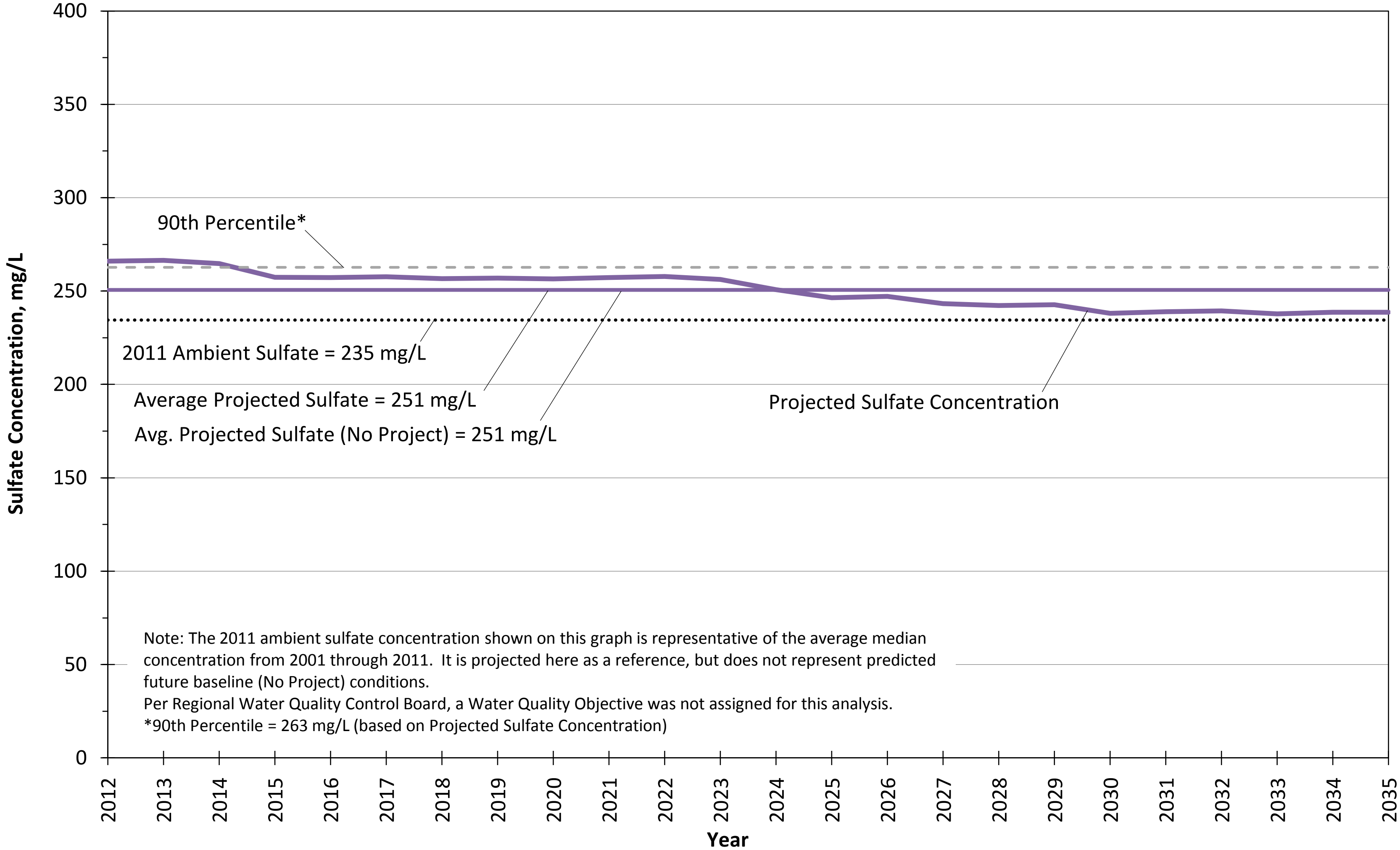
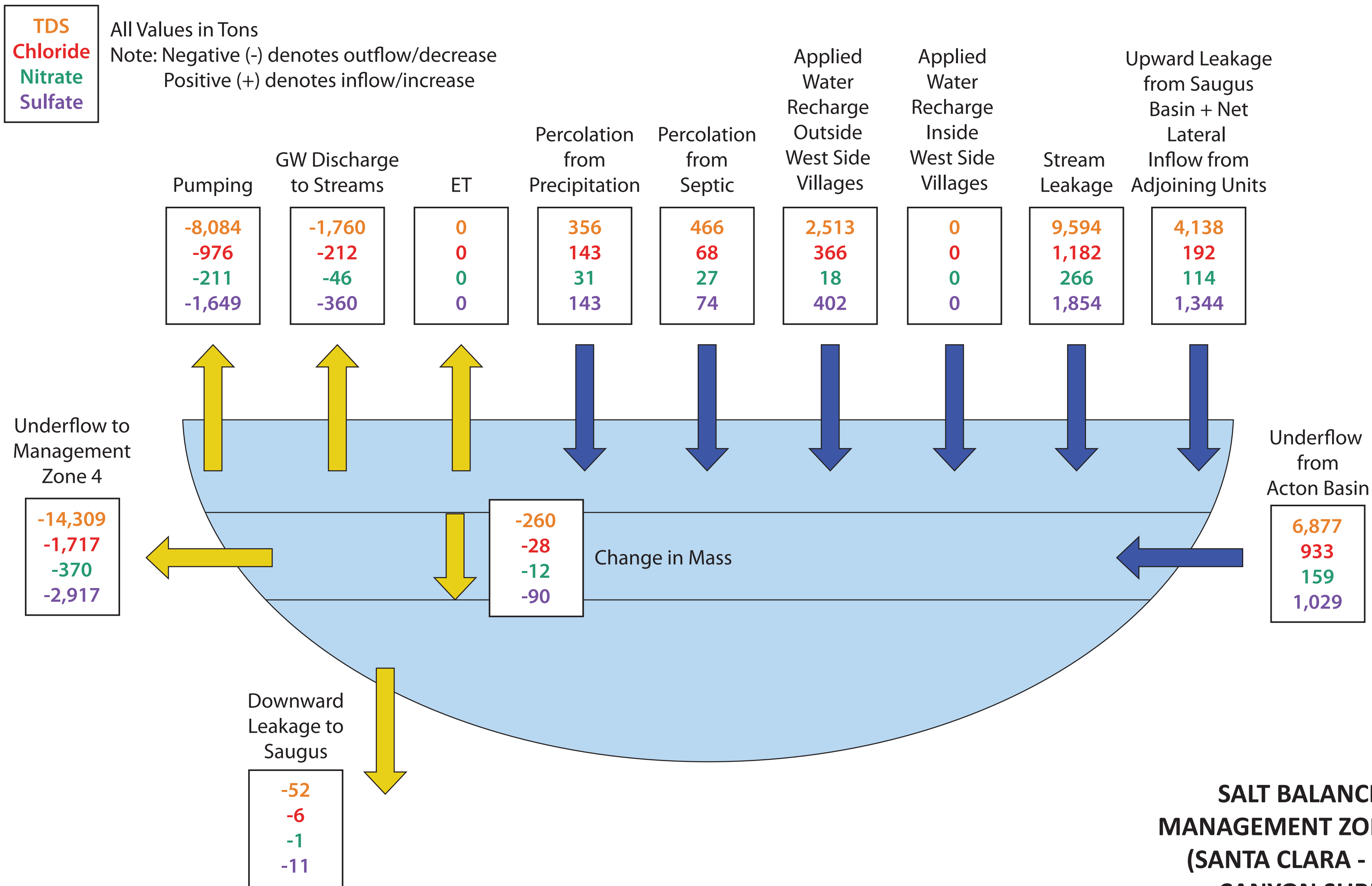


Figure 32.4.g



SALT BALANCE FOR MANAGEMENT ZONE 1a (SANTA CLARA - MINT CANYON SUBUNIT) NEWHALL WRP CONDITIONS 2012-2035

8-Dec-16

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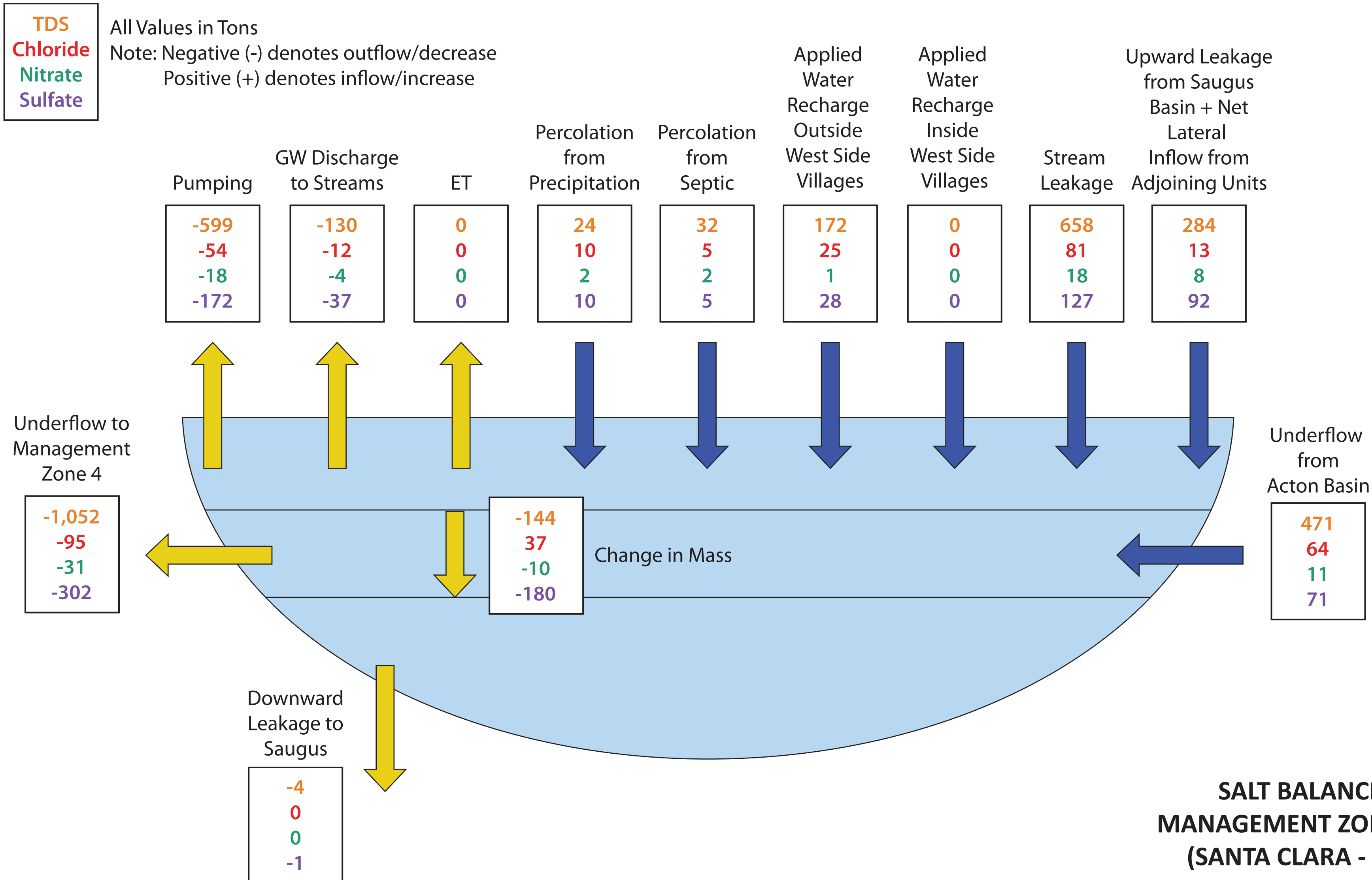
Figure 33a



SALT BALANCE FOR MANAGEMENT ZONE 1b (SANTA CLARA - MINT CANYON SUBUNIT) NEWHALL WRP CONDITIONS 2012-2035

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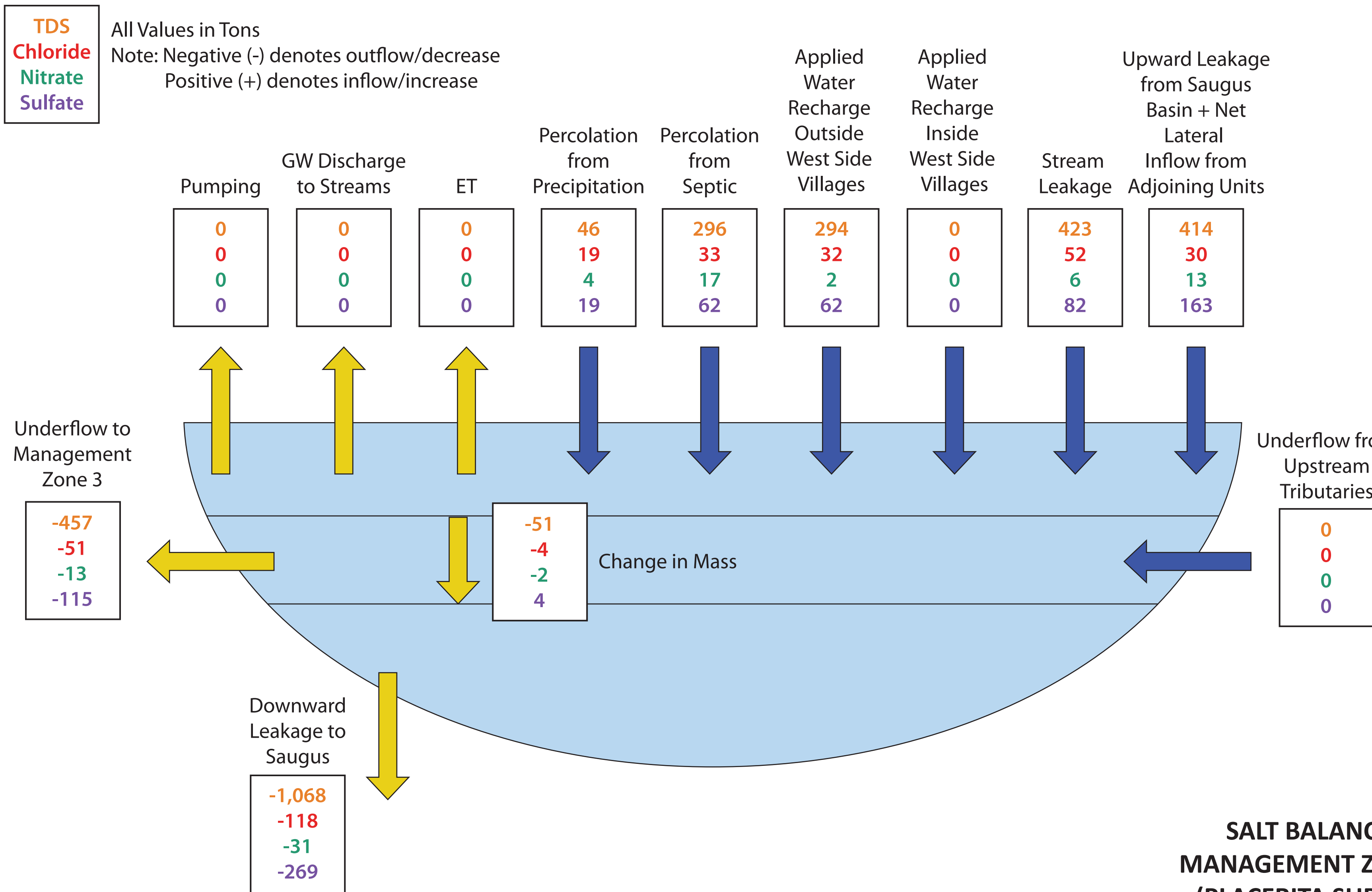
Figure 33b

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 2 (PLACERITA SUBUNIT) NEWHALL WRP CONDITIONS 2012-2035

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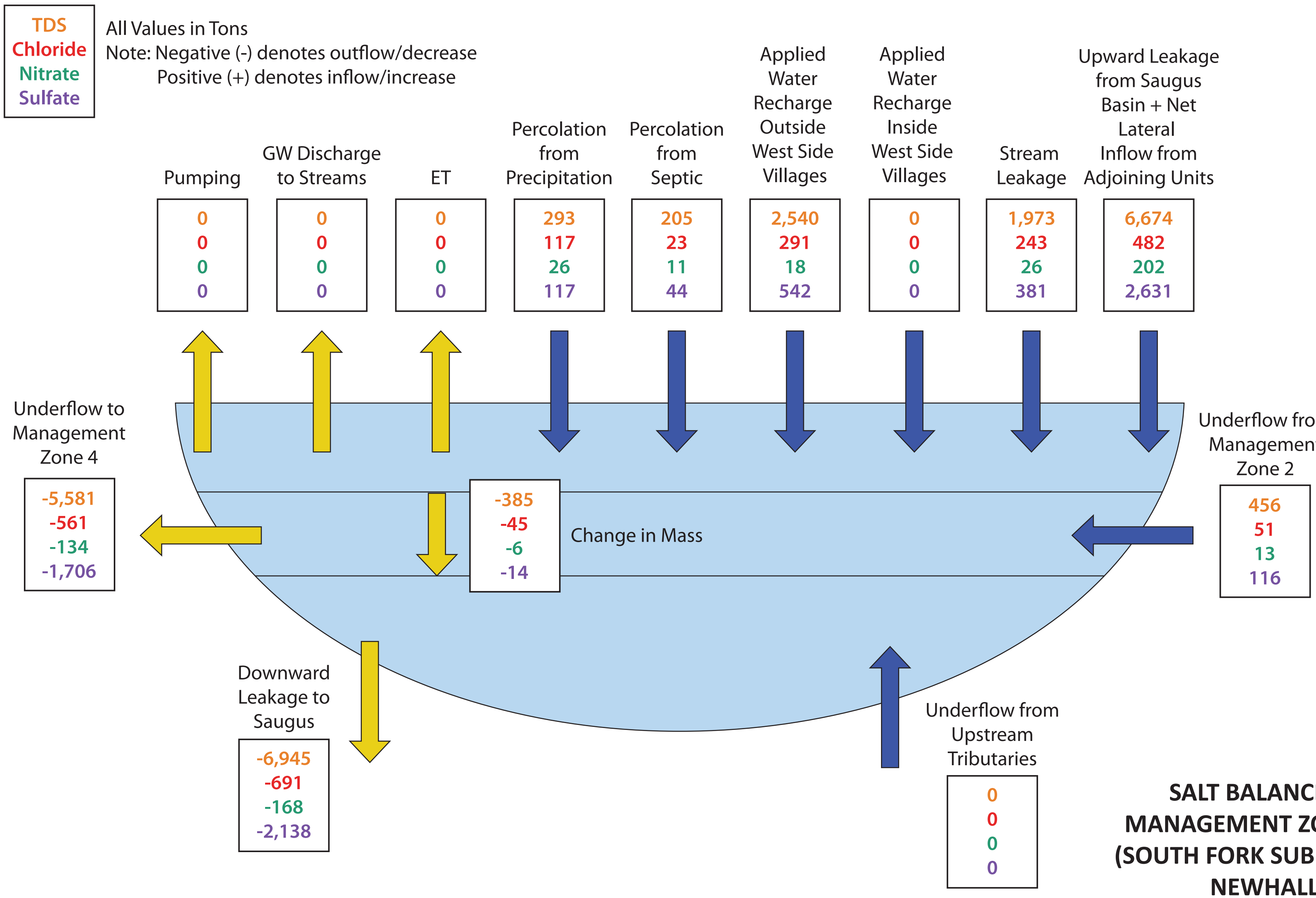
Figure 33c



SALT BALANCE FOR MANAGEMENT ZONE 3 (SOUTH FORK SUBUNIT) NEWHALL WRP CONDITIONS 2012-2035

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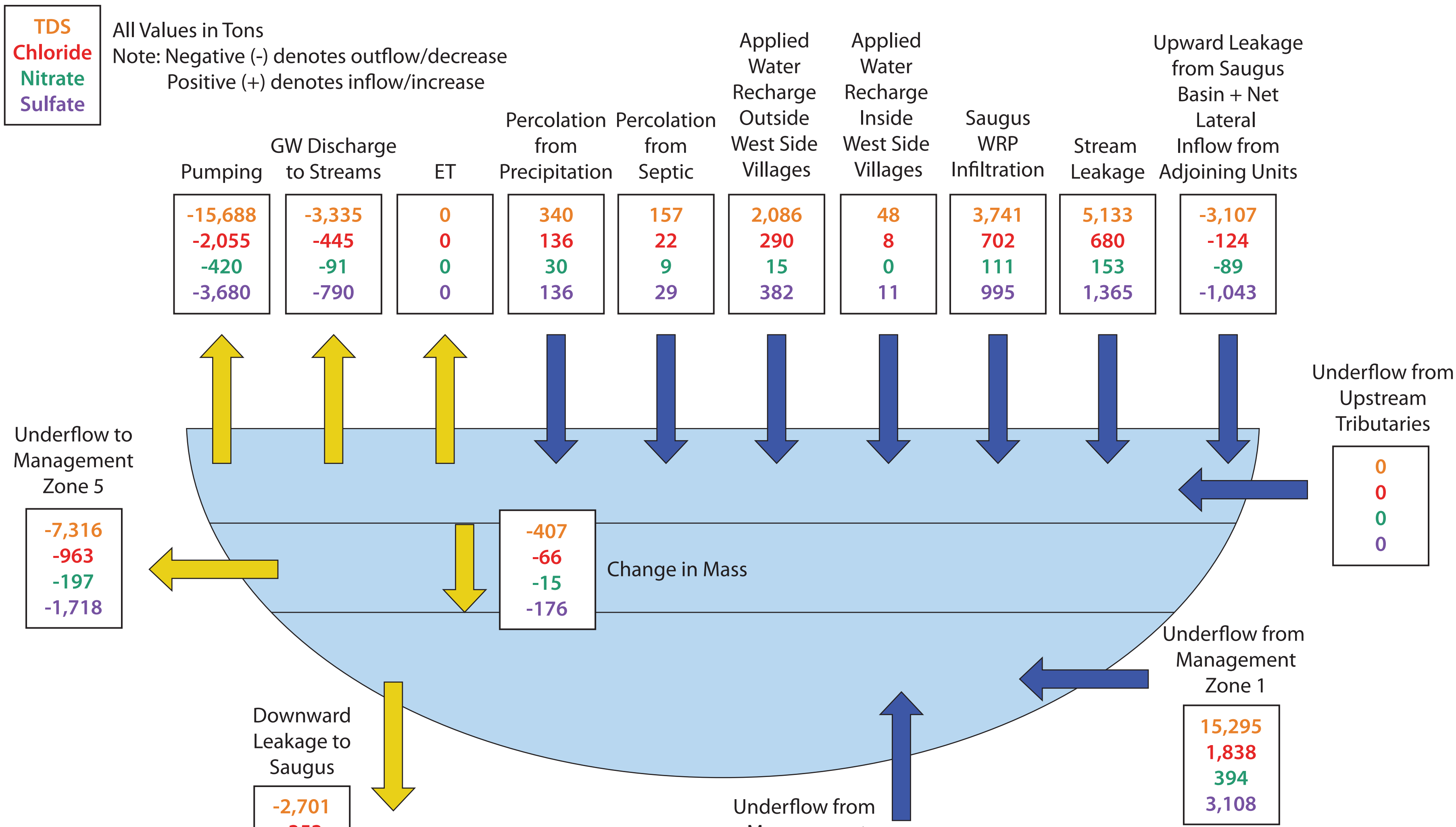
Figure 33d

CASTAC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 4
(SANTA CLARA - BOUQUET AND
SAN FRANCISQUITO CANYON SUBUNIT)
NEWHALL WRP
CONDITIONS
2012-2035

8-Dec-16

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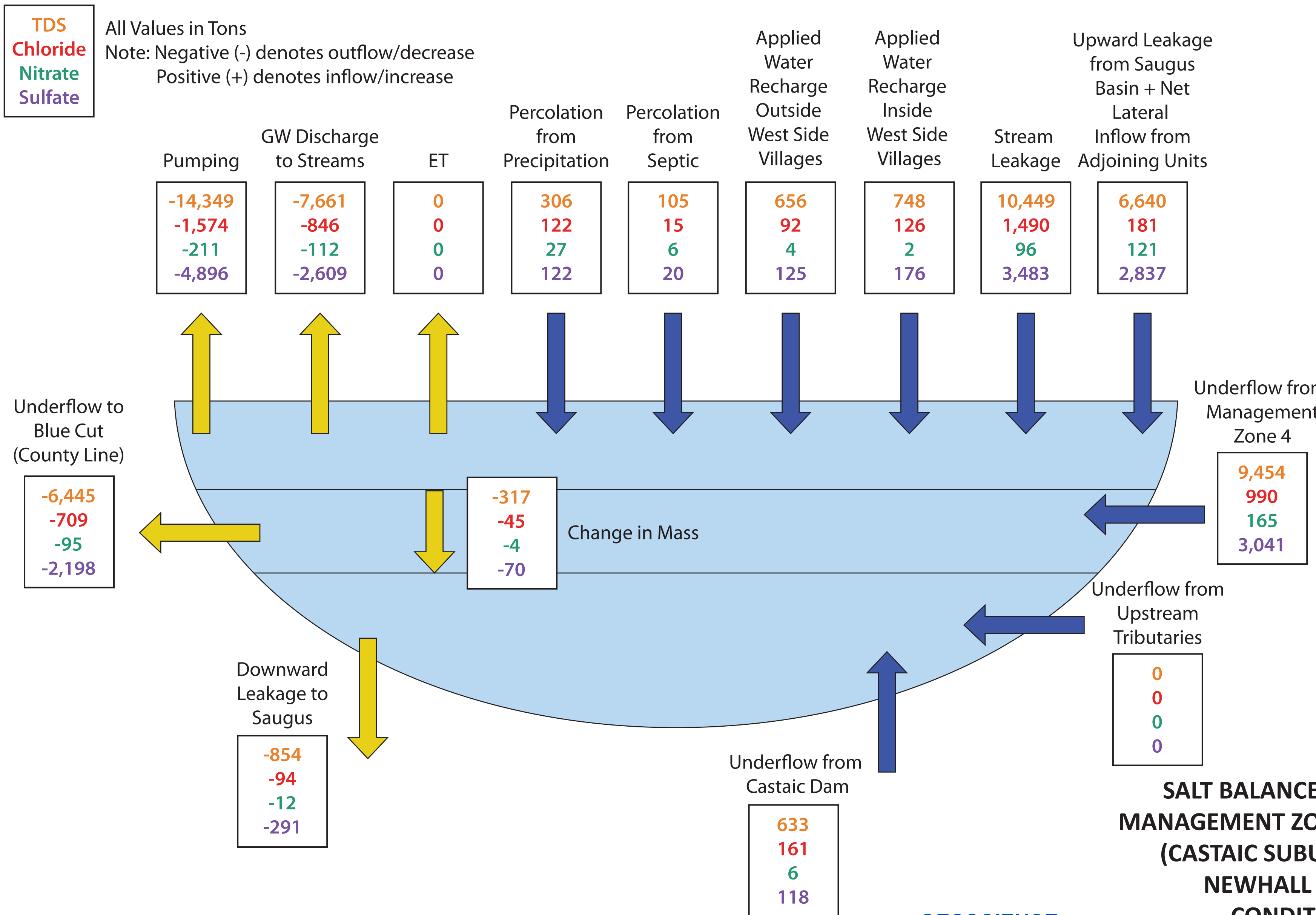
Figure 33e

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 5 (CASTAIC SUBUNIT) NEWHALL WRP CONDITIONS 2012-2035

Figure 33f

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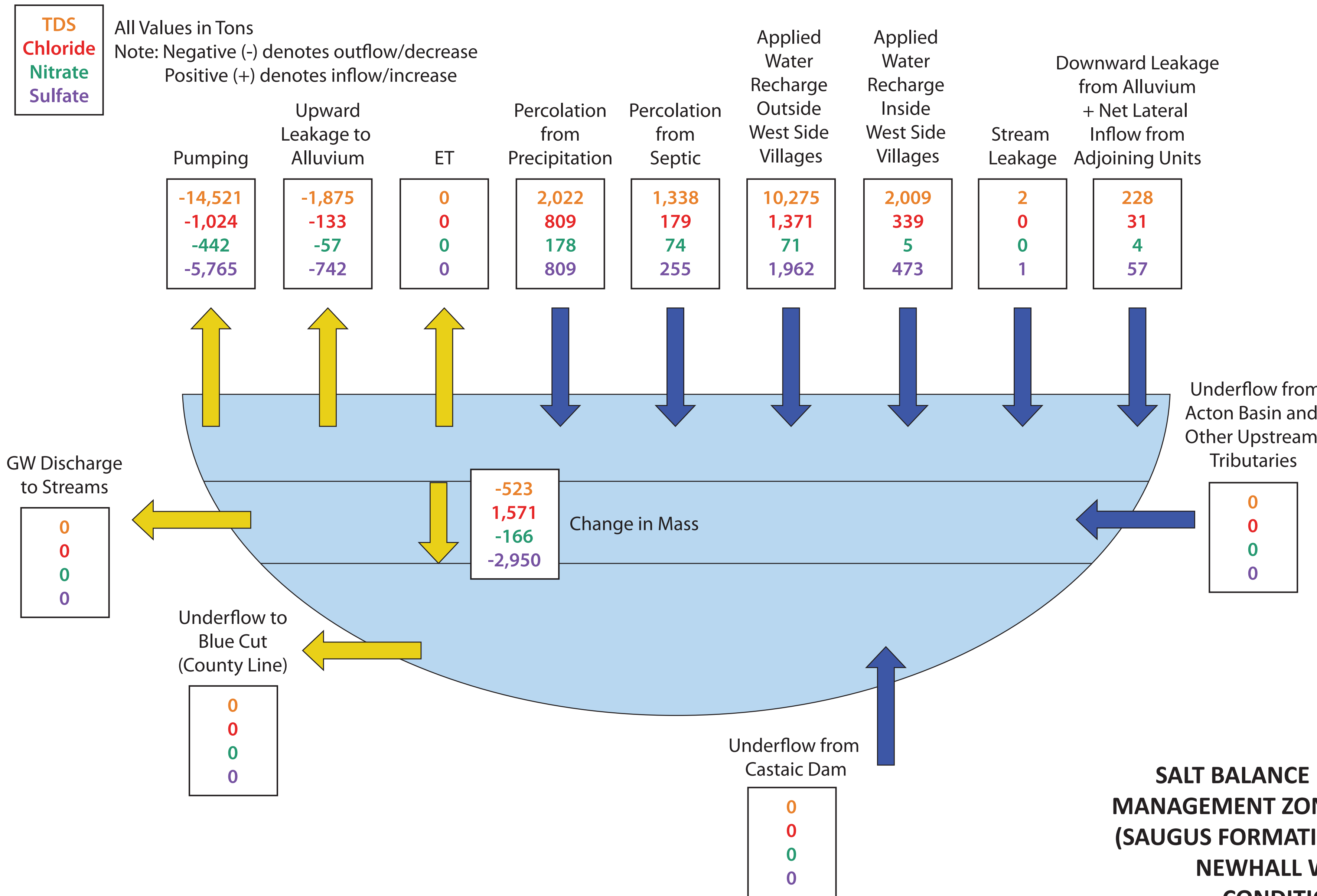
CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 6 (SAUGUS FORMATION) NEWHALL WRP CONDITIONS 2012-2035

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Figure 33g

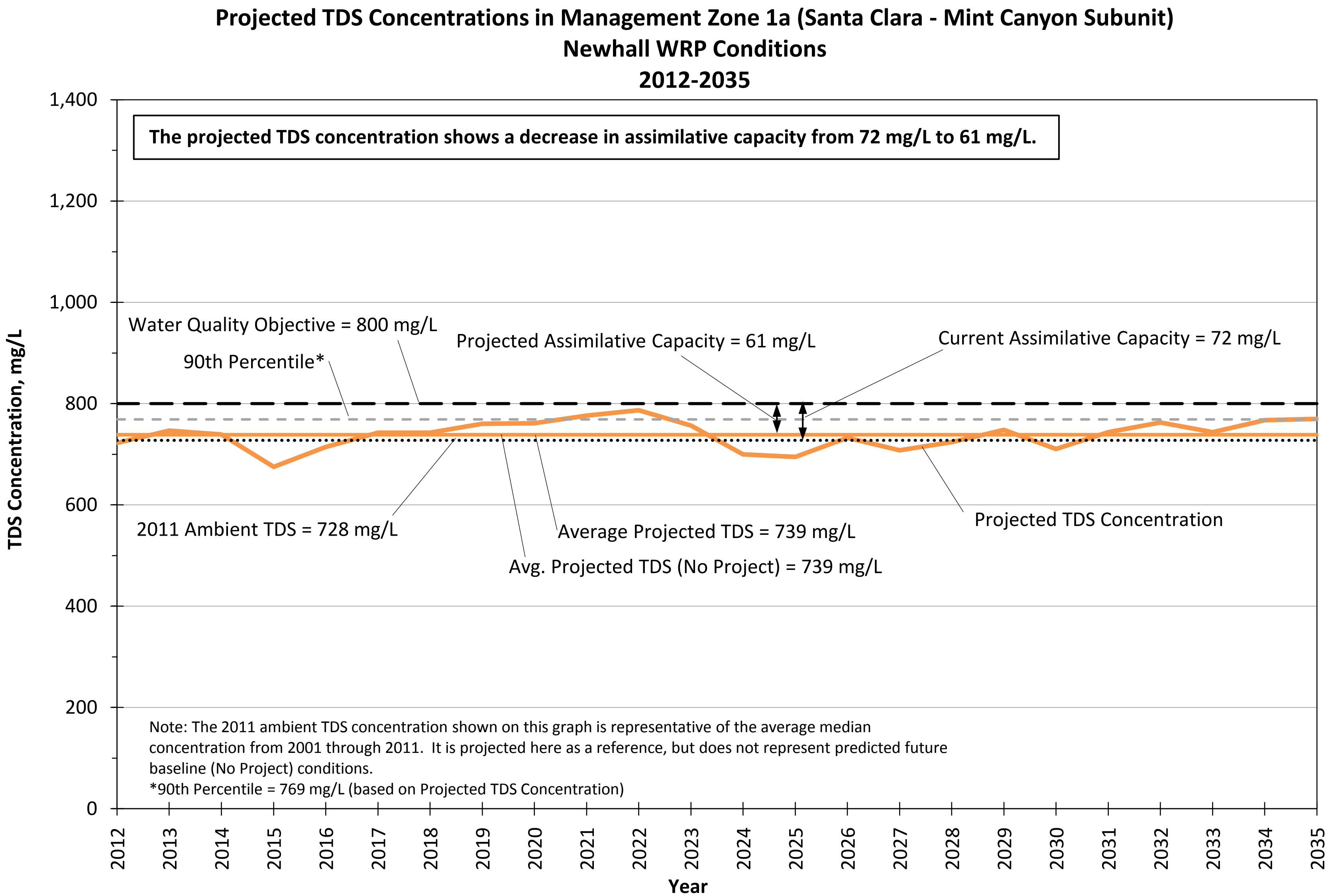

Projected TDS Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
Newhall WRP Conditions
2012-2035
The projected TDS concentration shows a decrease in assimilative capacity from 72 mg/L to 61 mg/L.
Water Quality Objective = 800 mg/L
90th Percentile*
Projected Assimilative Capacity = 61 mg/L
Current Assimilative Capacity = 72 mg/L
2011 Ambient TDS = 728 mg/L
Average Projected TDS = 739 mg/L
Avg. Projected TDS (No Project) = 739 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 769 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
Year
0
200
400
600
800
1,000
1,200
1,400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 34.1.a

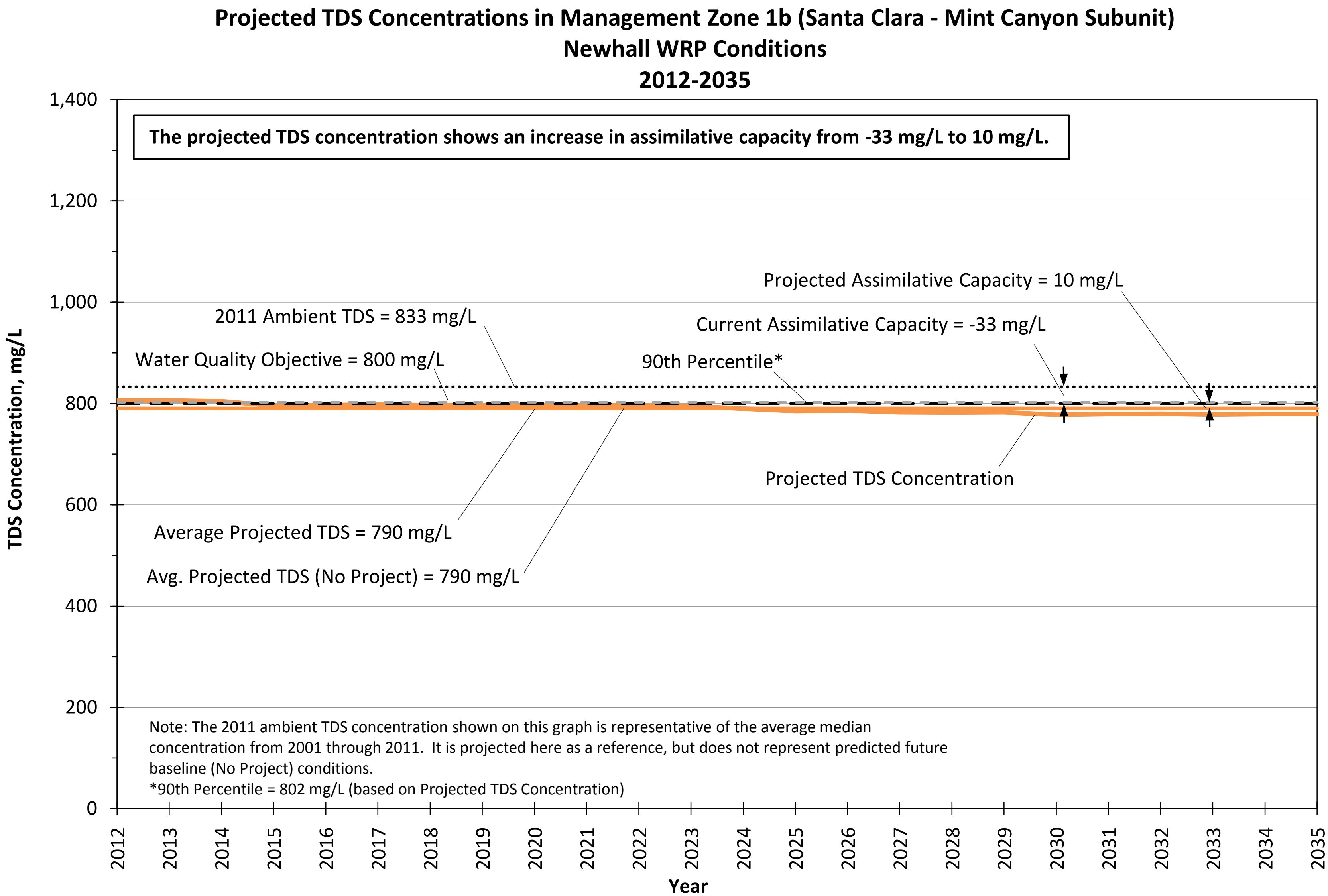

Projected TDS Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
Newhall WRP Conditions
2012-2035
The projected TDS concentration shows an increase in assimilative capacity from -33 mg/L to 10 mg/L.
Projected Assimilative Capacity = 10 mg/L
2011 Ambient TDS = 833 mg/L
Current Assimilative Capacity = -33 mg/L
Water Quality Objective = 800 mg/L
90th Percentile*
Projected TDS Concentration
Average Projected TDS = 790 mg/L
Avg. Projected TDS (No Project) = 790 mg/L
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 802 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 34.1.b

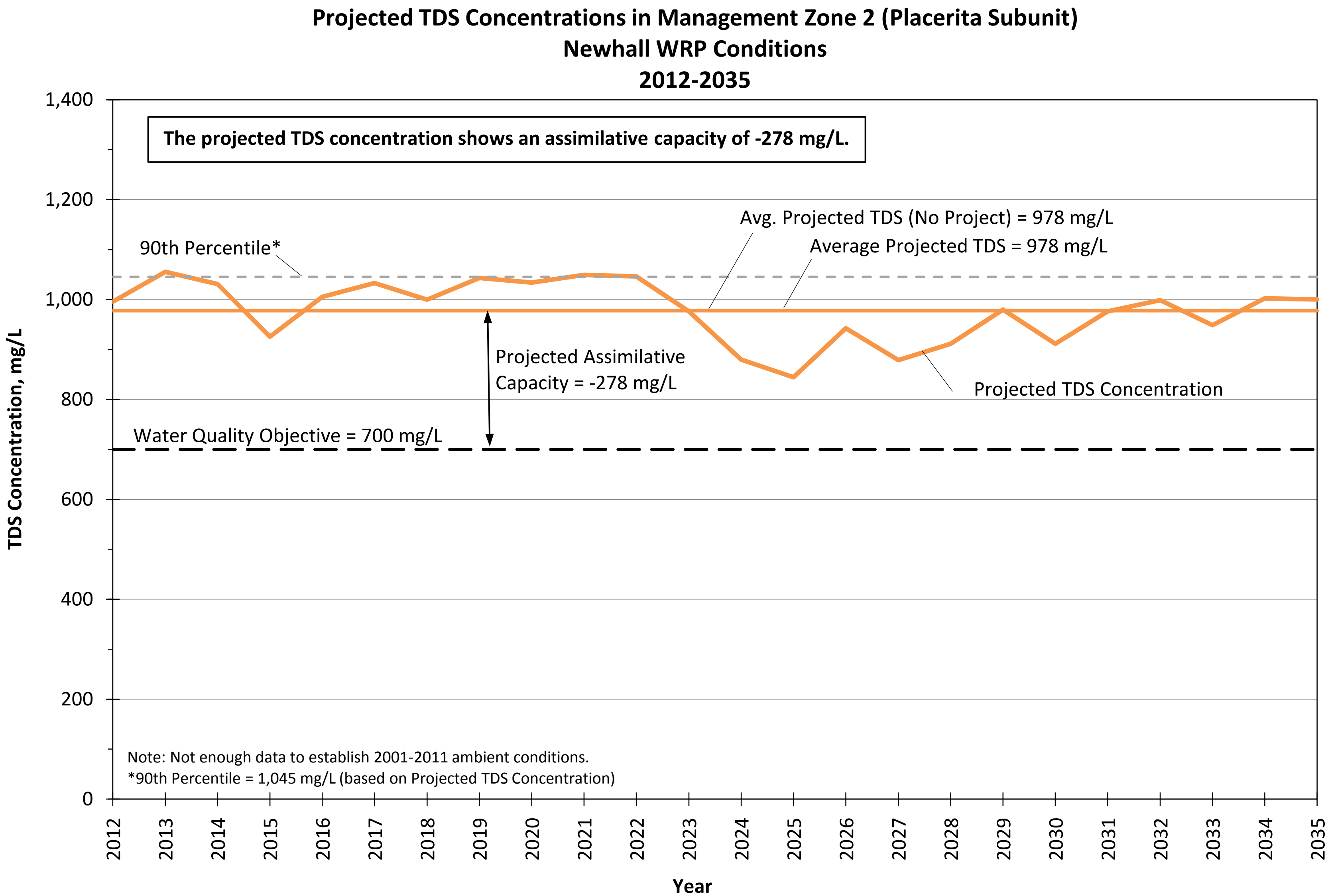

Projected TDS Concentrations in Management Zone 2 (Placerita Subunit)
Newhall WRP Conditions
2012-2035
The projected TDS concentration shows an assimilative capacity of -278 mg/L.
Avg. Projected TDS (No Project) = 978 mg/L
Average Projected TDS = 978 mg/L
90th Percentile*
Projected Assimilative
Capacity = -278 mg/L
Projected TDS Concentration
Water Quality Objective = 700 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 1,045 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
Year
1,400
1,200
1,000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 34.1.c

Projected TDS Concentrations in Management Zone 3 (South Fork Subunit)
Newhall WRP Conditions
2012-2035

