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SANTA CLARITA VALLEY SANITATION DISTRICT

UPPER SANTA CLARA RIVER CHLORIDE TMDL

Task 7 and 8 Report

Site Specific Objective and Anti-Degradation Analysis

Draft

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Acronyms and Abbreviations

AGR	LARWQCB acronym for the beneficial use of water for farming, horticulture, or ranching
AGTAP	Agricultural Technical Advisory Panel
AWRM Option	Alternative Water Resource Management Option
BPA	Basin Plan Amendment
CFR	Code of Federal Regulations
CLWA	Castaic Lake Water Agency
District	Santa Clarita Valley Sanitation District of Los Angeles County
DWR	California Department of Water Resources
GSWIM	Groundwater Surface Water Interaction Model
GWR	LARWQCB acronym for the use of water for natural or artificial recharge of ground water
LARWQCB	Los Angeles Regional Water Quality Control Board
LRE	Literature Review Evaluation
LWA	Larry Walker Associates
maf	Million acre-feet
MCL	Maximum Contaminant Level
MF	Microfiltration
MF/RO	Microfiltration followed by Reverse Osmosis
Mg/L	Milligram per liter
MUN	LARWQCB acronym for the beneficial use of water for municipal and domestic supply.
MWH	Montgomery Watson Harza
NPDES	National Pollution Discharge Elimination System
OAL	Office of Administrative Law
RO	Reverse Osmosis
RWQCB	Regional Water Quality Control Board
SCR	Santa Clara River
SCVSD	Santa Clarita Valley Sanitation District

SJVI	San Joaquin Valley Index
SRWS	Self-regenerating Water Softeners
SSO	Site Specific Objective
SVI	Sacramento Valley Index
SWP	State Water Project
TDS	Total Dissolved Solids
TES	Threatened and Endangered Species
TMDL	Total Maximum Daily Load
USCR	Upper Santa Clara River
USEPA	United States Environmental Protection Agency
USFWS	US Fish and Wildlife Service
USGS	United States Geological Survey
UTS	Unarmored threespine stickleback
UV	Ultra-violet
UWMP	Urban Water Management Plan
WLA	Waste Load Allocation
WQO	Water Quality Objective
WRP	Water Reclamation Plant

Executive Summary

As part of the Upper Santa Clara River Chloride TMDL (USCR Chloride TMDL), Implementation Task Nos. 7 and 8 require the development of technical analyses and an anti-degradation analysis that the Regional Board may use to develop a Basin Plan Amendment for the consideration of site-specific objectives (SSOs) for chloride, sulfate and TDS. The purpose of this document is to provide the technical and regulatory basis for consideration of SSOs for surface water and groundwater in Reaches 4B, 5 and 6 of the Santa Clara River.

INTRODUCTION

The SSOs being developed are based on protection of beneficial uses, re-analysis of historic water quality information using updated tools (models), and analysis of the Porter Cologne Factors necessary to determine the appropriate water quality objective. The analysis of appropriate water quality objectives for chloride, sulfate and TDS requires the consideration of both technical data and regulatory factors to determine the objectives that meet the requirements of the Porter Cologne Water Quality Control Act. As such, the technical and regulatory factors are linked in the SSO analysis.

A key regulatory consideration influencing the discussion of the SSOs is the Chloride Policy. In 1997, the Regional Board adopted Resolution No. 97-02, a Basin Plan Amendment (BPA) that adjusted the chloride objectives for waterbodies in the Los Angeles region. The BPA did not adjust chloride objectives for the Santa Clara or Calleguas Creek watersheds, but laid out a process for adjusting the objectives in the future based on further study to determine the objectives necessary to protect the agricultural beneficial use. The BPA required revisions to the water quality objectives to consider the following factors:

1. Chloride levels in supply waters (including fluctuations that may be due to future drought conditions).
2. Reasonable loading factors during beneficial use and treatment of supply waters and wastewaters.
3. Methods to control chloride loading.
4. Associated costs and effectiveness of various loading control measures.

The development of SSOs discussed in this report is based on the required considerations outlined in the Chloride Policy.

COMPLIANCE MEASURE ALTERNATIVES SUMMARY

The current water quality objectives in the USCR are 100 mg/L implemented as an instantaneous maximum. To comply with the 100 mg/L objective, the wastewater treatment facilities in the USCR (Valencia Water Reclamation Plant and Saugus Water Reclamation Plant) have basically two alternatives: (1) install sufficient advanced treatment (microfiltration and reverse osmosis) to ensure that the entire discharge volume (blend of advanced treated and tertiary treated) meets 100 mg/L at all times; or (2) reduce the WRP discharge volumes to the Santa Clara River to the minimum amount required to maintain habitat and protect endangered species, and then install sufficient advanced treatment to ensure that the minimal discharge volume (blend of advanced treated and tertiary treated) meets 100 mg/L at all times. Either of those scenarios would require the construction of a brine and/or secondary effluent pipeline and ocean outfall that discharges to the ocean (43 miles away), off of the Ventura County coast.

As an alternative to the advanced treatment scenarios at the WRPs, a number of stakeholders in the USCR watershed developed the Alternative Water Resources Management (AWRM) compliance option. The AWRM Program consists of several key elements, which combined, would provide a regional watershed solution for the Upper Santa Clara River Chloride TMDL that benefits all stakeholders within the watershed. The key elements of the AWRM Program include: (1) implementing measures to reduce chloride in the recycled water at the District's WRPs discharges; (2) constructing advanced treatment for a portion of the recycled water from the District's Valencia WRP; (3) procuring supplemental water to enhance assimilative capacity (i.e. local groundwater or surface water) for release to the Santa Clara River to improve water quality conditions and attain WQOs; (4) constructing water supply facilities in Ventura County; (5) providing alternative water supply to protect salt-sensitive agricultural beneficial uses of the Santa Clara River; (6) supporting the expansion of recycled water uses within the Santa Clarita Valley.

The AWRM compliance option provides many benefits in comparison with the other scenarios and compliance options that have been identified. However, it will not result in compliance with the 100 mg/L water quality objectives at all times and in all locations for Reaches 4B, 5 and 6 of the USCR. Given the broad stakeholder support for the AWRM compliance option, furthering the implementation of this compliance option requires the development of SSOs that support this compliance option, while still being protective of beneficial uses. This report provides the technical and regulatory justification for SSOs that support the AWRM, provide protection of beneficial uses, and are consistent with historic, current, and projected future water quality in the surface water and groundwater.

SUMMARY OF PROPOSED SSOS

Table ES-3 summarizes the proposed surface water objectives and averaging periods resulting from the analysis provided in the previous sections. Table ES-2 summarizes the recommended SSOs and averaging periods for groundwater.

Table ES-1. Proposed Surface Water SSOs

Reach	Proposed Chloride Objective (mg/L)	Proposed Sulfate Objective (mg/L)	Proposed Averaging Period
6	150	450	Annual
5	150		Annual
4B	117[a]		3-month
4B Critical Conditions	130[b]		Annual

a. The Reach 4B WQO of 117 mg/L applies at all times unless the following conditions and implementation requirements are met:
1. Water supply concentrations measured in Castaic Lake are ≥ 80 mg/L.
2. Salt-sensitive agricultural uses that are irrigated with surface water are protected during periods when Reach 4B surface water exceeds 117 mg/L.
3. Beginning May 4, 2016, the cumulative net chloride loading above 117 mg/L ($CNCl_{117}$) to Reach 4B of the SCR from the SCVSD WRPs is zero or less, where:

$CNCl_{117} = Cl_{(Above\ 117)} - Cl_{(Below\ 117)} - Cl_{(Export\ Ews)}$

Where:

$Cl_{(Above\ 117)}$ = ([WRP Cl Load[1]/Reach 4B Cl Load[2]] * [Reach 4B Cl Load>117]) $_{Cumulative}$

$Cl_{(Below\ 117)}$ = ([WRP Cl Load[1]/Reach 4B Cl Load[2]] * [Reach 4B Cl Load<117]) $_{Cumulative}$

$Cl_{(Export\ EWs)}$ = [Cl Load Removed by Extraction Wells]$_{Cumulative}$

[1] WRP Cl Load is determined as the as the monthly average Cl concentration multiplied by the monthly average flow measured at the Valencia WRP.

[2] Reach 4B Cl Load is determined as the monthly average Cl concentration at Receiving Water Station RF multiplied by the monthly average flow measured at USGS Gauging Station 11109000 (Las Brisas Bridge).

b. The critical condition objective applies if all of the conditions listed in note a are fulfilled and a letter is submitted to the LARWQCB documenting the fulfillment of these conditions.