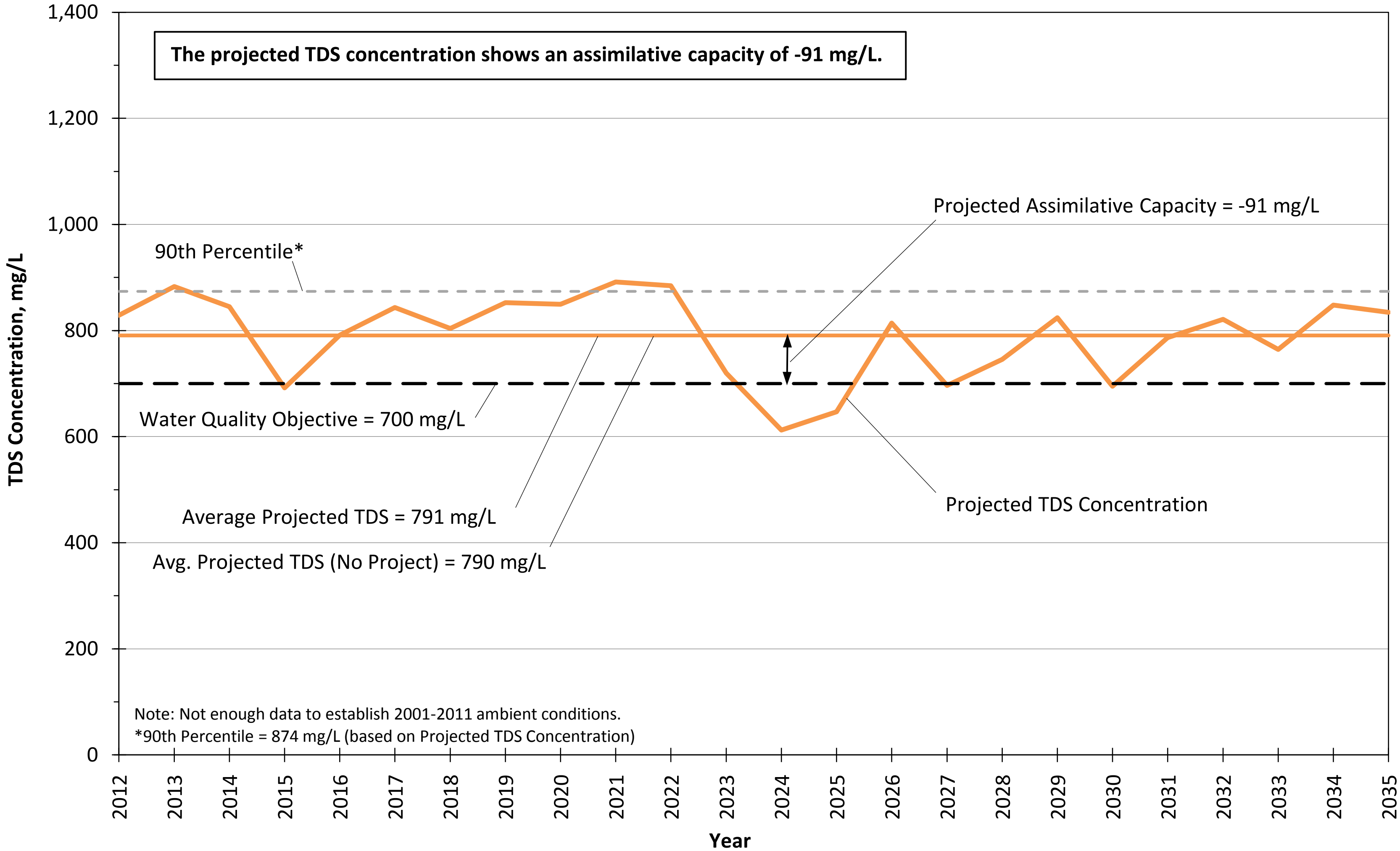


Figure 34.1.d

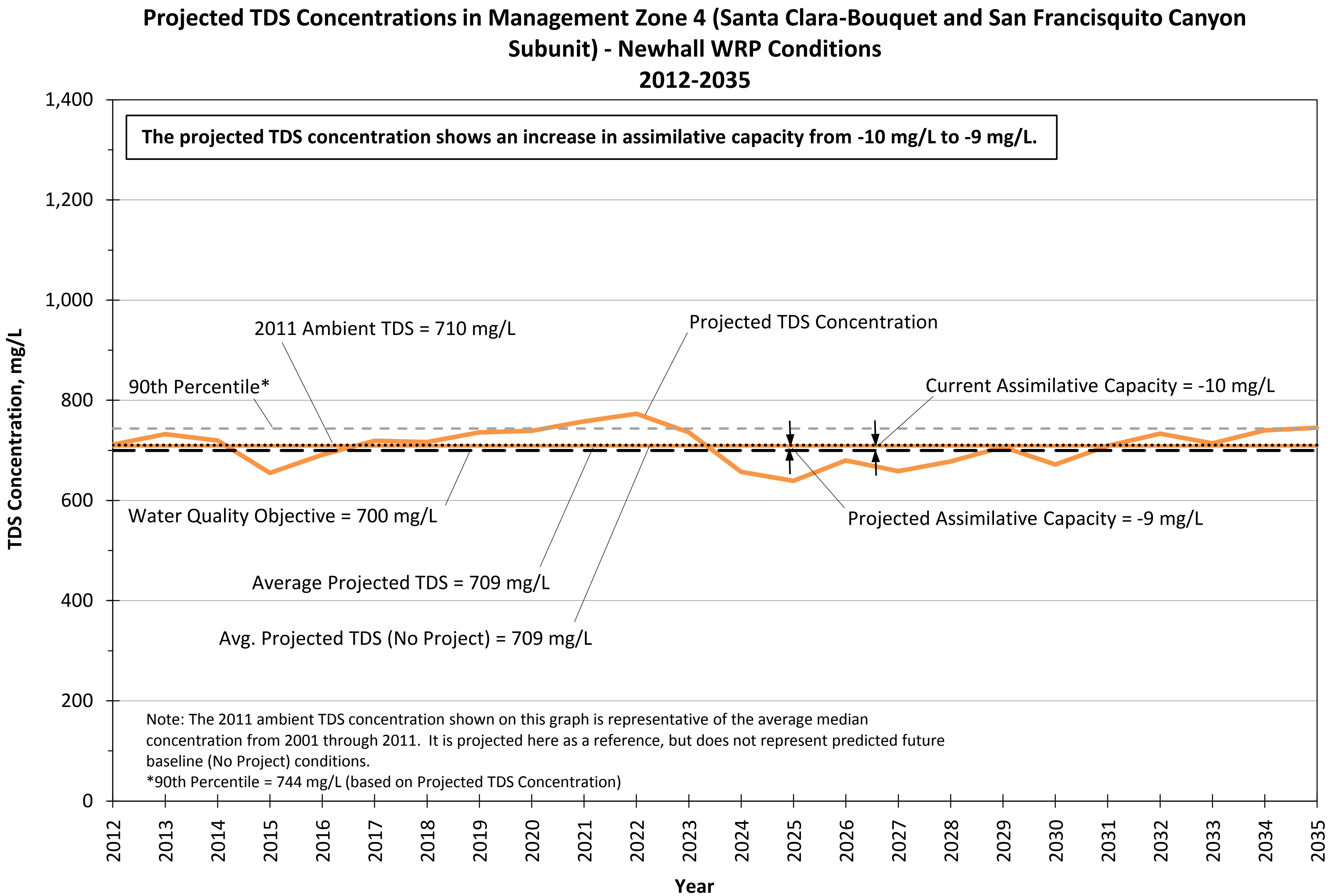

Projected TDS Concentrations in Management Zone 4 (Santa Clara-Bouquet and San Francisquito Canyon Subunit) - Newhall WRP Conditions
2012-2035
The projected TDS concentration shows an increase in assimilative capacity from -10 mg/L to -9 mg/L.
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
2011 Ambient TDS = 710 mg/L
Projected TDS Concentration
90th Percentile*
Current Assimilative Capacity = -10 mg/L
Water Quality Objective = 700 mg/L
Projected Assimilative Capacity = -9 mg/L
Average Projected TDS = 709 mg/L
Avg. Projected TDS (No Project) = 709 mg/L
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 744 mg/L (based on Projected TDS Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 34.1.e

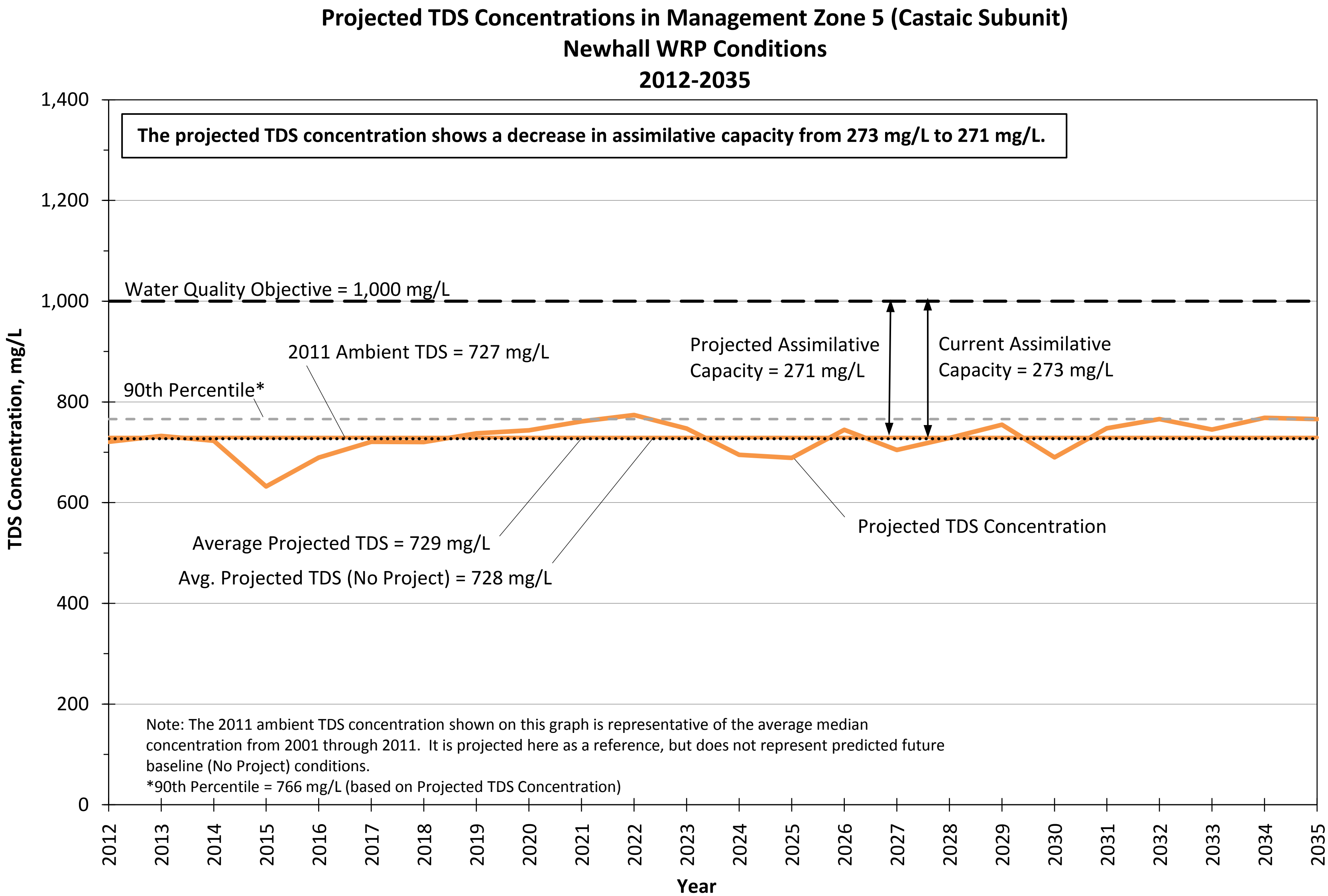

Projected TDS Concentrations in Management Zone 5 (Castaic Subunit)
Newhall WRP Conditions
2012-2035
The projected TDS concentration shows a decrease in assimilative capacity from 273 mg/L to 271 mg/L.
Water Quality Objective = 1,000 mg/L
2011 Ambient TDS = 727 mg/L
90th Percentile*
Projected Assimilative Capacity = 271 mg/L
Current Assimilative Capacity = 273 mg/L
Average Projected TDS = 729 mg/L
Avg. Projected TDS (No Project) = 728 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 766 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 34.1.f

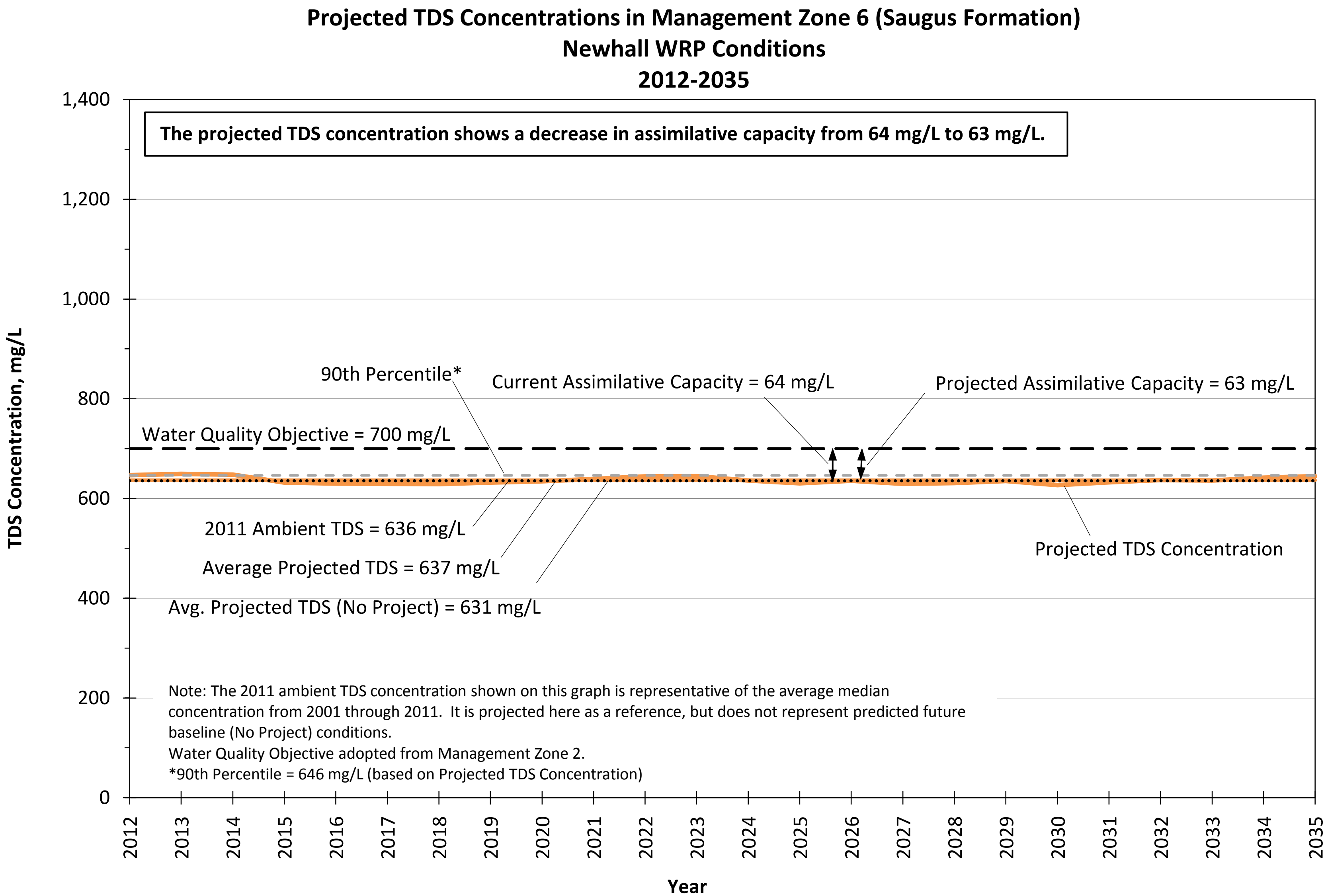

Projected TDS Concentrations in Management Zone 6 (Saugus Formation)
Newhall WRP Conditions
2012-2035
The projected TDS concentration shows a decrease in assimilative capacity from 64 mg/L to 63 mg/L.
90th Percentile*
Current Assimilative Capacity = 64 mg/L
Projected Assimilative Capacity = 63 mg/L
Water Quality Objective = 700 mg/L
2011 Ambient TDS = 636 mg/L
Average Projected TDS = 637 mg/L
Avg. Projected TDS (No Project) = 631 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Water Quality Objective adopted from Management Zone 2.
*90th Percentile = 646 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
Year
1,400
1,200
1,000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 34.1.g

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

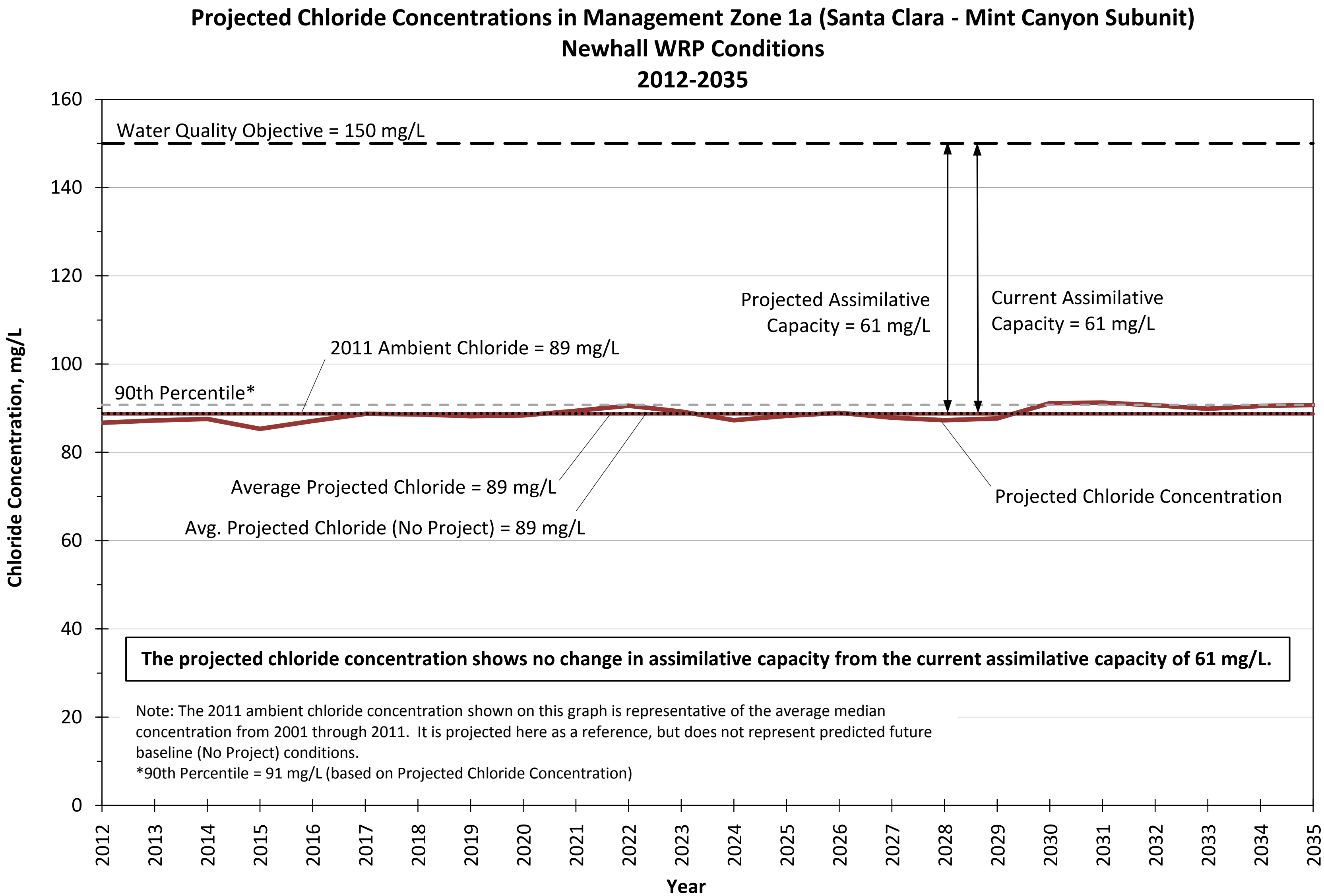


Figure 34.2.a

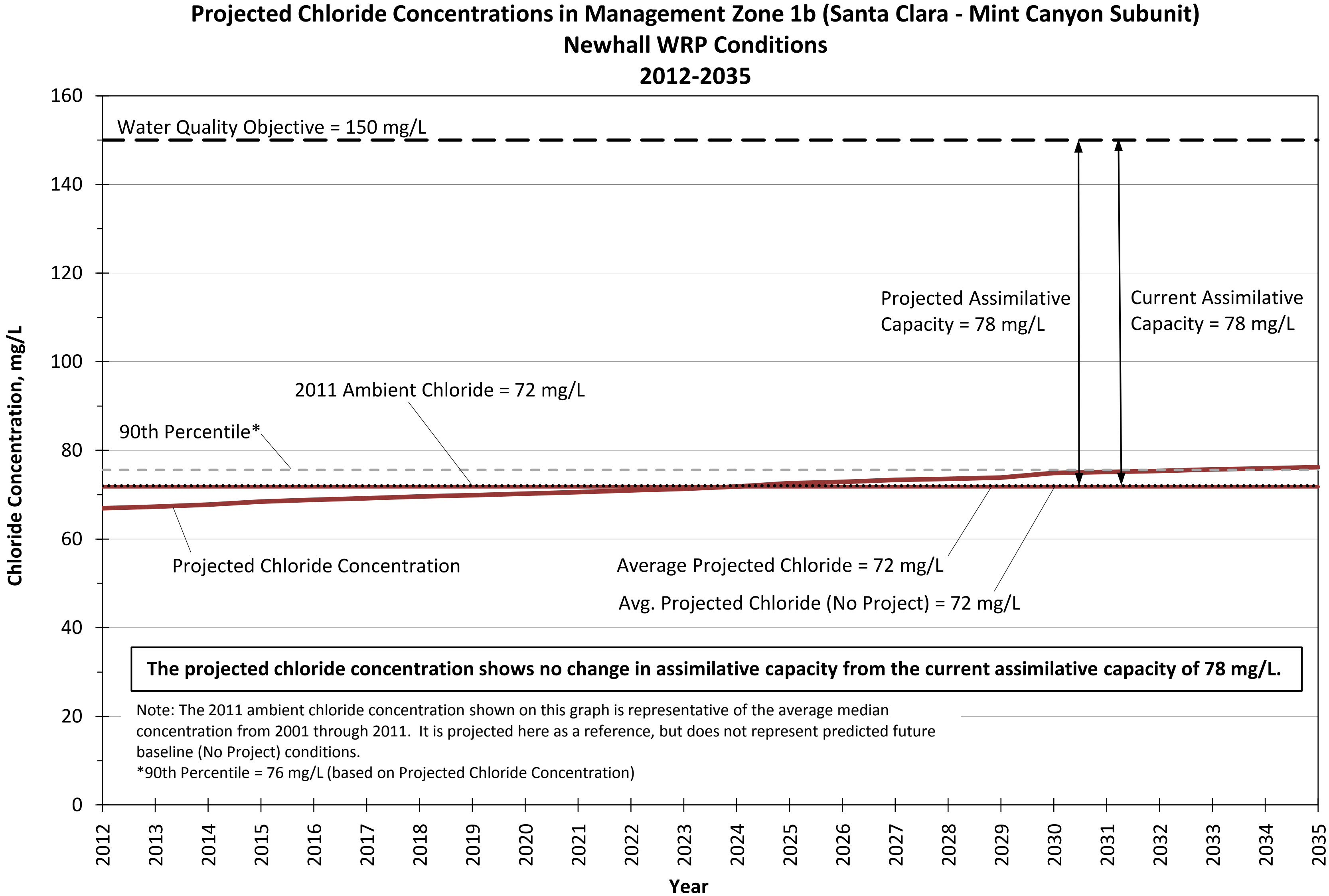

Projected Chloride Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
Newhall WRP Conditions
2012-2035
Chloride Concentration, mg/L
Year
Water Quality Objective = 150 mg/L
Projected Assimilative Capacity = 78 mg/L
Current Assimilative Capacity = 78 mg/L
2011 Ambient Chloride = 72 mg/L
90th Percentile*
Projected Chloride Concentration
Average Projected Chloride = 72 mg/L
Avg. Projected Chloride (No Project) = 72 mg/L
The projected chloride concentration shows no change in assimilative capacity from the current assimilative capacity of 78 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 76 mg/L (based on Projected Chloride Concentration)
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 34.2.b

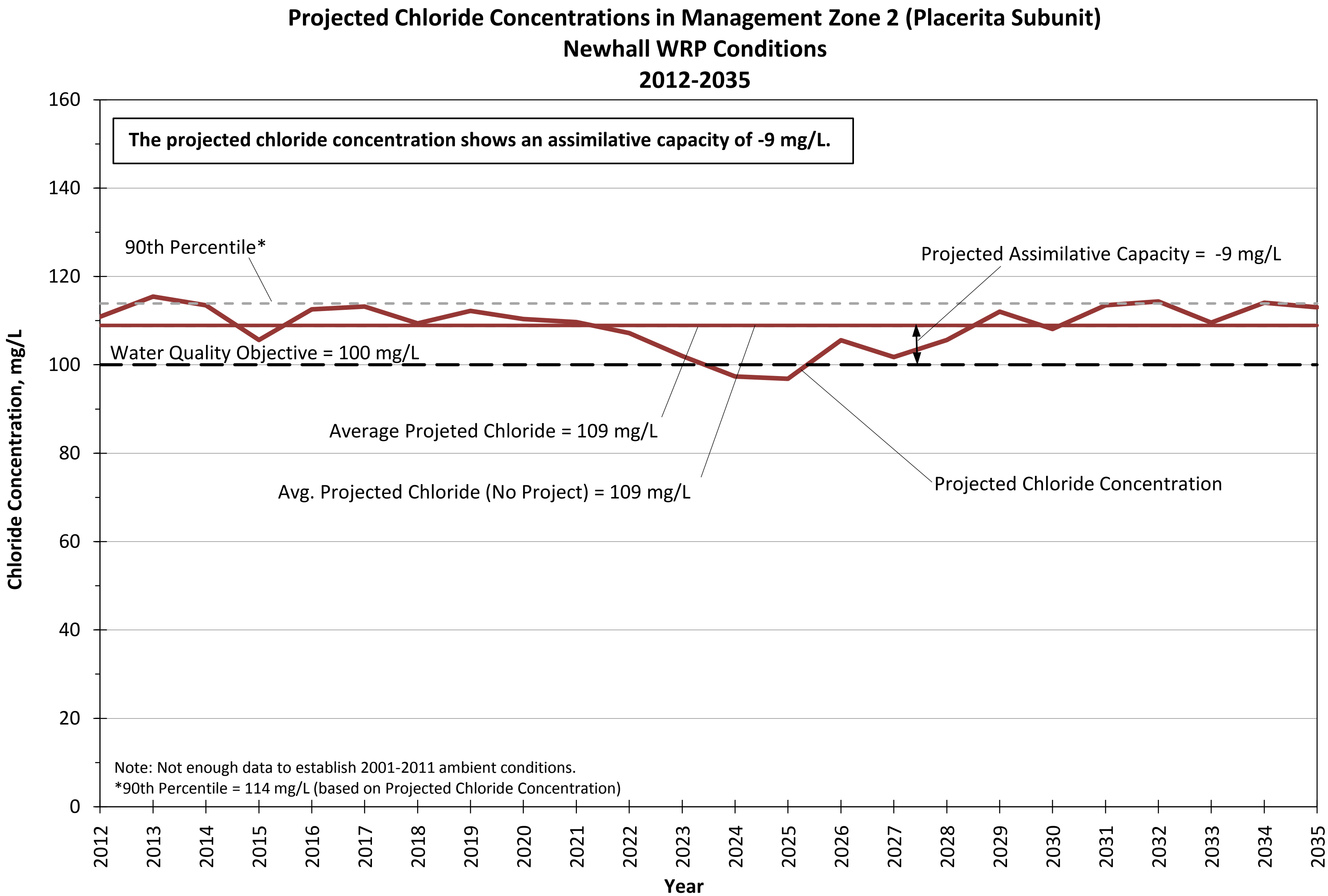

Projected Chloride Concentrations in Management Zone 2 (Placerita Subunit)
Newhall WRP Conditions
2012-2035
The projected chloride concentration shows an assimilative capacity of -9 mg/L.
90th Percentile*
Projected Assimilative Capacity = -9 mg/L
Water Quality Objective = 100 mg/L
Average Projeted Chloride = 109 mg/L
Avg. Projected Chloride (No Project) = 109 mg/L
Projected Chloride Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 114 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 34.2.c

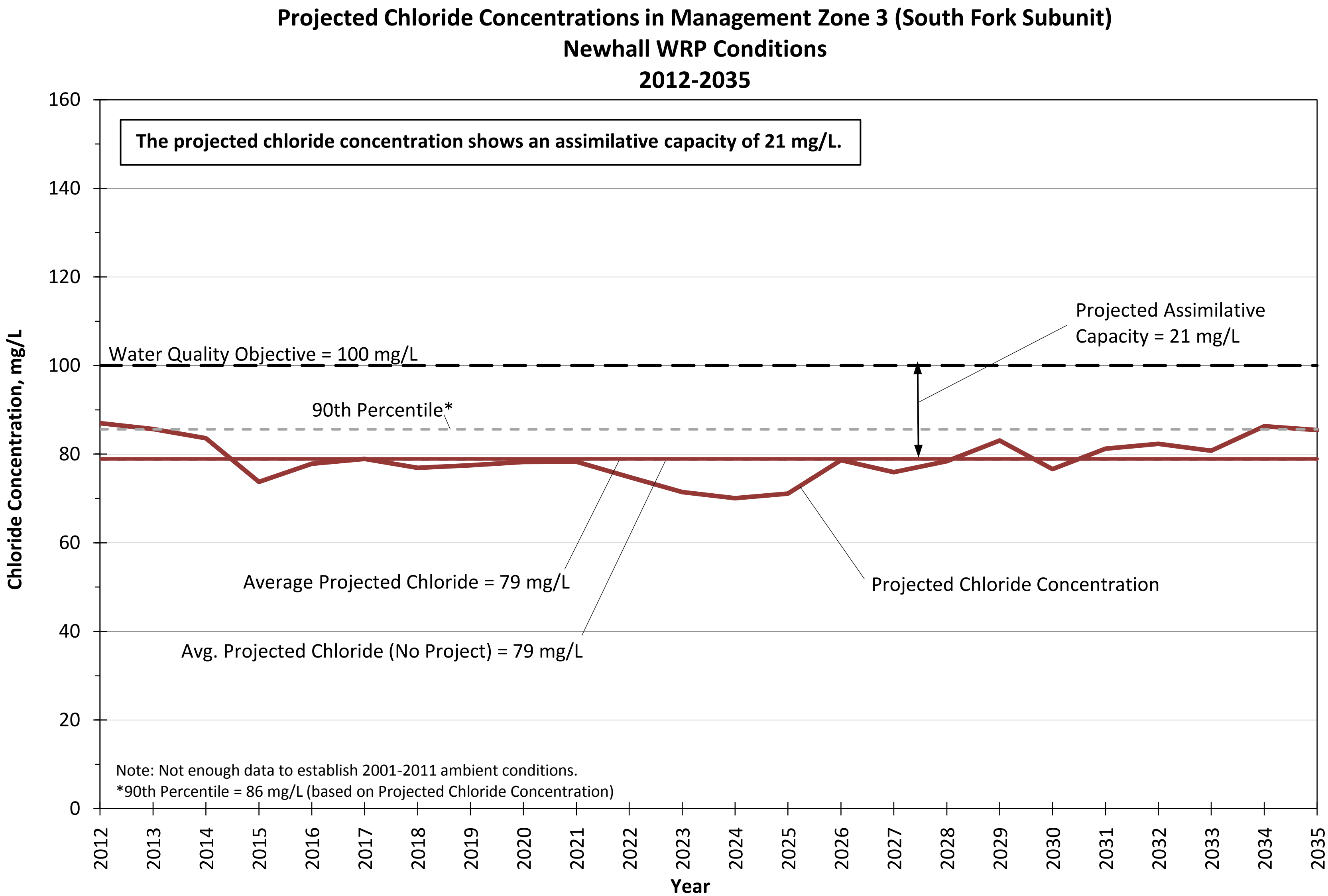

Projected Chloride Concentrations in Management Zone 3 (South Fork Subunit)
Newhall WRP Conditions
2012-2035
The projected chloride concentration shows an assimilative capacity of 21 mg/L.
Projected Assimilative Capacity = 21 mg/L
Water Quality Objective = 100 mg/L
90th Percentile*
Average Projected Chloride = 79 mg/L
Projected Chloride Concentration
Avg. Projected Chloride (No Project) = 79 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 86 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 34.2.d

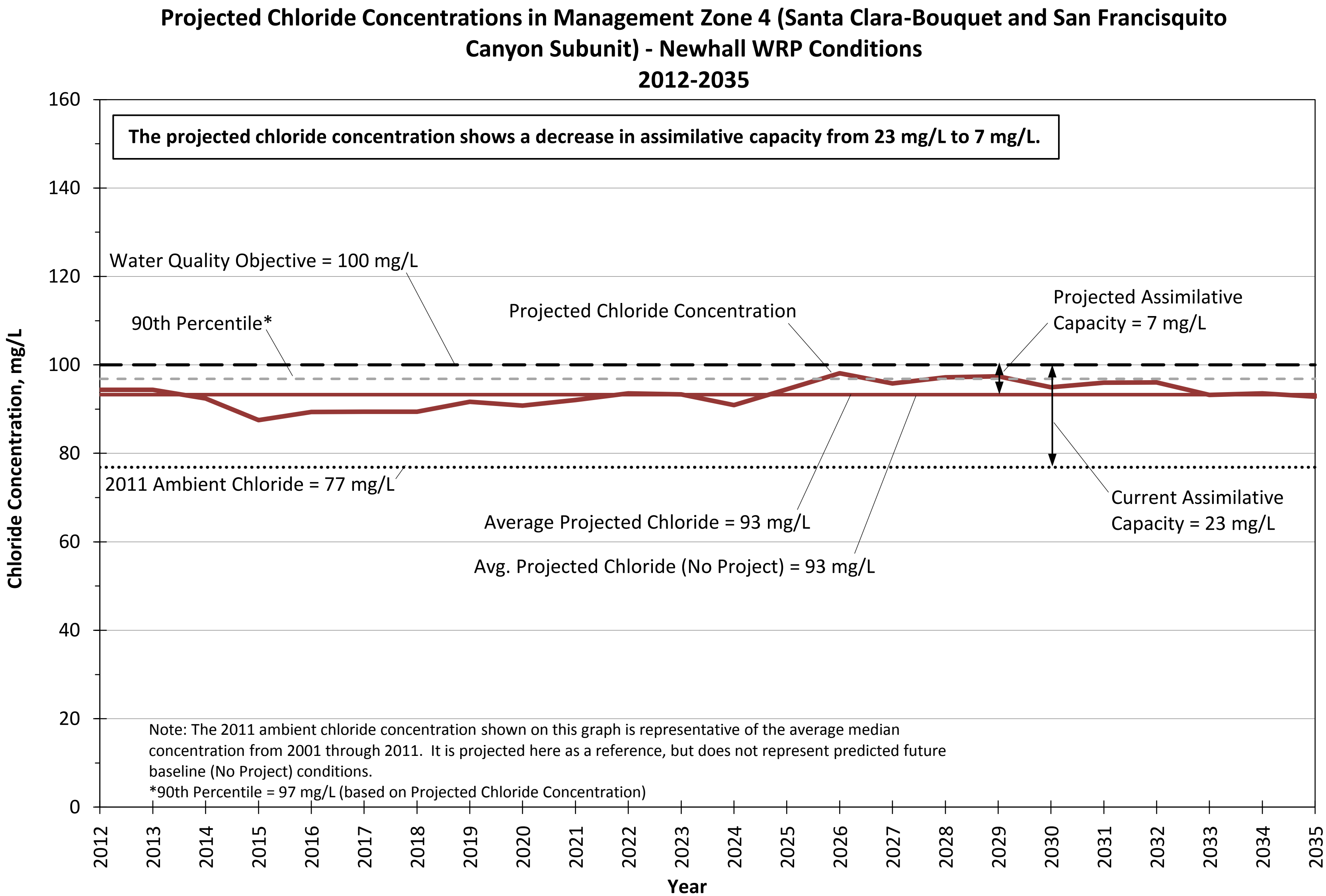
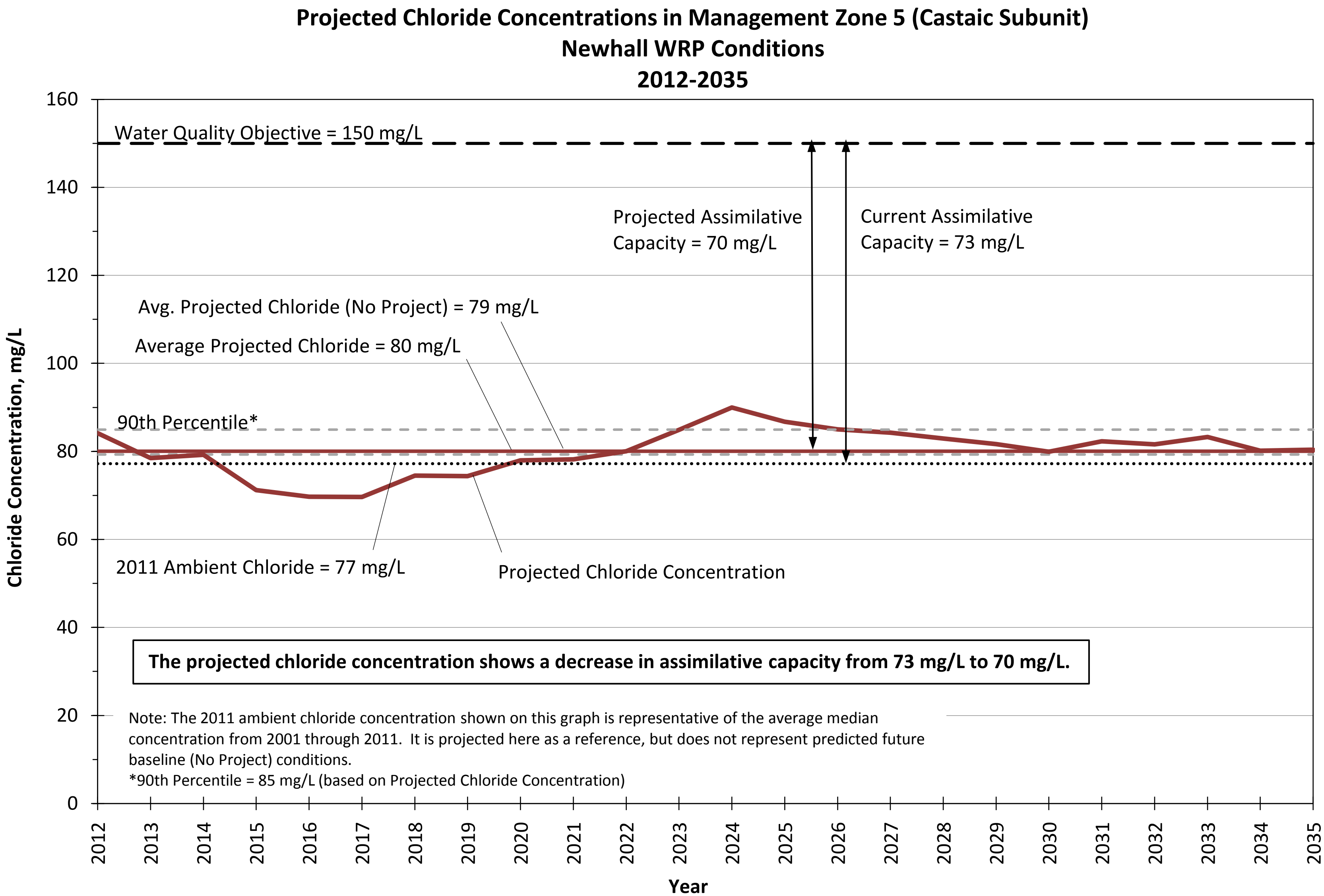

Projected Chloride Concentrations in Management Zone 4 (Santa Clara-Bouquet and San Francisquito Canyon Subunit) - Newhall WRP Conditions
2012-2035
The projected chloride concentration shows a decrease in assimilative capacity from 23 mg/L to 7 mg/L.
Water Quality Objective = 100 mg/L
90th Percentile*
Projected Chloride Concentration
Projected Assimilative Capacity = 7 mg/L
2011 Ambient Chloride = 77 mg/L
Average Projected Chloride = 93 mg/L
Avg. Projected Chloride (No Project) = 93 mg/L
Current Assimilative Capacity = 23 mg/L
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 97 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 34.2.e


Projected Chloride Concentrations in Management Zone 5 (Castaic Subunit)
Newhall WRP Conditions
2012-2035
Water Quality Objective = 150 mg/L
Projected Assimilative Capacity = 70 mg/L
Current Assimilative Capacity = 73 mg/L
Avg. Projected Chloride (No Project) = 79 mg/L
Average Projected Chloride = 80 mg/L
90th Percentile*
2011 Ambient Chloride = 77 mg/L
Projected Chloride Concentration
The projected chloride concentration shows a decrease in assimilative capacity from 73 mg/L to 70 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 85 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
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2026
2027
2028
2029
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2031
2032
2033
2034
2035

Figure 34.2.f

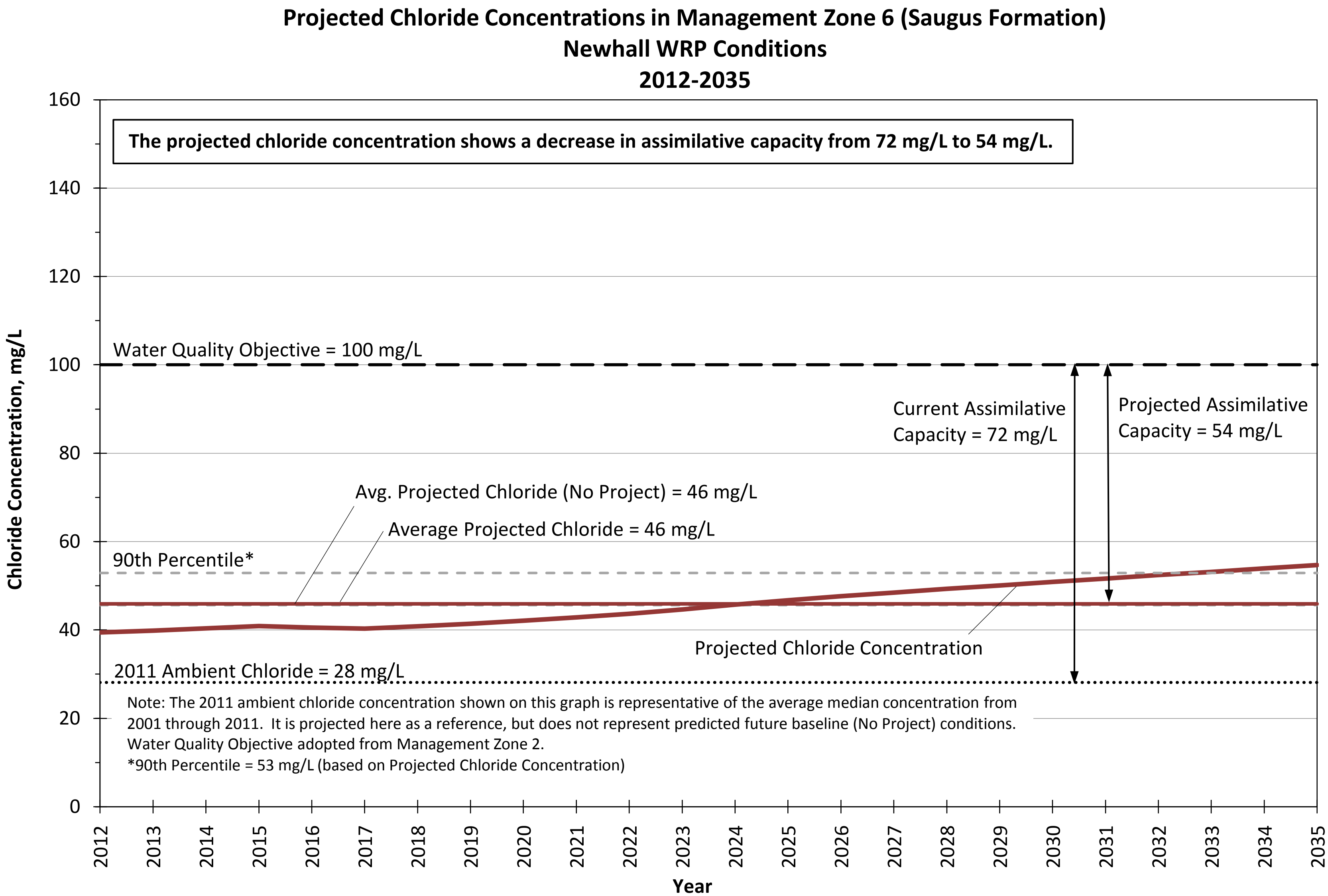
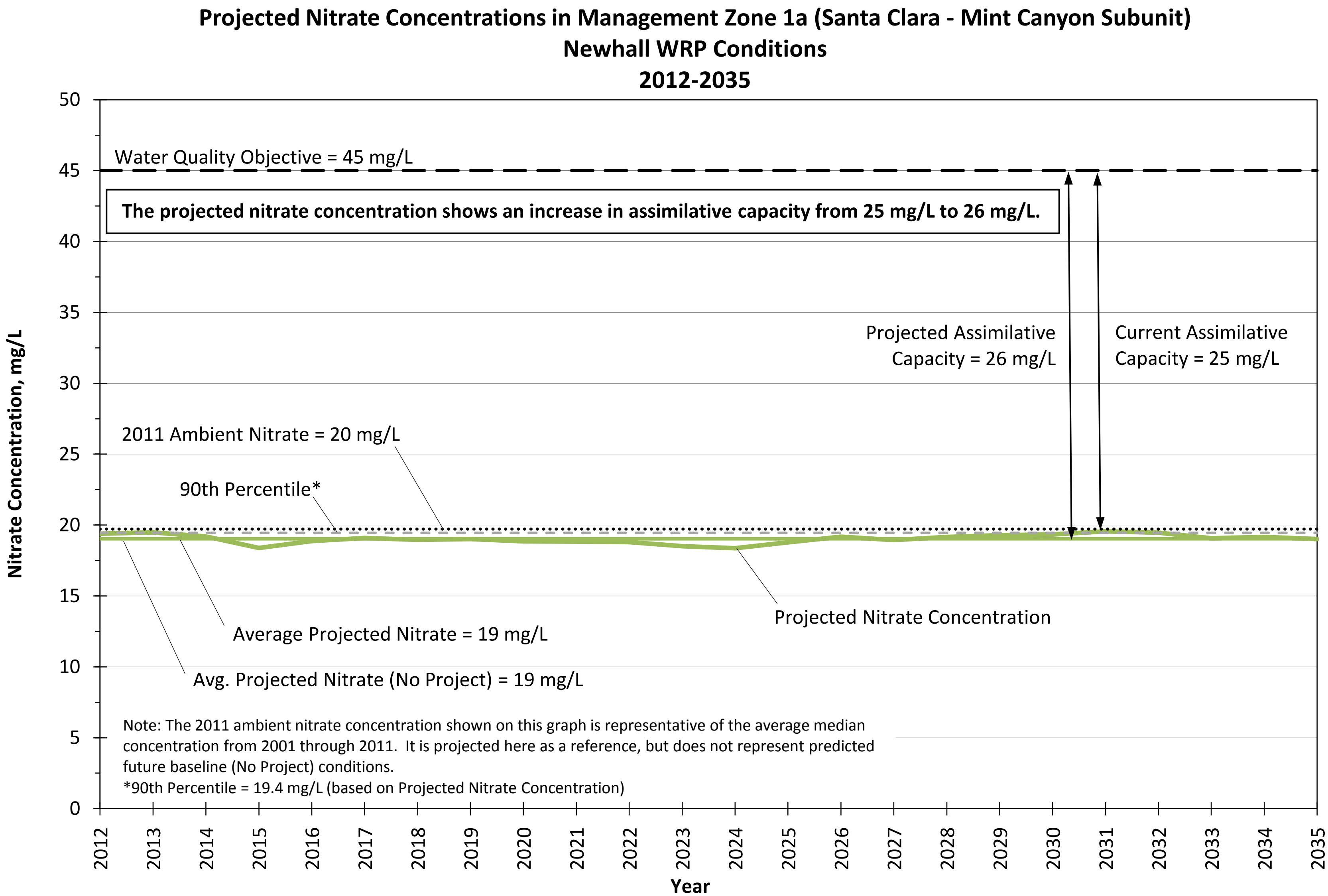

Projected Chloride Concentrations in Management Zone 6 (Saugus Formation)
Newhall WRP Conditions
2012-2035
The projected chloride concentration shows a decrease in assimilative capacity from 72 mg/L to 54 mg/L.
Water Quality Objective = 100 mg/L
Current Assimilative Capacity = 72 mg/L
Projected Assimilative Capacity = 54 mg/L
Avg. Projected Chloride (No Project) = 46 mg/L
Average Projected Chloride = 46 mg/L
90th Percentile*
Projected Chloride Concentration
2011 Ambient Chloride = 28 mg/L
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Water Quality Objective adopted from Management Zone 2.
*90th Percentile = 53 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
160
140
120
100
80
60
40
20
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 34.2.8


Projected Nitrate Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
Newhall WRP Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an increase in assimilative capacity from 25 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 25 mg/L
2011 Ambient Nitrate = 20 mg/L
90th Percentile*
Projected Nitrate Concentration
Average Projected Nitrate = 19 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 19.4 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
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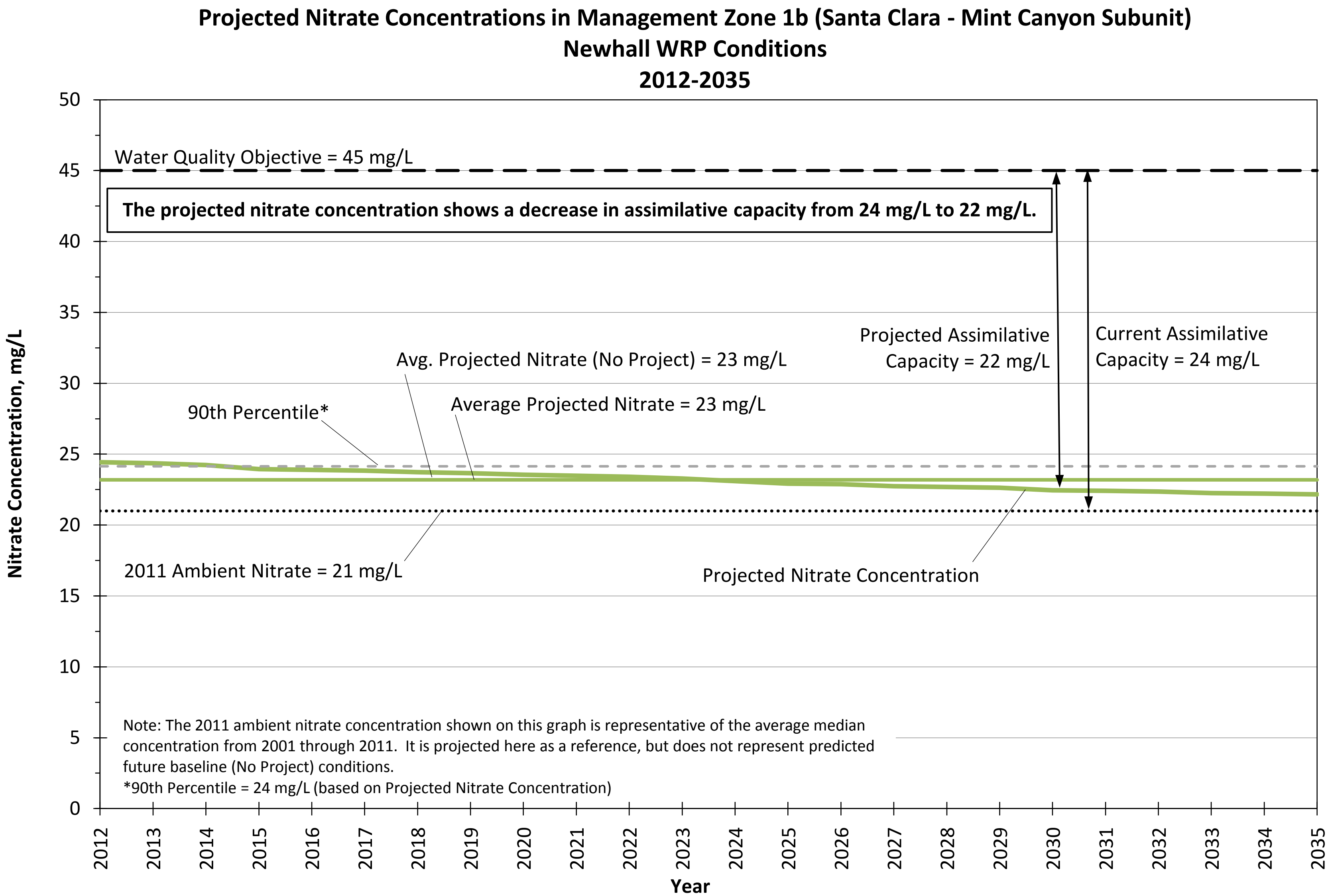
2034
2035

Figure 34.3.a


Projected Nitrate Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
Newhall WRP Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 24 mg/L to 22 mg/L.
Projected Assimilative Capacity = 22 mg/L
Current Assimilative Capacity = 24 mg/L
Avg. Projected Nitrate (No Project) = 23 mg/L
Average Projected Nitrate = 23 mg/L
90th Percentile*
2011 Ambient Nitrate = 21 mg/L
Projected Nitrate Concentration
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 24 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
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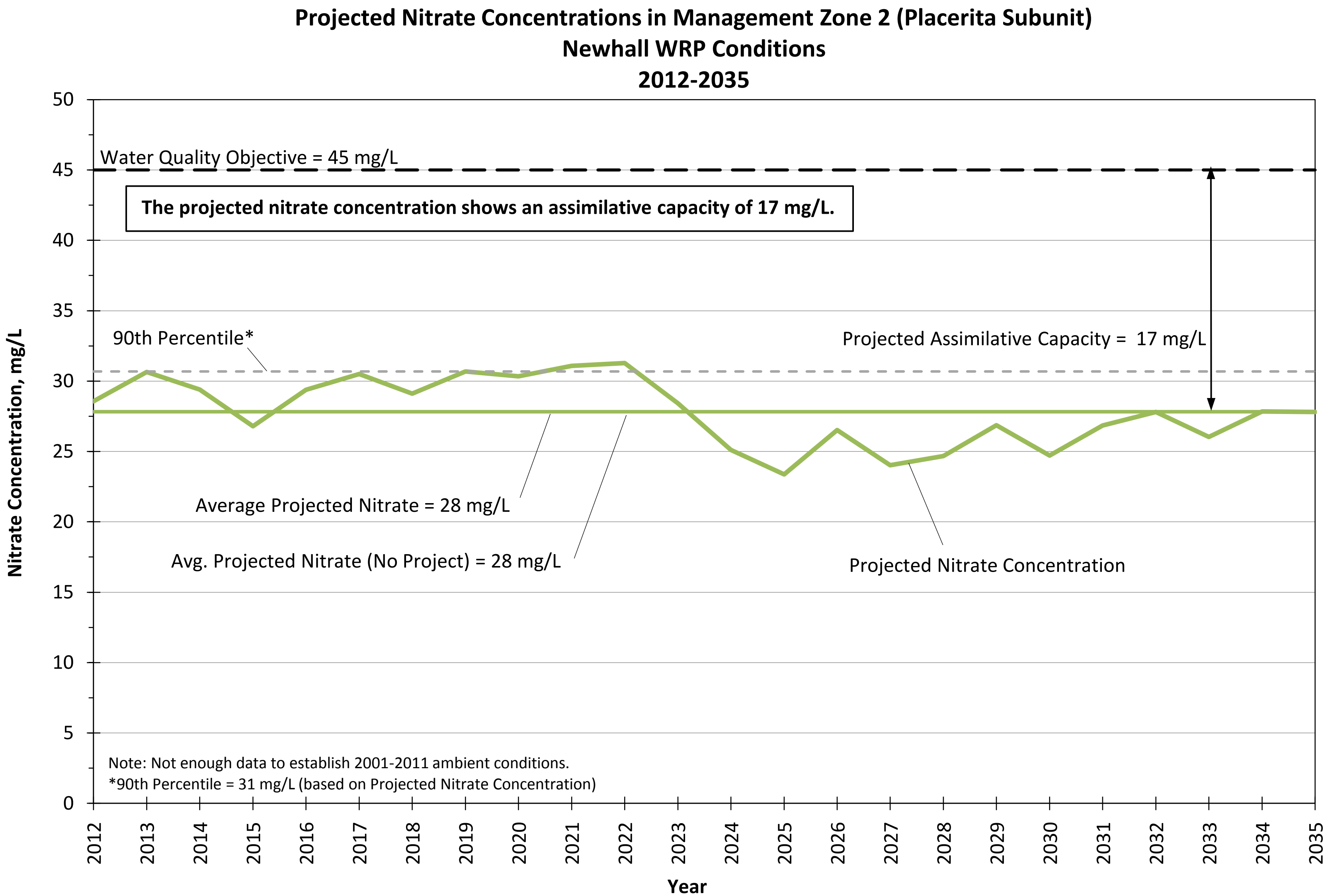
2034
2035

Figure 34.3.b


Projected Nitrate Concentrations in Management Zone 2 (Placerita Subunit)
Newhall WRP Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an assimilative capacity of 17 mg/L.
90th Percentile*
Projected Assimilative Capacity = 17 mg/L
Average Projected Nitrate = 28 mg/L
Avg. Projected Nitrate (No Project) = 28 mg/L
Projected Nitrate Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 31 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
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2020
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2034
2035

Figure 34.3.c

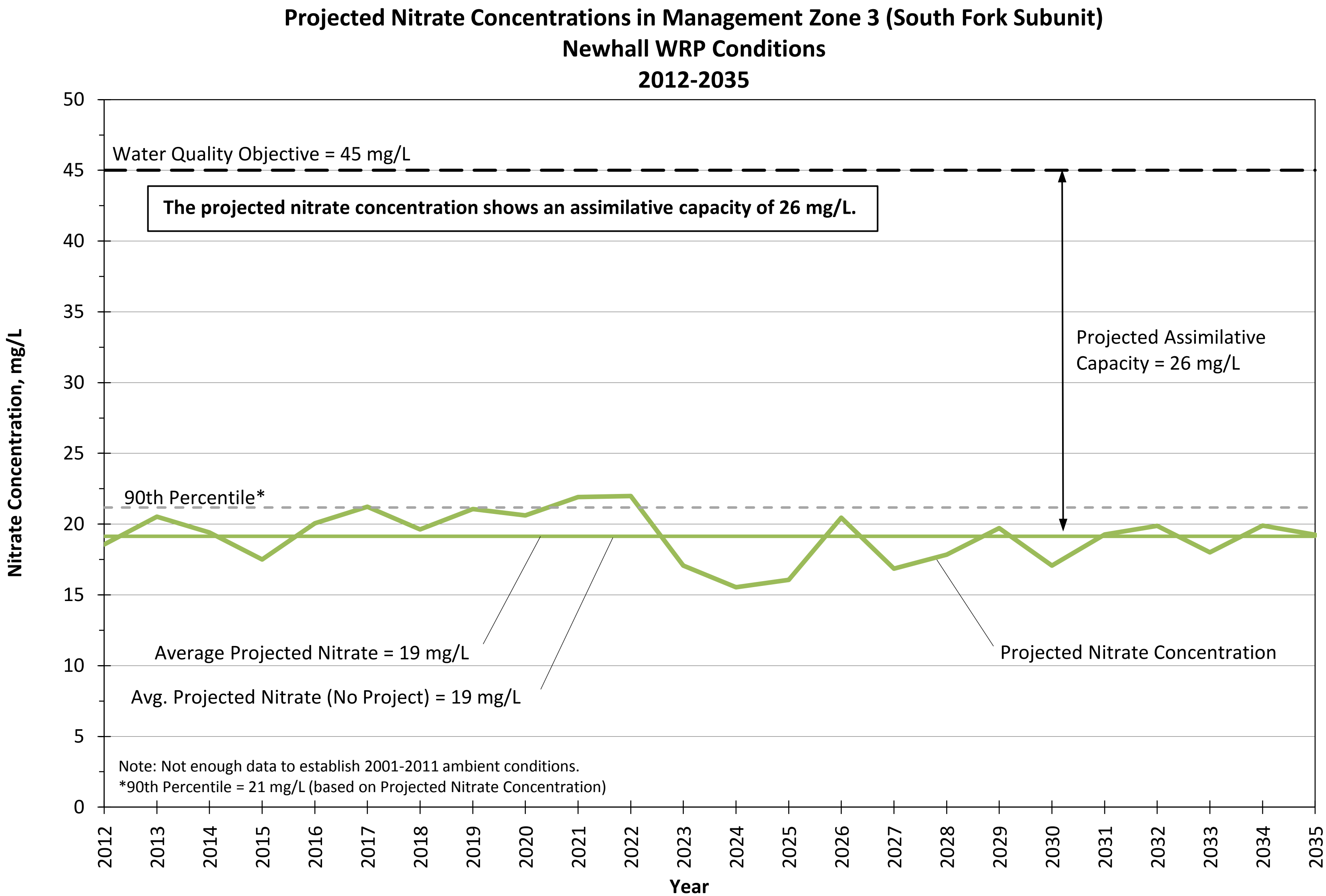
Projected Nitrate Concentrations in Management Zone 3 (South Fork Subunit)
Newhall WRP Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an assimilative capacity of 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
90th Percentile*
Average Projected Nitrate = 19 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Projected Nitrate Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 21 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
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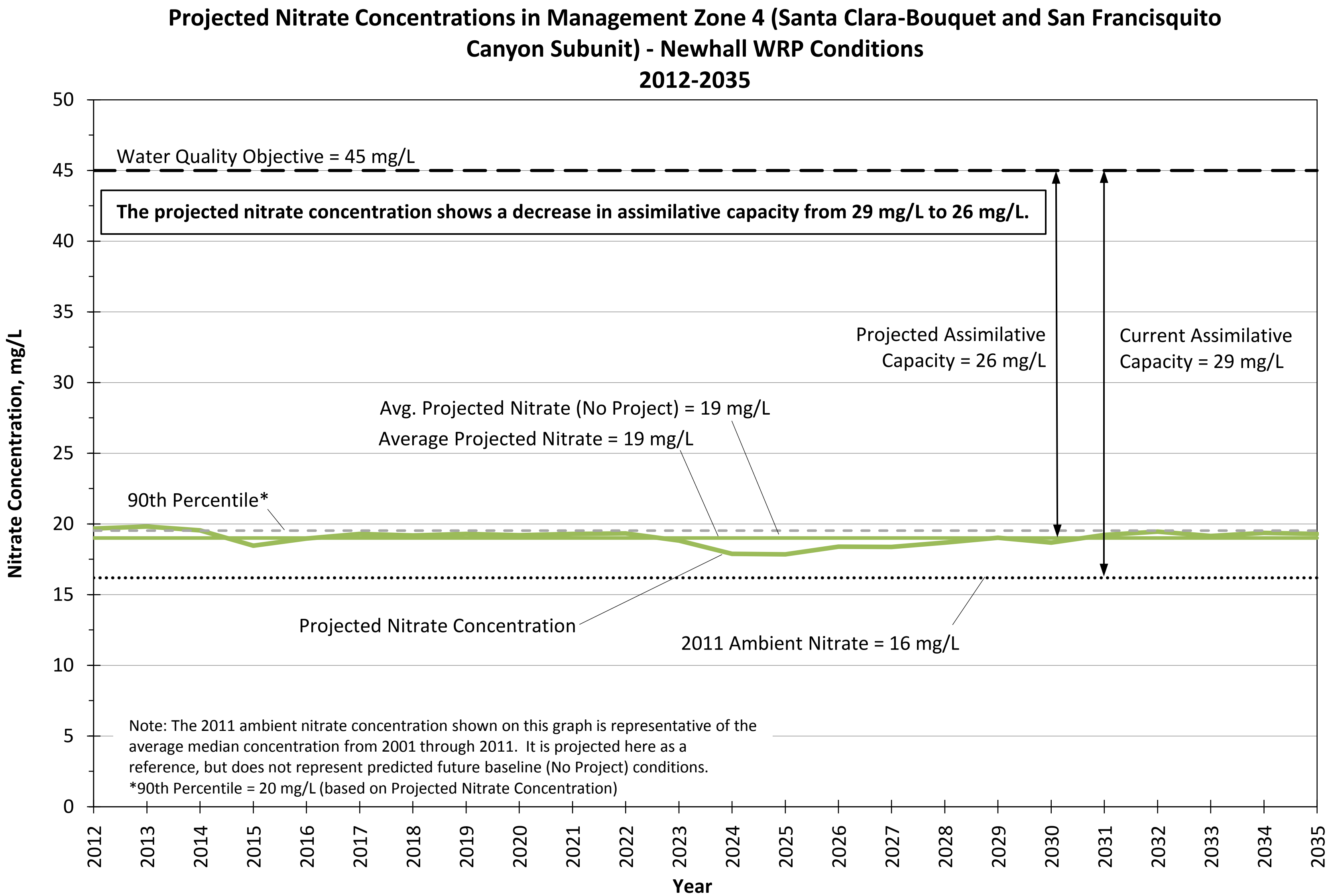
Figure 34.3.d


Projected Nitrate Concentrations in Management Zone 4 (Santa Clara-Bouquet and San Francisquito Canyon Subunit) - Newhall WRP Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 29 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 29 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Average Projected Nitrate = 19 mg/L
90th Percentile*
Projected Nitrate Concentration
2011 Ambient Nitrate = 16 mg/L
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 20 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
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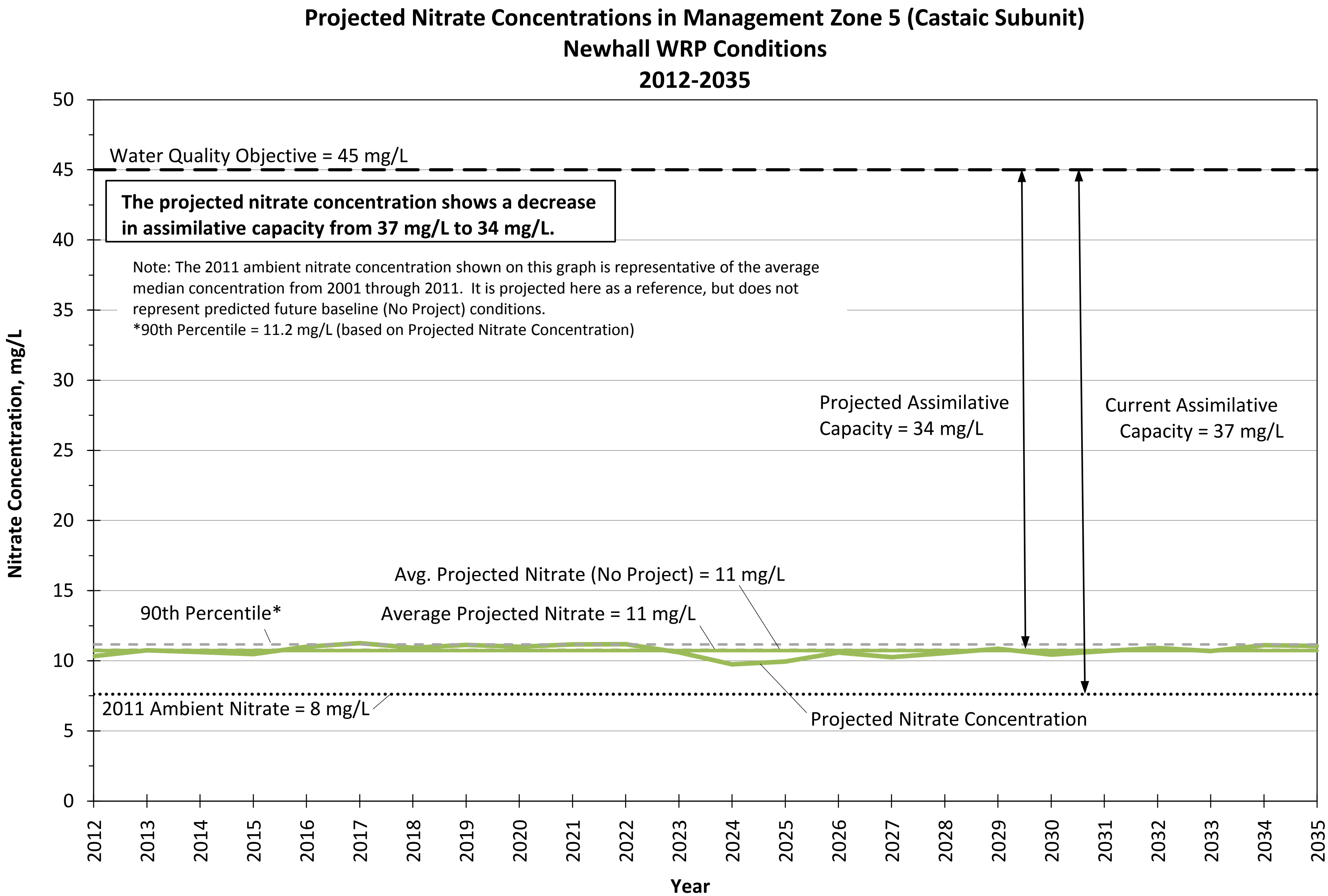
2034
2035

Figure 34.3.e


Projected Nitrate Concentrations in Management Zone 5 (Castaic Subunit)
Newhall WRP Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 37 mg/L to 34 mg/L.
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 11.2 mg/L (based on Projected Nitrate Concentration)
Projected Assimilative Capacity = 34 mg/L
Current Assimilative Capacity = 37 mg/L
Avg. Projected Nitrate (No Project) = 11 mg/L
90th Percentile*
Average Projected Nitrate = 11 mg/L
2011 Ambient Nitrate = 8 mg/L
Projected Nitrate Concentration
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
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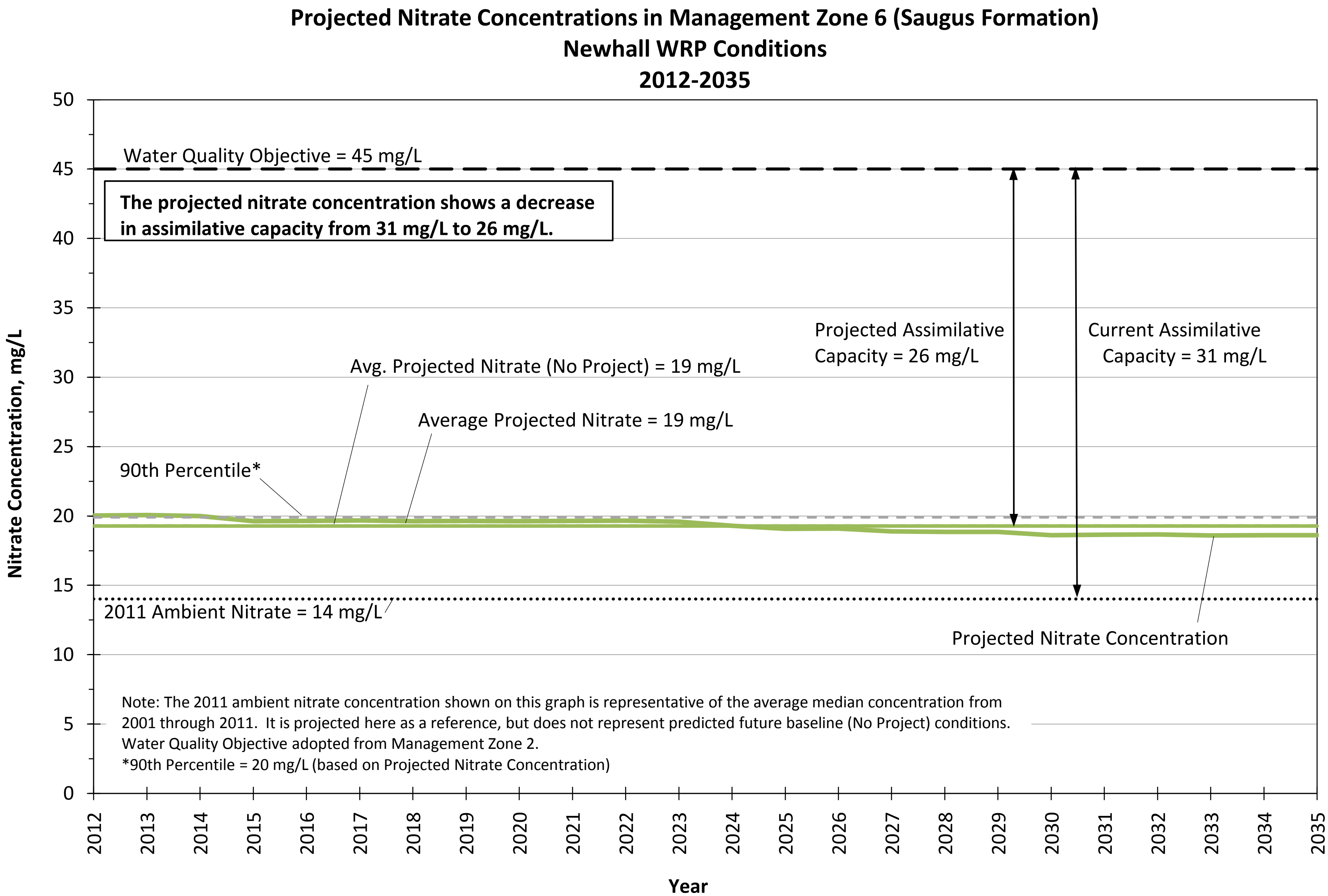
2034
2035

Figure 34.3.f


Projected Nitrate Concentrations in Management Zone 6 (Saugus Formation)
Newhall WRP Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 31 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 31 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Average Projected Nitrate = 19 mg/L
90th Percentile*
2011 Ambient Nitrate = 14 mg/L
Projected Nitrate Concentration
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Water Quality Objective adopted from Management Zone 2.
*90th Percentile = 20 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
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2035

Figure 34.3.8

Projected Sulfate Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
Newhall WRP Conditions
2012-2035

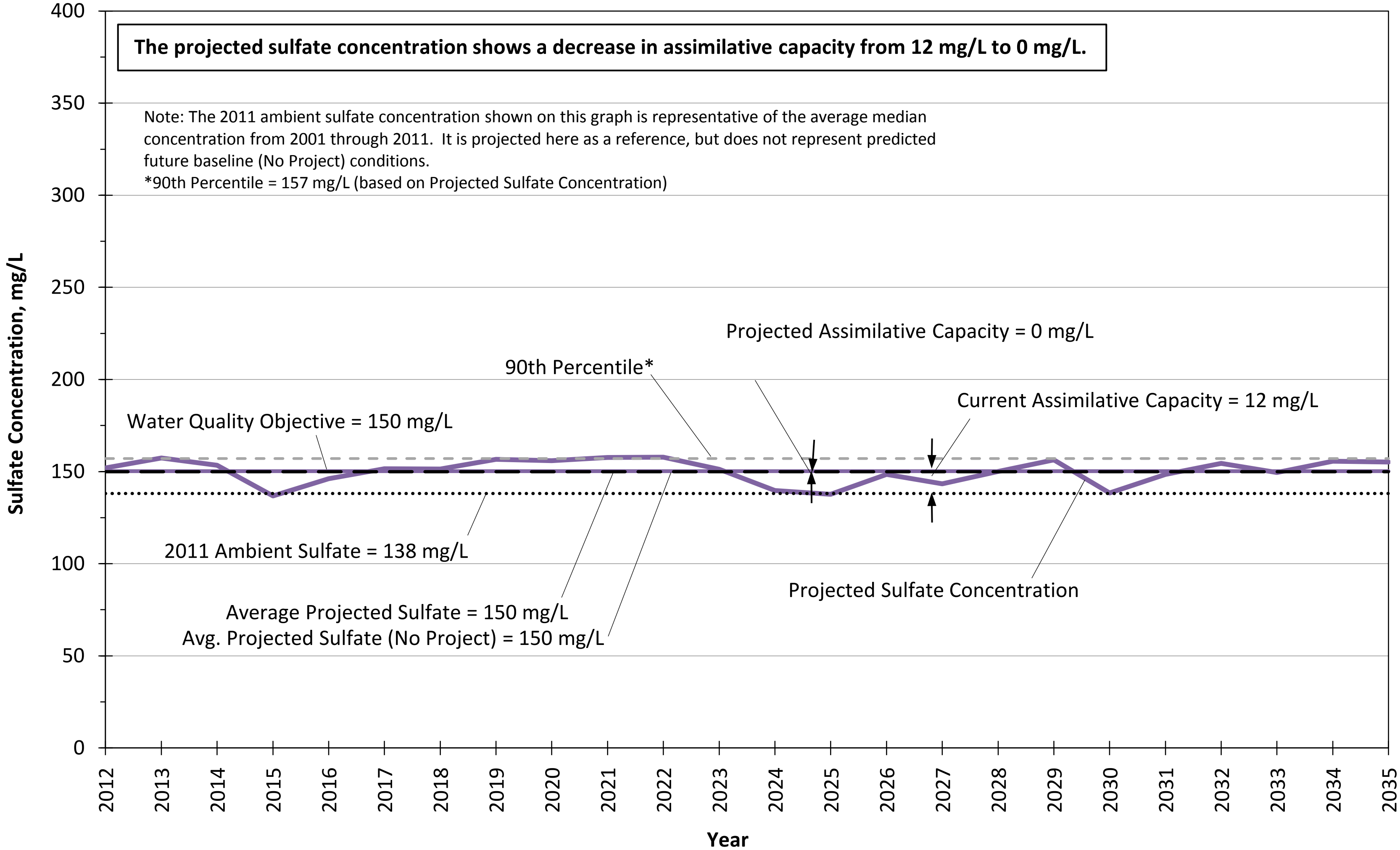


Figure 34.4.a

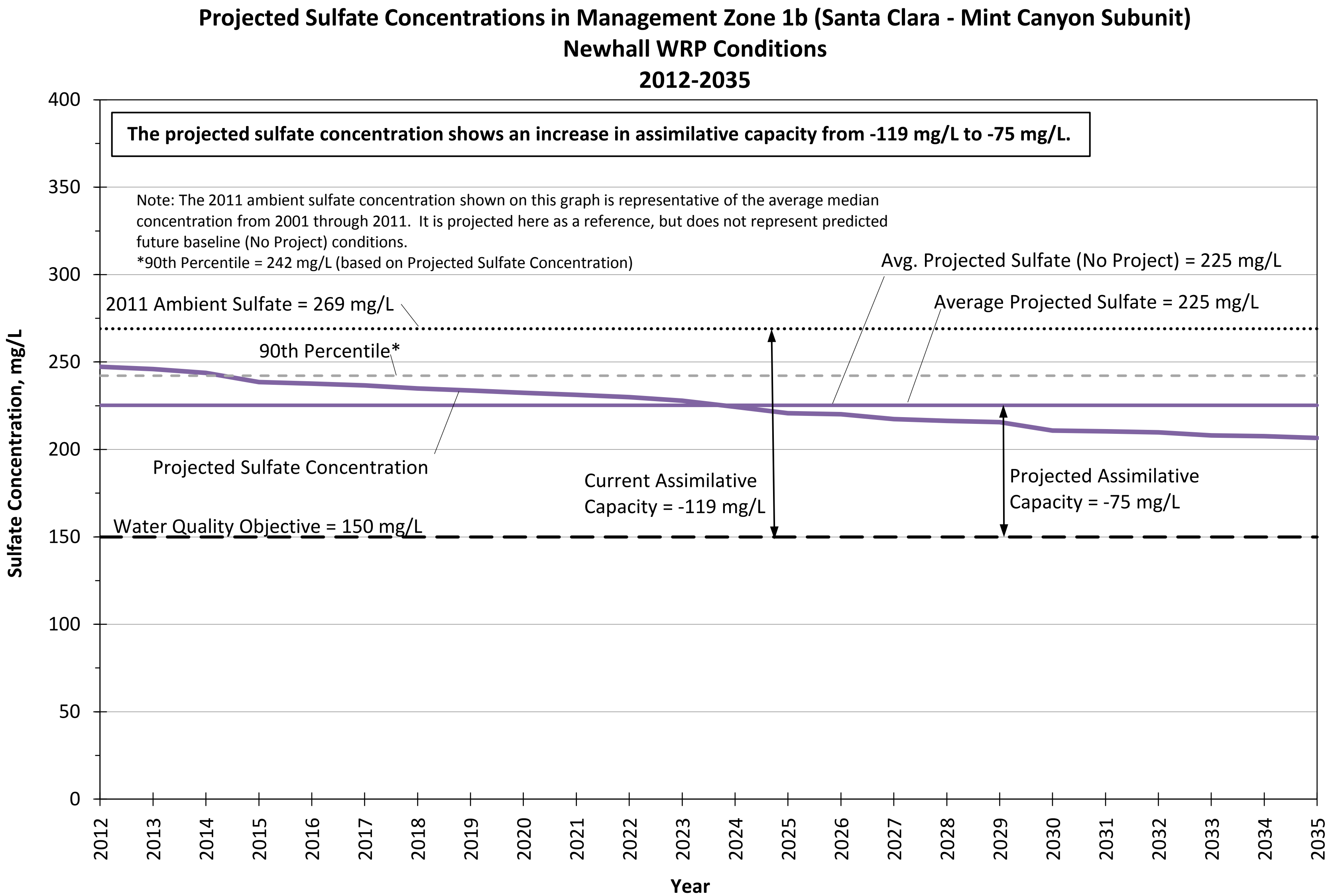
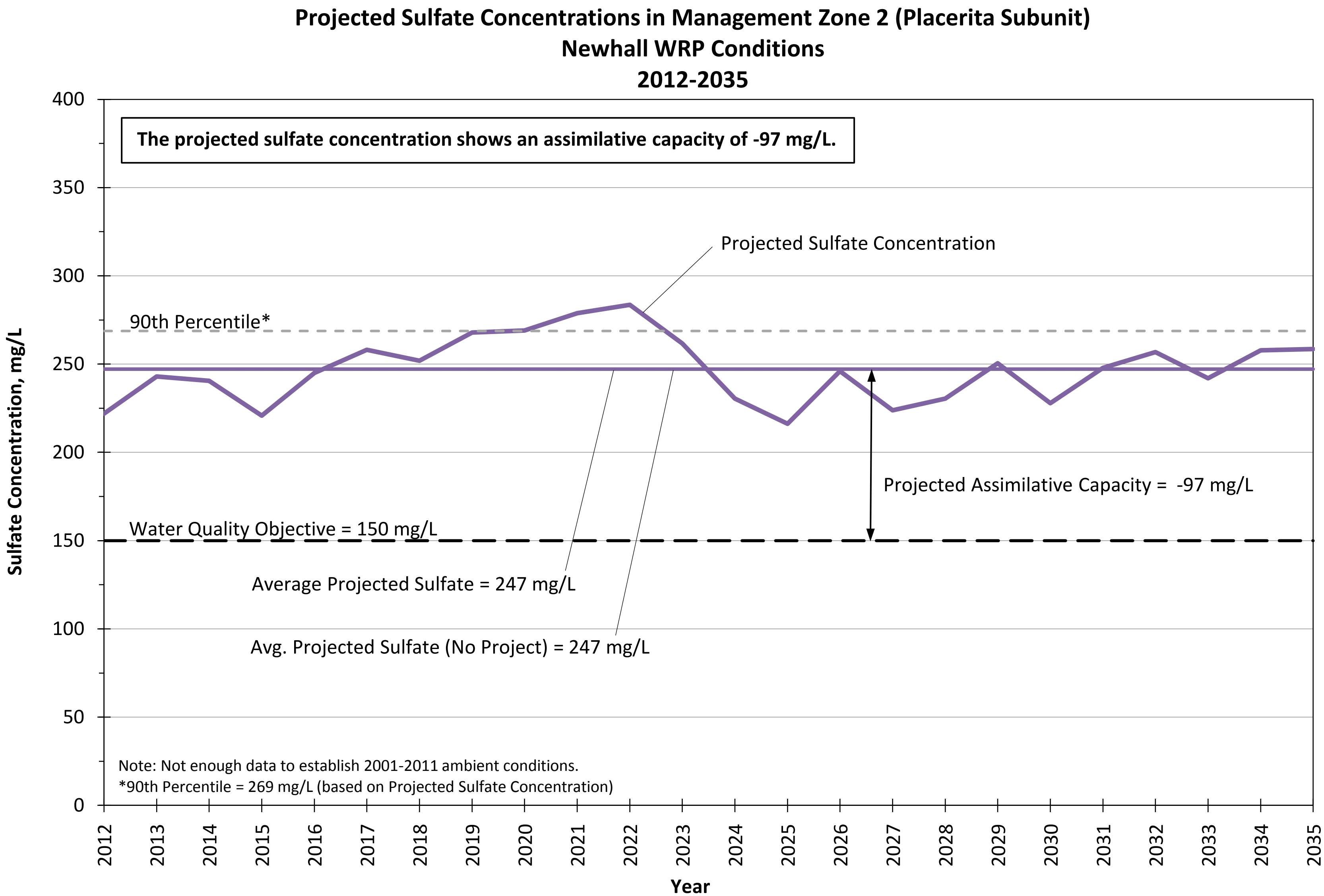

Projected Sulfate Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
Newhall WRP Conditions
2012-2035
The projected sulfate concentration shows an increase in assimilative capacity from -119 mg/L to -75 mg/L.
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 242 mg/L (based on Projected Sulfate Concentration)
Avg. Projected Sulfate (No Project) = 225 mg/L
Average Projected Sulfate = 225 mg/L
2011 Ambient Sulfate = 269 mg/L
90th Percentile*
Projected Sulfate Concentration
Current Assimilative Capacity = -119 mg/L
Projected Assimilative Capacity = -75 mg/L
Water Quality Objective = 150 mg/L
Sulfate Concentration, mg/L
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 34.4.b