Table ES-2. Proposed Groundwater SSOs

Basin	Santa Clara--Bouquet & San Francisquito Canyons (mg/L)	East Piru San Pedro Formation[1] (mg/L)
Chloride (mg/L)	150	TBD (150)
TDS (mg/L)	1000	1300
Sulfate (mg/L)	450	600
Averaging period	Annual	Annual

1. West of Las Brisas Bridge (at a certain well?)

TECHNICAL SUPPORT FOR THE PROPOSED SSOS

The technical analyses conducted to develop the proposed SSOs were based primarily on the protection of the agricultural (AGR) and groundwater recharge (GWR) beneficial uses. Consideration was given to protection of other beneficial uses that could be impacted by salt concentrations (aquatic life and municipal drinking water beneficial uses). However, in both cases, the salt concentrations necessary to protect the other beneficial uses are higher than the objectives required to protect the AGR and GWR beneficial uses in all reaches. As a result, the summary of the technical support for the proposed SSOs focuses on the analysis necessary to protect the AGR and GWR beneficial uses.

Reaches 5 and 6 Chloride Surface Water Objectives

For Reaches 5 and 6, the development of chloride SSOs is supported by findings that the use of surface water from Reaches 5 and 6 or groundwater that could be impacted by surface waters from Reaches 5 and 6 for irrigation of salt sensitive crops is not a past, present, or probable future use. As a result, chloride water quality objectives higher than the current 100 mg/L water quality objective for these reaches are justified.

Additionally, the development of the proposed averaging periods for these reaches is supported by the following findings:

- Instantaneous peaks near 150 mg/L do not cause harm to agriculture, even to salt sensitive agriculture. In the LRE averaging period study, exposure periods of weeks to months at higher concentrations than 150 mg/L were necessary to see impacts (Newfields, 2007). Because salt sensitive agriculture is not a beneficial use in this reach, instantaneous objectives are not needed and averaging periods longer than necessary to protect salt sensitive agriculture may be warranted.
- The GWR beneficial use is utilized to ensure groundwater quality is protected for other purposes. In this case, the objectives are being developed to ensure recharge of groundwater does not impact the use of the groundwater basin for agricultural uses. As discussed above, protection of the AGR beneficial use does not require instantaneous objectives. As a result, an averaging period is appropriate to protect the GWR use as well.

Given the fact that higher objectives and averaging periods are justified for Reaches 5 and 6, the following technical findings were used to select the proposed 150 mg/L annual average objective.

- Water quality objectives for the other areas in the Los Angeles Region for areas where similar crops and irrigation sources are utilized and agricultural guidance used in other regions to evaluate protection of the agricultural beneficial uses support the use of 150 mg/L as a chloride objective for Reaches 5 and 6.
- A review of historic and current water quality demonstrates that 150 mg/L has been repeatedly observed in Reaches 5 and 6. As a result, increasing the objective to 150 mg/L will not result in poorer water quality than has existed in this waterbody.
- An annual averaging period was selected because:
    - Prior to 1994, surface water objectives for salts in the Los Angeles Region were based on weighted annual averages.
    - Annual averages are applied to salts objectives in several other regions in California

- Given that annual averages were also used historically for the groundwater basins in the USCR, an annual average would protect the GWR beneficial use.

Reach 6 Groundwater Objectives

The rationale for developing mineral SSOs for the groundwater basin underlying Reach 6 of the USCR (Santa Clara-Bouquet and San Francisquito Canyons) is as follows:

- As discussed in White Paper No. 2A, salt sensitive agricultural beneficial uses are not a past, present, or probable future use of the groundwater in Reach 6. The only salt-sensitive agriculture currently in the vicinity of Reach 6 that could be impacted by groundwater recharged by surface water is irrigated using State Water Project water.
- Historic mineral water quality objectives for the groundwater basins underlying Reach 6 of the USCR were established at levels higher than the current water quality objectives and were reflective of historic and current basin water quality.
- Consistency between surface water and groundwater objectives is justified based on GSWIM results that indicate that overlying surface water incidentally recharges groundwater underlying Reach 6. Both historic and current surface water quality are consistent with the proposed water quality objectives for groundwater and surface water in Reach 6.

Given the fact that higher objectives and averaging periods are justified for surface water in Reaches 5 and 6, the following technical findings were used to select the proposed annual average chloride, TDS, and sulfate groundwater objectives for Reach 6.

- Historic and existing water quality exceeds the current Basin Plan objectives during dry periods.
- Prior to 1994, the groundwater objectives (1975 objectives) were higher than the current Basin Plan objectives. However, a review of the 1993 DWR report that was used to lower the objectives in the 1994 Basin Plan was based on some key assumptions that may not be appropriate given additional information available since the development of the DWR report, such as:
    - The 1975 Basin Plan objectives are still representative of the conditions found historically in the USCR and are consistent with beneficial use protection and the anti-degradation policy.
    - The use of the 1975 objectives more accurately accounts for the influence of imported water concentrations that may be observed in the future and the impacts of drought conditions. The 1975 objectives also more closely reflect the current state of groundwater quality.
    - The 1975 objectives support an annual averaging period for groundwater, consistent with the justification presented for the surface water objective averaging periods.
- Overlying surface water incidentally recharges groundwater in Reach 6. Historic and current surface water quality in Reach 6 supports the proposed groundwater and surface water mineral water quality objectives proposed for Reach 6.

- Adjustment of the groundwater objectives supports the expansion of recycled water uses in the Santa Clarita Valley, which is consistent with projected increases in recycled water demand, as well as California's statutory goal of increasing the use of recycled water to help meet the state's growing demand for potable water.

Reach 6 Sulfate Surface Water objectives

Reach 6 sulfate surface water SSOs were developed based on the same rationale provided for the Reach 5 and 6 groundwater objectives.

- In 1994, the Reach 6 sulfate surface water quality objectives were lowered based on analysis in the 1993 DWR report. More recent information and analysis conducted as part of the Chloride TMDL implementation plan supports the conclusion that higher water quality objectives (e.g., the 1975 objectives) are more reflective of historic and current conditions in this reach.
- The use of the 1975 objectives more accurately accounts for the influence of imported water concentrations that may be observed in the future, the impacts of drought conditions and is consistent with beneficial use protection and the anti-degradation policy.
- Increasing the sulfate objectives supports implementation of the AWRM to improve support for downstream agricultural beneficial uses in a shorter time frame than is possible without the use of supplemental water.

Reach 4B Surface Water Objectives

The development of SSOs for Reach 4B reflects the need to consider the results of this study in evaluating objectives for areas with salt-sensitive agriculture. The development of SSOs for Reach 4B also included the considerations required in the Chloride Policy.

- The results of the agricultural threshold study (LRE) determined that a conservative upper chloride threshold for avocados is 117 mg/L and that value should be protective of other salt-sensitive crops.
- Although the use of 117 mg/L is an appropriate SSO under most conditions, during periods when water supply chloride concentrations increase, 117 mg/L may not be achieved for the following reasons.
    - During periods when water supply concentrations increase (such as during dry and critically dry years), concentrations in the receiving water have exceeded 117 mg/L, including between 1968 and 1978 (the period during which the objectives were developed).
    - Model results for the historic period also predict exceedance of 117 mg/L during periods of increased water supply concentrations.
    - The results of the compliance measure analysis utilizing the GSWIM shows that achieving 117 mg/L at all times in Reach 4B can only be achieved by implementing large-scale advanced treatment facilities at the Valencia and Saugus WRPs, and limiting recycled water uses (CH2M Hill, 2008). The implementation of large scale advanced treatment, while complying with the existing 100 mg/L objective in Reaches 5 and 6, will not comply with the existing 100 mg/L objective in Reach 4B, due to the presence of other chloride sources.

    - Implementing alternative compliance measures, such as SRWS removals and conversion to UV disinfection, results in compliance with 117 mg/L in Reach 4B except during periods when water supply concentrations are elevated (CH2M Hill, 2008).
- Based on the factors above, a higher SSO of 130 mg/L is proposed for periods when water supply concentrations exceed 80 mg/L. This SSO will support the implementation of the AWRM and is supported by historic, current and projected future water quality analysis. Applicability of the higher SSOs is conditioned on compliance with a series of implementation provisions.
- An averaging period of 3 months was developed for the chloride surface water objective in Reach 4B based on recommendations in the LRE averaging period study.