Projected Sulfate Concentrations in Management Zone 2 (Placerita Subunit)
Newhall WRP Conditions
2012-2035
The projected sulfate concentration shows an assimilative capacity of -97 mg/L.
Projected Sulfate Concentration
90th Percentile*
Projected Assimilative Capacity = -97 mg/L
Water Quality Objective = 150 mg/L
Average Projected Sulfate = 247 mg/L
Avg. Projected Sulfate (No Project) = 247 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 269 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
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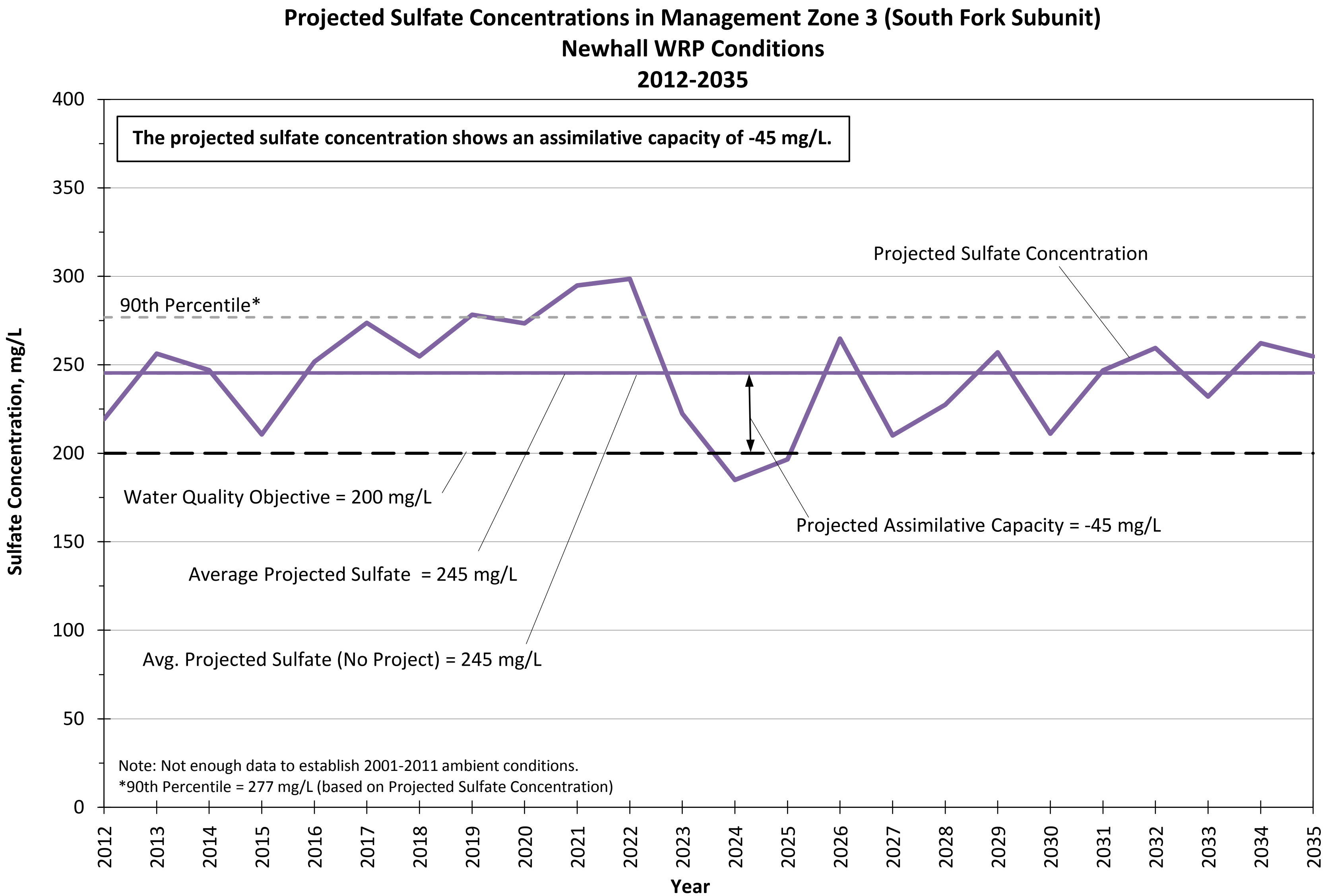
2035

Figure 34.4.c


Projected Sulfate Concentrations in Management Zone 3 (South Fork Subunit)
Newhall WRP Conditions
2012-2035
The projected sulfate concentration shows an assimilative capacity of -45 mg/L.
Projected Sulfate Concentration
90th Percentile*
Water Quality Objective = 200 mg/L
Projected Assimilative Capacity = -45 mg/L
Average Projected Sulfate = 245 mg/L
Avg. Projected Sulfate (No Project) = 245 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 277 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
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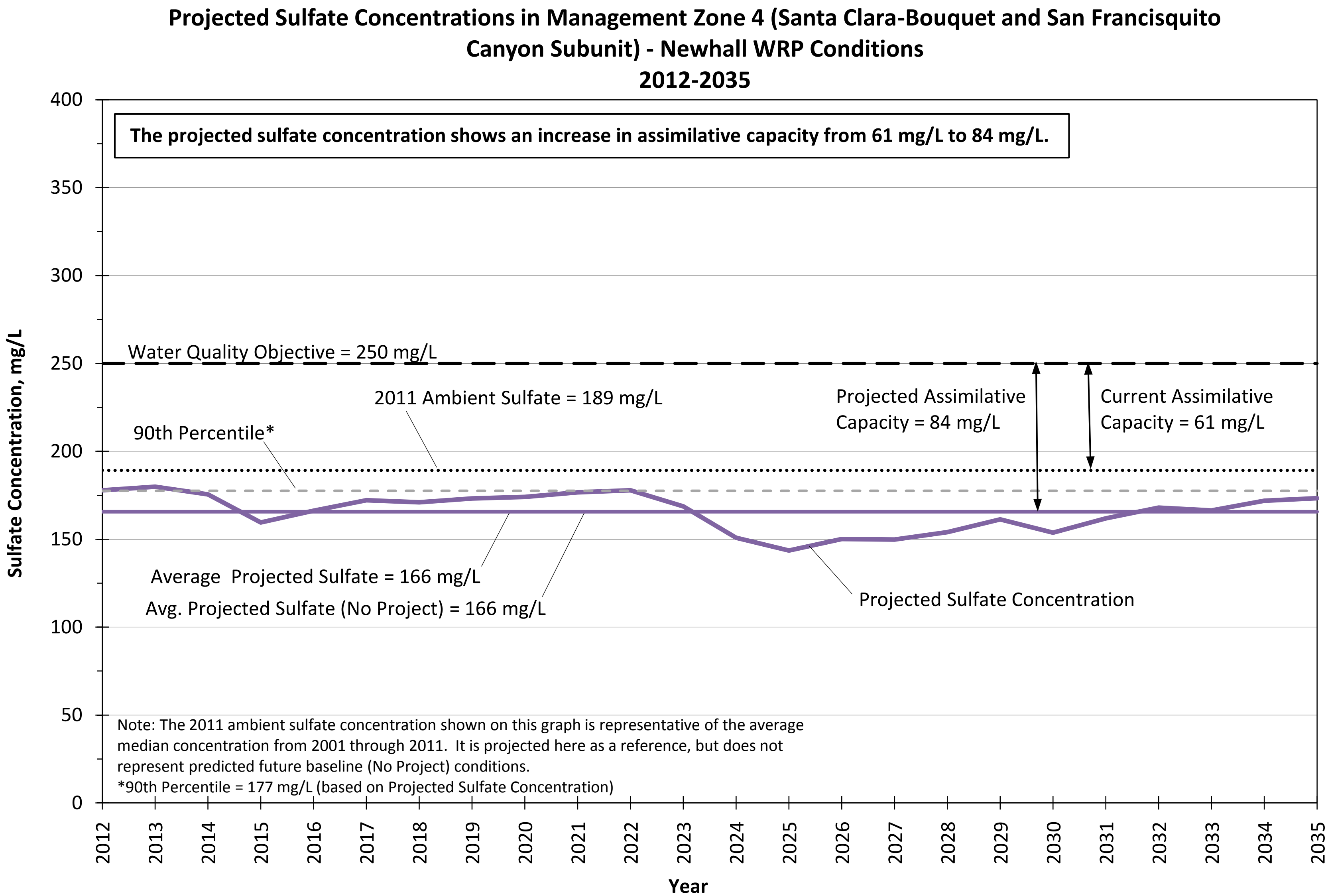
2035

Figure 34.4.d


Projected Sulfate Concentrations in Management Zone 4 (Santa Clara-Bouquet and San Francisquito Canyon Subunit) - Newhall WRP Conditions
2012-2035
The projected sulfate concentration shows an increase in assimilative capacity from 61 mg/L to 84 mg/L.
Water Quality Objective = 250 mg/L
2011 Ambient Sulfate = 189 mg/L
90th Percentile*
Projected Assimilative Capacity = 84 mg/L
Current Assimilative Capacity = 61 mg/L
Average Projected Sulfate = 166 mg/L
Avg. Projected Sulfate (No Project) = 166 mg/L
Projected Sulfate Concentration
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 177 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
0
50
100
150
200
250
300
350
400
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
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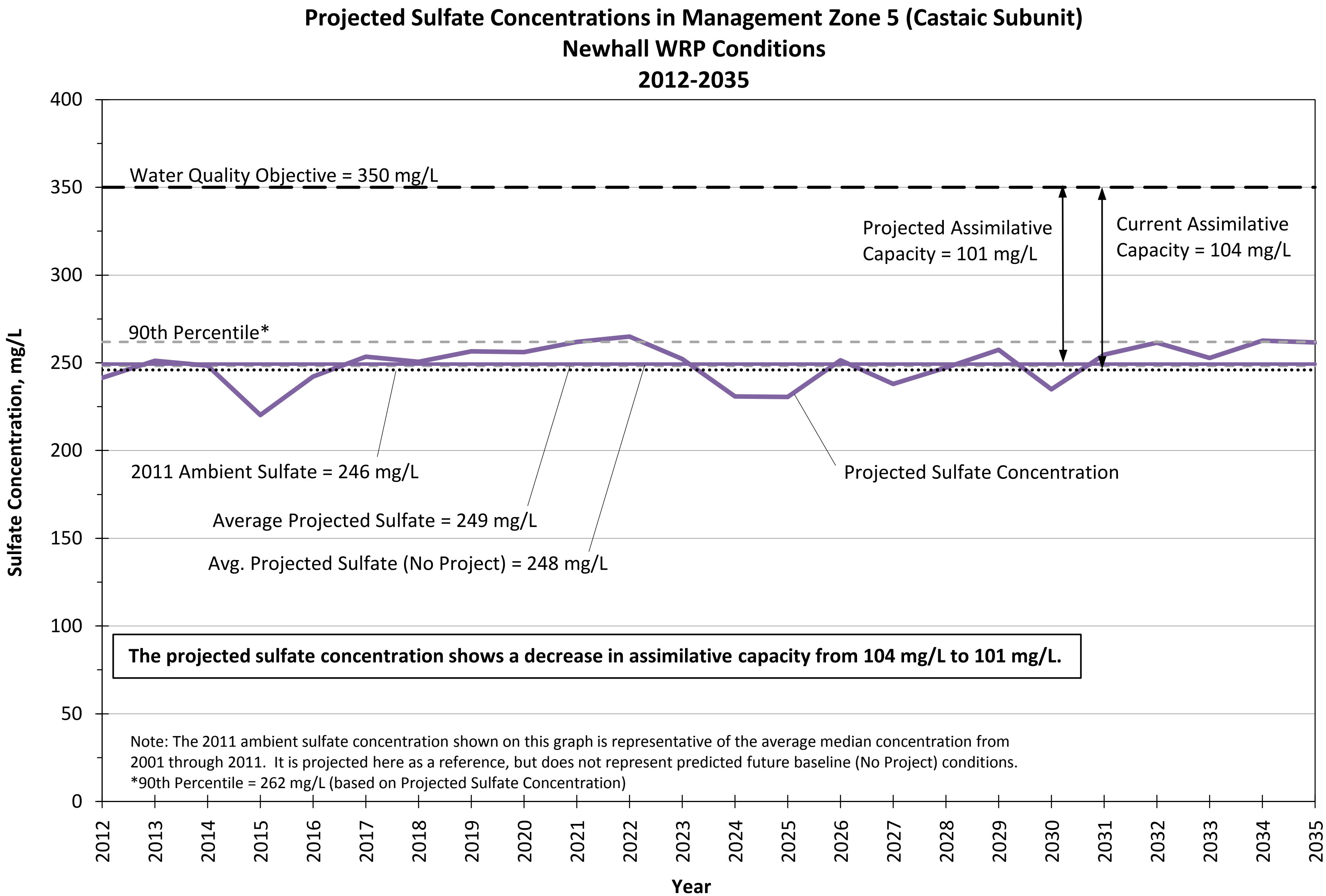
2032
2033
2034
2035

Figure 34.4.e


Projected Sulfate Concentrations in Management Zone 5 (Castaic Subunit)
Newhall WRP Conditions
2012-2035
Sulfate Concentration, mg/L
Water Quality Objective = 350 mg/L
Projected Assimilative Capacity = 101 mg/L
Current Assimilative Capacity = 104 mg/L
90th Percentile*
2011 Ambient Sulfate = 246 mg/L
Average Projected Sulfate = 249 mg/L
Avg. Projected Sulfate (No Project) = 248 mg/L
Projected Sulfate Concentration
The projected sulfate concentration shows a decrease in assimilative capacity from 104 mg/L to 101 mg/L.
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 262 mg/L (based on Projected Sulfate Concentration)
Year
400
350
300
250
200
150
100
50
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
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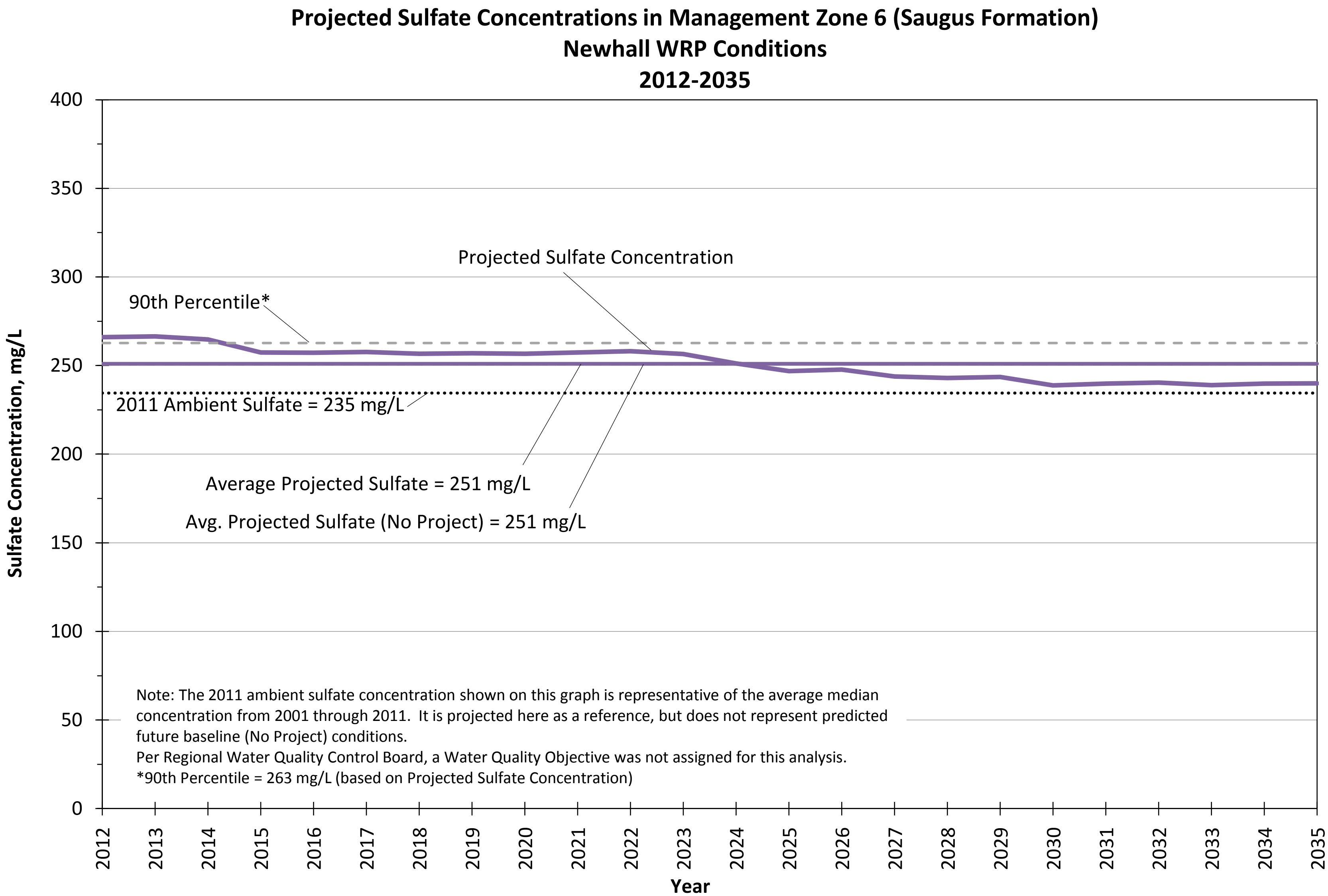
2035

Figure 34.4.f


Projected Sulfate Concentrations in Management Zone 6 (Saugus Formation)
Newhall WRP Conditions
2012-2035
Sulfate Concentration, mg/L
Year
Projected Sulfate Concentration
90th Percentile*
2011 Ambient Sulfate = 235 mg/L
Average Projected Sulfate = 251 mg/L
Avg. Projected Sulfate (No Project) = 251 mg/L
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Per Regional Water Quality Control Board, a Water Quality Objective was not assigned for this analysis.
*90th Percentile = 263 mg/L (based on Projected Sulfate Concentration)
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
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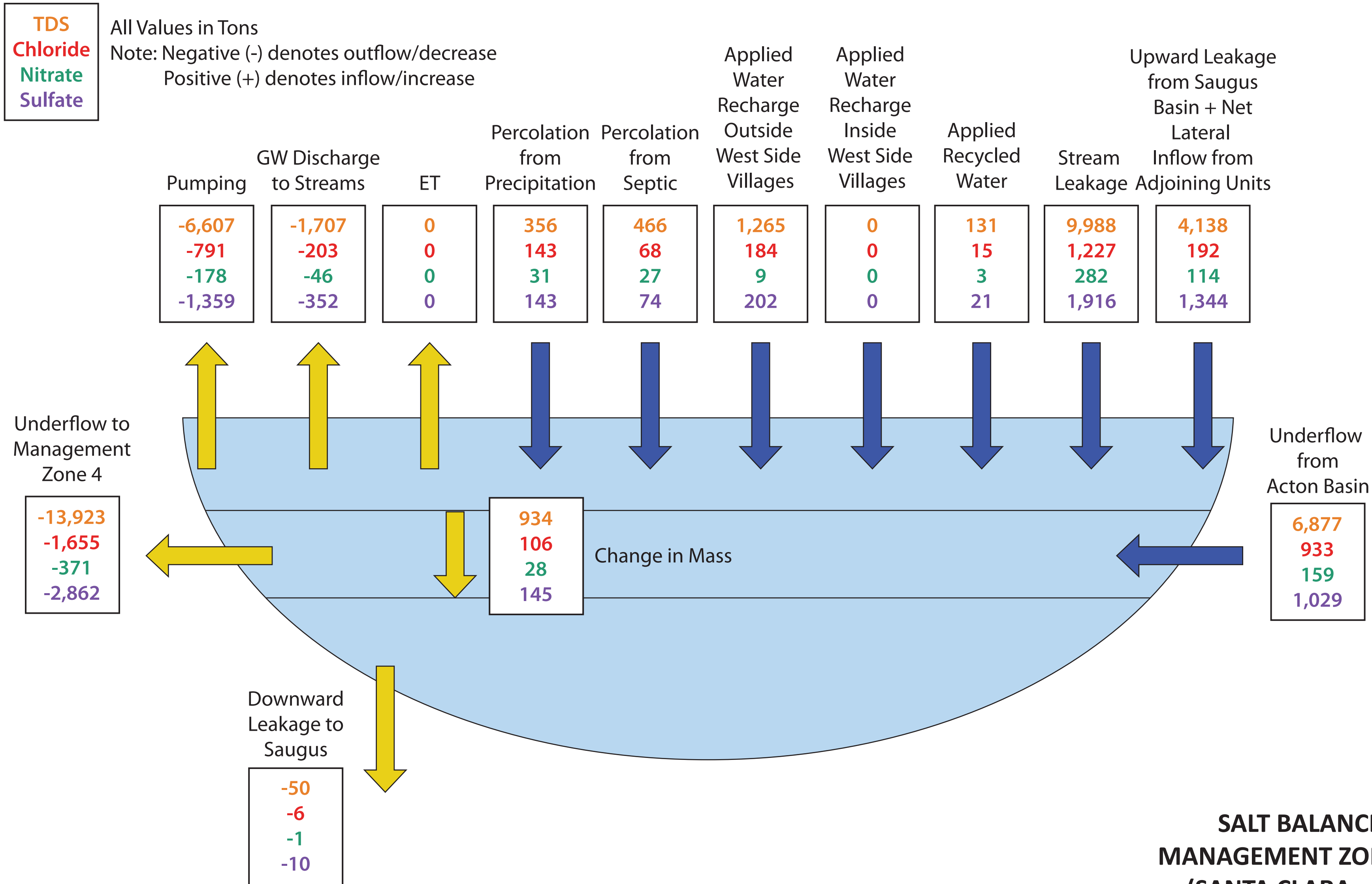
2033
2034
2035

Figure 34.4.g

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 1a (SANTA CLARA - MINT CANYON SUBUNIT) ALL PROJECTS 2012-2035

8-Dec-16

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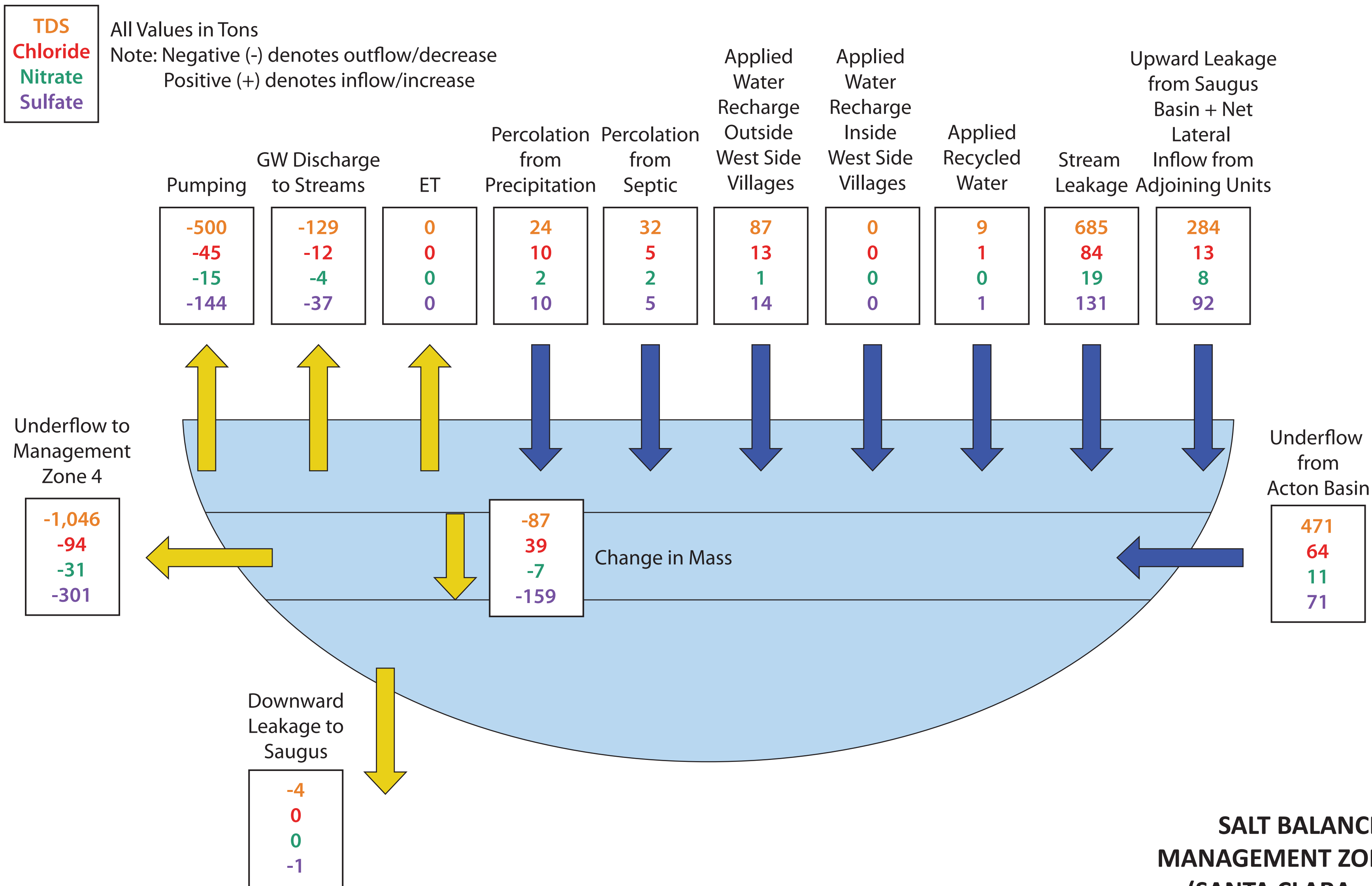
Figure 35a



SALT BALANCE FOR MANAGEMENT ZONE 1b (SANTA CLARA - MINT CANYON SUBUNIT) ALL PROJECTS 2012-2035

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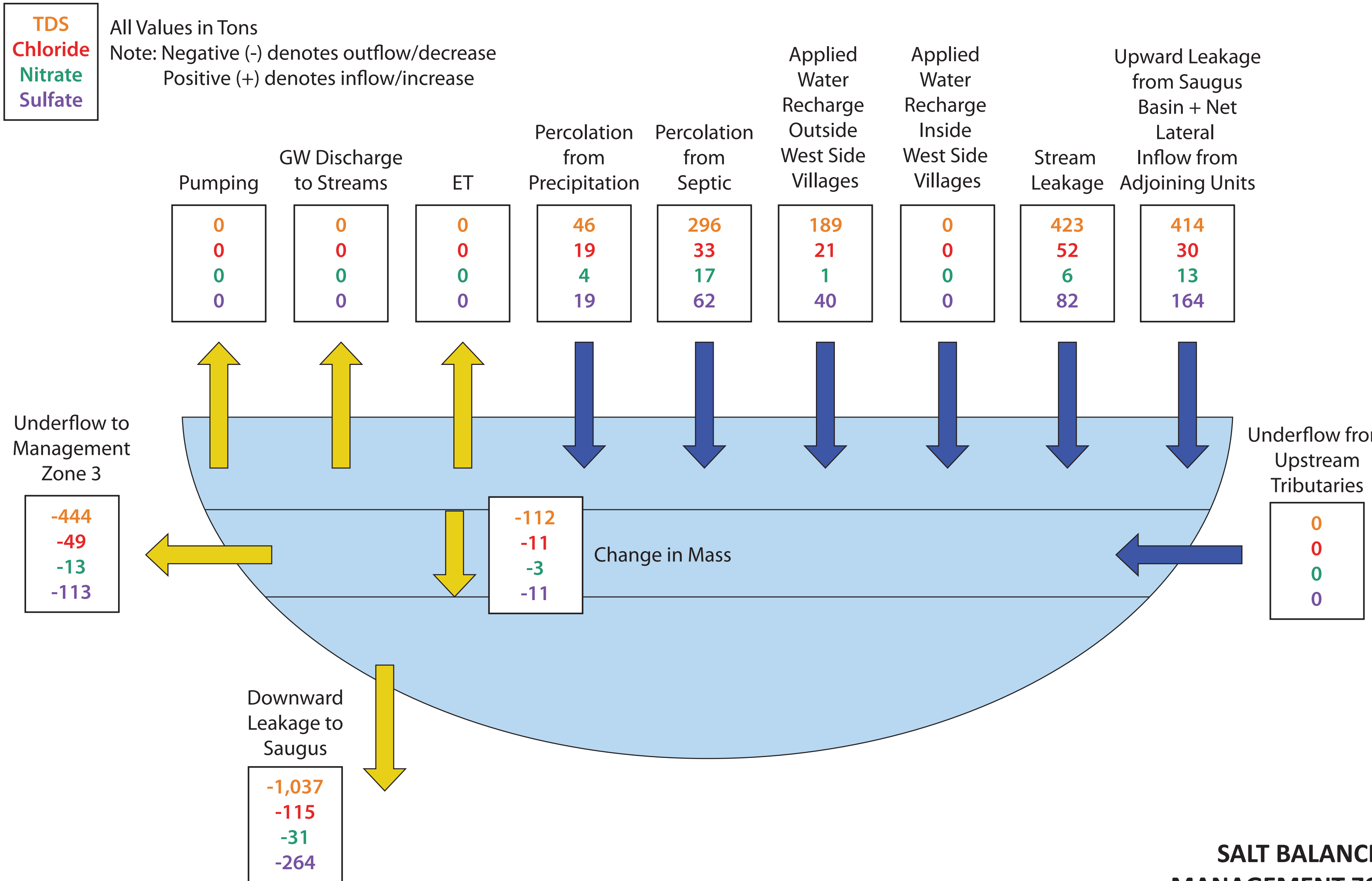
Figure 35b

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 2 (PLACERITA SUBUNIT) ALL PROJECTS 2012-2035

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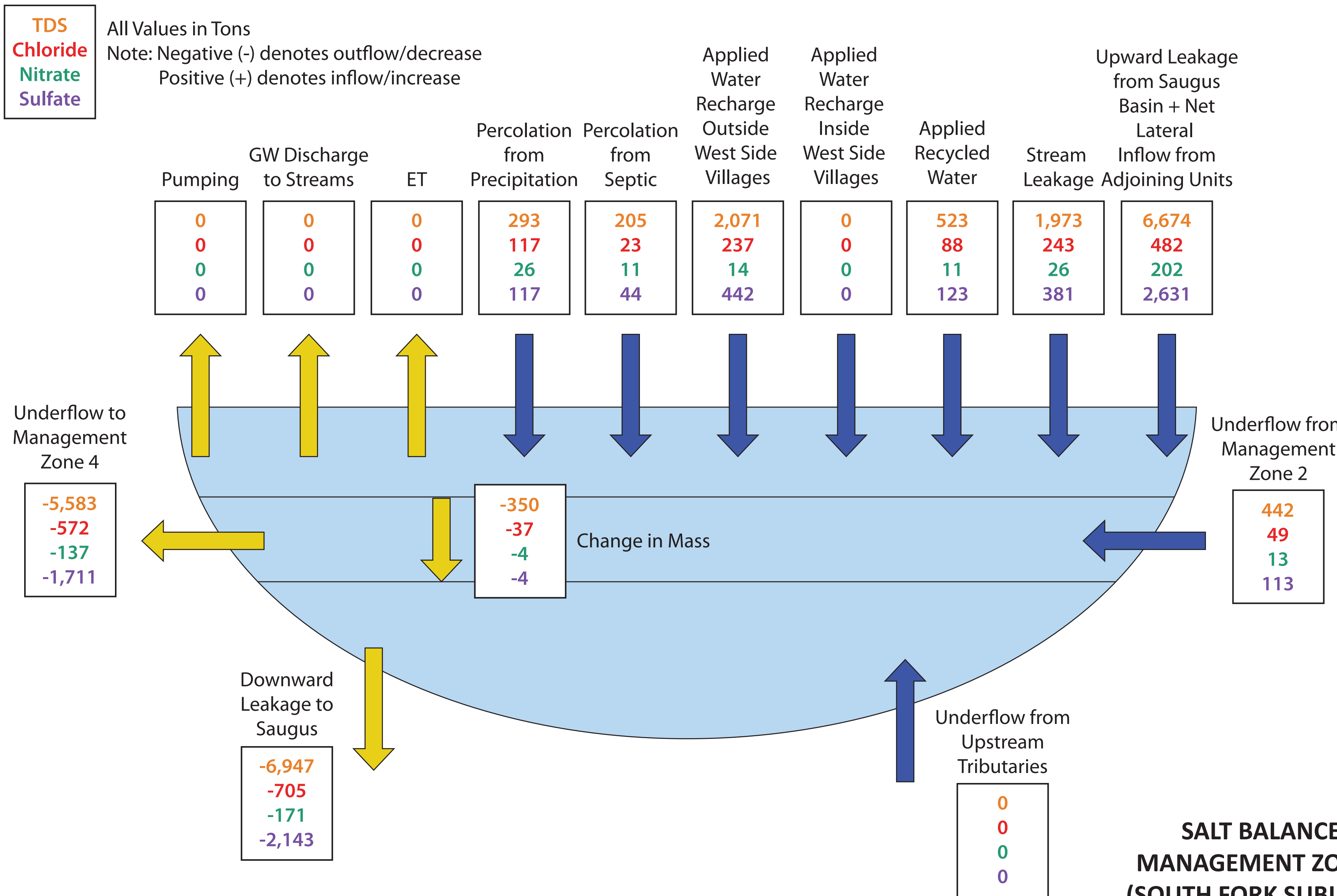
Figure 35c

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 3 (SOUTH FORK SUBUNIT) ALL PROJECTS 2012-2035

8-Dec-16

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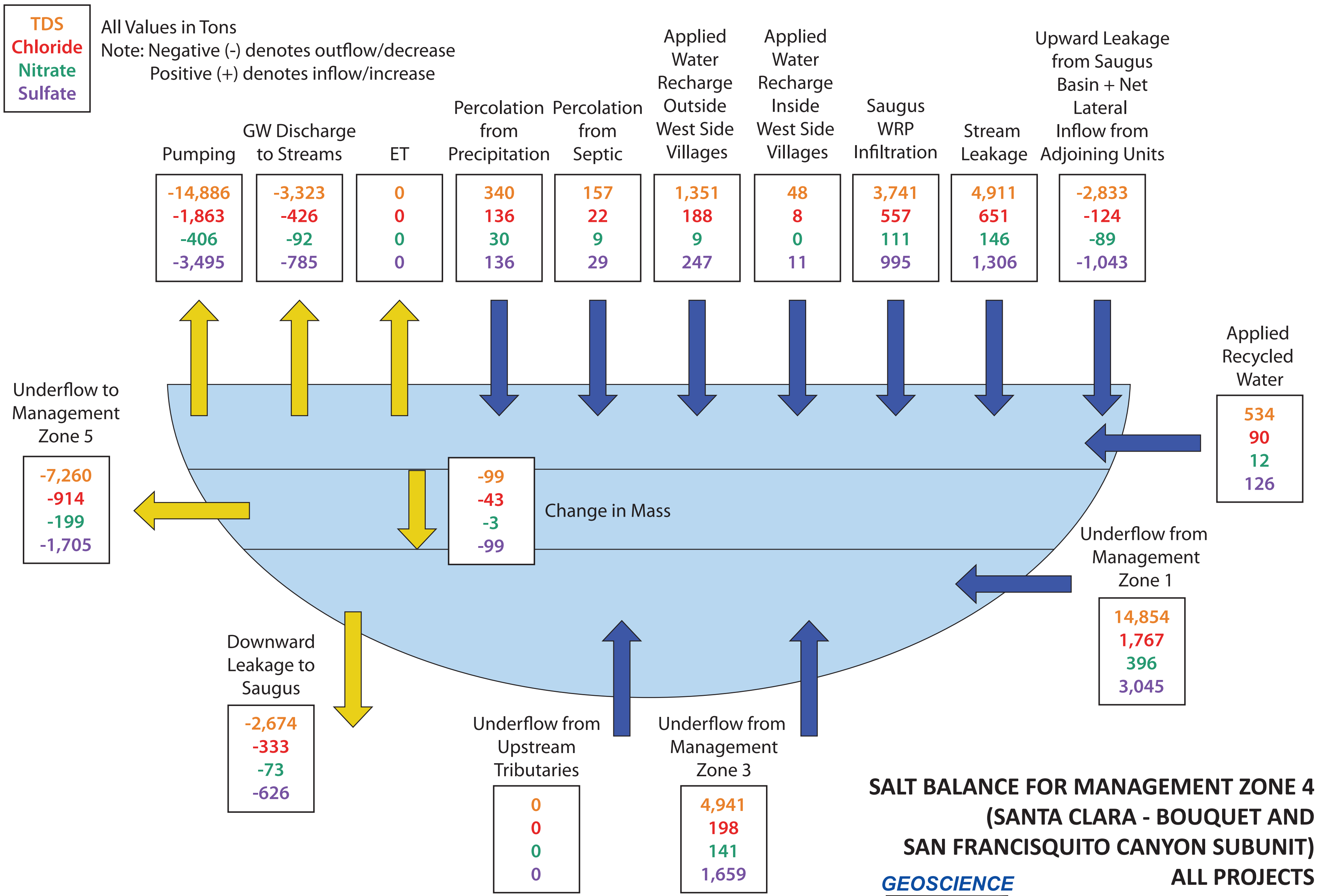
Figure 35d

CASTAC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN - SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 4 (SANTA CLARA - BOUQUET AND SAN FRANCISQUITO CANYON SUBUNIT) ALL PROJECTS 2012-2035

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Figure 35e

8-Dec-16

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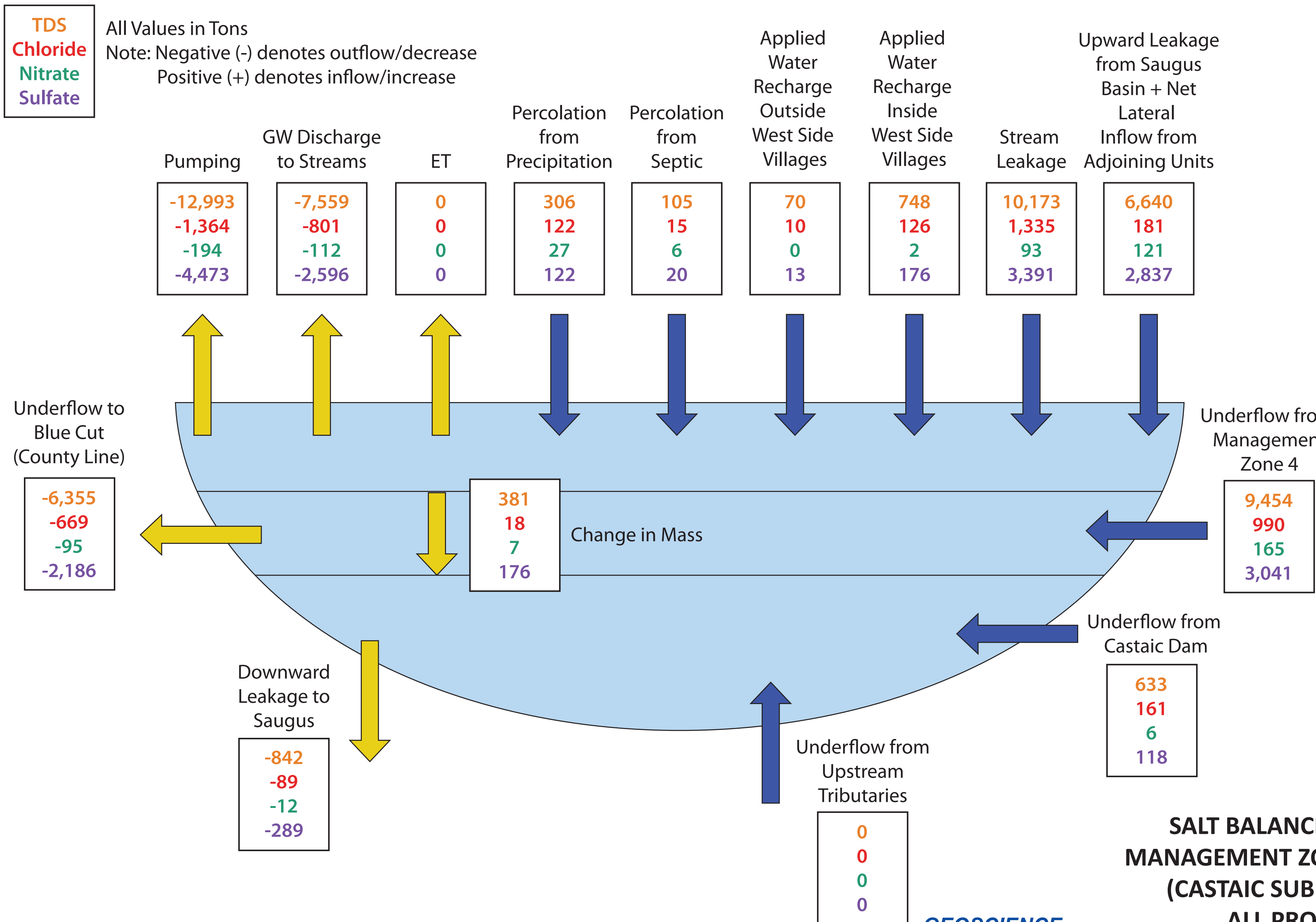

SALT BALANCE FOR MANAGEMENT ZONE 5 (CASTAIC SUBUNIT) ALL PROJECTS 2012-2035

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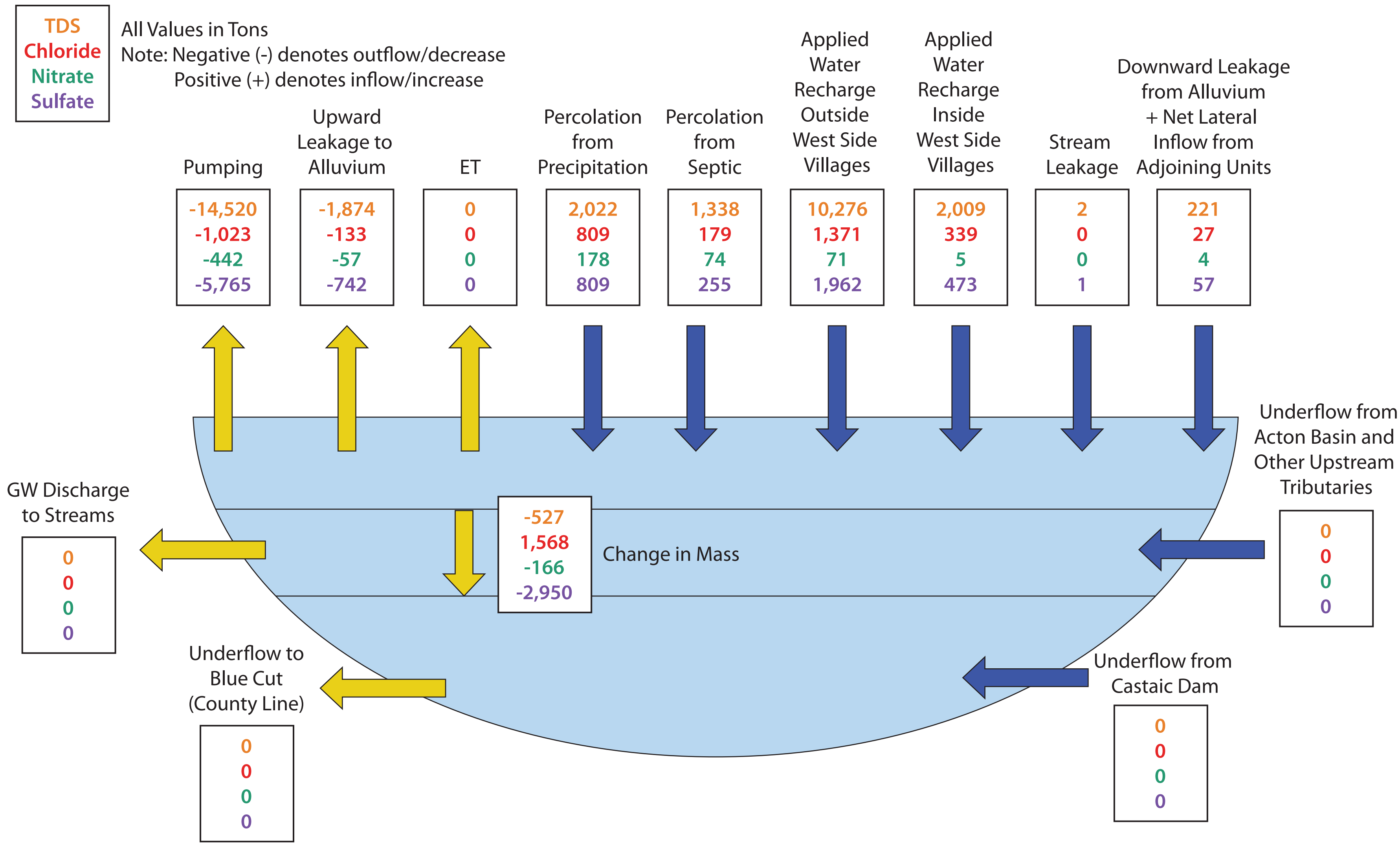
Figure 35f

CASTIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGMENT PLAN -
SANTA CLARA RIVER VALLEY EAST SUBBASIN



SALT BALANCE FOR MANAGEMENT ZONE 6 (SAUGUS FORMATION) ALL PROJECTS 2012-2035

Figure 35g

8-Dec-16

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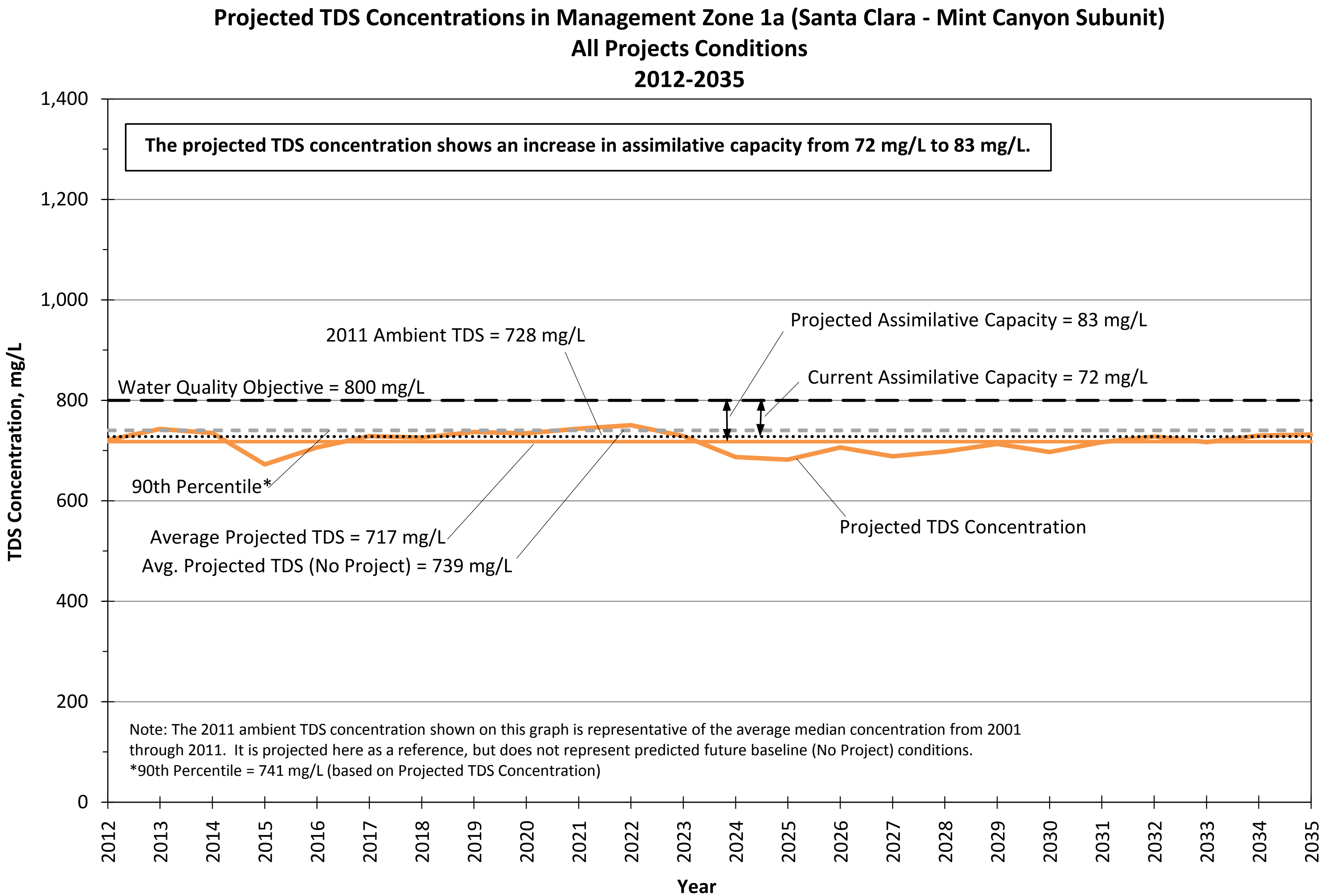

Projected TDS Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
All Projects Conditions
2012-2035
The projected TDS concentration shows an increase in assimilative capacity from 72 mg/L to 83 mg/L.
1,400
1,200
1,000
800
600
400
200
0
TDS Concentration, mg/L
2011 Ambient TDS = 728 mg/L
Projected Assimilative Capacity = 83 mg/L
Current Assimilative Capacity = 72 mg/L
Water Quality Objective = 800 mg/L
90th Percentile*
Average Projected TDS = 717 mg/L
Avg. Projected TDS (No Project) = 739 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 741 mg/L (based on Projected TDS Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 36.1.a

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

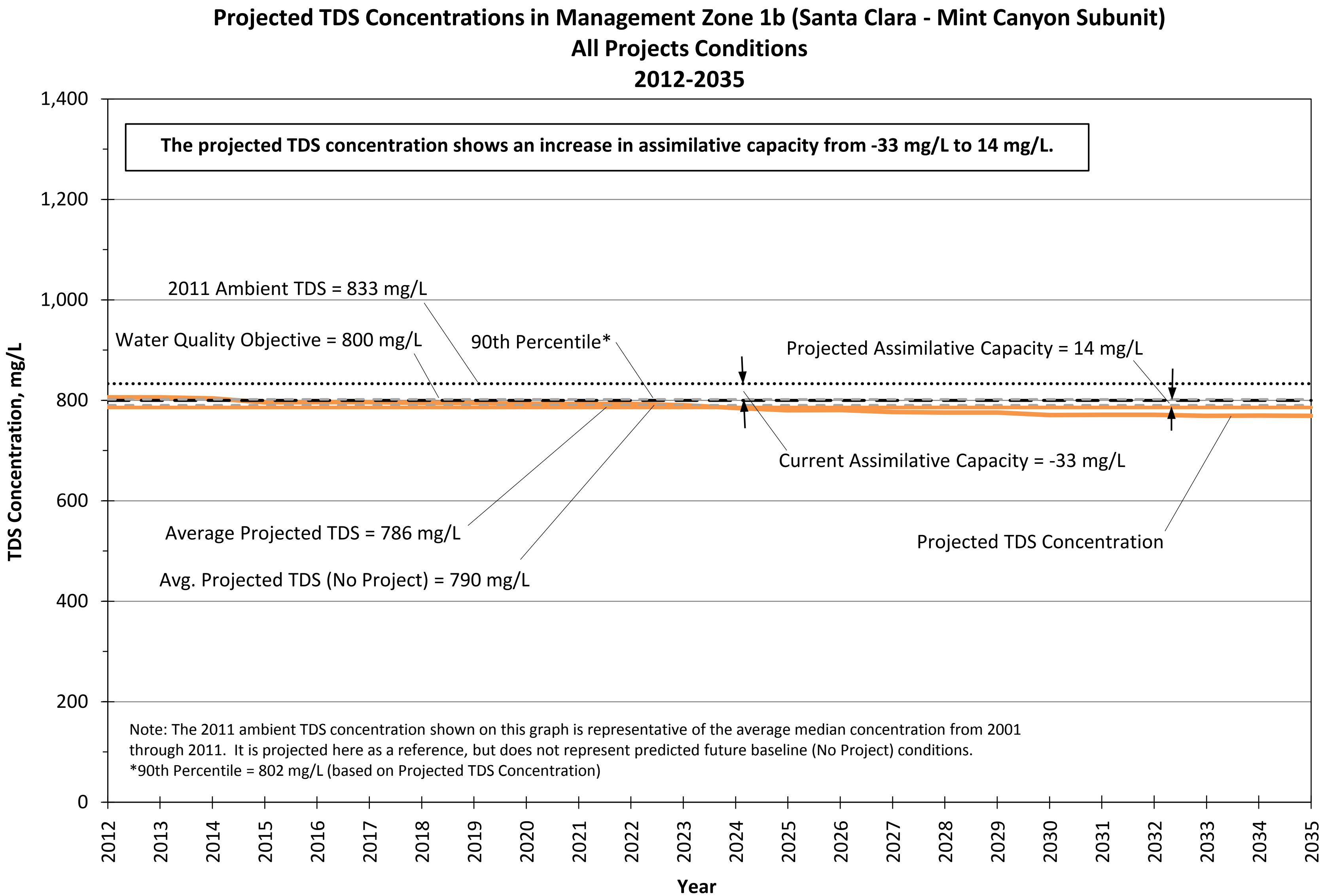


Figure 36.1.b

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

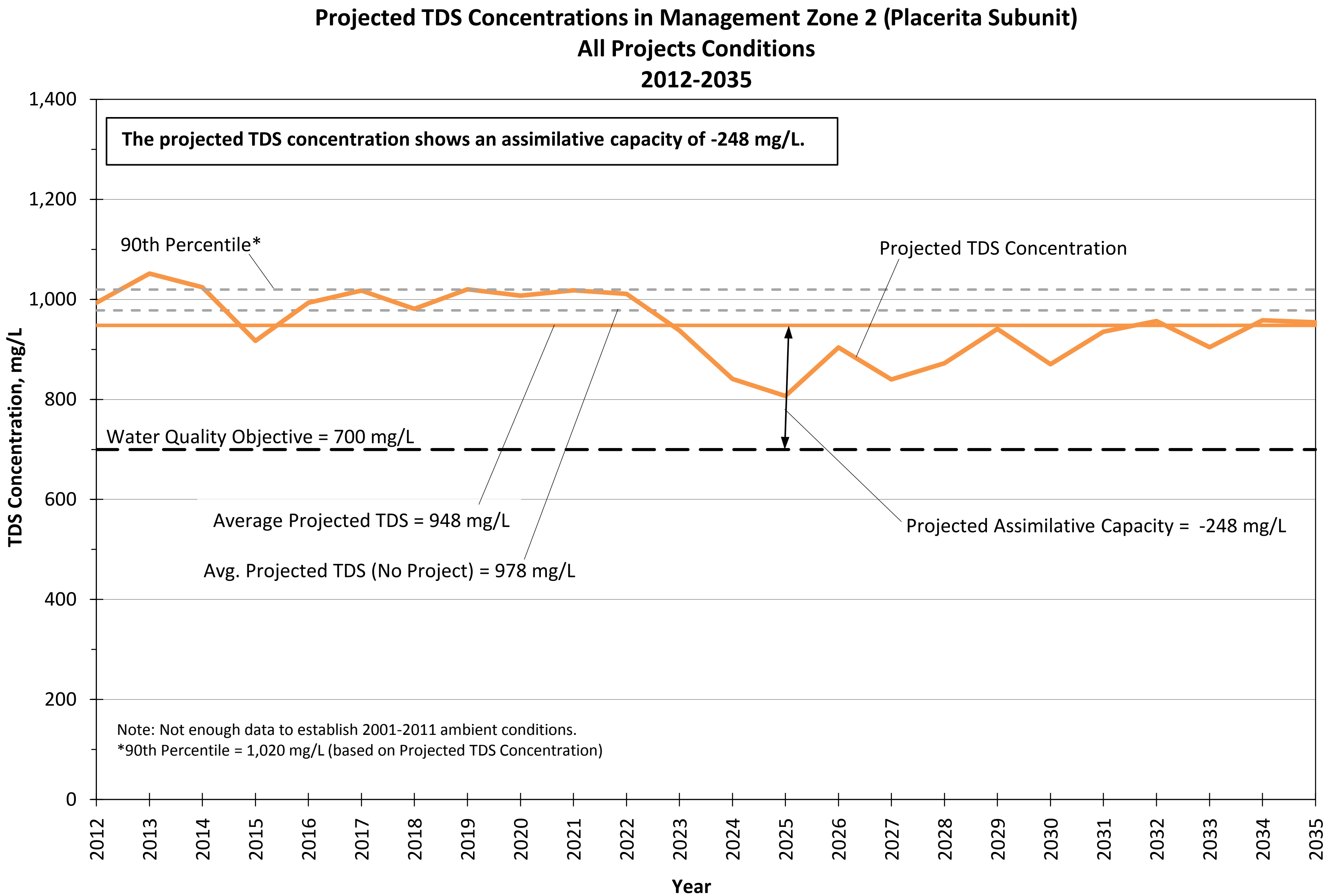


Figure 36.1.c

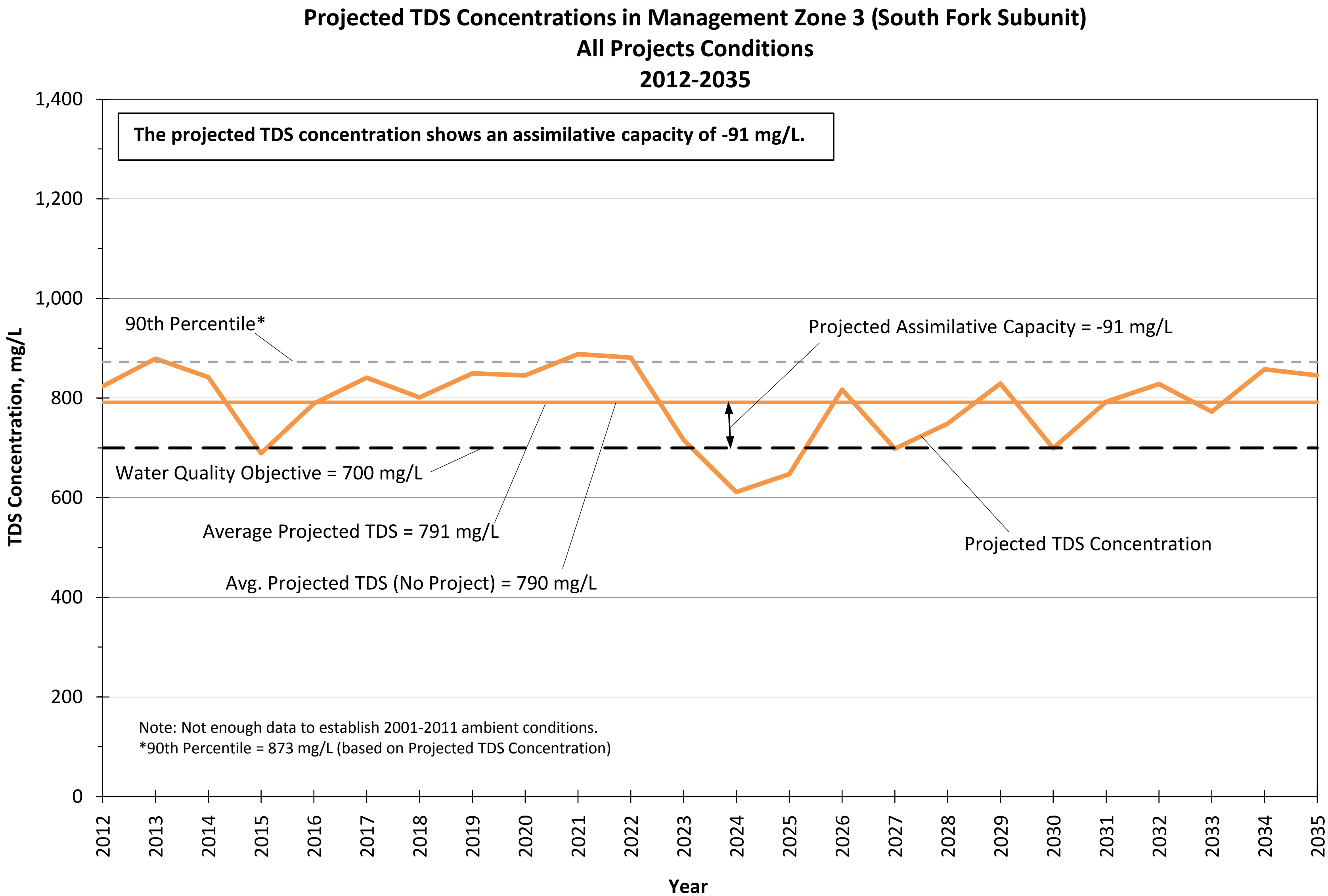

Projected TDS Concentrations in Management Zone 3 (South Fork Subunit)
All Projects Conditions
2012-2035
The projected TDS concentration shows an assimilative capacity of -91 mg/L.
1,400
1,200
1,000
800
600
400
200
0
TDS Concentration, mg/L
90th Percentile*
Projected Assimilative Capacity = -91 mg/L
Water Quality Objective = 700 mg/L
Average Projected TDS = 791 mg/L
Avg. Projected TDS (No Project) = 790 mg/L
Projected TDS Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 873 mg/L (based on Projected TDS Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 36.1.d

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

Projected TDS Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - All Projects Conditions 2012-2035

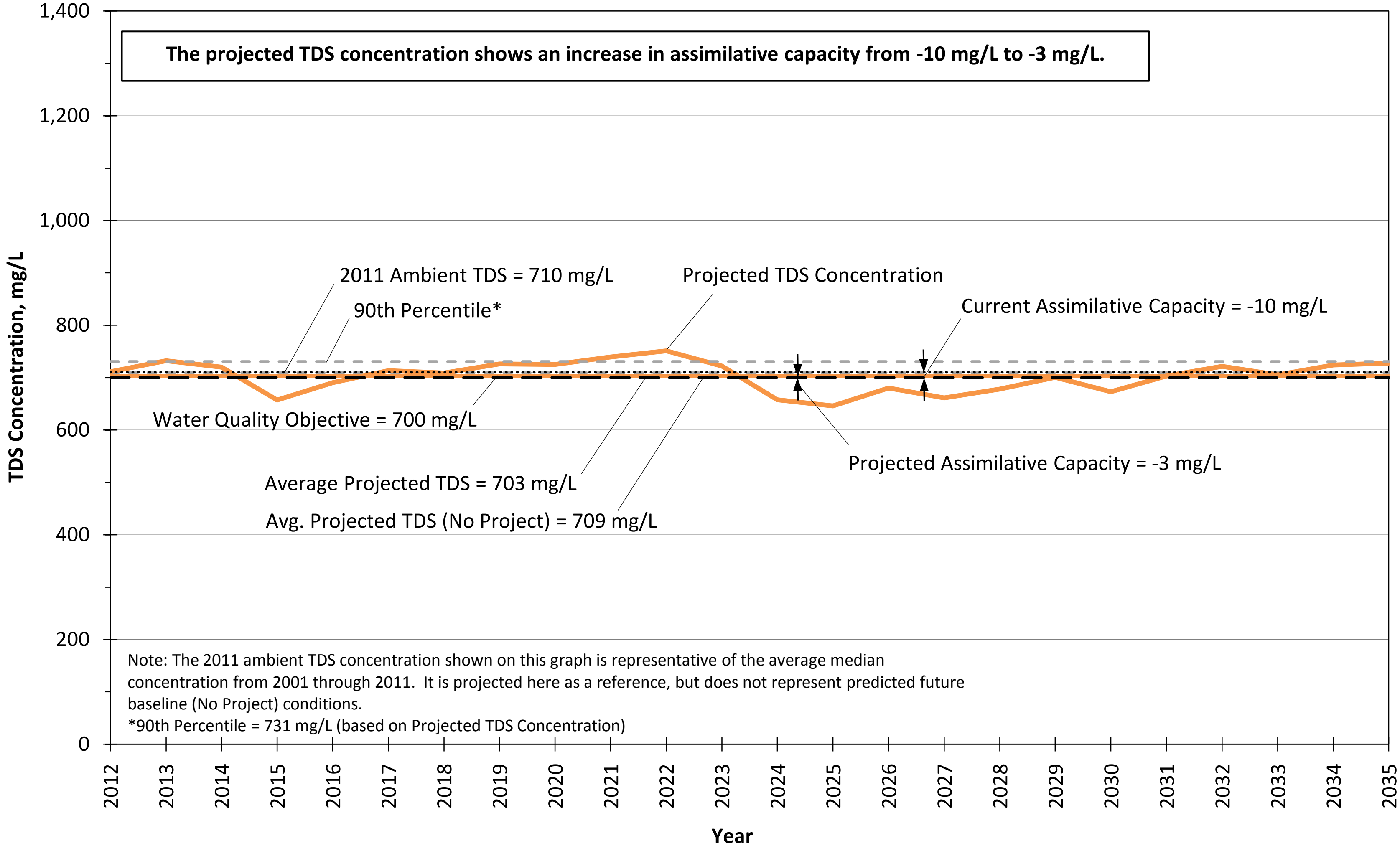


Figure 36.1.e

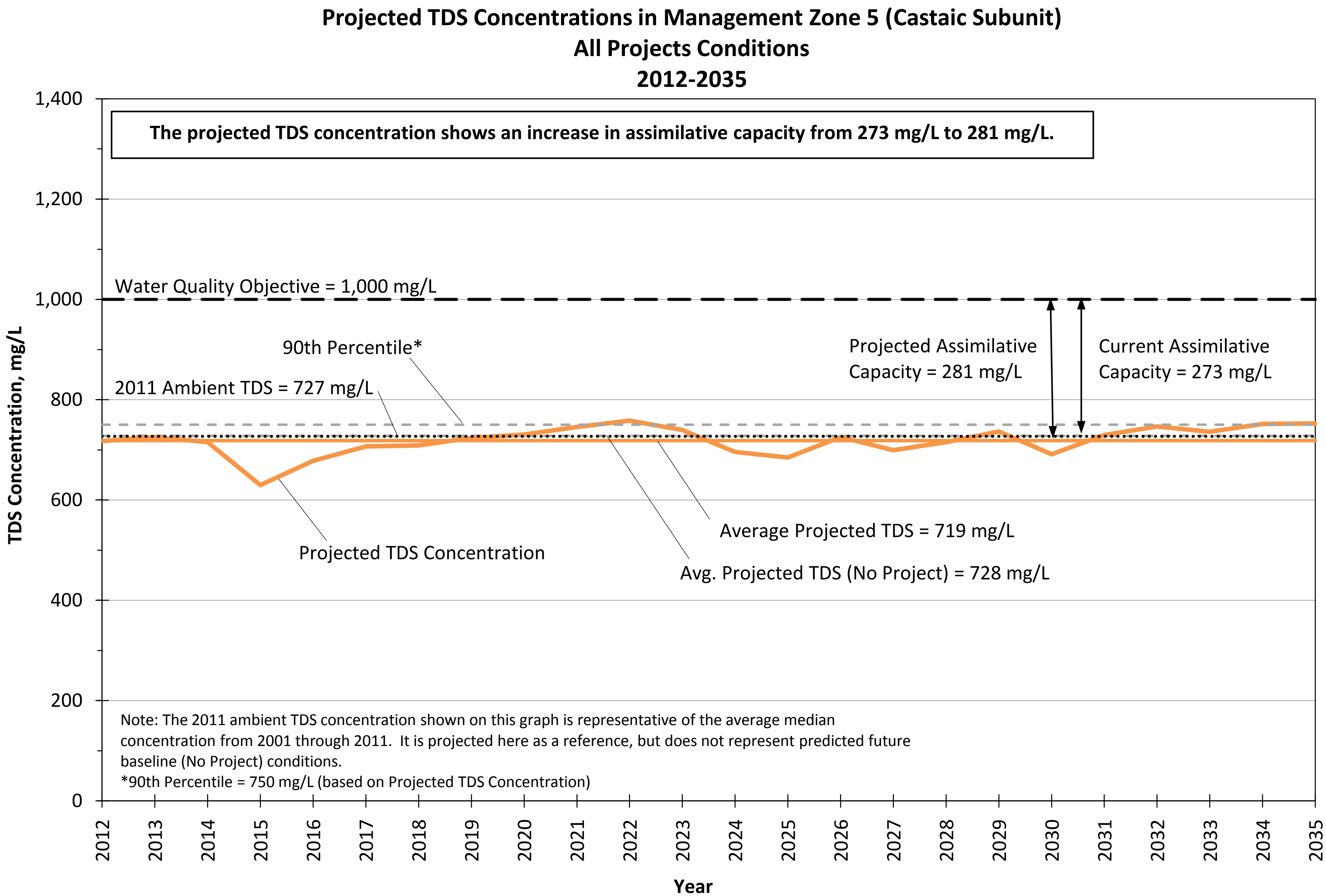

Projected TDS Concentrations in Management Zone 5 (Castaic Subunit)
All Projects Conditions
2012-2035
The projected TDS concentration shows an increase in assimilative capacity from 273 mg/L to 281 mg/L.
Water Quality Objective = 1,000 mg/L
90th Percentile*
2011 Ambient TDS = 727 mg/L
Projected Assimilative Capacity = 281 mg/L
Current Assimilative Capacity = 273 mg/L
Average Projected TDS = 719 mg/L
Avg. Projected TDS (No Project) = 728 mg/L
Projected TDS Concentration
Note: The 2011 ambient TDS concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 750 mg/L (based on Projected TDS Concentration)
TDS Concentration, mg/L
1,400
1,200
1,000
800
600
400
200
0
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 36.1.f

Projected TDS Concentrations in Management Zone 6 (Saugus Formation)
All Projects Conditions
2012-2035

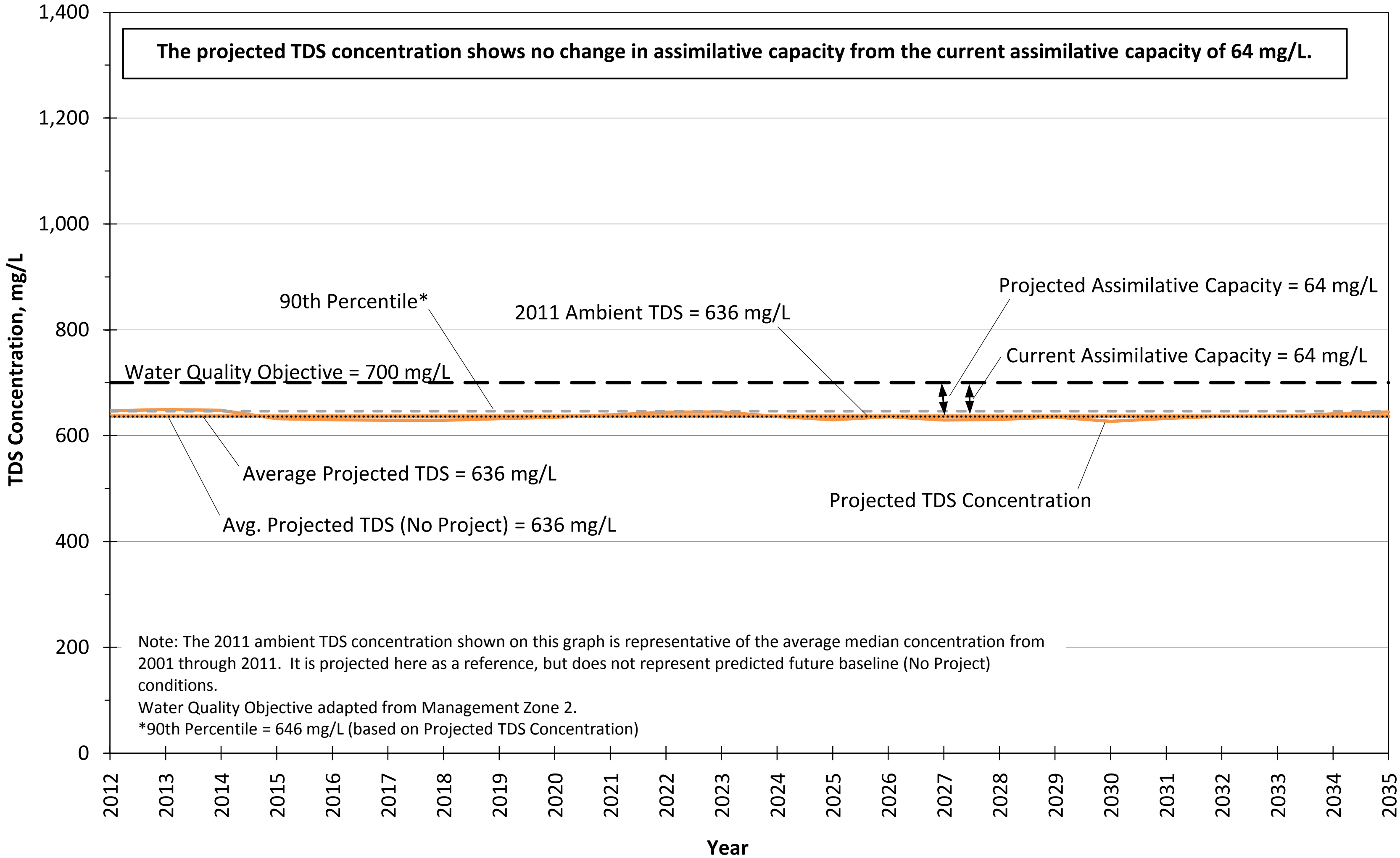


Figure 36.1.g

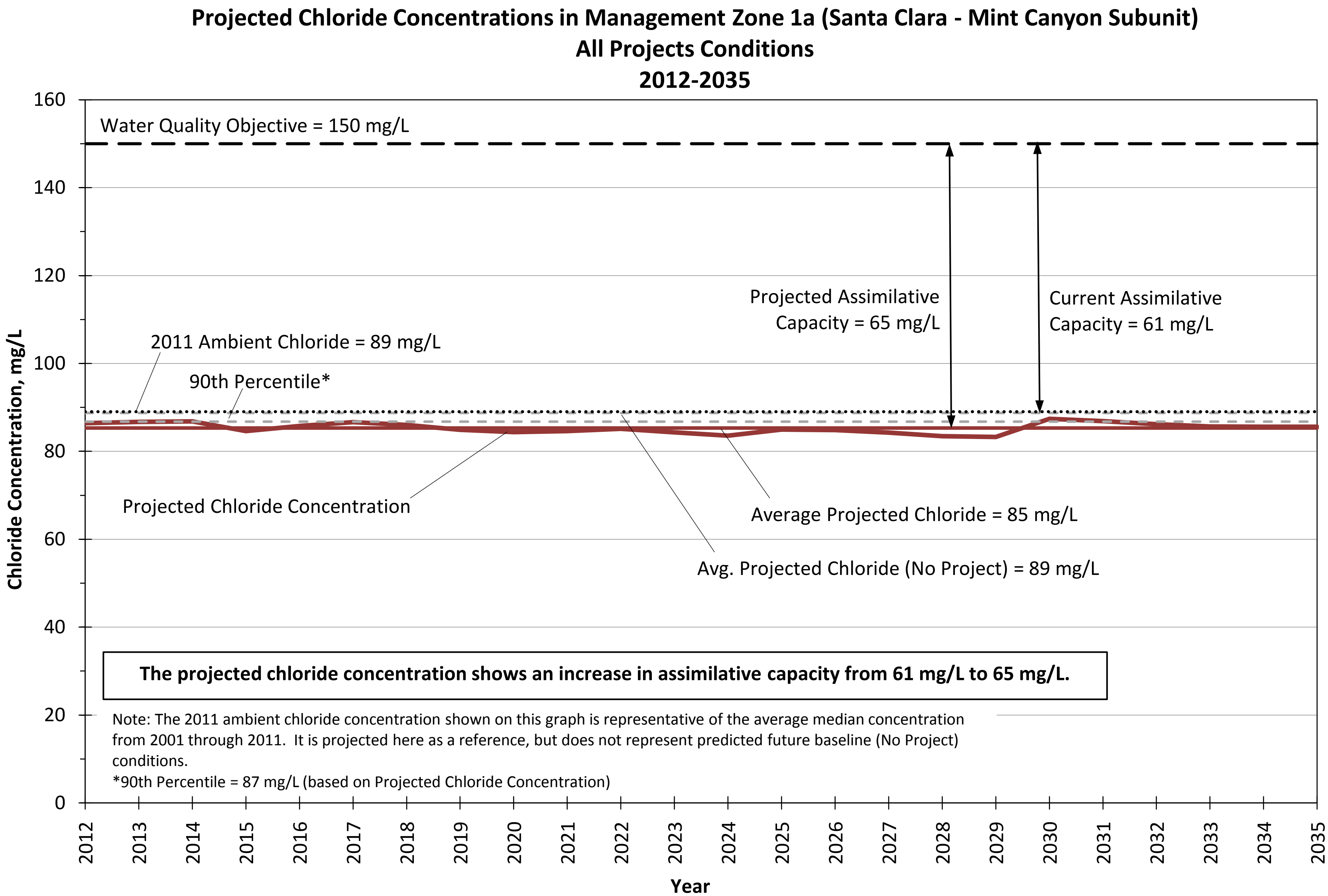

Projected Chloride Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
All Projects Conditions
2012-2035
Water Quality Objective = 150 mg/L
Projected Assimilative Capacity = 65 mg/L
Current Assimilative Capacity = 61 mg/L
2011 Ambient Chloride = 89 mg/L
90th Percentile*
Projected Chloride Concentration
Average Projected Chloride = 85 mg/L
Avg. Projected Chloride (No Project) = 89 mg/L
The projected chloride concentration shows an increase in assimilative capacity from 61 mg/L to 65 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 87 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 36.2.a

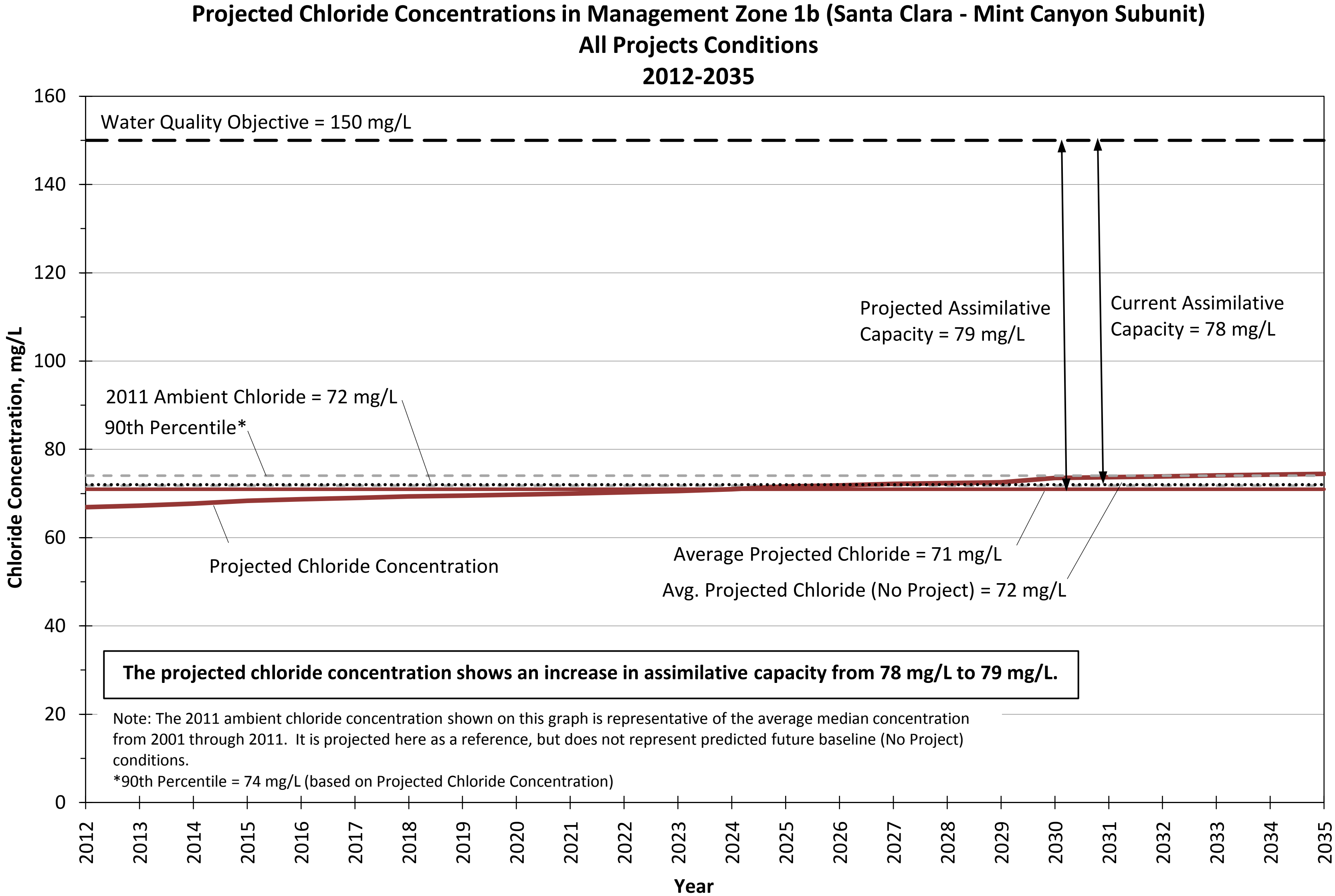

Projected Chloride Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
All Projects Conditions
2012-2035
Water Quality Objective = 150 mg/L
Projected Assimilative Capacity = 79 mg/L
Current Assimilative Capacity = 78 mg/L
2011 Ambient Chloride = 72 mg/L
90th Percentile*
Projected Chloride Concentration
Average Projected Chloride = 71 mg/L
Avg. Projected Chloride (No Project) = 72 mg/L
The projected chloride concentration shows an increase in assimilative capacity from 78 mg/L to 79 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 74 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 36.2.b

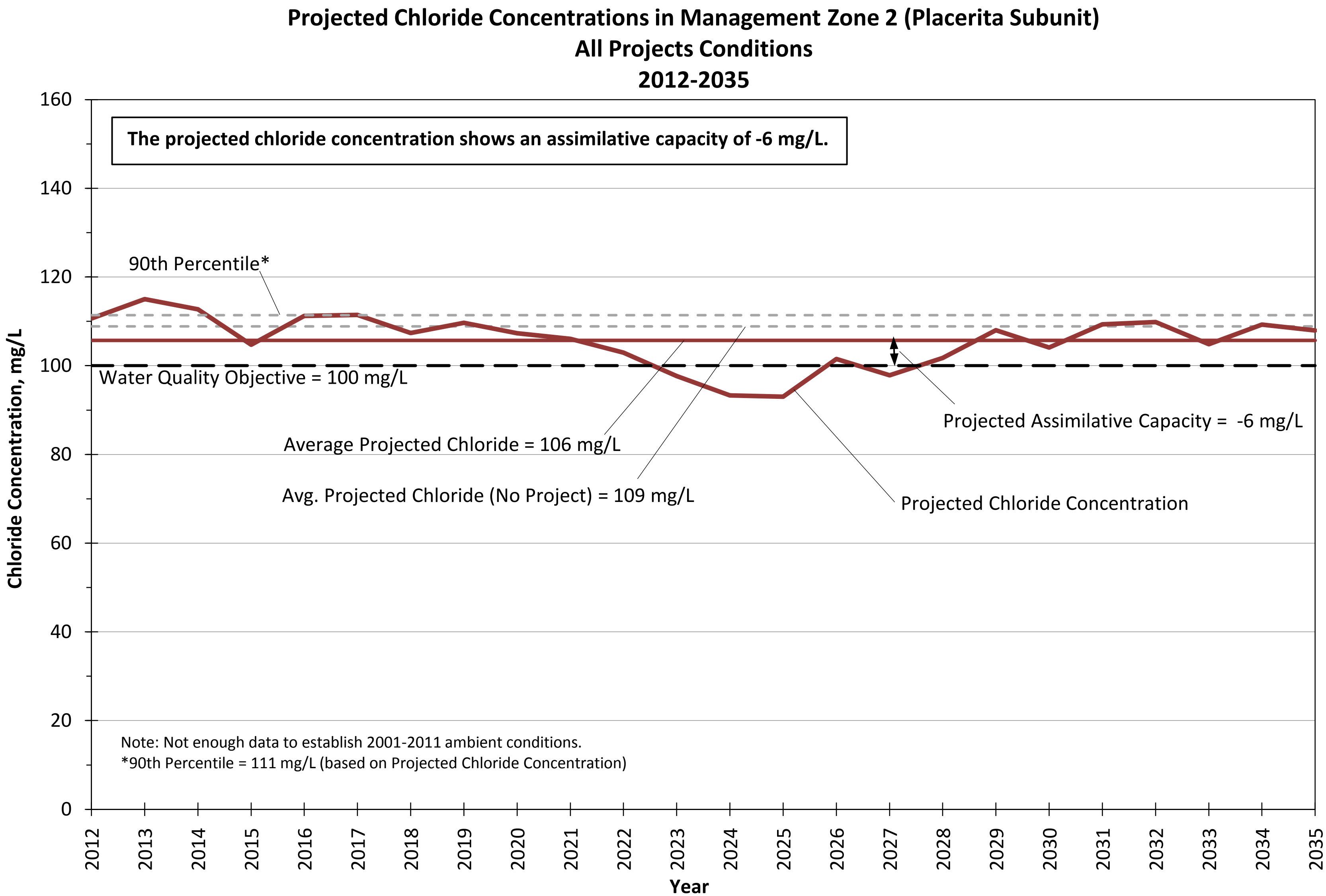

Projected Chloride Concentrations in Management Zone 2 (Placerita Subunit)
All Projects Conditions
2012-2035
The projected chloride concentration shows an assimilative capacity of -6 mg/L.
90th Percentile*
Water Quality Objective = 100 mg/L
Average Projected Chloride = 106 mg/L
Avg. Projected Chloride (No Project) = 109 mg/L
Projected Assimilative Capacity = -6 mg/L
Projected Chloride Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 111 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
Year
0
20
40
60
80
100
120
140
160
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 36.2.c

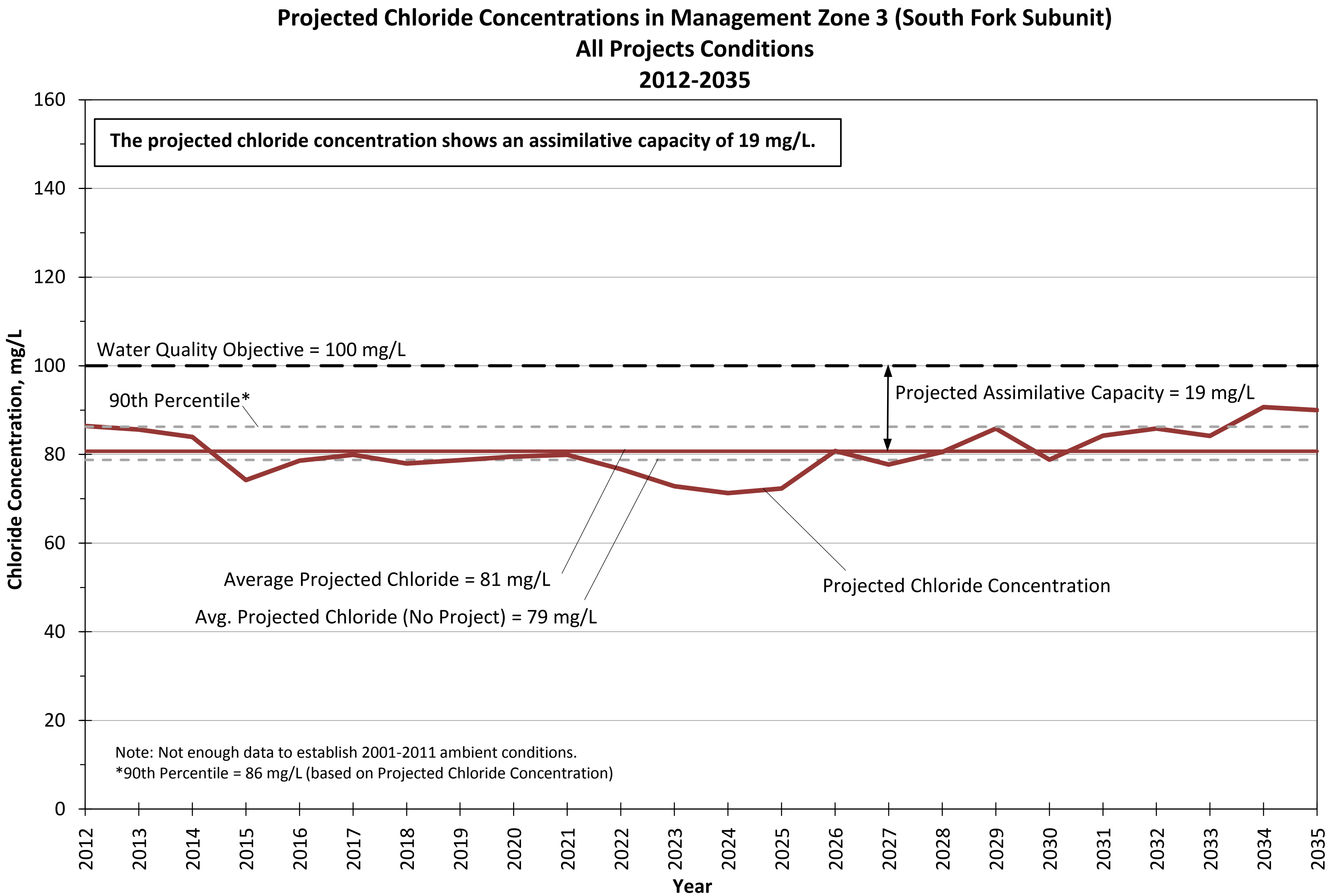

Projected Chloride Concentrations in Management Zone 3 (South Fork Subunit)
All Projects Conditions
2012-2035
The projected chloride concentration shows an assimilative capacity of 19 mg/L.
Water Quality Objective = 100 mg/L
90th Percentile*
Projected Assimilative Capacity = 19 mg/L
Average Projected Chloride = 81 mg/L
Avg. Projected Chloride (No Project) = 79 mg/L
Projected Chloride Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 86 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
0
20
40
60
80
100
120
140
160
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 36.2.d