Reach 4B Groundwater Objectives

Monitoring data for some wells in the Eastern Piru Basin suggested that current water quality may be better than the existing Basin Plan objectives in the basin. Additionally, the water quality objectives were higher than the objectives discussed in the rest of the report to support agriculture. As a result, the historic, current, and projected future water quality conditions for the Eastern Piru groundwater basin were evaluated for protection of beneficial uses.

The water quality analysis demonstrated that the historic, current, and projected future water quality varied throughout the basin. In the area east of Las Brisas Bridge, groundwater quality is consistent with the current Basin Plan objectives. In this portion of the basin, there is no current or expected future use of the shallow alluvium groundwater for beneficial uses. Groundwater production occurs both upstream and downstream of Blue Cut where the Saugus and San Pedro aquifers yield more water with greater saturated thicknesses.

In the area west of the Las Brisas Bridge, the water quality analysis indicated that the groundwater was of better quality than the Basin Plan objectives. Based on a review of the data and the objectives necessary to protect agricultural beneficial uses of the groundwater basin, 150 mg/L chloride was selected as the proposed objective. A reduction in the TDS and sulfate objectives are also proposed based on existing water quality in the basin west of Las Brisas Bridge.

REGULATORY ANALYSIS SUMMARY

Various regulatory analyses are required to support the adoption of the proposed site-specific objectives (SSOs). These analyses are intended to fulfill Basin Plan, statutory, and state and federal policy requirements in relation to site-specific objectives. Specifically, the analyses implement the requirements contained in Section 3 of the Basin Plan, Water Code Section 13241, and state and federal anti-degradation policies.

Basin Plan Requirements

The Basin Plan provides that several elements should be addressed to justify the need for an SSO. These elements and the results of the analyses for each are summarized below.

The current and achievable technology and technology-based limits to comply with existing WQOs:

A number of studies have demonstrated that compliance with an the current chloride objective of 100 mg/L at the point of discharge would require construction of reverse osmosis facilities treating the full discharge of both the Saugus and Valencia WRPs. Such level of wastewater treatment would, however, be costly and brine disposal options could have adverse environmental and political consequences. In addition, source control alone cannot achieve compliance with 100 mg/L as demonstrated by recent groundwater and surface water interaction modeling.

A thorough review of historical limits and compliance with these limits at facilities in the study reach:

The Saugus and Valencia WRP have been subject to a number of different chloride water quality objectives since the facilities began discharging to the Santa Clara River. The WRPs generally complied with the chloride limits during periods when permit-based or regional policy-based limits exceeded 100 mg/L. Policy-based limits such as the variable Drought Policy limit (which averaged around 148 mg/L) and the subsequent 190 mg/L limit reflected on Resolution 97-02 were imposed in recognition of the fact that statewide drought conditions made it unreasonably difficult for POTWs in southern California to comply with the permit-based limitations. Both reclamation plants generally complied with their initial limits that depended on domestic supply chloride levels or 125 mg/L, whichever was greater. The WRPs also complied with subsequent permit-based limits that exceeded 100 mg/L and ranged from 175 mg/L to 250 mg/L. Despite the above observations, with limited exceptions, the discharged chloride concentrations from both WRPs have consistently exceeded 100 mg/L over the discharge period reviewed.

A detailed economical analysis of compliance with existing objectives

The costs necessary to implement two advanced treatment alternatives were evaluated for compliance with potential final effluent chloride limits of 100 mg/L for the Saugus and Valencia WRPs. The Maximum Advanced Treatment alternative would involve constructing enough advanced treatment at the Saugus and Valencia WRPs, so that the entire WRP recycled water discharge at each plant meets 100 mg/L in all conditions. This alternative would consist of the installation and operation of advanced treatment facilities, consisting of Microfiltration (MF), Membrane Bioreactors (MBR) and Reverse Osmosis (RO) at the Valencia WRP and MF/RO at the Saugus WRP. In addition, brine disposal facilities at the Valencia and Saugus WRPs would be necessary to dispose of brine wastes generated as part of the RO process. The other alternative, the Minimum Advanced Treatment alternative, would reduce or eliminate the amount of recycled water discharged from each WRP, so that only the minimum amount of discharge necessary to maintain habitat, would comply with 100 mg/L under all conditions (approximately 10 MGD). In this alternative, advanced treatment on WRP recycled water would only be needed on the portion of the minimum discharge to the river that was necessary to support habitat and comply with potential 100 mg/L chloride limits at the WRPs. The balance of WRP recycled water flows would be discharged into an effluent conveyance pipeline to the ocean, which would also be used to convey and dispose of the brine waste from the smaller advanced treatment facility.

Maximum Advanced Treatment and Brine Ocean Discharge

Based on construction costs estimates by Trussell Technologies, the Maximum Advanced Treatment alternative would require construction of a 15.4 MGD MF/RO and/or MBR/RO facility at the Valencia WRP and a 3.6 MF/RO facility at the Saugus WRP. Based on these proposed treatment processes, construction costs were estimated at $118,000,000, which would include RO facilities at both WRPs and MF and MBR facilities at Valencia and an MF facility at Saugus in addition to non-process general costs. In addition to these costs, brine disposal costs were also estimated by Montgomery Watson Harza. The only feasible alternative for disposing of the large volume of brine waste that would be generated under the Maximum Advanced Treatment alternative was identified as the construction of a 43-mile brine conveyance pipeline and new ocean outfall off the coast of Ventura County. Construction costs for this conveyance system and outfall are estimated at $230,000,000 and an additional $9,500,000 in annual costs would be needed to operate and maintain the advanced treatment and brine disposal systems. Assuming an interest rate of 5.5% and a period of 20 years, the combined present worth of the estimated Capital and O&M Costs for compliance with the existing objectives by providing advanced treatment and brine disposal is approximately $460 Million.

Minimum Advanced Treatment and Ocean Discharge

Based on estimates provided by Trussell Technologies and Montgomery Watson Harza, the construction and annual O&M costs for a minimum advanced treatment and ocean discharge compliance option is estimated at approximately be $468,000,000 and $2,700,000, respectively, not including land acquisition, utility relocation, permitting or environmental assessment costs. Assuming an interest rate of 5.5% and a period of 20 years, the combined present worth of the Capital and O&M cost for this option is estimated at approximately $524 Million.

A detailed economical analysis of compliance with the proposed objectives

The District and its consultants prepared cost estimates for the various key elements of the AWRM Program. The costs necessary to carry out each of these key elements and comply with the proposed site-specific objectives is estimated at approximately $255 Million. Table ES-3 shows the present worth capital and O&M cost for each key element based on an interest rate of 5.5% and a period of 20 years.

Table ES-3. Summary of Project Capital and O&M Costs for AWRM Key Elements

AWRM Element	Capital Cost	Present Worth O&M	TOTAL
Source Control Measures	$15,500,000	$6,000,000	$21,500,000
Advanced Treatment and Brine Disposal	$78,000,000	$44,000,000	$122,000,000
Supplemental Water	$37,500,000	N/A	$37,500,000
Ventura Water Supply Facilities	$70,100,000	$3,600,000	$73,700,000
TOTAL AWRM Program	**$201,100,000**	**$53,600,000**	**$254,700,000**

Note: All costs are as of September 2007

An analysis of compliance and consistency with all federal, state, and regional plans and policies:

This Basin Plan element was fulfilled by considering the above required Basin Plan elements, as well as the State Antidegradation Policy contained in State Water Resources Control Board Resolution 68-16 and the federal antidegradation requirements the state policy incorporates. The adoption of the proposed SSOs would be consistent with all relevant federal, state, and regional plans, and policies including antidegradation considerations.

Water Code Section 13241 Requirements

Water Code section 13241 requires the Regional Board to consider the following when establishing a water quality objective:

1. The past, present, and probable future beneficial uses of water
2. The environmental characteristics of the hydrographic unit under consideration,
3. Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area.
4. Economic considerations.
5. The need for developing housing within the region.
6. The need to develop and use recycled water.

Past, Present, and Probable Future Beneficial Uses of Water

The 1975 Basin Plan designated nine beneficial uses to the Santa Clara River including agricultural supply (AGR), industrial process supply (PROC), industrial service supply (IND), groundwater recharge (GWR), freshwater replenishment (FRSH), cold freshwater habitat (COLD), wildlife habitat (WILD), water contact recreation (REC-1) and non-contact water recreation. The 1995 Basin Plan designated an additional six beneficial uses including municipal and domestic supply (MUN), migration of aquatic organisms (MIGR), warm freshwater habitat (WARM), rare, threatened and endangered species habitat (RARE).