Projected Chloride Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - All Projects Conditions 2012-2035

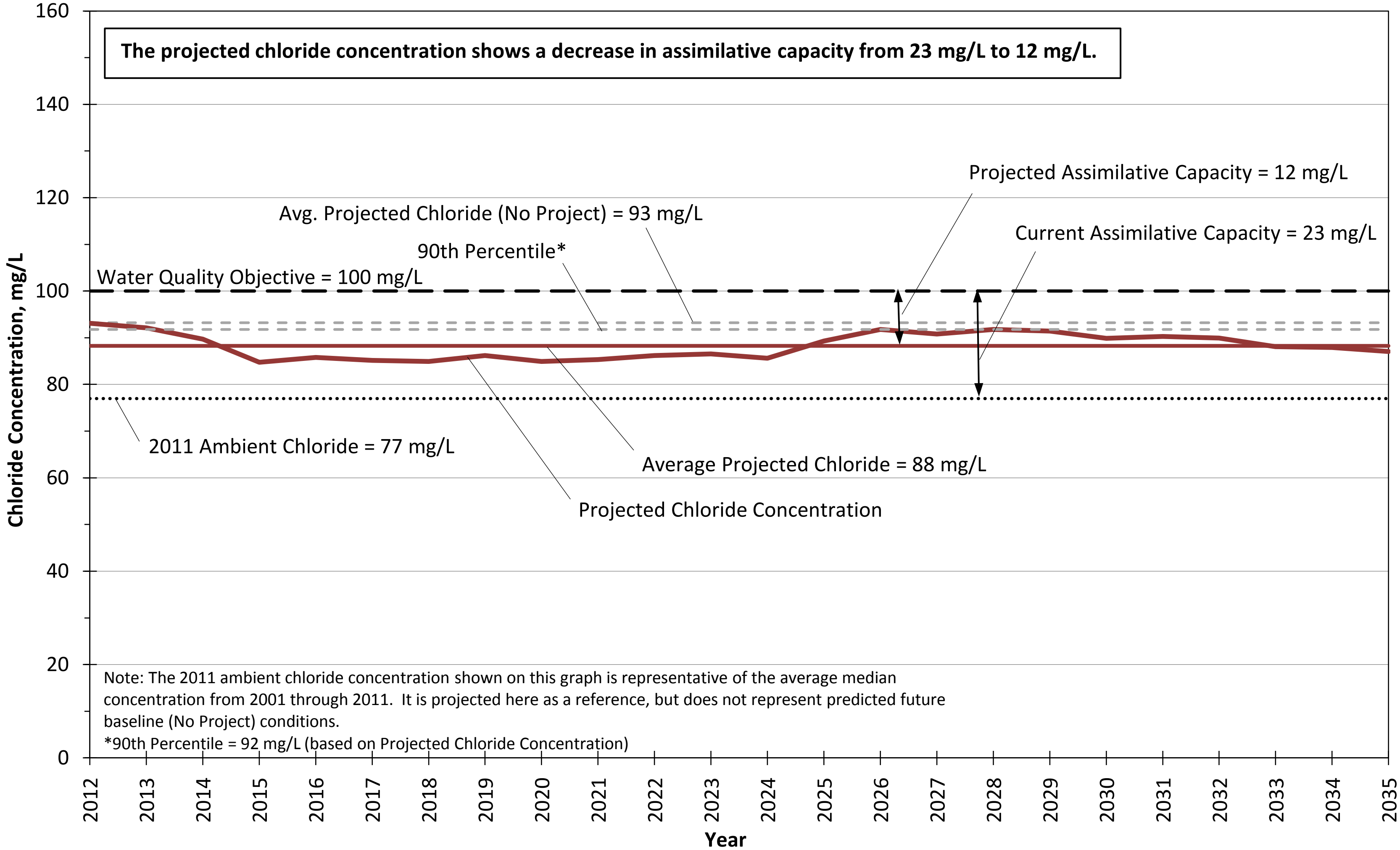
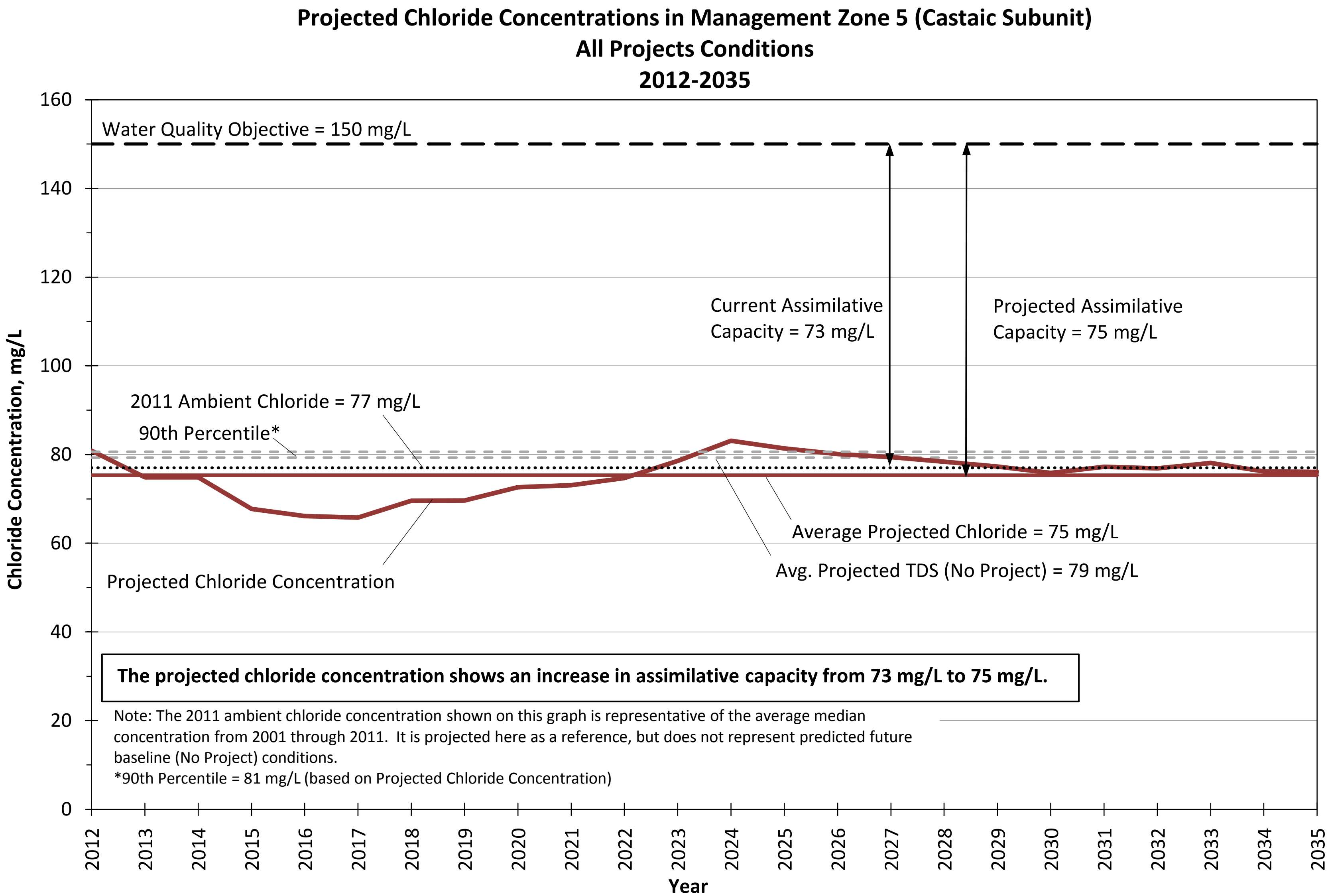


Figure 36.2.e


Projected Chloride Concentrations in Management Zone 5 (Castaic Subunit)
All Projects Conditions
2012-2035
Water Quality Objective = 150 mg/L
Current Assimilative Capacity = 73 mg/L
Projected Assimilative Capacity = 75 mg/L
2011 Ambient Chloride = 77 mg/L
90th Percentile*
Average Projected Chloride = 75 mg/L
Avg. Projected TDS (No Project) = 79 mg/L
Projected Chloride Concentration
The projected chloride concentration shows an increase in assimilative capacity from 73 mg/L to 75 mg/L.
Note: The 2011 ambient chloride concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 81 mg/L (based on Projected Chloride Concentration)
Chloride Concentration, mg/L
0
20
40
60
80
100
120
140
160
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
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2032
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2034
2035

Figure 36.2.f

Projected Chloride Concentrations in Management Zone 6 (Saugus Formation)
All Projects Conditions
2012-2035

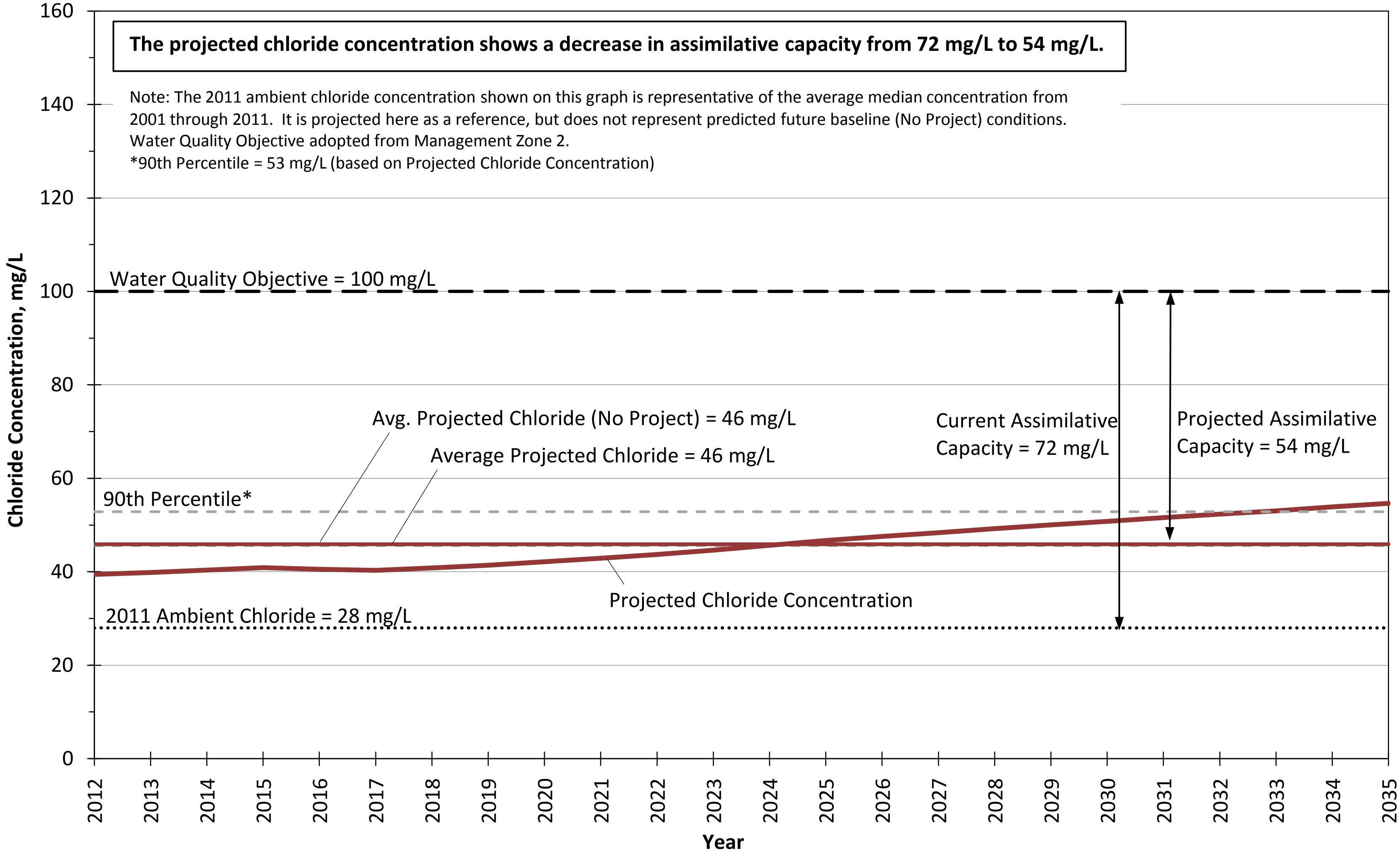
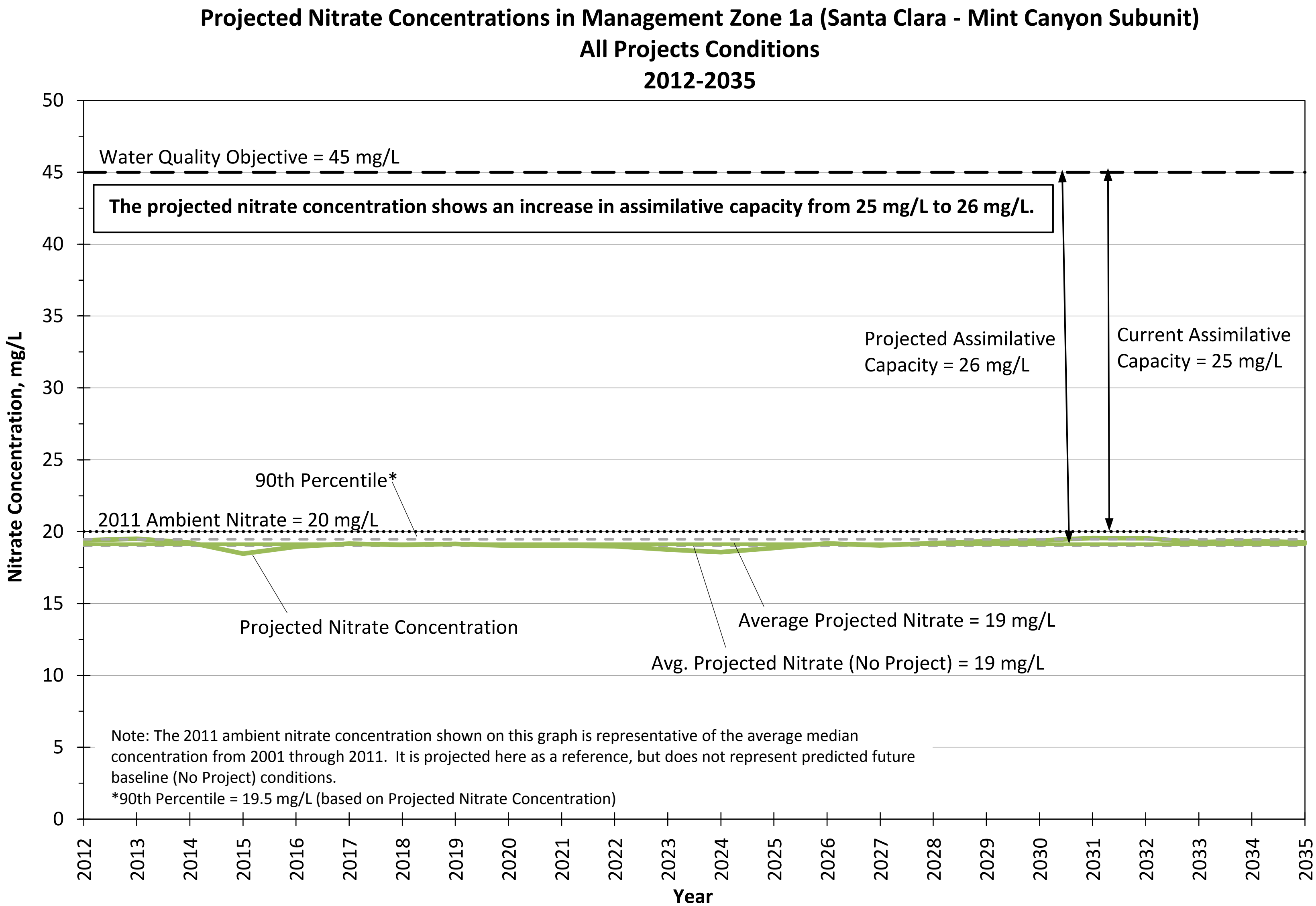


Figure 36.2.g


Projected Nitrate Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
All Projects Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an increase in assimilative capacity from 25 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 25 mg/L
90th Percentile*
2011 Ambient Nitrate = 20 mg/L
Projected Nitrate Concentration
Average Projected Nitrate = 19 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 19.5 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
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2034
2035

Figure 36.3.a

Projected Nitrate Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
All Projects Conditions
2012-2035

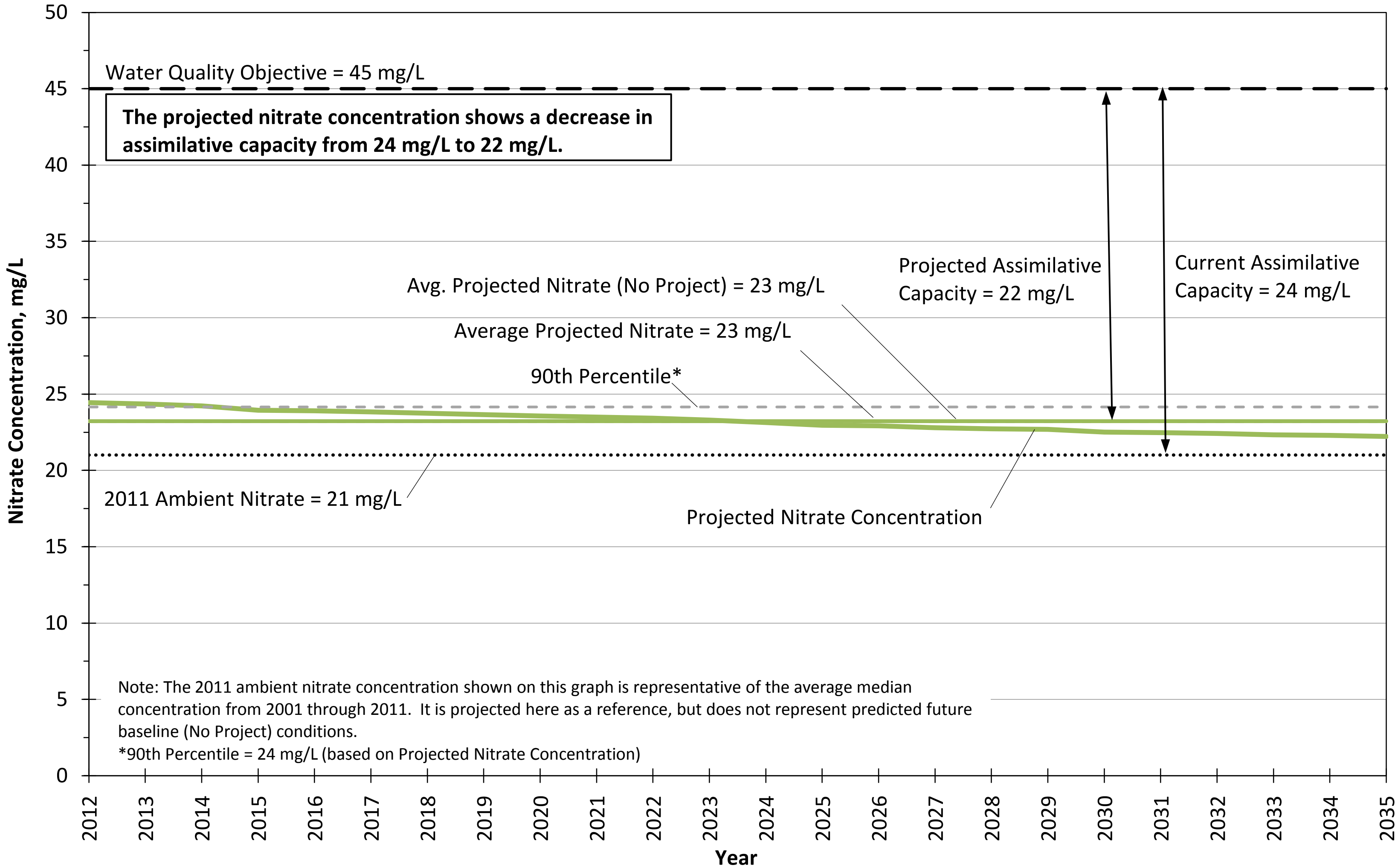


Figure 36.3.b

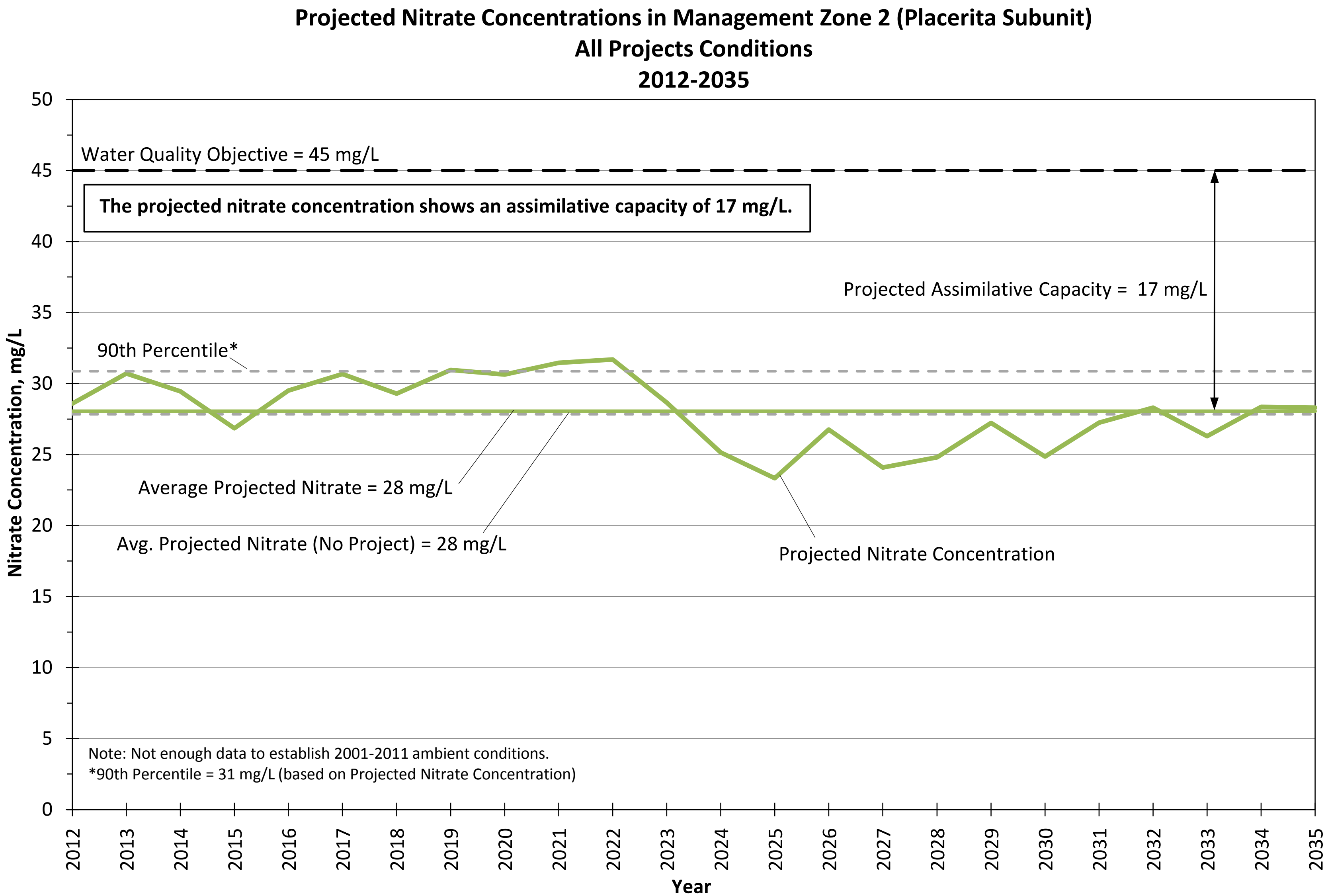
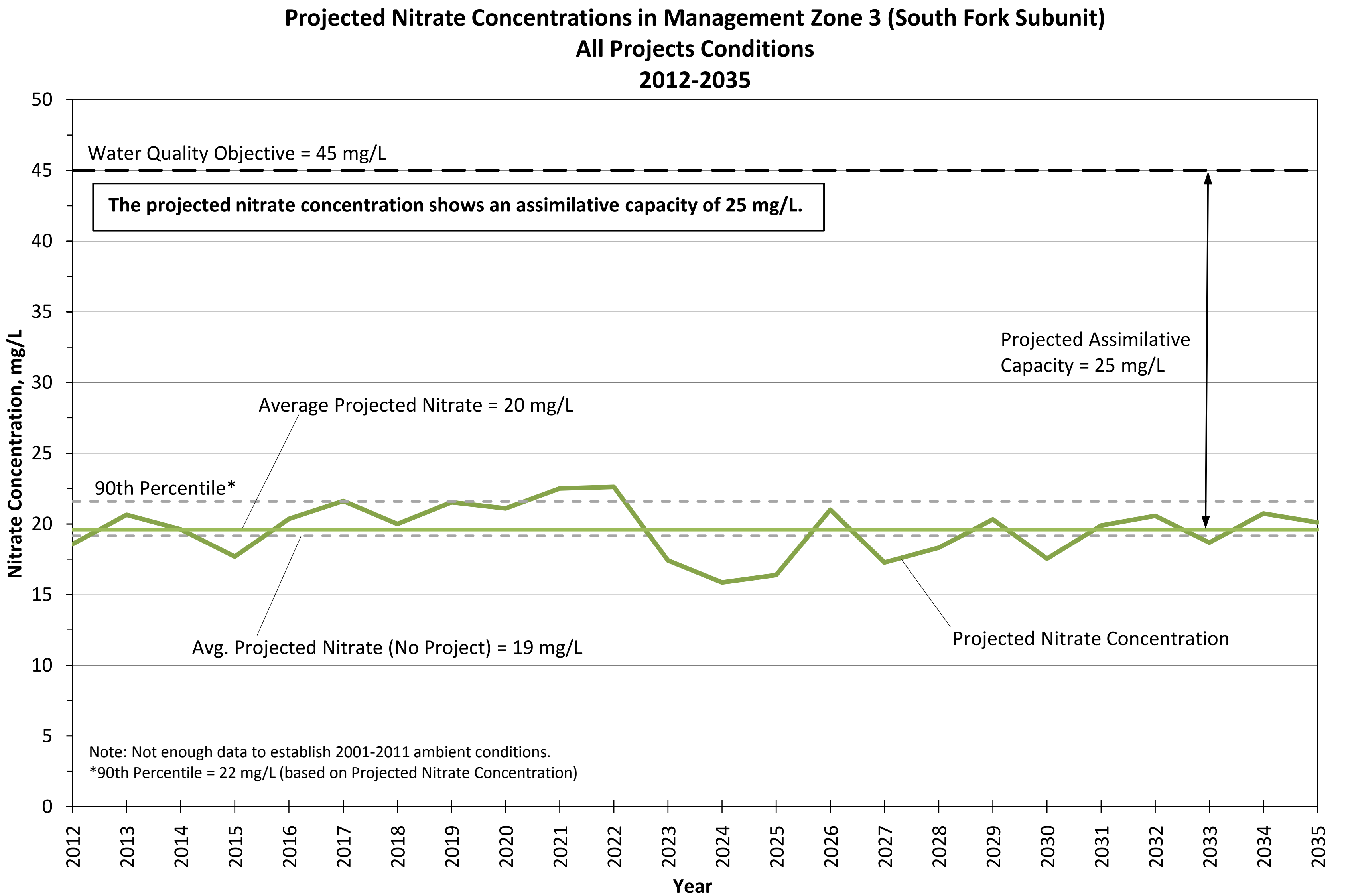

Projected Nitrate Concentrations in Management Zone 2 (Placerita Subunit)
All Projects Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an assimilative capacity of 17 mg/L.
Projected Assimilative Capacity = 17 mg/L
90th Percentile*
Average Projected Nitrate = 28 mg/L
Avg. Projected Nitrate (No Project) = 28 mg/L
Projected Nitrate Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 31 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 36.3.c


Projected Nitrate Concentrations in Management Zone 3 (South Fork Subunit)
All Projects Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows an assimilative capacity of 25 mg/L.
Projected Assimilative Capacity = 25 mg/L
Average Projected Nitrate = 20 mg/L
90th Percentile*
Avg. Projected Nitrate (No Project) = 19 mg/L
Projected Nitrate Concentration
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 22 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
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2034
2035

Figure 36.3.d

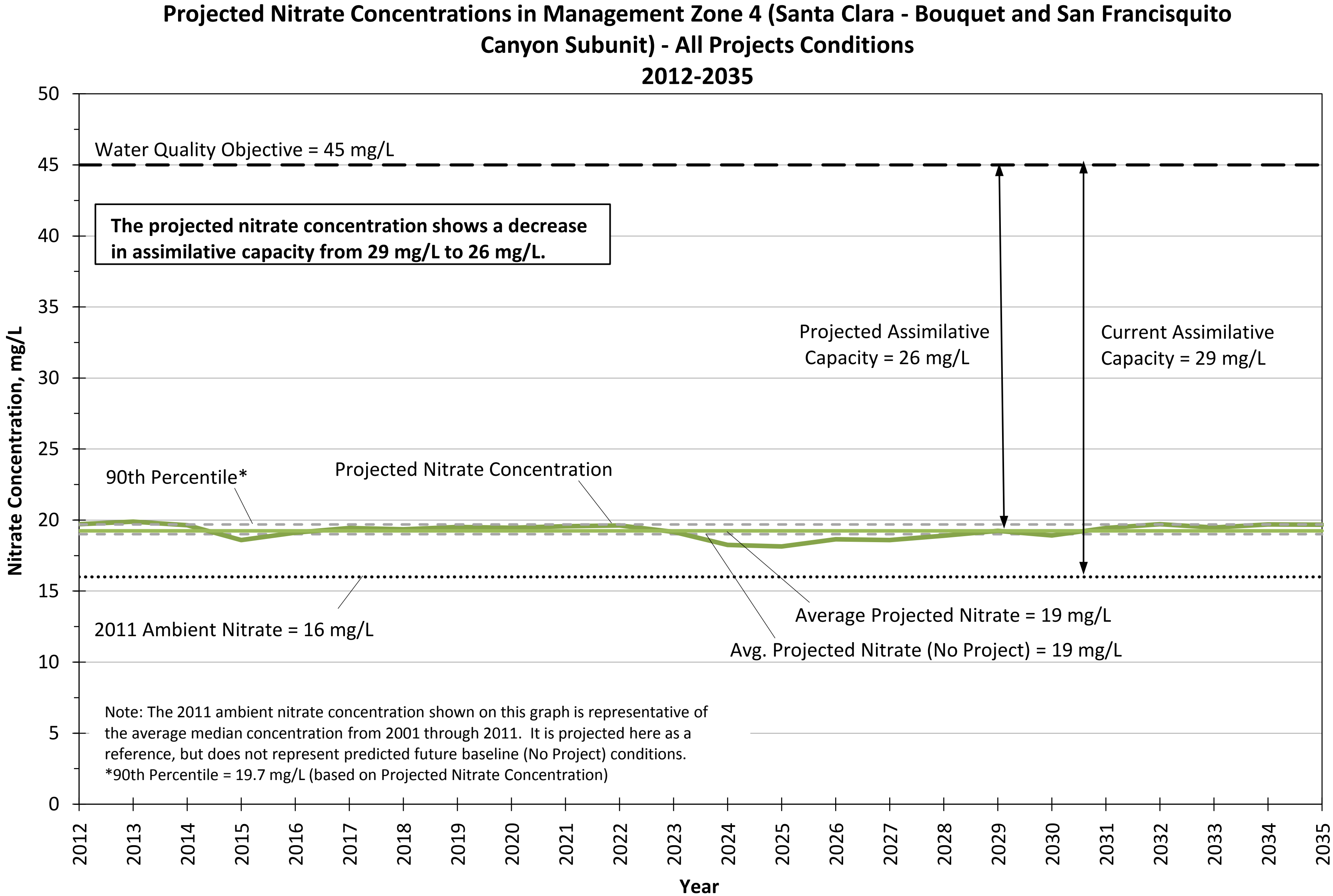
Projected Nitrate Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - All Projects Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 29 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 29 mg/L
90th Percentile*
Projected Nitrate Concentration
2011 Ambient Nitrate = 16 mg/L
Average Projected Nitrate = 19 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 19.7 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
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Figure 36.3.e

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

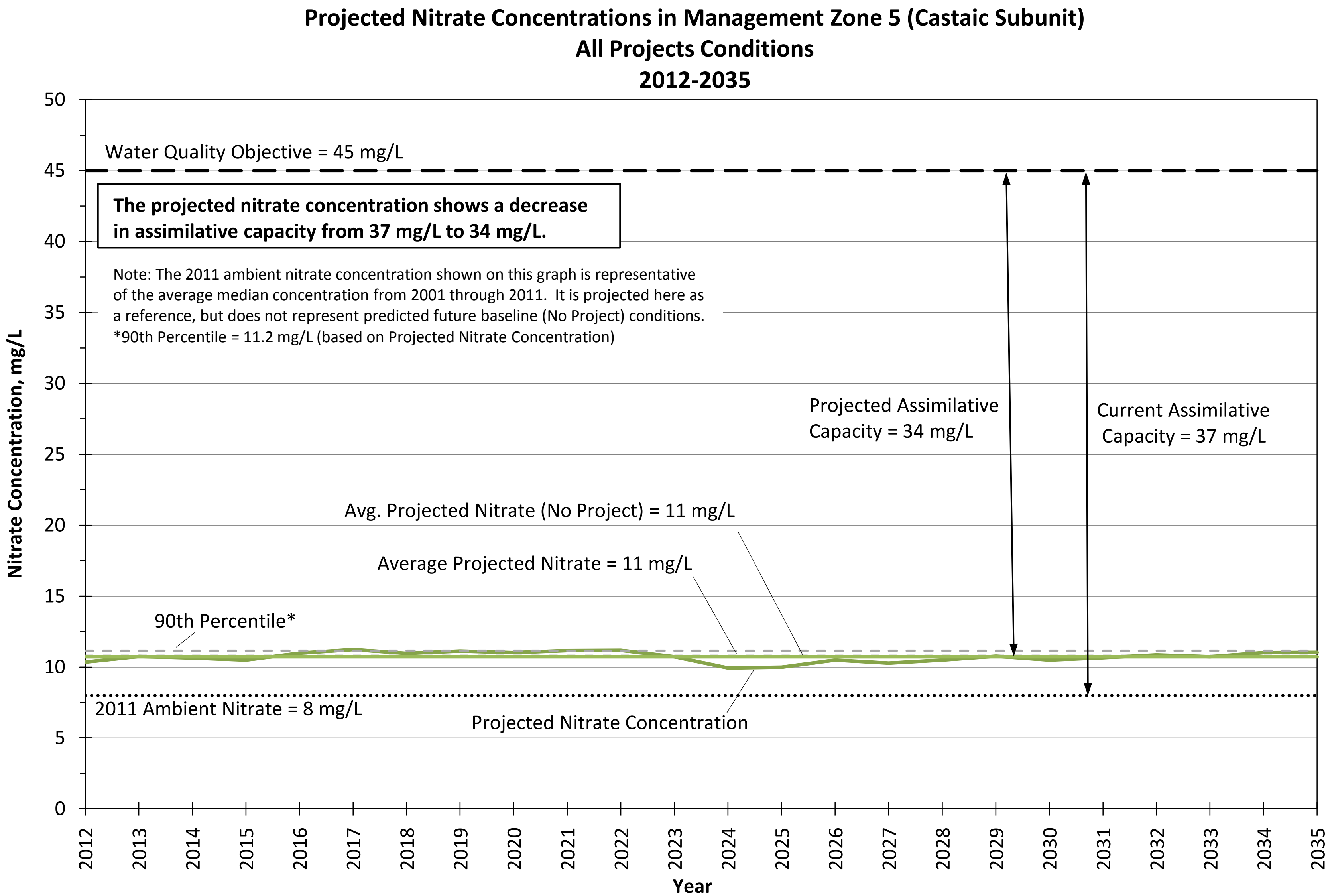
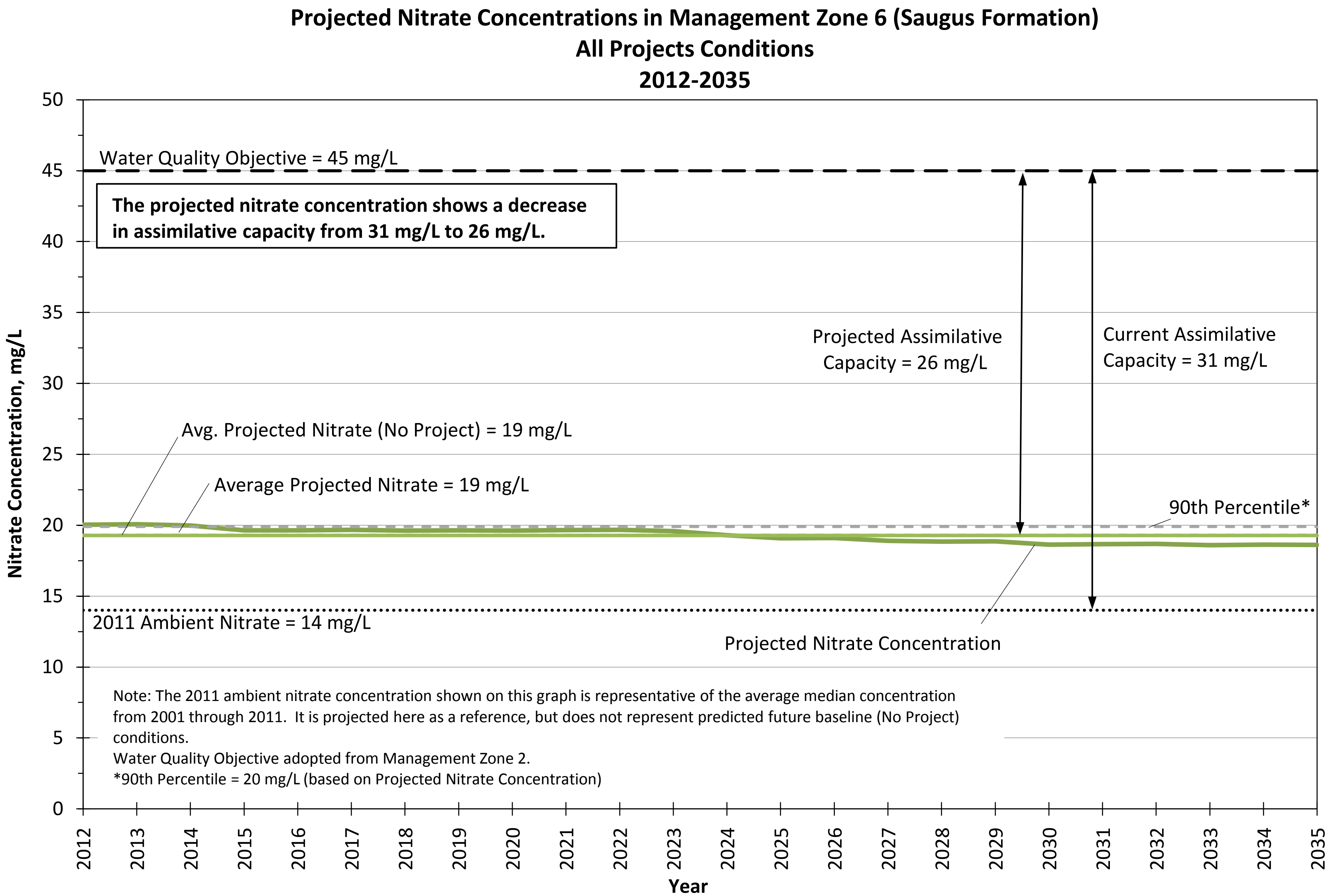


Figure 36.3.f


Projected Nitrate Concentrations in Management Zone 6 (Saugus Formation)
All Projects Conditions
2012-2035
Water Quality Objective = 45 mg/L
The projected nitrate concentration shows a decrease in assimilative capacity from 31 mg/L to 26 mg/L.
Projected Assimilative Capacity = 26 mg/L
Current Assimilative Capacity = 31 mg/L
Avg. Projected Nitrate (No Project) = 19 mg/L
Average Projected Nitrate = 19 mg/L
90th Percentile*
2011 Ambient Nitrate = 14 mg/L
Projected Nitrate Concentration
Note: The 2011 ambient nitrate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Water Quality Objective adopted from Management Zone 2.
*90th Percentile = 20 mg/L (based on Projected Nitrate Concentration)
Nitrate Concentration, mg/L
Year
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
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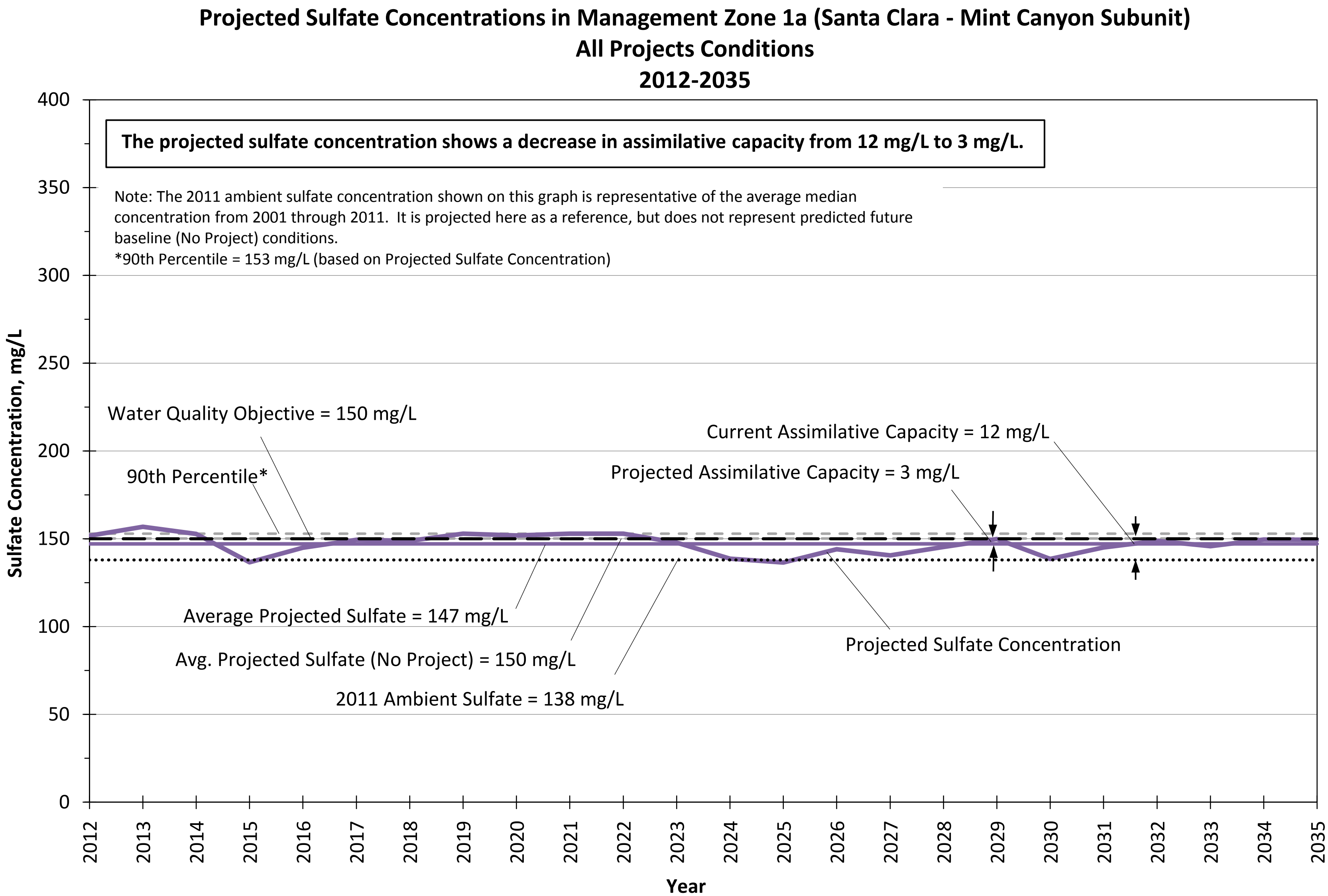
2034
2035