The probable future beneficial uses of the surface waters in the USCR is likely to remain consistent with existing uses with the exception of agriculture supply (AGR). The agricultural beneficial use of water has been determined to be the most sensitive use under the chloride TMDL and SSOs designed to protect this use will be protective of other uses in the waterbody. As a result of land use changes in Reaches 5 and 6, the area currently used for agriculture is likely to decline over time. In Reaches 4A and 4B the agricultural area will likely remain constant.

The proposed SSOs for surface and groundwater within Reaches 5 and 6 are protective of the AGR beneficial use because surface waters and groundwater potentially impacted by these surface waters are not currently and have not historically been used as an irrigation supply for salt-sensitive crops. This situation is unlikely to change due to climatic conditions that impact the ability to grow salt sensitive crops and because the use of irrigation water for crops is anticipated to decline in Reaches 5 and 6 due to planned urban development.

When implemented with the AWRM Compliance Option, the proposed SSOs in Reach 4B and the underlying groundwater will be fully protective of agricultural uses in the area.

The environmental characteristics of the hydrographic unit

The environmental characteristics of the USCR was considered, as well as the impact this rulemaking would have on instream and riparian species and habitat. The proposed SSOs when implemented with the AWRM Compliance Option will result in reduced chloride discharges from the primary point sources in the USCR. The 150 mg/L chloride surface WQOs in Reaches 4B, 5, and 6 are more stringent than the effluent limitations that have applied to the Saugus and Valencia WRPs over a significant portion of their operating histories. In addition, the proposed SSOs are substantially below the existing USEPA aquatic life chloride criteria, which according to the TES Study are protective of the most chloride-sensitive organisms for which data are available. Therefore, it is not expected that this rulemaking will result in actual harm to in-stream or riparian species or habitat.

Water quality conditions that could reasonably be achieved through the coordinated control of all factors, which affect water quality in the area.

The Task 2B-1 and Task 2B-2/Task 9 reports discuss the compliance options and water quality that can be achieved through different approaches to compliance. The Task 2B-1 report found that other compliance measures, such as large scale advanced treatment facilities, could consistently achieve 100 mg/L in Reaches 5 and 6, but not in Reach 4B. The AWRM will not consistently result in compliance with 100 mg/L, but will result in compliance with the proposed SSOs and provide protection of agricultural beneficial uses. Given the technical constraints on large scale advanced treatment facilities and the environmental and water resource benefits of the AWRM, the AWRM is the preferred compliance measure because it will protect beneficial uses and improve the water quality in the Eastern Piru groundwater basin within an implementation framework that will result in compliance with the proposed SSOs.

Baseline Economic Considerations

Baseline economic conditions are summarized above in the Detailed Economic Analysis of Compliance with the Proposed Objectives section.

The Need to Develop Housing

The proposed water quality objectives would not restrict the development of housing near the reaches of the Santa Clara River affected by the proposed SSOs because they do not result in discharge requirements that affect housing or any economic costs related to housing development. Additionally, the proposed SSOs will support water recycling and the use of the AWRM compliance option in the USCR. Both of these factors will provide water resources to support housing that may be lost with other compliance options.

The Need to Develop and Use Recycled Water

The proposed water quality objectives will support the expansion of recycled water uses in the Santa Clarita Valley consistent with California's stated goal of increasing the use of recycled water to help meet the state's growing demand for potable water. The Castaic Lake Water Agency's (CLWA) 2005 Urban Water Management Plan (UWMP) projects that water demand in the area will continue to increase, and that additional sources of water including recycled water will be necessary to meet projected demand. Given the demonstrated need to expand recycling in the USCR to meet the region's future water requirements, the proposed SSOs are needed to ensure the required compliance mechanisms allow for recycling to take place.

Antidegradation Policy

The adoption of the proposed SSOs would be consistent with the States' Antidegradation Policy as contained in State Water Resource Control Board Resolution 68-16, as well as the federal antidegradation policy it incorporates. When implemented with existing efforts to reduce chloride discharges from residences and the commitments delineated in the Alternative Water Resources Management Option, the revised water quality objectives will be protective of all beneficial uses that apply to the affected waters. This assessment is based on the following findings:

1. The SSOs will not result in the lowering of water quality as current water quality exceeds the proposed SSOs. Water quality will, in fact, improve with implementation of the Alternative Water Resources Management Option.
2. The proposed SSOs are protective of beneficial uses.
3. The proposed implementation activities will offset any increases in chloride discharges with accompanying increases in chloride export from impacted groundwater basins.
4. The proposed SSOs support important economic and social development by supporting water recycling and providing for additional water resources for agriculture and aquatic habitat.
5. Wastewater NPDES permits will require effluent limits and salt export requirements designed to ensure that wastewater dischargers maintain or improve current levels of performance and prevent degradation of the downstream groundwater basins.

1 Introduction

1.1 BACKGROUND

As part of the Upper Santa Clara River Chloride TMDL (USCR Chloride TMDL), Implementation Task Nos. 7 and 8 require the development of technical analyses and an anti-degradation analysis that the Regional Board may use to develop a Basin Plan Amendment for the consideration of site-specific objectives (SSOs) for chloride, sulfate and TDS. The purpose of this document is to provide the technical and regulatory basis for consideration of SSOs for surface water and groundwater in Reaches 4B, 5 and 6 of the Santa Clara River.

The SSOs being developed are based on protection of beneficial uses, re-analysis of historic water quality information using updated tools (models), and analysis of the Porter Cologne Factors necessary to determine the appropriate water quality objective. The analysis of appropriate water quality objectives for chloride, sulfate and TDS requires the consideration of both technical data and regulatory factors to determine the objectives that meet the requirements of the Porter Cologne Water Quality Control Act. As such, the technical and regulatory factors are linked in this SSO analysis. The following sections provide a summary of regulatory and technical background information that will be used throughout this report for the analysis.

1.1.1 Chloride Policy

In 1997, the Regional Board adopted Resolution No. 97-02, a Basin Plan Amendment (BPA) that adjusted the chloride objectives for waterbodies in the Los Angeles region. The BPA did not adjust chloride objectives for the Santa Clara River or Calleguas Creek watersheds, but laid out a process for adjusting the objectives in the future based on further study to determine the objectives necessary to protect the agricultural beneficial use. The BPA required a number of studies to be completed and based on the results of the studies "the Regional Board may reconsider revisions to water quality objectives for chloride in the Santa Clara River and Calleguas Creek watersheds." (LARWQCB, 1997) The revisions to the water quality objectives were required to be based on consideration of the following factors:

1. Chloride levels in supply waters (including fluctuations that may be due to future drought conditions).
2. Reasonable loading factors during beneficial use and treatment of supply waters and wastewaters.
3. Methods to control chloride loading.
4. Associated costs and effectiveness of various loading control measures.

The development of SSOs discussed in this report is based on the required considerations outlined in the Chloride Policy.

1.1.2 Current Water Quality Objectives

The current Basin Plan objectives for chloride, sulfate and TDS for the USCR are shown in Table 1 and Table 2. Objectives with proposed SSOs discussed in this report are noted in bold.

Table 1. Surface Water Basin Plan Objectives[1]

Basin Plan Name	Reach	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)
Above Lang gauging station	8	50	500	100
Between Lang gauging station and Bouquet Canyon Road Bridge	7	100	800	150
Between Bouquet Canyon Road Bride and West Pier Hwy 99	6	**100**	1000	**300**
Between West Pier Hwy 99 and Blue Cut gauging station	5	**100**	1000	400
Between Blue Cut gauging station and Piru Creek	4B	**100**	1300	600
Between Piru Creek and A St. Fillmore	4A	100	1300	600

1. No averaging period applies to any of the objectives.

Table 2. Groundwater Basin Plan Objectives[1]

Basin Plan Name	Reach	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)
Santa Clara-Mint Canyon	8	150	800	150
South Fork		100	700	200
Placerita Canyon	7	100	700	150
Santa Clara-Bouquet & San Francsquito Canyon	6	**100**	**700**	**250**
Castaic Valley	5	150	1000	**350**
Saugus Aquifer	5/6	-	-	-
Santa Clara-Piru Creek area				
Lower area east of Piru Creek	4B	**200**	**2500**	**1200**
Lower area west of Piru Creek	4A	100	1200	600

1. No averaging period applies to any of the objectives.

1.1.3 Beneficial Uses

The USCR Chloride TMDL is based primarily on the protection of the agricultural beneficial use. In the Los Angeles Region Water Quality Control Plan (Basin Plan), the agricultural beneficial use is defined as follows:

> Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

However, the range of activities protected under the agricultural beneficial use includes the cultivation of crops that are sensitive to the concentration of chloride in irrigation water and other agricultural activities that are not as sensitive to chloride concentrations. As a result, a distinction is made throughout this document between the protection of the cultivation of salt-sensitive agricultural crops and the remaining agricultural beneficial uses. For the purposes of this document and the discussion of site-specific objectives, salt sensitive agriculture is considered to be the cultivation of avocados, strawberries and nursery crops.

1.1.4 Technical Studies

As required in the Chloride TMDL implementation plan, three key technical studies were developed:

1. Chloride Threshold Study for Protection of Sensitive Agricultural Supply Use (TMDL Implementation Task Nos. 4 and 6).
2. Chloride Threshold Study for Protection of Endangered Species (TMDL Implementation Task No. 6)
3. Groundwater/Surface Water Interaction Model (TMDL Implementation Task No. 5)

The studies provide information that can be used to satisfy the study requirements in the Chloride Policy (evaluation of appropriate chloride standards for agriculture, sources of chloride, and loading from sources).

In addition to these three major studies, additional technical analyses have been completed to address specific questions or issues. The results of the three studies as well as other supporting technical efforts have been summarized in a number of technical reports and memorandums. The reports are summarized in Table 3 and included as appendices to this report.

Table 3. Chloride TMDL Study Reports Summary

Study	Reports and Tech Memos	Contents	Appendix #
Agricultural Chloride Threshold Study	Literature Review and Evaluation (LRE)[1]	Review of available literature on sensitivity of crops to chloride	1
	LRE Averaging period technical memorandum[2]	Analysis of LRE studies to determine a potential averaging period for the water quality objective	1
Endangered Species Chloride Threshold Study	Chloride Water Quality Criteria Protectiveness of Upper Santa Clara River Threatened and Endangered Species[3]	Evaluation of USEPA aquatic life criteria for protection of threatened and endangered species in the USCR	2
Groundwater/Surface Water Interaction Model (GSWI)	Task 1A[4]	Summary of available information	3
	Task 2A[5]	Conceptual model development	4
	Task 2B-1[6]	Numerical model development, calibration and initial scenario modeling results	5
	Task 2B-2/Task 9[7]	Identification and evaluation of alternative compliance measures	6

[1] CH2M Hill, 2005. *Final Report: Literature Evaluation and Recommendations, Upper Santa Clara River Chloride TMDL Collaborative Process.* September 2005.

[2] NewFields Agricultural and Environmental Resource, 2007. *Technical Memorandum: Compliance Averaging Period for Chloride Threshold Guidelines in Avocado.* December 2007.

[3] Advent-Environ, 2007. *Evaluation of Chloride Water Quality Criteria Protectiveness of Upper Santa Clara River Aquatic Life: An Emphasis on Threatened and Endangered Species*. May 2007.

[4] CH2M Hill and HGL, 2006. *Literature Review and Data Acquisition - Task 1A-Evaluate Existing Models, Literature, and Data, Upper Santa Clara River Chloride TMDL Collaborative Process*. March 2006.

[5] CH2M Hill and HGL, 2006. *Task 2A-Conceptual Model Development East and Piru Subbasins, Upper Santa Clara River Chloride TMDL Collaborative Process*. October 2006.

[6] CH2M Hill and HGL, 2008. *Task 2B-1-Numerical Model Development and Scenario Results East and Piru Subbaasins, Upper Santa Clara River Chloride TMDL Collaborative Process*. February 2008.

[7] Geomatrix, 2008. *Task 2B-2 Report-Assessment of Alternatives for Compliance Options Using the Groundwater/Surface Water Interaction Model, Upper Santa Clara River Chloride TMDL Collaborative Process*. June, 2008.

Study	Reports and Tech Memos	Contents	Appendix #
Other Supporting Technical Documents	White Paper No. 2A and No. 2B[8]	Analysis of past, present and probable future salt sensitive agricultural beneficial uses in Reaches 5 and 6 of the USCR	7
	Alternative Water Resources Management Plan: Effects in Ventura County[9]	Discussion of water resource and salt balance impacts of the AWMS in Ventura County	8
	Technical Memo: Response to Concerns Regarding Predicted Shallow Groundwater Concentrations in USCR Reach 4B[10]	Discussion of alluvium groundwater chloride concentrations in the Blue Cut area. Covers both model and monitoring results.	9
	Technical Memos: Monitoring Wells in the Vicinity of Blue Cut[11]	Series of memos discussing the selection and installation of new alluvium monitoring wells in the Blue Cut area.	10

The results of these special studies and other supporting technical documentation provide much of the technical information used to develop SSOs for the chloride TMDL. Short summaries of the key findings are presented in the text of this report, but the full reports located in the Appendices referenced above should be reviewed for a complete understanding of the technical findings of the documents.

1.2 NEED FOR SITE-SPECIFIC OBJECTIVES

As discussed above, a variety of technical studies and regulatory analysis have been completed as required in the USCR Chloride TMDL Implementation Plan, and in accordance with the Chloride Policy 97-02. In addition to the technical studies (TMDL Implementation Task Nos, 4, 5 and 6), analysis of potential compliance measures (TMDL Implementation Task No. 9) has been conducted. Based on the results of the technical, regulatory, and compliance measure analyses, a need to develop site-specific objectives has been identified.

Based on these analyses (as will be discussed further below) the following conclusions support the development of SSOs:

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[8] Sanitation Districts of Los Angeles County, 2007. *Santa Clarita Valley Sanitation Districts, Upper Santa Clara River chloride TMDL. White Paper No. 2A Agricultural Beneficial Use Considerations Santa Clara River-Reaches 5 and 6.*

[9] Bachman, Steve, 2008. *Alternative Water Resources Management Program-Effects in Ventura County*. June 2008.

[10] Geomatrix, 2007. *Memorandum: Monitoring Wells in the Vicinity of Blue Cut*. Groundwater/Surface Water Interaction Modeling Subcommittee. August 16, 2007.

[11] Geomatrix, 2008. *Memorandum: Response to Concerns Regarding Predicted Shallow Groundwater Concentrations in USCR Reach 4B*. Groundwater/Surface Water Interaction Modeling Subcommittee. June, 2008.

- A range of chloride concentrations has been found to be protective of salt sensitive agriculture and the range includes values that are higher than the current water quality objectives.
- Salt sensitive agriculture is not a past, present or probable beneficial use for groundwater and surface waters in some reaches of the USCR.
- Analysis of historic water quality shows that surface water and groundwater concentrations have exceeded the current water quality objectives as a result of dry and critically dry climatic conditions.
- Alternative compliance measures that result in benefits for water resources, water recycling, and agriculture, while protecting beneficial uses, require certain site-specific objectives to be feasible compliance measures.

Each of these conclusions support the development of site-specific objectives and the first three conclusions are derived from the technical analyses that are discussed in more detail in the remaining sections of the document. However, the consideration of an alternative compliance measure that requires certain site-specific objectives, though not a technical or regulatory justification, is the major impetus for developing the site-specific objectives. As such, a summary of the potential compliance measures is provided here. A full discussion of all of the compliance measures is included in the TMDL Implementation Task 2B-2/9 report (Appendix 6).

1.2.1 Compliance Measure Alternatives Summary

The current water quality objectives in the USCR are 100 mg/L implemented as an instantaneous maximum. To comply with the 100 mg/L objective, there are basically two alternatives for upgrades to the wastewater treatment facilities in the USCR (Valencia Water Reclamation Plant and Saugus Water Reclamation Plant): (1) install sufficient advanced treatment (microfiltration and reverse osmosis) to ensure that the entire discharge volume (blend of advanced treated and tertiary treated) meets 100 mg/L at all times; or (2) reduce the WRP discharge volumes to the Santa Clara River to the minimum amount required to maintain habitat and protect endangered species, and then install sufficient advanced treatment to ensure that the minimal discharge volume (blend of advanced treated and tertiary treated) meets 100 mg/L at all times. Either of those scenarios would require the construction of a brine and/or secondary effluent pipeline and ocean outfall that discharges to the ocean (43 miles away), off of the Ventura County coast.

As discussed in the GSWIM Task 2B-1 report, GSWIM analyses of source control measures and increased recycled water uses alone will not result in compliance with the 100 mg/L objective at all times and in all locations. Additionally, evaluation of various advanced treatment scenarios (including the compliance measures discussed above) indicates that compliance with the 100 mg/L objective at all times and all locations was not attainable under any of these initial scenarios. (CH2M Hill, 2008).