Figure 36.3.g


Projected Sulfate Concentrations in Management Zone 1a (Santa Clara - Mint Canyon Subunit)
All Projects Conditions
2012-2035
The projected sulfate concentration shows a decrease in assimilative capacity from 12 mg/L to 3 mg/L.
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 153 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
Year
Water Quality Objective = 150 mg/L
90th Percentile*
Current Assimilative Capacity = 12 mg/L
Projected Assimilative Capacity = 3 mg/L
Average Projected Sulfate = 147 mg/L
Avg. Projected Sulfate (No Project) = 150 mg/L
2011 Ambient Sulfate = 138 mg/L
Projected Sulfate Concentration
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
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2032
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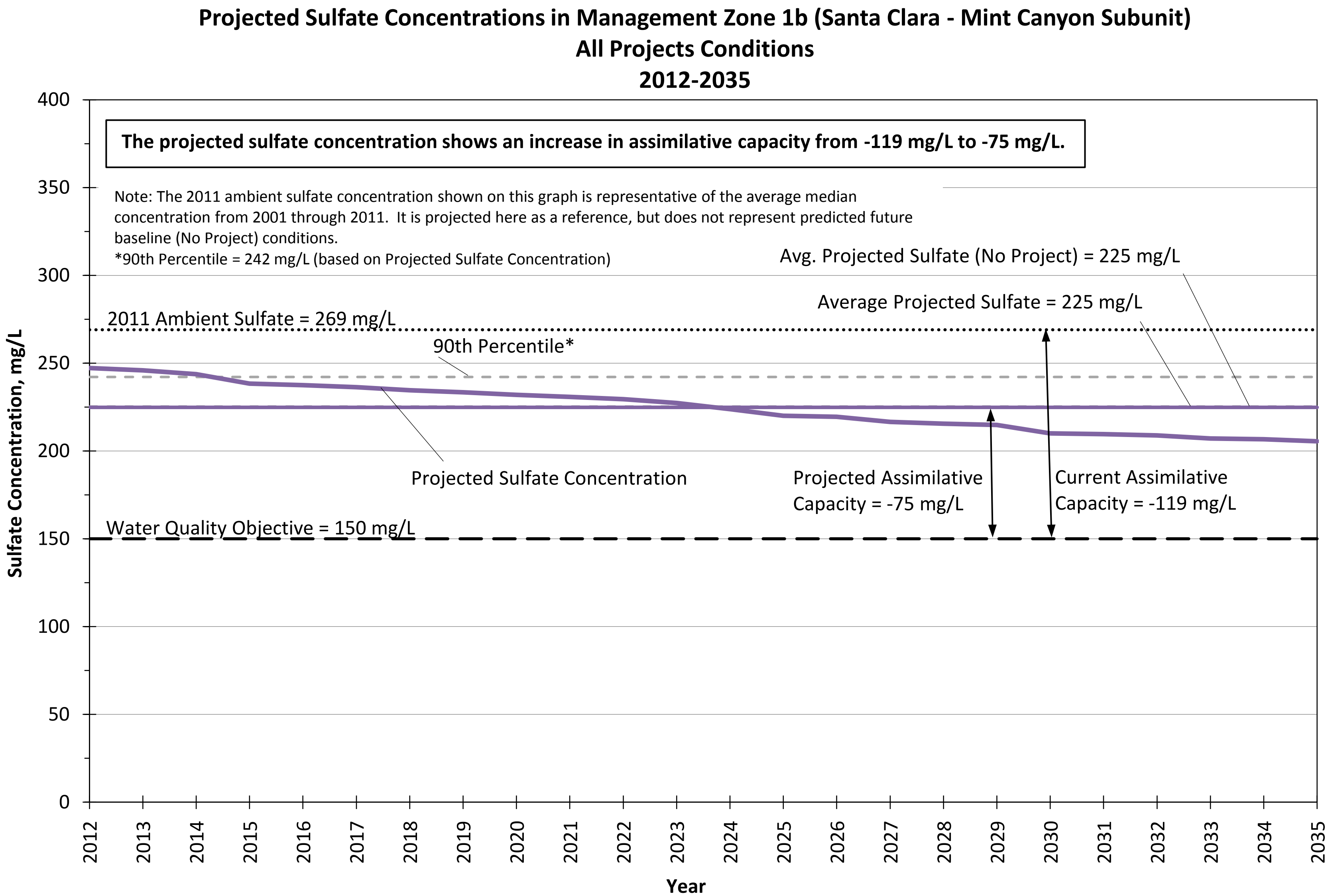
2034
2035

Figure 36.4.a


Projected Sulfate Concentrations in Management Zone 1b (Santa Clara - Mint Canyon Subunit)
All Projects Conditions
2012-2035
The projected sulfate concentration shows an increase in assimilative capacity from -119 mg/L to -75 mg/L.
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 242 mg/L (based on Projected Sulfate Concentration)
Avg. Projected Sulfate (No Project) = 225 mg/L
Average Projected Sulfate = 225 mg/L
2011 Ambient Sulfate = 269 mg/L
90th Percentile*
Projected Sulfate Concentration
Projected Assimilative Capacity = -75 mg/L
Current Assimilative Capacity = -119 mg/L
Water Quality Objective = 150 mg/L
Sulfate Concentration, mg/L
0
50
100
150
200
250
300
350
400
Year
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
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2031
2032
2033
2034
2035

Figure 36.4.b

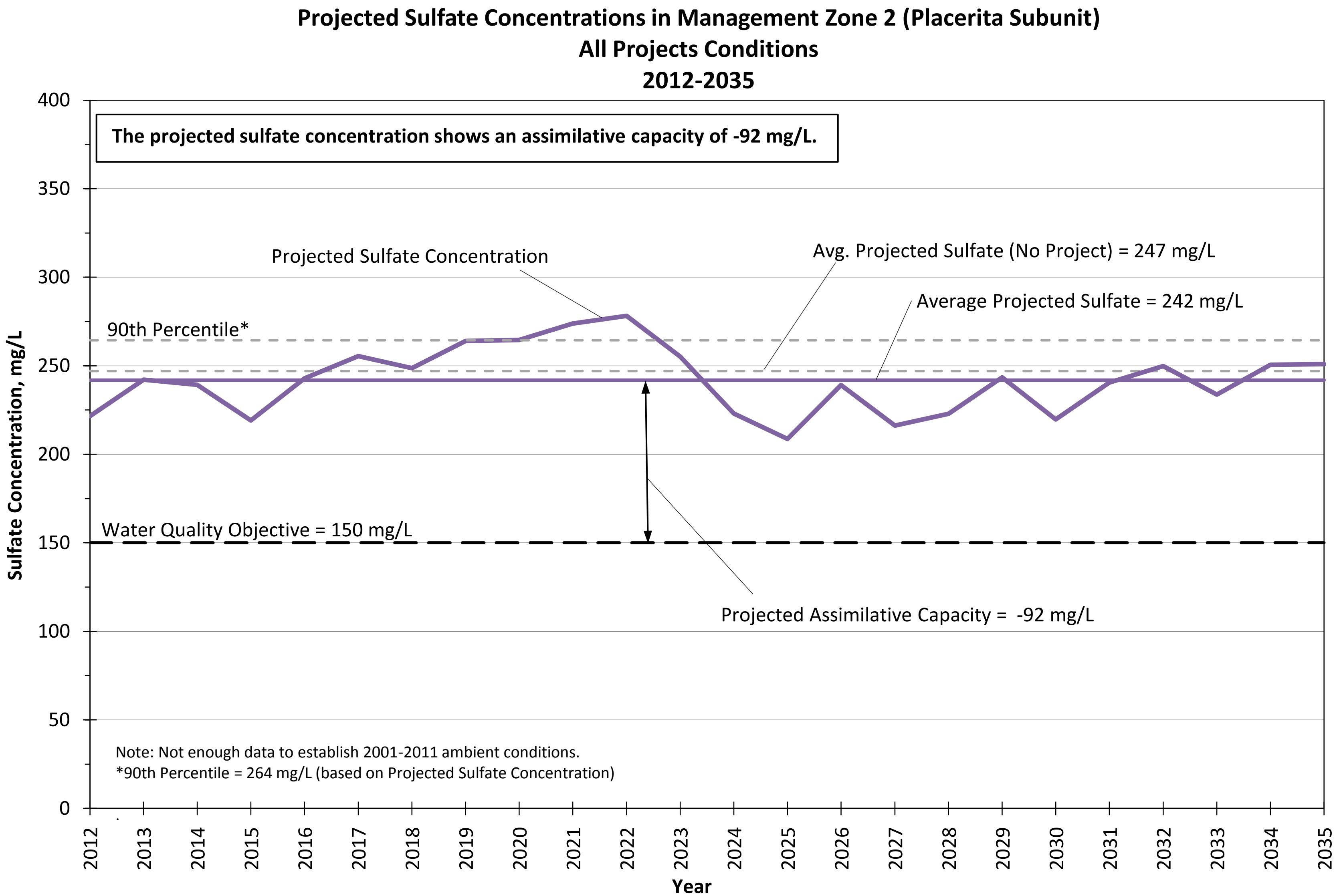

Projected Sulfate Concentrations in Management Zone 2 (Placerita Subunit)
All Projects Conditions
2012-2035
The projected sulfate concentration shows an assimilative capacity of -92 mg/L.
Projected Sulfate Concentration
Avg. Projected Sulfate (No Project) = 247 mg/L
Average Projected Sulfate = 242 mg/L
90th Percentile*
Water Quality Objective = 150 mg/L
Projected Assimilative Capacity = -92 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 264 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 36.4.c

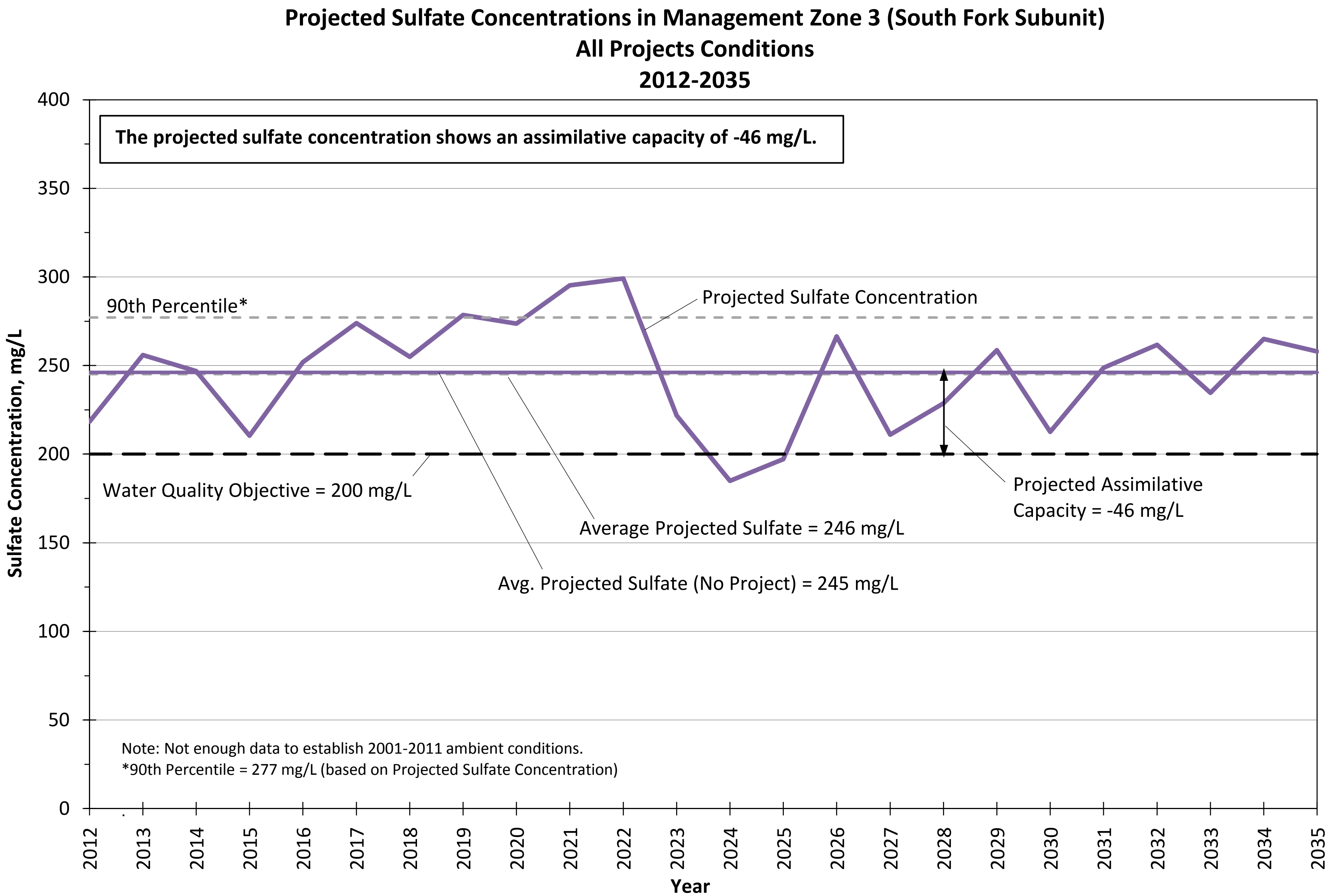
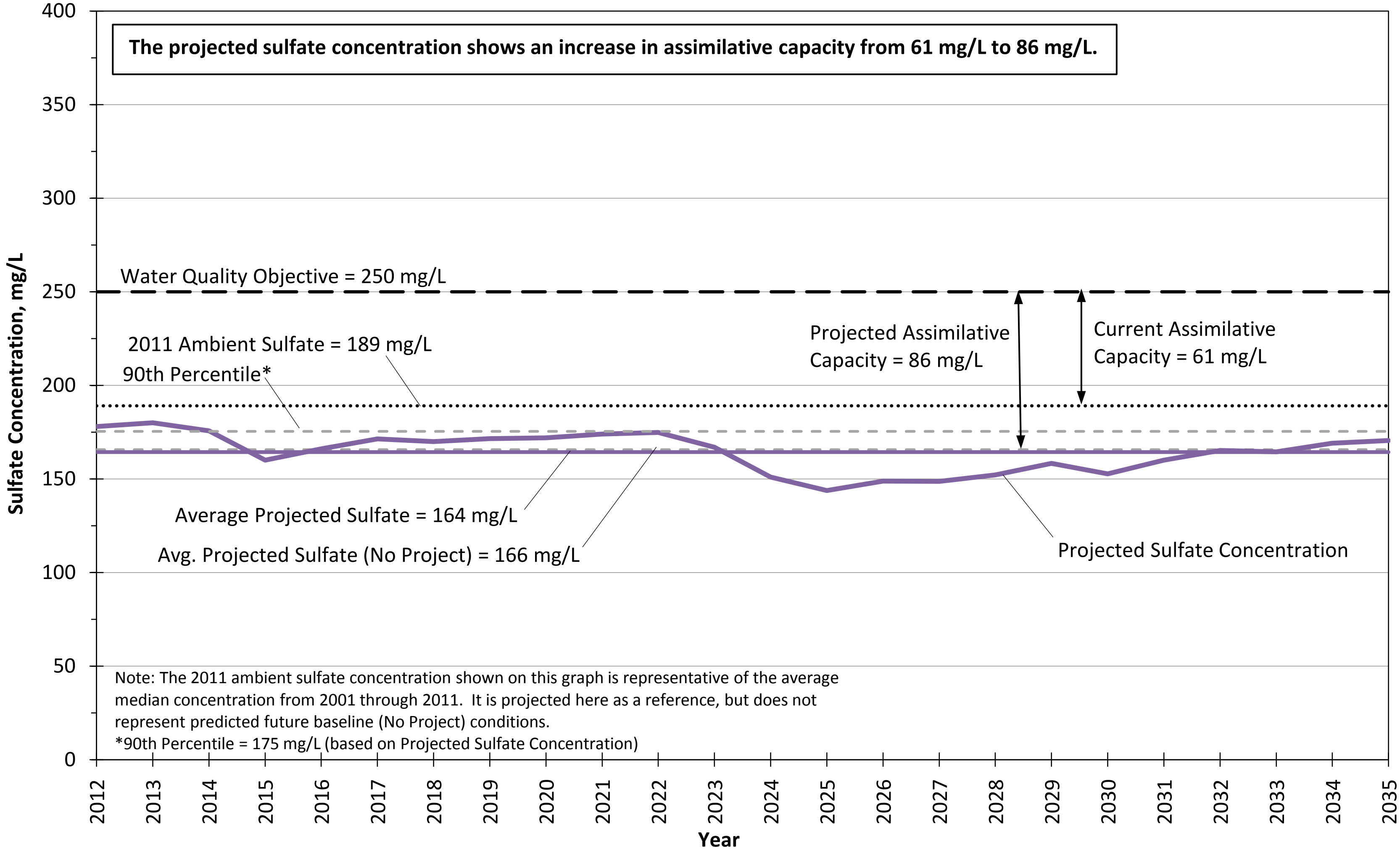

Projected Sulfate Concentrations in Management Zone 3 (South Fork Subunit)
All Projects Conditions
2012-2035
The projected sulfate concentration shows an assimilative capacity of -46 mg/L.
Sulfate Concentration, mg/L
400
350
300
250
200
150
100
50
0
90th Percentile*
Projected Sulfate Concentration
Water Quality Objective = 200 mg/L
Average Projected Sulfate = 246 mg/L
Avg. Projected Sulfate (No Project) = 245 mg/L
Projected Assimilative Capacity = -46 mg/L
Note: Not enough data to establish 2001-2011 ambient conditions.
*90th Percentile = 277 mg/L (based on Projected Sulfate Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 36.4.d

Castaic Lake Water Agency
Salt and Nutrient Management Plan
Santa Clara River Valley East Subbasin

Projected Sulfate Concentrations in Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit) - All Projects Conditions 2012-2035



Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 175 mg/L (based on Projected Sulfate Concentration)

Figure 36.4.e

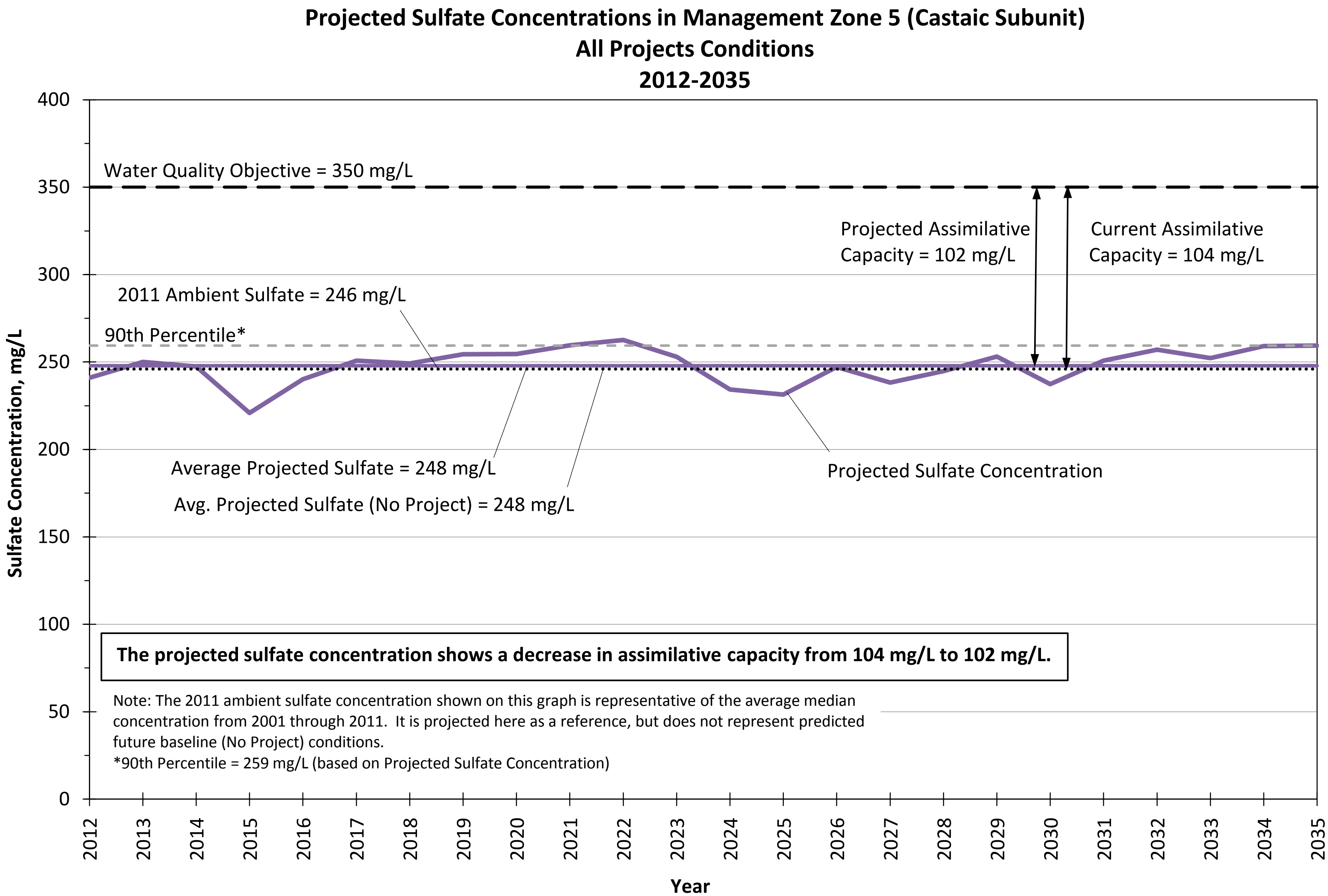

Projected Sulfate Concentrations in Management Zone 5 (Castaic Subunit)
All Projects Conditions
2012-2035
Water Quality Objective = 350 mg/L
Projected Assimilative Capacity = 102 mg/L
Current Assimilative Capacity = 104 mg/L
2011 Ambient Sulfate = 246 mg/L
90th Percentile*
Average Projected Sulfate = 248 mg/L
Avg. Projected Sulfate (No Project) = 248 mg/L
Projected Sulfate Concentration
The projected sulfate concentration shows a decrease in assimilative capacity from 104 mg/L to 102 mg/L.
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
*90th Percentile = 259 mg/L (based on Projected Sulfate Concentration)
Sulfate Concentration, mg/L
Year
0
50
100
150
200
250
300
350
400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Figure 36.4.f

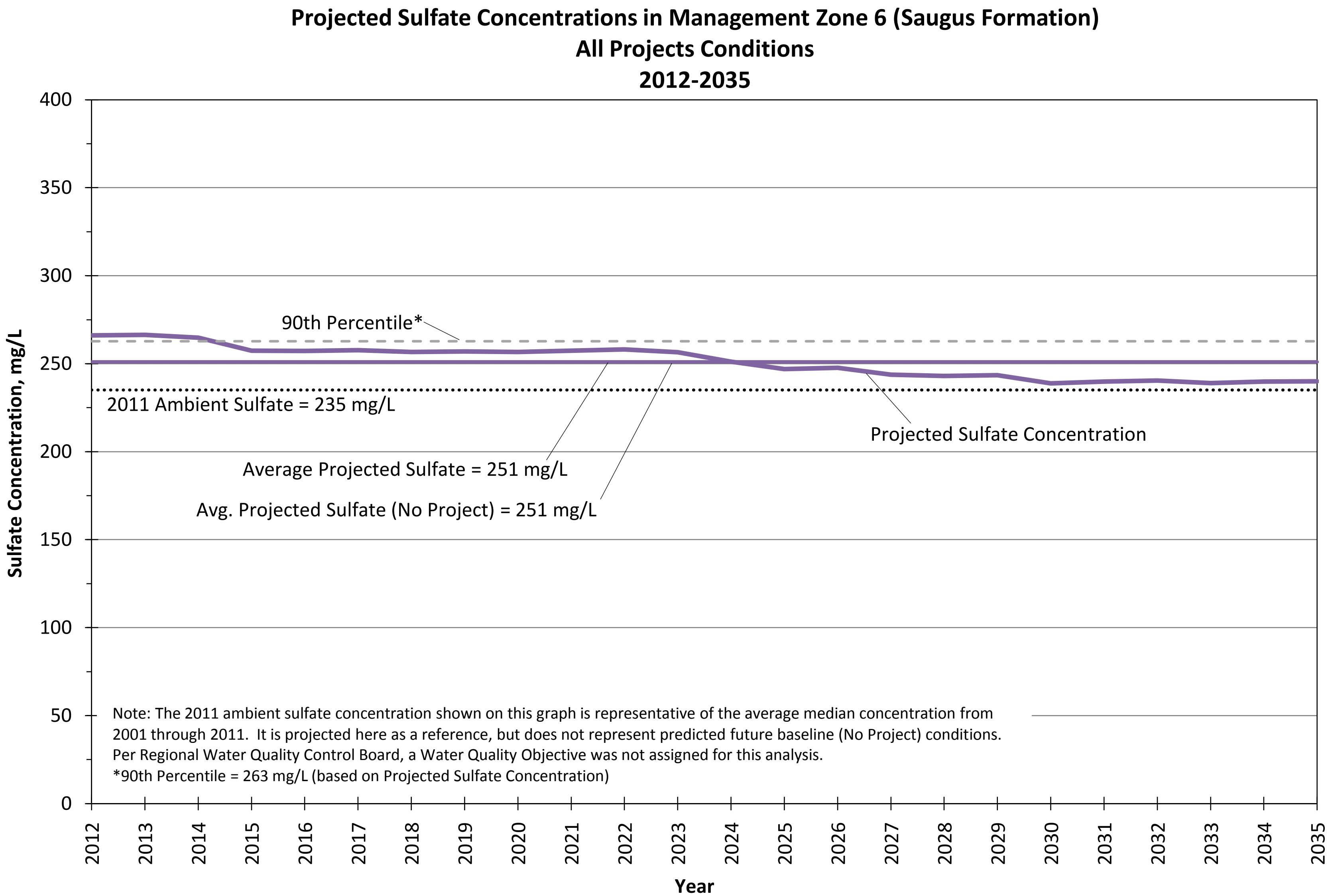
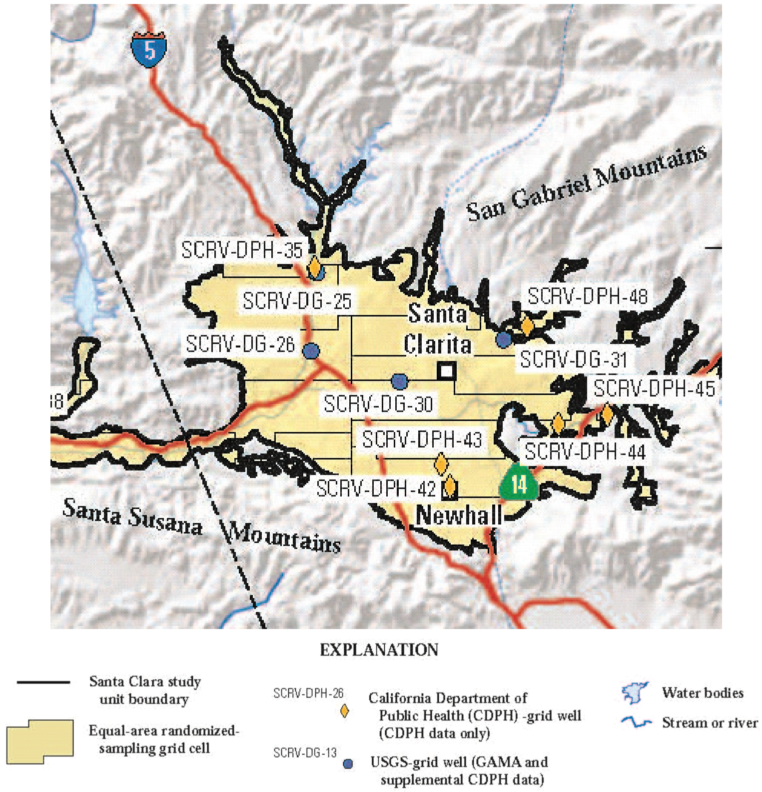
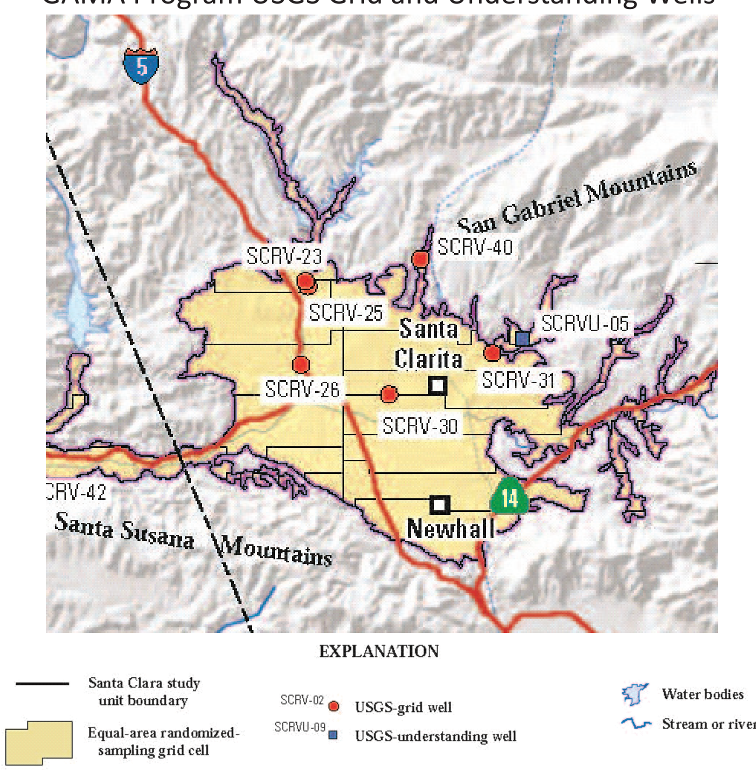

Projected Sulfate Concentrations in Management Zone 6 (Saugus Formation)
All Projects Conditions
2012-2035
Sulfate Concentration, mg/L
0
50
100
150
200
250
300
350
400
90th Percentile*
2011 Ambient Sulfate = 235 mg/L
Projected Sulfate Concentration
Average Projected Sulfate = 251 mg/L
Avg. Projected Sulfate (No Project) = 251 mg/L
Note: The 2011 ambient sulfate concentration shown on this graph is representative of the average median concentration from 2001 through 2011. It is projected here as a reference, but does not represent predicted future baseline (No Project) conditions.
Per Regional Water Quality Control Board, a Water Quality Objective was not assigned for this analysis.
*90th Percentile = 263 mg/L (based on Projected Sulfate Concentration)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Year

Figure 36.4.g

GAMA Program CDPH and USGS Wells



GAMA Program USGS Grid and Understanding Wells



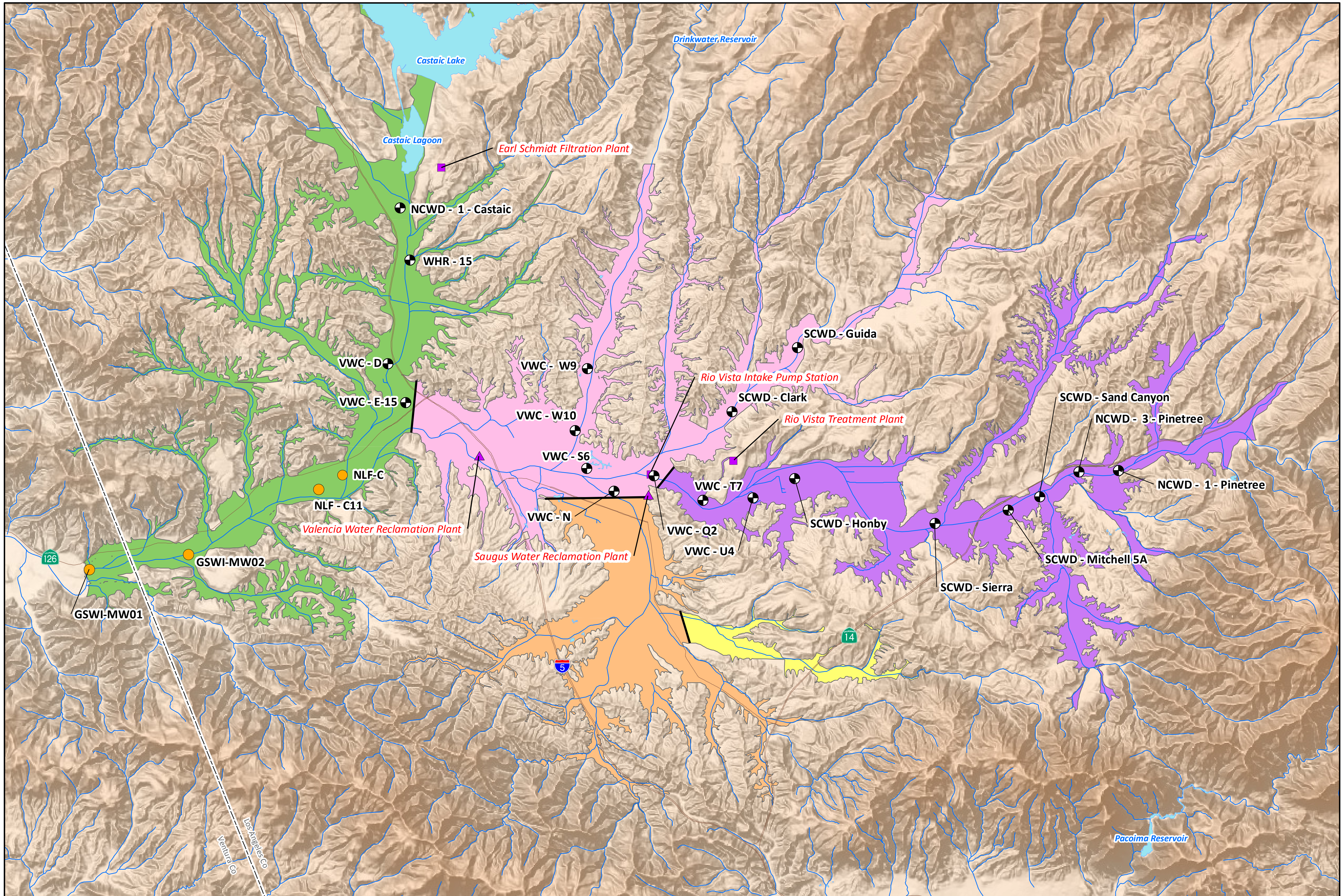
Source: Status and Understanding of Groundwater Quality in the Santa Clara River Valley, 2007: California GAMA Priority Basin Project. USGS Scientific Investigations Report 2011–5052

GEOSCIENCE GEOSCIENCE Support Services, Incorporated P.O. Box 220, Claremont, CA 91711 Tel: (909)451-6650 Fax: (909)451-6638 www.gssiwater.com	Drawn: LB	CASTIC LAKE WATER AGENCY	Figure 37
	Checked: JK	LOCATIONS OF CALIFORNIA GAMA PROGRAM SAMPLING	
	Approved:		
	Date: 8-Dec-16		

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

PROPOSED GROUNDWATER QUALITY MONITORING LOCATIONS ALLUVIAL AQUIFER



EXPLANATION

Alluvial Aquifer Wells by Owner

- Active Municipal Well
- Active Monitoring Well

LACFCD = LA County Flood Control District
NCWD = Newhall County Water District
NLF = Newhall Land and Farming
(GSWI = Groundwater / Surface Water Interaction)
SCWD = Santa Clarita Water Division
VWC = Valencia Water Company
WHR - Wayside Honor Ranch

LARWQCB Groundwater Subunit

- Management Zone 1 (Santa Clara - Mint Canyon)
- Management Zone 2 (Placerita Canyon)
- Management Zone 3 (South Fork)
- Management Zone 4 (Santa Clara-Bouquet and San Francisquito Canyons)
- Management Zone 5 (Castaic Valley)
- Boundary Between Adjacent Management Zones
- Water Treatment Facility
- Water Reclamation Plant

8-Dec-16

Prepared by: DB. Map Projection: State Plane 1983, Zone V.

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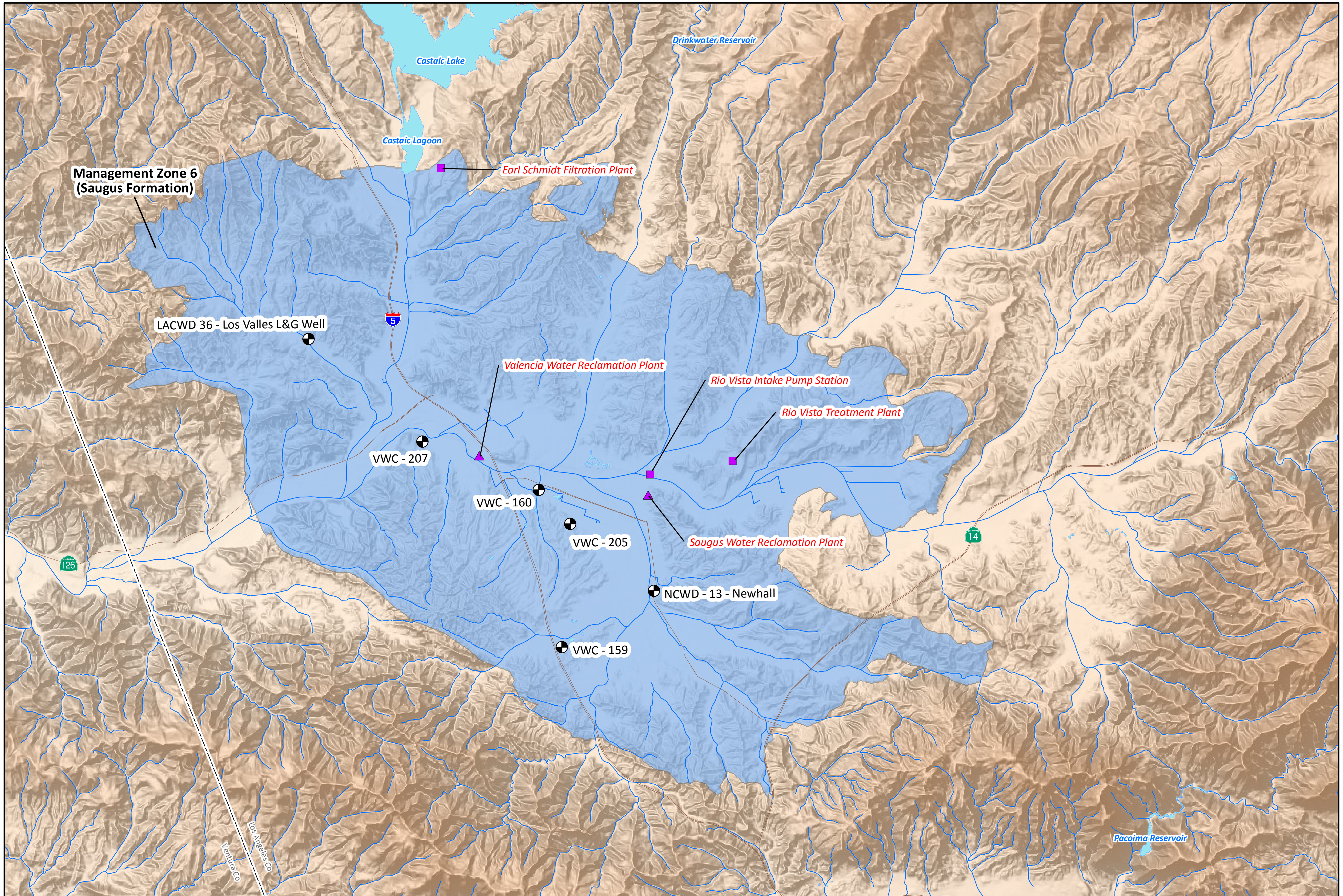
Figure 38

GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_38_prop_alluvial_gw_mon_network_12-16.mxd

PROPOSED GROUNDWATER LEVEL MONITORING LOCATIONS SAUGUS FORMATION



EXPLANATION

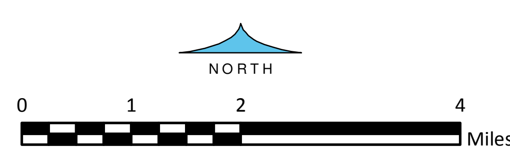
Saugus Formation Wells by Owner

Active

LACWD	LA County Waterworks District No. 36 - Val Verde
NCWD	Newhall County Water District
SCWD	Santa Clarita Water Division
VWC	Valencia Water Company

Water Treatment Facility

Water Reclamation Plant



8-Dec-16

Prepared by: DB. Map Projection: State Plane 1983, Zone V.

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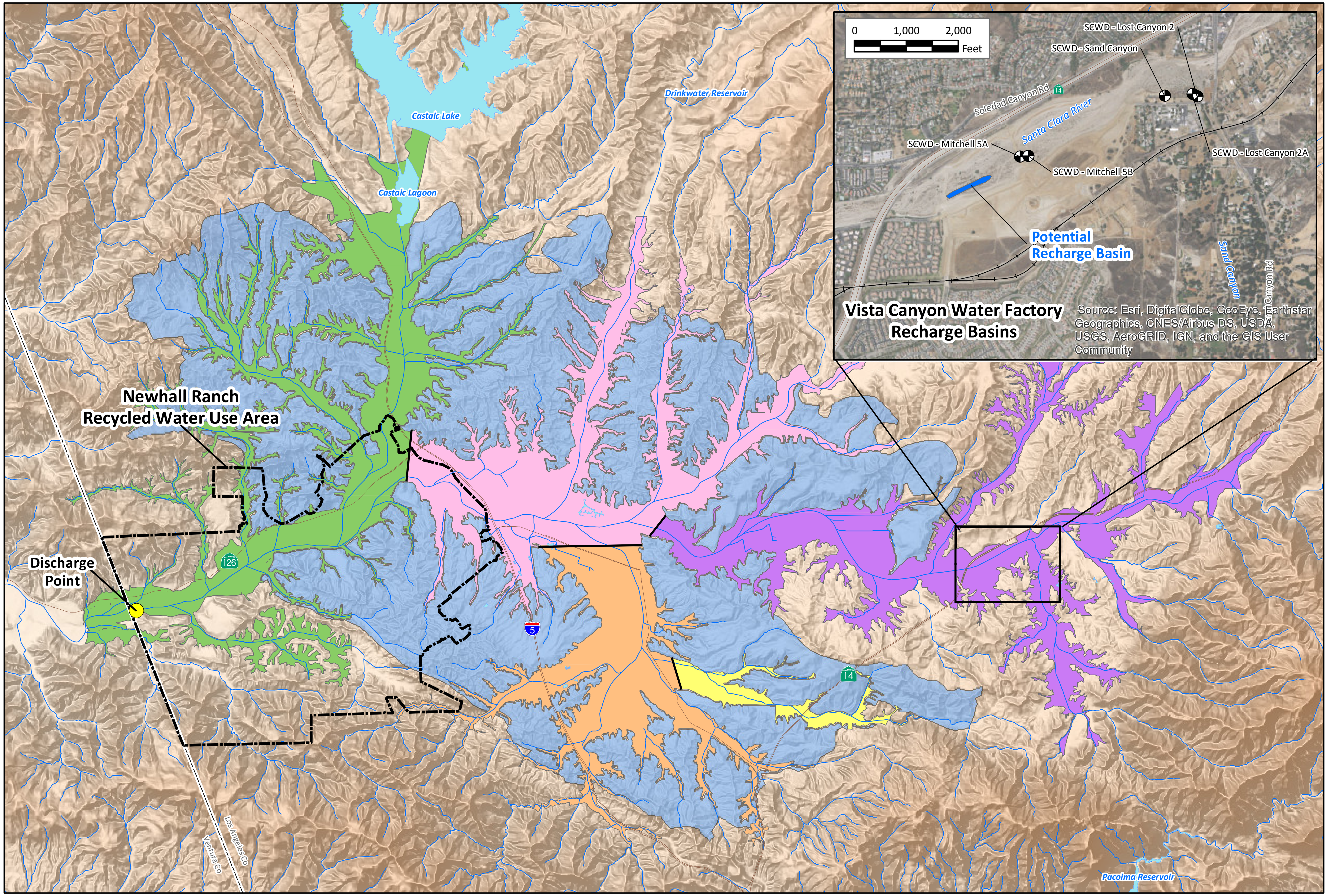
Figure 39

CASTAIC LAKE WATER AGENCY

SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN

FUTURE PROJECTS FOR ANTI-DEGRADATION ANALYSIS



EXPLANATION

LARWQCB Groundwater Subunit

- Management Zone 1 (Santa Clara - Mint Canyon)
- Management Zone 2 (Placerita Canyon)
- Management Zone 3 (South Fork)
- Management Zone 4 (Santa Clara-Bouquet and San Francisquito Canyons)
- Management Zone 5 (Castaic Valley)
- Management Zone 6 (Saugus Formation)
- Boundary Between Adjacent Alluvial Management Zones
- Existing Well Location
- Newhall Specific Plan Areas and NLF Westside Communities
- Dischare Point

8-Dec-16

Prepared by: DB. Map Projection: State Plane 1983, Zone V.