As an alternative to the advanced treatment scenarios at the WRPs, a number of stakeholders in the USCR watershed developed the Alternative Water Resources Management (AWRM) compliance option. The AWRM Program consists of several key elements, which combined, would provide a regional watershed solution for the Upper Santa Clara River Chloride TMDL that benefits all stakeholders within the watershed. The key elements of the AWRM Program include: (1) implementing measures to reduce chloride in the recycled water at the District's

WRPs discharges; (2) constructing advanced treatment for a portion of the recycled water from the District's Valencia WRP; (3) procuring assimilative capacity enhancement water (i.e. local groundwater or surface water) for release to the Santa Clara River to improve water quality conditions and attain WQOs; (4) constructing water supply facilities in Ventura County; (5) providing alternative water supply to protect salt-sensitive agricultural beneficial uses of the Santa Clara River; (6) supporting the expansion of recycled water uses within the Santa Clarita Valley; and (7) revising the surface water and groundwater WQOs to support all of these elements. A more detailed discussion of the key elements is included in The Task 2B-2/9 Report (Appendix 6).

The AWRM compliance option provides many benefits in comparison with the other scenarios and compliance options that have been identified. However, it will not result in compliance with the 100 mg/L water quality objectives at all times and in all locations for Reaches 4B, 5 and 6 of the USCR. Given the broad stakeholder support for the AWRM compliance option, furthering the implementation of this compliance option requires the development of SSOs that support this compliance option, while still being protective of beneficial uses.

Table 4 show the proposed SSOs for Reaches 4B, 5 and 6 of the Santa Clara River and underlying groundwater based on the technical reports discussed above and to support the AWRM compliance option.

Table 4. Proposed Revisions to Surface Water WQOs to Support AWRM Program

Reach	Current Instantaneous Chloride Objective (mg/L)	Proposed Chloride Objective (mg/L)	Current Instantaneous Sulfate Objective (mg/L)	Proposed Sulfate Objective (mg/L)	Averaging Period
6	100	150	300	450	Annual
5	100	150			Annual
4B	100	117[a]			3-month
4B Critical Conditions	100	130[b]			Annual

a. The Reach 4B WQO of 117 mg/L applies at all times unless the following conditions and implementation requirements are met:

1. Water supply concentrations measured in Castaic Lake are ≥ 80 mg/L.
2. Salt-sensitive agricultural uses that are irrigated with surface water are protected during periods when Reach 4B surface water exceeds 117 mg/L.
3. Beginning May 4, 2016, the cumulative net chloride loading above 117 mg/L ($CNCl_{117}$) to Reach 4B of the SCR from the SCVSD WRPs is zero or less, where:

$$CNCl_{117} = Cl_{(Above\ 117)} - Cl_{(Below\ 117)} - Cl_{(Export\ Ews)}$$

Where:

$Cl_{(Above\ 117)}$ = ([WRP Cl Load[1]/Reach 4B Cl Load[2]] * [Reach 4B Cl Load>117]) $_{Cumulative}$

$Cl_{(Below\ 117)}$ = ([WRP Cl Load[1]/Reach 4B Cl Load[2]] * [Reach 4B Cl Load<117]) $_{Cumulative}$

$Cl_{(Export\ EWs)}$ = [Cl Load Removed by Extraction Wells] $_{Cumulative}$

[1] WRP Cl Load is determined as the monthly average Cl concentration multiplied by the monthly average flow measured at the Valencia WRP.

[2] Reach 4B Cl Load is determined as the monthly average Cl concentration at Receiving Water Station RF multiplied by the monthly average flow measured at USGS Gauging Station 11109000 (Las Brisas Bridge).

b. The critical condition objective applies if all of the conditions listed in note a are fulfilled and a letter is submitted to the LARWQCB documenting the fulfillment of these conditions.

Table 5. Proposed Revisions to Groundwater WQOs to Support AWRM Program

Constituent	Santa Clara--Bouquet & San Francisquito Canyons		Castaic Valley		East Piru San Pedro Formation[1]	
	Proposed Objective (mg/L)	Current Objective (mg/L)	Proposed Objective (mg/L)	Current Objective (mg/L)	Proposed Objective (mg/L)	Current Objective (mg/L)
Chloride	150	100	No Change	150	TBD (150)	200
TDS	1000	700	No Change	1000	1300	2500
Sulfate	450	250	No Change	350	600	1200
Averaging period	Annual	None	Annual	None	Annual	None

[1] West of Las Brisas Bridge (at a certain well?)

The remainder of the report provides the technical and regulatory analysis to support the proposed SSOs shown above.

2 Technical Analysis for Site-Specific Objectives

This section provides the technical analysis to support revisions to the surface water and groundwater objectives in Reaches 4B, 5 and 6 of the USCR. The technical basis for the proposed SSOs varies by reach and includes a discussion of numeric changes to the objectives and the associated averaging periods. The analysis is organized in various sub-sections as follows:

2.1 Reaches 5 and 6 surface water SSOs for chloride

2.2 Reach 6 groundwater SSOs for chloride, TDS, and sulfate

2.3 Reach 6 surface water SSO for sulfate

2.4 Reach 4B surface water SSOs for chloride

2.5 Reach 4B groundwater SSOs for chloride, TDS, and sulfate

Within each sub-section, a brief summary of the rationale for developing an SSO for the reach is followed by a discussion of the analysis process, the analysis conducted, alternatives considered, and the recommended alternative.

2.1 REACHES 5 AND 6 CHLORIDE SURFACE WATER OBJECTIVES

As part of the technical analysis in support of the SSOs, the District developed a white paper on the presence of historic, current, and probable future salt-sensitive agriculture in Reaches 5 and 6 of the SCR. The White Paper No. 2A is included as Appendix 7. The information in the White Paper finds that the use of surface water from Reaches 5 and 6 or groundwater that could be impacted by surface waters from Reaches 5 and 6 for irrigation of salt sensitive crops is not a past, present, or probable future use. This finding is based on the following:

- No surface water diversions have taken place or are taking place in these reaches
- No claims of riparian water rights by riparian landowners have been made in these reaches
- Of the seven riparian landowners within the reaches, only Newhall Land and Farm, conducts agricultural operations. This company does not, however, irrigate salt-sensitive crops with surface water or groundwater within Reaches 5 and 6.
- None of the current riparian landowners will be irrigating salt-sensitive crops in the future with surface water from the Santa Clara River.
- Land use records reflect the continued transition from agricultural to residential/urban uses in the riparian land within Reaches 5 and 6.
- There are no landowners who cultivate salt-sensitive crops irrigated with groundwater that could be impacted by surface water from Reaches 5 and 6.

Based on this information, within Reaches 5 and 6 of the SCR, salt-sensitive crops are not an existing AGR beneficial use and are not likely to be a potential AGR beneficial use.

Based on this finding, the current Basin Plan chloride objective for Reaches 5 and 6 of the SCR is overprotective of the agricultural uses that are present in the reaches. As a result, the development of site-specific objectives is appropriate and feasible.

Given the finding that salt sensitive agriculture is not a past, present, or probable future use of the surface water in Reaches 5 and 6, the development of SSOs needs to ensure the protection of existing beneficial uses in the reaches and prevent degradation of the waterbody. To define an appropriate surface water quality objective for Reaches 5 and 6, the following approach was utilized.

1. To evaluate the SSO necessary to protect aquatic life, the TES study was used to determine the chloride concentration necessary to protect endangered species and other sensitive aquatic life present in the USCR.
2. To evaluate the SSO necessary to protect other agricultural uses in Reaches 5 and 6, water quality objectives and agricultural guidelines used in California to protect agriculture other than salt-sensitive crop cultivation were evaluated.
3. Historic, current, and projected water quality in Reaches 5 and 6 were compared to the current and proposed SSOs to ensure that objectives were not set higher than values that had been observed or are expected to be observed after implementation of the AWRM in the waterbody.

Each of these analyses is discussed in detail in the following sub-sections.

2.1.1 Threatened and Endangered Species (TES) Study

The TES study found that the existing USEPA aquatic life chloride criteria are protective of threatened and endangered species. Following is an excerpt from the executive summary discussing the results of the evaluation.