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Figure 40

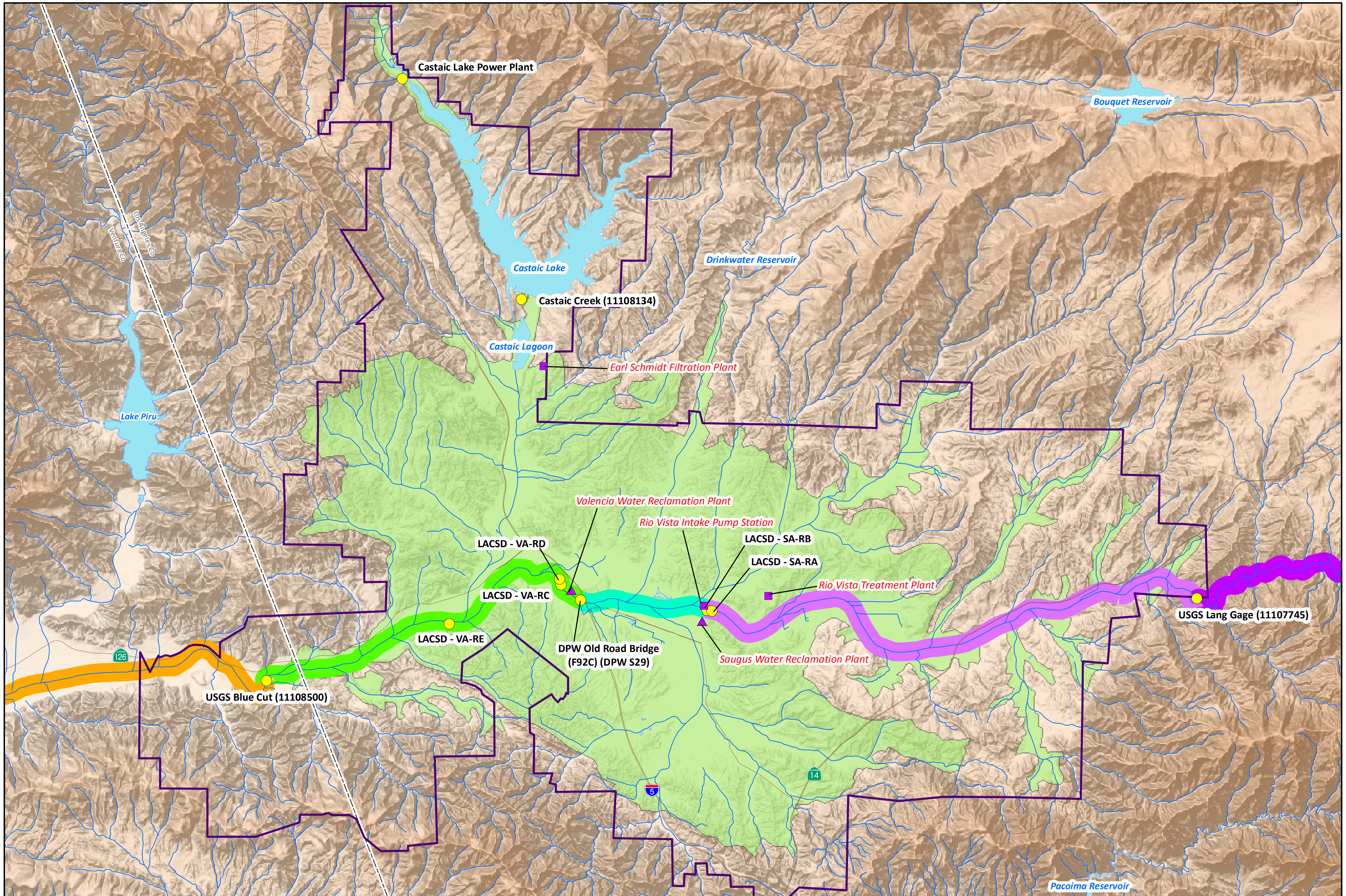
GIS_proj/castaic_lake_SNMP_6-12/21_CastaicSNMP_Fig_40_future_projects_12-16.mxd

Source: AMEC; Comprehensive Water Quality Monitoring Plan for the Santa Clara River Watershed, March 2006. Figure 46

Figure 41	Drawn: LB	CASTAIC LAKE WATER AGENCY	GEOSCIENCE
	Checked: JK	COMPREHENSIVE SURFACE WATER QUALITY MONITORING PLAN - AMEC, 2006	GEOSCIENCE Support Services, Incorporated P.O. Box 220, Claremont, CA 91711 Tel: (909) 451-6650 Fax: (909) 451-6638 www.gssiwater.com
	Approved:		
	Date: 8-Dec-16		

X:\Projects\Castaic Lake Water Agency\15) Draft SNMP_11_14\26) FINAL FINAL\Figures

PROPOSED SURFACE WATER MONITORING NETWORK



EXPLANATION

- Castaic Lake Water Agency Boundary
- Santa Clara River Valley East Ground Water Subbasin
- Proposed Surface Water Monitoring Network

Owner Abbreviation

DPW	LA County Department of Public Works
LACSD	LA County Sanitation District
USGS	United States Geological Survey

- Water Treatment Facility
- Water Reclamation Plant

Santa Clara River Reaches (Number, Name)

- Reach 4b (Between Blue Cut Gaging Station and the Confluence Between Piru Creek)
- Reach 5 (Blue Cut)
- Reach 6 (Highway 99)
- Reach 7 (Bouquet Canyon)
- Reach 8 (Above Lang Gaging Station)

8-Dec-16

Prepared by: DB. Map Projection: State Plane 1983, Zone V.

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Figure 42

TABLES

GEOSCIENCE

Table 1a

Summary of Assimilative Capacity Changes for TDS, No Project, Single Project and All Projects

Agency Proponent	Description		Management Zone 1a	Management Zone 1b	Management Zone 2*	Management Zone 3*	Management Zone 4	Management Zone 5	Management Zone 6
2001-2011 Conditions	Water Quality Objective (mg/L)		800	800	700	700	700	1,000	700
	Average (Ambient) Conc. (mg/L)		728	833	-	-	710	727	636
	Current Assimilative Capacity		72	-33	-	-	-10	273	64
No Project** (2012-2035)	"No-Project" Average Conc. (mg/L)	Average Conc. (mg/L)	739	790	978	790	709	728	636
		Assimilative Capacity	61	10	-278	-90	-9	272	64
		Assimilative Capacity Used (Percentage)	-15%	129%	-	-	12%	0%	-1%
SCVSD Treatment Plant Revision (2012-2035)	Single Project Average Conc. (mg/L)	Average Conc. (mg/L)	739	790	978	790	709	728	636
		Assimilative Capacity	61	10	-278	-90	-9	272	64
		Assimilative Capacity Used (Percentage)	-15%	129%	-	-	12%	0%	-1%
SCWD Water Use Efficiency Programs (2014-2020)	Single Project Average Conc. (mg/L)	Average Conc. (mg/L)	720	787	961	784	694	728	636
		Assimilative Capacity	80	13	-261	-84	6	272	64
		Assimilative Capacity Used (Percentage)	10%	141%	-	-	158%	0%	0%
Vista Canyon Water Reclamation Plant (2014-2019)	Single Project Average Conc. (mg/L)	Average Conc. (mg/L)	741	791	978	790	710	728	636
		Assimilative Capacity	59	9	-278	-90	-10	272	64
		Assimilative Capacity Used (Percentage)	-18%	128%	-	-	2%	0%	-1%
CLWA Recycled Water Master Plan (2014-2035)	Single Project Average Conc. (mg/L)	Average Conc. (mg/L)	739	790	978	810	717	728	636
		Assimilative Capacity	61	10	-278	-110	-17	272	64
		Assimilative Capacity Used (Percentage)	-15%	129%	-	-	-67%	0%	-1%
CLWA SCV WUE SP (2012-2035)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	733	789	965	778	702	717	636
		Assimilative Capacity	67	11	-265	-78	-2	283	64
		Assimilative Capacity Used (Percentage)	-7%	133%	-	-	85%	3%	0%
Newhall Water Reclamation Plant (2023-2033)	Single Project Average Conc. (mg/L)	Average Conc. (mg/L)	739	790	978	791	709	729	637
		Assimilative Capacity	61	10	-278	-91	-9	271	63
		Assimilative Capacity Used (Percentage)	-15%	129%	-	-	12%	-1%	-1%
All Projects (2012-2035)	"All-Projects" Average Conc. (mg/L)	Average Conc. (mg/L)	717	786	948	791	703	719	636
		Assimilative Capacity	83	14	-248	-91	-3	281	64
		Assimilative Capacity Used (Percentage)	14%	143%	-	-	70%	3%	-1%

Note: A positive percentage represents an increase in assimilative capacity while a negative percentage indicates a decrease.
* Due to the limited data available for Management Zones 2 and 3, the values in this table should be considered speculative. The values will be refined in the future when sufficient data is available.
** No Project = Land Use Build-Out Condition Only

Table 1b

Summary of Assimilative Capacity Changes for Chloride, No Project, Single Project and All Projects

Agency Proponent	Description		Management Zone 1a	Management Zone 1b	Management Zone 2*	Management Zone 3*	Management Zone 4	Management Zone 5	Management Zone 6
2001-2011 Conditions	Water Quality Objective (mg/L)		150	150	100	100	100	150	100
	Average (Ambient) Conc. (mg/L)		89	72	-	-	77	77	28
	Current Assimilative Capacity		61	78	-	-	23	73	72
No Project** (2012-2035)	"No-Project" Average Conc. (mg/L)	Average Conc. (mg/L)	89	72	109	79	93	79	46
		Assimilative Capacity	61	78	-9	21	7	71	54
		Assimilative Capacity Used (Percentage)	0%	0%	-	-	-71%	-3%	-24%
SCVSD Treatment Plant Revision (2012-2035)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	89	72	109	79	90	79	46
		Assimilative Capacity	61	78	-9	21	10	71	54
		Assimilative Capacity Used (Percentage)	0%	0%	-	-	-56%	-3%	-24%
SCWD Water Use Efficiency Programs (2014-2020)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	86	71	107	78	91	79	46
		Assimilative Capacity	64	79	-7	22	9	71	54
		Assimilative Capacity Used (Percentage)	5%	1%	-	-	-61%	-3%	-24%
Vista Canyon Water Reclamation Plant (2014-2019)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	89	72	109	79	93	79	46
		Assimilative Capacity	61	78	-9	21	7	71	54
		Assimilative Capacity Used (Percentage)	0%	0%	-	-	-71%	-3%	-24%
CLWA Recycled Water Master Plan (2014-2035)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	89	72	109	83	95	79	46
		Assimilative Capacity	61	78	-9	17	5	71	54
		Assimilative Capacity Used (Percentage)	0%	0%	-	-	-77%	-3%	-24%
CLWA Recycled Water Master Plan Chloride Sensitivity Analysis (2014-2035)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	89	72	109	84	95	79	46
		Assimilative Capacity	61	78	-9	16	5	71	54
		Assimilative Capacity Used (Percentage)	0%	0%	-	-	-80%	-3%	-24%
CLWA SCV WUE SP (2012-2035)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	88	72	107	77	92	78	46
		Assimilative Capacity	62	78	-7	23	8	72	54
		Assimilative Capacity Used (Percentage)	2%	1%	-	-	-66%	0%	-24%
Newhall Water Reclamation Plant (2023-2033)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	89	72	109	79	93	80	46
		Assimilative Capacity	61	78	-9	21	7	70	54
		Assimilative Capacity Used (Percentage)	0%	0%	-	-	-71%	-4%	-25%
All Projects (2012-2035)	"All-Projects" Average Conc. (mg/L)	Average Conc. (mg/L)	85	71	106	81	88	75	46
		Assimilative Capacity	65	79	-6	19	12	75	54
		Assimilative Capacity Used (Percentage)	6%	1%	-	-	-49%	3%	-25%
All Projects Chloride Sensitivity Analysis (2012-2035)	"All-Projects" Average Conc. (mg/L)	Average Conc. (mg/L)	85	71	106	82	89	75	46
		Assimilative Capacity	65	79	-6	18	11	75	54
		Assimilative Capacity Used (Percentage)	6%	1%	-	-	-52%	3%	-25%

Note: A positive percentage represents an increase in assimilative capacity while a negative percentage indicates a decrease.
* Due to the limited data available for Management Zones 2 and 3, the values in this table should be considered speculative. The values will be refined in the future when sufficient data is available.
** No Project = Land Use Build-Out Condition Only

Table 1c

Summary of Assimilative Capacity Changes for Nitrate, No Project, Single Project and All Projects

Agency Proponent	Description		Management Zone 1a	Management Zone 1b	Management Zone 2*	Management Zone 3*	Management Zone 4	Management Zone 5	Management Zone 6
2001-2011 Conditions	Water Quality Objective (mg/L)		45	45	45	45	45	45	45
	Average (Ambient) Conc. (mg/L)		20	21	-	-	16	8	14
	Current Assimilative Capacity		25	24	-	-	29	37	31
No Project** (2012-2035)	"No-Project" Average Conc. (mg/L)	Average Conc. (mg/L)	19	23	28	19	19	11	19
		Assimilative Capacity	26	22	17	26	26	34	26
		Assimilative Capacity Used (Percentage)	3%	-9%	-	-	-10%	-8%	-17%
SCVSD Treatment Plant Revision (2012-2035)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	19	23	28	19	19	11	19
		Assimilative Capacity	26	22	17	26	26	34	26
		Assimilative Capacity Used (Percentage)	3%	-9%	-	-	-10%	-8%	-17%
SCWD Water Use Efficiency Programs (2014-2020)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	19	23	28	19	19	11	19
		Assimilative Capacity	26	22	17	26	26	34	26
		Assimilative Capacity Used (Percentage)	3%	-9%	-	-	-10%	-8%	-17%
Vista Canyon Water Reclamation Plant (2014-2019)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	19	23	28	19	19	11	19
		Assimilative Capacity	26	22	17	26	26	34	26
		Assimilative Capacity Used (Percentage)	2%	-9%	-	-	-10%	-8%	-17%
CLWA Recycled Water Master Plan (2014-2035)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	19	23	28	20	19	11	19
		Assimilative Capacity	26	22	17	25	26	34	26
		Assimilative Capacity Used (Percentage)	3%	-9%	-	-	-10%	-8%	-17%
CLWA SCV WUE SP (2012-2035)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	19	23	28	19	19	11	19
		Assimilative Capacity	26	22	17	26	26	34	26
		Assimilative Capacity Used (Percentage)	3%	-9%	-	-	-10%	-8%	-17%
Newhall Water Reclamation Plant (2023-2033)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	19	23	28	19	19	11	19
		Assimilative Capacity	26	22	17	26	26	34	26
		Assimilative Capacity Used (Percentage)	3%	-9%	-	-	-10%	-8%	-17%
All Projects (2012-2035)	"All-Projects" Average Conc. (mg/L)	Average Conc. (mg/L)	19	23	28	20	19	11	19
		Assimilative Capacity	26	22	17	25	26	34	26
		Assimilative Capacity Used (Percentage)	2%	-9%	-	-	-11%	-8%	-17%

Note: A positive percentage represents an increase in assimilative capacity while a negative percentage indicates a decrease.
* Due to the limited data available for Management Zones 2 and 3, the values in this table should be considered speculative. The values will be refined in the future when sufficient data is available.
** No Project = Land Use Build-Out Condition Only

Table 1d

Summary of Assimilative Capacity Changes for Sulfate, No Project, Single Project and All Projects

Agency Proponent	Description		Management Zone 1a	Management Zone 1b	Management Zone 2*	Management Zone 3*	Management Zone 4	Management Zone 5	Management Zone 6
2001-2011 Conditions	Water Quality Objective (mg/L)		150	150	150	200	250	350	-
	Average (Ambient) Conc. (mg/L)		138	269	-	-	189	246	235
	Current Assimilative Capacity		12	-119	-	-	61	104	-
No Project** (2012-2035)	"No-Project" Average Conc. (mg/L)	Average Conc. (mg/L)	150	225	247	245	166	248	251
		Assimilative Capacity	0	-75	-97	-45	84	102	-
		Assimilative Capacity Used (Percentage)	-102%	37%	-	-	39%	-2%	-
SCVSD Treatment Plant Revision (2012-2035)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	150	225	247	245	166	248	251
		Assimilative Capacity	0	-75	-97	-45	84	102	-
		Assimilative Capacity Used (Percentage)	-102%	37%	-	-	39%	-2%	-
SCWD Water Use Efficiency Programs (2014-2020)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	148	225	244	244	163	248	251
		Assimilative Capacity	2	-75	-94	-44	87	102	-
		Assimilative Capacity Used (Percentage)	-80%	37%	-	-	43%	-2%	-
Vista Canyon Water Reclamation Plant (2014-2019)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	150	225	247	245	166	248	251
		Assimilative Capacity	0	-75	-97	-45	84	102	-
		Assimilative Capacity Used (Percentage)	-104%	37%	-	-	39%	-2%	-
CLWA Recycled Water Master Plan (2014-2035)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	150	225	247	249	168	248	251
		Assimilative Capacity	0	-75	-97	-49	82	102	-
		Assimilative Capacity Used (Percentage)	-102%	37%	-	-	36%	-2%	-
CLWA SCV WUE SP (2012-2035)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	149	225	245	243	164	247	251
		Assimilative Capacity	1	-75	-95	-43	86	103	-
		Assimilative Capacity Used (Percentage)	-95%	37%	-	-	41%	-1%	-
Newhall Water Reclamation Plant (2023-2033)	Single Project Average Conc.(mg/L)	Average Conc. (mg/L)	150	225	247	245	166	249	251
		Assimilative Capacity	0	-75	-97	-45	84	101	-
		Assimilative Capacity Used (Percentage)	-102%	37%	-	-	39%	-3%	-
All Projects (2012-2035)	"All-Projects" Average Conc. (mg/L)	Average Conc. (mg/L)	147	225	242	246	164	248	251
		Assimilative Capacity	3	-75	-92	-46	86	102	-
		Assimilative Capacity Used (Percentage)	-76%	37%	-	-	41%	-2%	-

Note: A positive percentage represents an increase in assimilative capacity while a negative percentage indicates a decrease.
* Due to the limited data available for Management Zones 2 and 3, the values in this table should be considered speculative. The values will be refined in the future when sufficient data is available.
** No Project = Land Use Build-Out Condition Only

Table 2a

Comparison of TDS Changes from LUB and Single Projects, and All Projects

Agency Proponent	Description	Management Zone 1a	Management Zone 1b	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5	Management Zone 6
2001-2011 Conditions	Water Quality Objective (mg/L)	800	800	700	700	700	1,000	700
	Average (Ambient) Conc. (mg/L)	728	833	-	-	710	727	636
	Current Assimilative Capacity	72	-33	-	-	-10	273	64
No Project[1] (2012-2035)	Assimilative Capacity (mg/L)	61	10	-	-	-9	272	64
SCVSD Treatment Plant Revision (2012-2035)	Assimilative Capacity (mg/L)	61	10	-	-	-9	272	64
	Single Project AC[2] - LUB[3] AC	0.0	0.0	-	-	0.0	0.0	0.0
SCWD Water Use Efficiency Programs (2014-2020)	Assimilative Capacity (mg/L)	80	13	-	-	6	272	64
	Single Project AC - LUB AC	18.3	3.9	-	-	15.2	0.0	0.1
Vista Canyon Water Reclamation Plant (2014-2019)	Assimilative Capacity (mg/L)	59	9	-	-	-10	272	64
	Single Project AC - LUB AC	-2.1	-0.5	-	-	-1.1	0.0	0.0
CLWA Recycled Water Master Plan (2014-2035)	Assimilative Capacity (mg/L)	61	10	-	-	-17	272	64
	Single Project AC - LUB AC	0.0	0.0	-	-	-8.2	0.0	-0.1
CLWA SCV WUE SP (2012-2035)	Assimilative Capacity (mg/L)	67	11	-	-	-2	283	64
	Single Project AC - LUB AC	5.9	1.3	-	-	7.6	10.7	0.1
Newhall Water Reclamation Plant (2023-2033)	Assimilative Capacity (mg/L)	61	10	-	-	-9	271	63
	Single Project AC - LUB AC	0.0	0.0	-	-	-0.1	-1.4	-0.5
All Projects (2012-2035)	Assimilative Capacity (mg/L)	83	14	-	-	-3	281	64
	Single Project AC - LUB AC	21.3	4.7	-	-	6.0	9.3	-0.4

*Note: A positive value represents an increase in assimilative capacity while a negative value indicates a decrease.
1. No Project = Land Use Build-Out Condition Only
2. AC = Assimilative Capacity
3. LUB = Land Use Build-Out

Table 2b

Comparison of Chloride Changes from LUB and Single Projects, and All Projects

Agency Proponent	Description	Management Zone 1a	Management Zone 1b	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5	Management Zone 6
2001-2011 Conditions	Water Quality Objective (mg/L)	150	150	100	100	100	150	100
	Average (Ambient) Conc. (mg/L)	89	72	-	-	77	77	28
	Current Assimilative Capacity	61	78	-	-	23	73	72
No Project[1] (2012-2035)	Assimilative Capacity (mg/L)	61	78	-	-	7	71	54
SCVSD Treatment Plant Revision (2012-2035)	Assimilative Capacity (mg/L)	61	78	-	-	10	71	54
	Single Project AC[2] - LUB[3] AC	0.0	0.0	-	-	3.3	0.0	0.0
SCWD Water Use Efficiency Programs (2014-2020)	Assimilative Capacity (mg/L)	64	79	-	-	9	71	54
	Single Project AC - LUB AC	2.9	0.7	-	-	2.3	0.0	0.0
Vista Canyon Water Reclamation Plant (2014-2019)	Assimilative Capacity (mg/L)	61	78	-	-	7	71	54
	Single Project AC - LUB AC	-0.3	-0.1	-	-	-0.1	0.0	0.0
CLWA Recycled Water Master Plan (2014-2035)	Assimilative Capacity (mg/L)	61	78	-	-	5	71	54
	Single Project AC - LUB AC	0.0	0.0	-	-	-1.5	0.0	0.0
CLWA SCV WUE SP (2012-2035)	Assimilative Capacity (mg/L)	62	78	-	-	8	72	54
	Single Project AC - LUB AC	0.9	0.3	-	-	1.1	1.8	0.0
Newhall Water Reclamation Plant (2023-2033)	Assimilative Capacity (mg/L)	61	78	-	-	7	70	54
	Single Project AC - LUB AC	0.0	0.0	-	-	0.0	-0.7	-0.3
All Projects (2012-2035)	Assimilative Capacity (mg/L)	65	79	-	-	12	75	54
	Single Project AC - LUB AC	3.4	0.8	-	-	5.0	4.0	-0.2

***Note: A positive value represents an increase in assimilative capacity while a negative value indicates a decrease.**
1. No Project = Land Use Build-Out Condition Only
2. AC = Assimilative Capacity
3. LUB = Land Use Build-Out

Table 2c

Comparison of Nitrate Changes from LUB and Single Projects, and All Projects

Agency Proponent	Description	Management Zone 1a	Management Zone 1b	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5	Management Zone 6
2001-2011 Conditions	Water Quality Objective (mg/L)	45	45	45	45	45	45	45
	Average (Ambient) Conc. (mg/L)	20	21	-	-	16	8	14
	Current Assimilative Capacity	25	24	-	-	29	37	31
No Project[1] (2012-2035)	Assimilative Capacity (mg/L)	26	22	-	-	26	34	26
SCVSD Treatment Plant Revision (2012-2035)	Assimilative Capacity (mg/L)	26	22	-	-	26	34	26
	Single Project AC[2] - LUB[3] AC	0.0	0.0	-	-	0.0	0.0	0.0
SCWD Water Use Efficiency Programs (2014-2020)	Assimilative Capacity (mg/L)	26	22	-	-	26	34	26
	Single Project AC - LUB AC	0.0	0.0	-	-	0.0	0.0	0.0
Vista Canyon Water Reclamation Plant (2014-2019)	Assimilative Capacity (mg/L)	26	22	-	-	26	34	26
	Single Project AC - LUB AC	-0.1	0.0	-	-	0.0	0.0	0.0
CLWA Recycled Water Master Plan (2014-2035)	Assimilative Capacity (mg/L)	26	22	-	-	26	34	26
	Single Project AC - LUB AC	0.0	0.0	-	-	-0.2	0.0	0.0
CLWA SCV WUE SP (2012-2035)	Assimilative Capacity (mg/L)	26	22	-	-	26	34	26
	Single Project AC - LUB AC	0.0	0.0	-	-	0.0	0.0	0.0
Newhall Water Reclamation Plant (2023-2033)	Assimilative Capacity (mg/L)	26	22	-	-	26	34	26
	Single Project AC - LUB AC	0.0	0.0	-	-	0.0	0.1	0.0
All Projects (2012-2035)	Assimilative Capacity (mg/L)	26	22	-	-	26	34	26
	Single Project AC - LUB AC	-0.1	0.0	-	-	-0.2	0.1	0.0

*Note: A positive value represents an increase in assimilative capacity while a negative value indicates a decrease.
1. No Project = Land Use Build-Out Condition Only
2. AC = Assimilative Capacity
3. LUB = Land Use Build-Out

Table 2d

Comparison of Sulfate Changes from LUB and Single Projects, and All Projects

Agency Proponent	Description	Management Zone 1a	Management Zone 1b	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5	Management Zone 6
2001-2011 Conditions	Water Quality Objective (mg/L)	150	150	150	200	250	350	-
	Average (Ambient) Conc. (mg/L)	138	269	-	-	189	246	235
	Current Assimilative Capacity	12	-119	-	-	61	104	-
No Project[1] (2012-2035)	Assimilative Capacity (mg/L)	0	-75	-	-	84	102	-
SCVSD Treatment Plant Revision (2012-2035)	Assimilative Capacity (mg/L)	0	-75	-	-	84	102	-
	Single Project AC[2] - LUB[3] AC	0.0	0.0	-	-	0.0	0.0	-
SCWD Water Use Efficiency Programs (2014-2020)	Assimilative Capacity (mg/L)	2	-75	-	-	87	102	-
	Single Project AC - LUB AC	2.6	0.3	-	-	2.4	0.0	-
Vista Canyon Water Reclamation Plant (2014-2019)	Assimilative Capacity (mg/L)	0	-75	-	-	84	102	-
	Single Project AC - LUB AC	-0.2	0.2	-	-	-0.1	0.0	-
CLWA Recycled Water Master Plan (2014-2035)	Assimilative Capacity (mg/L)	0	-75	-	-	82	102	-
	Single Project AC - LUB AC	0.0	0.0	-	-	-2.0	0.0	-
CLWA SCV WUE SP (2012-2035)	Assimilative Capacity (mg/L)	1	-75	-	-	86	103	-
	Single Project AC - LUB AC	0.8	0.0	-	-	1.1	1.4	-
Newhall Water Reclamation Plant (2023-2033)	Assimilative Capacity (mg/L)	0	-75	-	-	84	101	-
	Single Project AC - LUB AC	0.0	0.0	-	-	-0.1	-1.1	-
All Projects (2012-2035)	Assimilative Capacity (mg/L)	3	-75	-	-	86	102	-
	Single Project AC - LUB AC	3.0	0.5	-	-	1.3	0.3	-

*Note: A positive value represents an increase in assimilative capacity while a negative value indicates a decrease.
1. No Project = Land Use Build-Out Condition Only
2. AC = Assimilative Capacity
3. LUB = Land Use Build-Out

Table 3a

Summary of Net Increase/Decrease in Assimilative Capacity Use for TDS, Single Project and All Projects

Agency Proponent	Description		Management Zone 1a	Management Zone 1b	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5	Management Zone 6
2001-2011 Conditions	Water Quality Objective (mg/L)		800	800	700	700	700	1,000	700
	Average (Ambient) Conc. (mg/L)		728	833	-	-	710	727	636
	Current Assimilative Capacity		72	-33	-	-	-10	273	64
No Project* (2012-2035)	"No-Project" Average Conc. (mg/L)	Assimilative Capacity Used (Percentage)	-15.3% **	129.0%	-	-	12.3%	-0.5%	-0.6%
SCVSD Treatment Plant Revision (2012-2035)	Single Project Average Conc. (mg/L)	Assimilative Capacity Used (Percentage)	-15.3%	129.0%	-	-	12.3%	-0.5%	-0.6%
		Net Increase/Decrease From LUB	0.0%	0.0%	-	-	0.0%	0.0%	0.0%
SCWD Water Use Efficiency Programs (2014-2020)	Single Project Average Conc. (mg/L)	Assimilative Capacity Used (Percentage)	10.0%	140.9%	-	-	158.3%	-0.5%	-0.4%
		Net Increase/Decrease From LUB	25.4%	11.8%	-	-	146.0%	0.0%	0.2%
Vista Canyon Water Reclamation Plant (2014-2019)	Single Project Average Conc. (mg/L)	Assimilative Capacity Used (Percentage)	-18.3%	127.6%	-	-	1.6%	-0.5%	-0.6%
		Net Increase/Decrease From LUB	-3.0%***	-1.4%	-	-	-10.7%	0.0%	0.0%
CLWA Recycled Water Master Plan (2014-2035)	Single Project Average Conc. (mg/L)	Assimilative Capacity Used (Percentage)	-15.3%	129.0%	-	-	-66.8%	-0.5%	-0.7%
		Net Increase/Decrease From LUB	0.0%	0.0%	-	-	-79.1%	0.0%	-0.1%
CLWA SCV WUE SP (2012-2035)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	-7.2%	133.1%	-	-	85.1%	3.5%	-0.5%
		Net Increase/Decrease From LUB	8.2%	4.0%	-	-	72.8%	3.9%	0.1%
Newhall Water Reclamation Plant (2023-2033)	Single Project Average Conc. (mg/L)	Assimilative Capacity Used (Percentage)	-15.3%	129.0%	-	-	11.8%	-1.0%	-1.3%
		Net Increase/Decrease From LUB	0.0%	0.0%	-	-	-0.5%	-0.5%	-0.7%
All Projects (2012-2035)	"All-Projects" Average Conc. (mg/L)	Assimilative Capacity Used (Percentage)	14.1%	143.4%	-	-	70.0%	3.0%	-1.2%
		Net Increase/Decrease From LUB	29.4%	14.3%	-	-	57.8%	3.4%	-0.6%

*No Project = Land Use Build-Out Condition Only
**A positive percentage represents an increase in assimilative capacity while a negative percentage indicates a decrease.
***Example: Considering Vista Canyon Water Reclamation Plant. Net decrease of assimilative capacity is calculated as follows:
-18.3% (Assimilative Capacity Used by Project) minus -15.3% (Assimilative Capacity Used by LUB) = -3.0%

Table 3b

Summary of Net Increase/Decrease in Assimilative Capacity Use for Chloride, Single Project and All Projects

Agency Proponent	Description		Management Zone 1a	Management Zone 1b	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5	Management Zone 6
2001-2011 Conditions	Water Quality Objective (mg/L)		150	150	100	100	100	150	100
	Average (Ambient) Conc. (mg/L)		89	72	-	-	77	77	28
	Current Assimilative Capacity		61	78	-	-	23	73	72
No Project* (2012-2035)	"No-Project" Average Conc. (mg/L)	Assimilative Capacity Used (Percentage)	0.1% **	0.3%	-	-	-70.8%	-2.9%	-24.4%
SCVSD Treatment Plant Revision (2012-2035)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	0.1%	0.3%	-	-	-56.4%	-2.9%	-24.3%
		Net Increase/Decrease From LUB	0.0%	0.0%	-	-	14.3%	0.0%	0.0%
SCWD Water Use Efficiency Programs (2014-2020)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	4.8%	1.2%	-	-	-60.9%	-2.9%	-24.3%
		Net Increase/Decrease From LUB	4.7%	0.9%	-	-	9.9%	0.0%	0.0%
Vista Canyon Water Reclamation Plant (2014-2019)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	-0.4%	0.1%	-	-	-71.4%	-2.9%	-24.4%
		Net Increase/Decrease From LUB	-0.5%***	-0.2%	-	-	-0.6%	0.0%	0.0%
CLWA Recycled Water Master Plan (2014-2035)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	0.1%	0.3%	-	-	-77.4%	-2.9%	-24.4%
		Net Increase/Decrease From LUB	0.0%	0.0%	-	-	-6.6%	0.0%	0.0%
CLWA SCV WUE SP (2012-2035)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	1.6%	0.6%	-	-	-66.0%	-0.5%	-24.3%
		Net Increase/Decrease From LUB	1.5%	0.3%	-	-	4.7%	2.4%	0.0%
Newhall Water Reclamation Plant (2023-2033)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	0.1%	0.3%	-	-	-71.0%	-3.9%	-24.7%
		Net Increase/Decrease From LUB	0.0%	0.0%	-	-	-0.2%	-1.0%	-0.4%
All Projects (2012-2035)	"All-Projects" Average Conc. (mg/L)	Assimilative Capacity Used (Percentage)	5.6%	1.3%	-	-	-49.3%	2.5%	-24.7%
		Net Increase/Decrease From LUB	5.5%	1.1%	-	-	21.4%	5.5%	-0.3%

***No Project = Land Use Build-Out Condition Only**
****A positive percentage represents an increase in assimilative capacity while a negative percentage indicates a decrease.**
*****Example: Considering Vista Canyon Water Reclamation Plant. Net decrease of assimilative capacity is calculated as follows:**
-0.4% (Assimilative Capacity Used by Project) minus 0.1% (Assimilative Capacity Used by LUB) = -0.5%

Table 3c

Summary of Net Increase/Decrease in Assimilative Capacity Use for Nitrate, Single Project and All Projects

Agency Proponent	Description		Management Zone 1a	Management Zone 1b	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5	Management Zone 6
2001-2011 Conditions	Water Quality Objective (mg/L)		45	45	45	45	45	45	45
	Average (Ambient) Conc. (mg/L)		20	21	-	-	16	8	14
	Current Assimilative Capacity		25	24	-	-	29	37	31
No Project* (2012-2035)	"No-Project" Average Conc. (mg/L)	Assimilative Capacity Used (Percentage)	2.7% **	-9.1%	-	-	-9.8%	-8.5%	-17.1%
SCVSD Treatment Plant Revision (2012-2035)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	2.7%	-9.1%	-	-	-9.8%	-8.5%	-17.1%
		Net Increase/Decrease From LUB	0.0%	0.0%	-	-	0.0%	0.0%	0.0%
SCWD Water Use Efficiency Programs (2014-2020)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	2.6%	-9.2%	-	-	-9.9%	-8.5%	-17.1%
		Net Increase/Decrease From LUB	-0.1%	-0.1%	-	-	-0.1%	0.0%	0.0%
Vista Canyon Water Reclamation Plant (2014-2019)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	2.4%	-9.1%	-	-	-9.9%	-8.5%	-17.1%
		Net Increase/Decrease From LUB	-0.3%***	0.0%	-	-	-0.1%	0.0%	0.0%
CLWA Recycled Water Master Plan (2014-2035)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	2.7%	-9.1%	-	-	-10.4%	-8.5%	-17.1%
		Net Increase/Decrease From LUB	0.0%	0.0%	-	-	-0.6%	0.0%	0.0%
CLWA SCV WUE SP (2012-2035)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	2.7%	-9.2%	-	-	-9.9%	-8.5%	-17.1%
		Net Increase/Decrease From LUB	0.0%	0.0%	-	-	0.0%	0.0%	0.0%
Newhall Water Reclamation Plant (2023-2033)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	2.7%	-9.1%	-	-	-9.8%	-8.3%	-17.0%
		Net Increase/Decrease From LUB	0.0%	0.0%	-	-	0.0%	0.2%	0.1%
All Projects (2012-2035)	"All-Projects" Average Conc. (mg/L)	Assimilative Capacity Used (Percentage)	2.3%	-9.3%	-	-	-10.6%	-8.3%	-17.0%
		Net Increase/Decrease From LUB	-0.4%	-0.1%	-	-	-0.8%	0.2%	0.1%

*No Project = Land Use Build-Out Condition Only
**A positive percentage represents an increase in assimilative capacity while a negative percentage indicates a decrease.
***Example: Considering Vista Canyon Water Reclamation Plant. Net decrease of assimilative capacity is calculated as follows:
2.4% (Assimilative Capacity Used by Project) minus 2.7% (Assimilative Capacity Used by LUB) = -0.3%

Table 3d

Summary of Net Increase/Decrease in Assimilative Capacity Use for Sulfate, Single Project and All Projects

Agency Proponent	Description		Management Zone 1a	Management Zone 1b	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5	Management Zone 6
2001-2011 Conditions	Water Quality Objective (mg/L)		150	150	150	200	250	350	-
	Average (Ambient) Conc. (mg/L)		138	269	-	-	189	246	235
	Current Assimilative Capacity		12	-119	-	-	61	104	-
No Project* (2012-2035)	"No-Project" Average Conc. (mg/L)	Assimilative Capacity Used (Percentage)	-101.9% **	36.7%	-	-	38.8%	-2.2%	-
SCVSD Treatment Plant Revision (2012-2035)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	-101.9%	36.7%	-	-	38.8%	-2.2%	-
		Net Increase/Decrease From LUB	0.0%	0.0%	-	-	0.0%	0.0%	-
SCWD Water Use Efficiency Programs (2014-2020)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	-80.2%	37.0%	-	-	42.7%	-2.2%	-
		Net Increase/Decrease From LUB	21.6%	0.3%	-	-	3.9%	0.0%	-
Vista Canyon Water Reclamation Plant (2014-2019)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	-103.6%	36.9%	-	-	38.6%	-2.2%	-
		Net Increase/Decrease From LUB	-1.8% ***	0.1%	-	-	-0.2%	0.0%	-
CLWA Recycled Water Master Plan (2014-2035)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	-101.9%	36.7%	-	-	35.6%	-2.2%	-
		Net Increase/Decrease From LUB	0.0%	0.0%	-	-	-3.2%	0.0%	-
CLWA SCV WUE SP (2012-2035)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	-94.9%	36.8%	-	-	40.7%	-0.8%	-
		Net Increase/Decrease From LUB	6.9%	0.0%	-	-	1.9%	1.3%	-
Newhall Water Reclamation Plant (2023-2033)	Single Project Average Conc.(mg/L)	Assimilative Capacity Used (Percentage)	-101.9%	36.7%	-	-	38.7%	-3.2%	-
		Net Increase/Decrease From LUB	0.0%	0.0%	-	-	-0.1%	-1.0%	-
All Projects (2012-2035)	"All-Projects" Average Conc. (mg/L)	Assimilative Capacity Used (Percentage)	-76.1%	37.1%	-	-	40.9%	-1.8%	-
		Net Increase/Decrease From LUB	25.7%	0.4%	-	-	2.1%	0.3%	-

*No Project = Land Use Build-Out Condition Only
**A positive percentage represents an increase in assimilative capacity while a negative percentage indicates a decrease.
***Example: Considering Vista Canyon Water Reclamation Plant. Net decrease of assimilative capacity is calculated as follows:
-103.6% (Assimilative Capacity Used by Project) minus -101.9% (Assimilative Capacity Used by LUB) = -1.8%

Proposed SNMP Monitoring Wells and Sampling Frequency

Water Well Identification for Proposed Key Well (See Figures 37 and 38 for Map Locations)	Well Owner	Type of Well	Water Quality Constituent				Proposed Water Quality Sampling Frequency	Proposed Water Level Sampling Frequency
			TDS	Chloride	Nitrate (as NO3)	Sulfate		
Management Zone 1 (Santa Clara - Mint Canyon Subunit)								
NCWD- 3 - PINETREE	NCWD	Alluvial	X	X	X	X	Annual	Annual
SCWD-Sierra	SCWD	Alluvial	X	X	X	X	Annual	Annual
SCWD-Honby	SCWD	Alluvial	X	X	X	X	Annual	Annual
Management Zone 2 (Placerita Subunit)								
New Monitoring Well	Drinking Water Purveyors	Alluvial	X	X	X	X	Annual	Annual
Management Zone 3 (South Fork Subunit)								
New Monitoring Well	Drinking Water Purveyors	Alluvial	X	X	X	X	Annual	Annual
New Monitoring Well	Drinking Water Purveyors	Alluvial	X	X	X	X	Annual	Annual
Management Zone 4 (Santa Clara - Bouquet and San Francisquito Canyon Subunit)								
SCWD-Guida	SCWD	Alluvial	X	X	X	X	Annual	Annual
VWC-Well S6	LACSD/VWC	Alluvial	X	X	X	X	Annual	Annual
VWC-Well W9	VWC	Alluvial	X	X	X	X	Annual	Annual
Management Zone 5 (Castaic Valley)								
NCWD-1-Castaic	NCWD	Alluvial	X	X	X	X	Annual	Annual
VWC-D	VWC	Alluvial	X	X	X	X	Annual	Annual
GSWI-MW-2	NLF	Alluvial		X			Annual	Annual
Management Zone 6 (Saugus Formation)								
NCWD- 13 - Newhall	NCWD	Saugus	X	X	X	X	Annual	Annual
VWC-159	VWC	Saugus	X	X	X	X	Annual	Annual
VWC-W160	VWC	Saugus	X	X	X	X	Annual	Annual
LACWD 36-Los Valles L&G Well	LACWD 36	Saugus	X	X	X	X	Annual	Annual

Cells in yellow reflect additional sampling beyond what is currently being conducted.

Proposed SNMP Surface Water Sampling Locations and Sampling Frequency

Surface Water Sampling Locations	Owner	Water Quality Constituent				Proposed Water Quality Sampling Frequency
		TDS	Chloride	Nitrate (as NO3)	Sulfate	
Reach 7						
SA-RA	Sanitation District	x	x	x	x	Annual
Reach 6						
SA-RB	Sanitation District	x	x	x	x	Annual
Saugus WRP Effluent	Sanitation District	x	x	x	x	Annual
Reach 5						
Valencia WRP Effluent	Sanitation District	x	x	x	x	Annual
VA-RC	Sanitation District	x	x	x	x	Annual
VA-RD	Sanitation District	x	x	x	x	Annual
VA-RE	Sanitation District	x	x	x	x	Annual

See Figure 42 for Monitoring Locations

Table 5

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