> "Comparison of toxicity data used in the development of the 1988 Ambient Water Quality Criteria (AWQC) for chloride and more recent data generated after 1988 found that the USEPA acute and chronic chloride criteria (860 mg/L and 230 mg/L, respectively) are protective of the most chloride-sensitive organisms for which data are available, including a highly chloride- sensitive species (*Ceriodaphnia dubia*) for which data were not available in 1988. Toxicity data using surrogate amphibian genera (*Bufo americanus*, *Rana clamitans*, *R. pipiens*, and chorus frog tadpoles *Pseudachris triseriata*) and a surrogate fish species (threespine stickleback, *Gasterosteus aculeatus*) for T&E species identified in the USCR watershed indicated that they are not particularly sensitive to chloride, and the 1988 USEPA AWQC for chloride would be protective of them as well. Comparisons of literature-reported toxicity data for other T&E species to that of conventionally-tested organisms for other water quality constituents indicated that T&E species are not generally more sensitive than the conventionally-tested organisms (which are the basis for all AWQC derivations)." (Advent-Environ, 2007, Appendix 2)

In conclusion, the existing aquatic life criteria of 230 mg/L as a four-day average and 860 mg/L as a one-hour average are protective of the TES of the Santa Clara River. These thresholds are significantly higher than the agricultural thresholds discussed below. As a result, threatened and endangered species will be protected by SSOs developed to protect agriculture in Reaches 4B, 5 and 6.

2.1.2 Agricultural Chloride Water Quality Objectives and Guidelines

As a first step in evaluating potential surface water SSOs to protect non-salt sensitive agriculture, water quality objectives that have been established in the Los Angeles Region and throughout California for this purpose were evaluated. For areas where water quality objectives have not been developed, agricultural guideline values were considered.

2.1.2.1 Los Angeles Region

Chloride objectives have been determined for areas that are predominantly agricultural in the Los Angeles-Ventura area. For the Santa Clara River, these objectives range from 100 to 150 mg/L for all areas below the Lang gauging station to the Highway 101 Bridge. In the Santa Clara River reaches below Reach 5, salt sensitive agriculture is grown in Reaches 3 and 4 and the water quality objective is set at 100 mg/L. In Reach 2, between the Highway 101 Bridge and the Freeman Diversion, a water quality objective of 150 mg/L has been established for chloride. In this area, strawberries, citrus, and row crops are all grown. The source of water supply for agricultural irrigation in this reach has not been established, but the above crops are currently being grown in Reach 2. As a result, a water quality objective of 150 mg/L could be considered appropriate for other types of agriculture grown in the Santa Clara River.

Additionally, the chloride objective for the Calleguas Creek Watershed above Potrero Road is 150 mg/L. Agriculture in the Calleguas Creek watershed is diverse, including both salt sensitive and more salt tolerant crops, and varies spatially according to such factors as coastal proximity, altitude, slope, and soil type. Citrus crops such as lemons, oranges, and avocados commonly occur in flat or gently sloping foothill areas that are slightly inland, with avocado orchards tending to exist somewhat upslope of lemon groves and oranges usually growing a bit further inland than lemons. Floodplain areas are currently predominated by a wide range of truck crops such as strawberries, peppers, green beans, celery, onions, garlic, lettuce, melons, and squash; as well as turf farms and various types of nurseries (LWA, 2007). Most growers in the Calleguas Creek Watershed rely on groundwater delivered through local mutual water companies as their primary water supply. Surface water is not diverted for use on salt sensitive crops in the watershed except for the Conejo Creek Diversion Project in Camrosa. However, the Conejo Creek Diversion Project water is blended before it is supplied to sensitive agricultural users. In the Conejo and Calleguas Creeks, water right appropriations prevent the diversion of water in the stream for uses other than the Conejo Creek Diversion Project (LWA, 2007).

For other water bodies that have "no waterbody specific objective" for salt constituents, the Basin Plan sets forth guidelines for the range of concentrations necessary to protect different categories of uses.[12] For the protection of agriculture, the guideline for chloride presented in the Basin Plan ranges from 100 to 355 mg/L. As noted in Table 5 of the Chloride TMDL for the USCR, the range specified in the Basin Plan is based on the needs of the crops grown in the reach (LARWQCB, 2002). As a result, the levels necessary to protect crops that are not salt-sensitive could vary and fall anywhere within that range.

2.1.2.2 Other Regions in California

For other regions in California, water quality objectives that are specifically linked to protection of agricultural beneficial uses have not been established. However, like the Los Angeles-Ventura region, agricultural guidelines are utilized for protecting the agricultural beneficial use in areas where specific water quality objectives have not been identified. As stated above, no uniform guidelines for protecting crops from the adverse effects of chloride exists in California. The various Regional Water Quality Control Boards establish their own guidelines for irrigation of crops throughout the state. These guidelines vary between regions and clear-cut information

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[12] See footnote "f" to Table 3-8 in Water Quality Control Plan Los Angeles Region (June 13, 1994).

on the specific types of crops protected by them has not been developed. Table below is a summary of the chloride guidelines used by the various Regional Water Boards throughout California according to their respective Basin Plans.

Table 6. Basin Plan Agricultural Chloride Guidelines by Regional Water Quality Control Board

Region	Agricultural Guidelines for Chloride
1. North Coast	No chloride guideline thresholds.
2. SF Bay	Guideline Threshold: 142.0 mg/L[13] WQO "Limit:" 355.0 mg/L[13] No crops specifically discussed. "The University of California Cooperative Extension has developed threshold and limiting concentrations for livestock and irrigation water. Continued irrigation often leads to one or more of four types of hazards related to water quality and the nature of soils and crops. These hazards are (1) soluble salt accumulations, (2) chemical changes in the soil, (3) toxicity to crops, and (4) potential disease transmission to humans through reclaimed water use." (p9) For an extensive discussion of water quality for agricultural purposes, see "A Compilation of Water Quality Goals," Central Valley Regional Water Quality Control Board, May 1993.
3. Central Coast	Waters shall not contain concentrations of chemical constituents in amounts which adversely affect the agricultural beneficial use. Interpretation of adverse effect shall be as derived from the University of California Agricultural Extension Service guidelines provided in Table 3-3: **Excerpts from Table 3-3. Guidelines for Interpretation of Quality of Water for Irrigation[a]** **Specific ion toxicity from root absorption - chloride:** "No problem": <142 mg/L "Increasing problems": 142 – 355 mg/L "Severe: >355 mg/L "Most tree crops and woody ornamentals are sensitive to sodium and chloride (use values shown). Most annual crops are not sensitive (use salinity tolerance tables)" **Specific ion toxicity from foliar absorption (sprinklers) – chloride:** "No problem": <106 mg/L "Increasing problems": >106 mg/L a. Interpretations are based on possible effects of constituents on crops and/or soils. Guidelines are flexible and should be modified when warranted by local experience or special conditions of crop, soil, and method of irrigation.
4. Los Angeles	For areas with "no waterbody specific objective" the guideline range for establishing effluent limits is 100 – 355 mg/L chloride based on various references. See footnote "f" to Table 3-8 in Basin Plan.

[13] See Table 3-6 in San Francisco Bay (Region 2) Water Quality Control Plan (amendments approved by OAL as of January 18, 2007).

Region	Agricultural Guidelines for Chloride
5. Central Valley	The Sacramento-San Joaquin River Basin Plan contains no specific chloride objectives for the AGR beneficial use. Table III-3 (non-Delta Sacramento-San Joaquin river basins) establishes limits for salinity (TDS and electrical conductivity) only. However, the Regional Board has published a "Management Guidance for Salinity in Waste Discharge Requirements," which generally is used by permit writers to establish Salinity Limitations in permits.[14] The general guidance is that salinity values up to 700 umhos/cm are considered to have no impact on any crop. The most salt-sensitive crops become impacted at around 700 umhos/cm, etc. In addition, permit writers are to utilize a screening value of "700 umhos/cm, or 450 mg/l TDS, and 106 mg/L chloride" in establishing salinity effluent limits.[15] The Tulare Lake Basin Plan does not contain water quality objectives for chloride, but does contain chloride limits for wastewater discharges that vary by waterbody. Among the discharge limits is a category under "Discharges to Land" that establishes criteria for mineral quality of irrigation water. For chloride the criteria is as follows: Class I <175 mg/L Class II 175-350 mg/L Class III >350 mg/L In addition, the Basin Plan contains limits for electrical conductivity in surface waters and limits on annual increases in electrical conductivity in groundwater.
6. Lahontan	The Basin Plan contains chloride WQOs, which vary by water body. No specific guidelines for protecting crops is specified in the Basin Plan other than a general statement that "in determining compliance with objectives including references to the AGR designated use, the Regional Board will refer to water quality goals and recommendations from sources such as the Food and Agriculture Organization of the United Nations, University of California Cooperative Extension, Committee of Experts, and McKee and Wolf's "Water Quality Criteria" (1963)."
7. Colorado River Basin	No chloride guideline thresholds for agriculture.
8. Santa Ana	"A safe value for irrigation is considered to be less than 175 mg/L of chloride." (p. 4-7) Water quality objectives for specific water bodies range from 55 mg/L to 180 mg/L.

[14] See Memo "Management Guidance for Salinity in Waste Discharge Requirements" from the Regional Board's Executive Management Group (April 26, 2007) available at http://www.waterboards.ca.gov/centralvalley/water_issues/salinity/programs_policies_reports/salt-2007-guide-mem.pdf.

[15] *Id*. at p. 12 (Attachment A flowchart).

Region	Agricultural Guidelines for Chloride
9. San Diego	**Guidelines for Interpretation of Quality of Water for Irrigation – Degree or Restriction on Use:** **Specific ion toxicity from surface irrigation - chloride:** None: <140 mg/L Slight to Moderate: 140 – 350 mg/L “Severe: >350 mg/L “Most tree crops and woody ornamentals are sensitive to sodium and chloride (use values shown). Most annual crops are not sensitive (use salinity tolerance tables)” **Specific ion toxicity from sprinkler irrigation – chloride:** None: <100 mg/L Slight to moderate: >100 mg/L “Interpretations are based on possible effects of constituents on crops and/or soils. Guidelines are flexible and should be modified when warranted by local experience or special conditions of crop, soil, and method of irrigation. Table 3-1 is based on Table 3-4 contained in "*Irrigation with Reclaimed Municipal Wastewater, A Guidance Manual,*" California State Water Resources Control Board, Report Number 84-1, July 1984.” (p3-9) “Most tree crops and woody ornamentals are sensitive to sodium and chloride; use the values shown. Most annual crops are not sensitive; use the salinity tolerance tables” (p3-9) “With overhead sprinkler irrigation and low humidity (<30%), sodium or chloride greater than 70 or 100 mg/l, respectively, have resulted in excessive leaf absorption and crop damage to sensitive crops.” (p3-9)

In summary, both water quality objectives and regional guidelines for the protection of crops vary by region and individual water body. The Los Angeles Region has established water quality objectives ranging from 100 mg/L to 150 mg/L for areas with agricultural beneficial uses. The Santa Ana Region declares that “[a] safe value for irrigation is considered to be less than 175 mg/L of chloride.” and the Tulare Lake Basin Plan uses <175 mg/L to define Class I irrigation waters. The Central Coast Region has uses a threshold value of less than 142 mg/L at which specific chloride toxicity from root absorption presents no problem, while the “no problem” threshold for foliar absorption (sprinklers) is less than 106 mg/L. The Bay Area Regional Water Board’s guideline threshold is 142 mg/L similar to the Central Coast region, but establishes an actual water quality objective “limit” of 355 mg/L. The San Diego Regional Water Board uses a threshold guidance of less than 140 mg/L at which no harm occurs for non-sprinkler irrigation and less than 100 mg/L for sprinkler irrigation. For water bodies in the Los Angeles-Ventura region that do not have a chloride objective, the guideline range for establishing effluent limits is 100 – 355 mg/L chloride depending on the types of crops being grown.

2.1.3 Reaches 5 and 6 Surface Water Chloride SSO Alternatives and Recommended SSOs

A number of alternatives were considered as site-specific objectives for Reaches 5 and 6 of the Santa Clara River:

1. Maintain 100 mg/L and add an averaging period.
2. Use 150 mg/L as the SSO to match the established water quality objectives in the Santa Clara and Calleguas Creek watersheds.
3. Use 142 mg/L as the SSO because of its use as low threshold in *Guidelines for Interpretation of Quality of Water for Irrigation* (Guidelines).
4. Use 175 mg/L as the SSO as the high end of the available guidance.

Alternative 1 was not selected because it was considered to be overly conservative for reaches that do not contain salt-sensitive crops. The LRE study provided a range of chloride guidelines that were appropriate for salt-sensitive crops (100 mg/L to 117 mg/L) and utilizing the low end of the range for reaches where salt-sensitive crops do not currently exist and are not likely to exist in the future, is considered to be overly conservative. Additionally, the use of this SSO alternative would prevent the consideration of the AWRM compliance option.

Alternative 2 is the proposed alternative. A chloride objective of 150 mg/L for Reaches 5 and 6 is consistent with the water quality objectives for the Santa Clara River Reach 2 and the Calleguas Creek watershed above Potrero Road. Both of these areas have designated agricultural beneficial uses and a variety of crops are grown. The crop types grown in Reach 2 (strawberries, row crops, and citrus) as well as in the Calleguas Creek watershed (avocados, citrus, strawberries, row crops, nurseries) cover the types of crops that are present in Reaches 5 and 6. Although information about the irrigation practices in Santa Clara River Reach 2 is not available, in the Calleguas Creek watershed, growers do not generally use surface water from the Calleguas Creek watershed to irrigate their crops. The primary water supply sources for agriculture in the Calleguas Creek watershed are similar to Reaches 5 and 6 of the USCR (local groundwater, reclaimed wastewater, and imported water). Finally, 150 mg/L is consistent with guidance used throughout California for protection of the AGR beneficial use (and lower than the values used for some regions) and is within the agricultural guidelines outlined in the Los Angeles Basin Plan. Based on the consistency of the crops grown and water supplies used for agricultural irrigation between the three areas and consistency with other agricultural guidelines, 150 mg/L is the recommended alternative.

Alternative 3 requires the use of guidelines utilized by other regions for protection of agricultural uses. Given that the Los Angeles Regional Water Quality Control Board has already established chloride water quality objective for surface waters in the Santa Clara and neighboring Calleguas Creek watershed, and these watersheds support agricultural beneficial uses, the use of guidelines from other regions is not the preferred alternative.

Alternative 4 was based on guideline thresholds for agriculture contained in the Santa Ana Regional Water Quality Control Board (Region 8) Basin Plan, which states "A safe value for irrigation is considered to be less than 175 mg/L of chloride" (p. 4-7) and the Tulare Lake criteria for Class I irrigation waters. This guideline was not selected for the same reasons as Alternative 3. The use of established water quality objectives in the Los Angeles Region was preferred over the use of a guideline from other regions.

2.1.3.1 Comparison of Historical and Projected Water Quality with Existing WQOs and Proposed SSOs for Reaches 5 and 6

Historical (1975-2005) and projected (2006-2030) chloride concentrations for surface water were compared with the existing WQOs and proposed SSOs for Reaches 5 and 6 to ensure that a water quality objective of 150 mg/L is consistent with observed concentrations. Based on GSWIM results, an estimate of the percentage of time that the water quality has exceeded 100 mg/L and 150 mg/L for the periods 1975 -2005 (GSWIM calibration period), and 2006 – 2030 (GSWIM future projection periods) was developed. Table 10 and Table 8summarize the estimated percentage of time the existing chloride objectives and proposed chloride SSOs for Reaches 5 and 6 have been exceeded based on model calibration (1975-2005) and future projection (2006-2030) periods, respectively. The projected water quality is based on chloride concentrations simulated based on the AWRM compliance option as discussed in the Task 2B-2 report.

Table 7. Summary of Exceedances of Water Quality Objectives in Reaches 5 and 6 (1975-2005)

Reach	Location	Percent exceedance 100 mg/L	Percent exceedance 150 mg/L
6	Downstream Saugus (RB)	82%	18%
5	Upstream Valencia (RC)	39%	3%
5	Downstream Valencia (RD)	62%	13%
5	Near Castaic (RE)	53%	9%

Table 8. Summary of Exceedances of Water Quality Objectives in Reaches 5 and 6 (2006-2030) with AWRM Compliance Option

Reach	Location	Percent exceedance 100 mg/L	Percent exceedance 150 mg/L
6	Downstream Saugus (RB)	68%	1.4%
5	Upstream Valencia (RC)	43%	0.3%
5	Downstream Valencia (RD)	63%	0.4%
5	Near Castaic (RE)	56%	0.3%

Figures 1, 2, and 3 show the GSWIM output over time for the receiving water stations identified in Table 10 and Table 8. The figures include highlighted lines to show how historical and future projected chloride concentrations compare with the existing WQO and proposed SSO of 100 mg/L and 150 mg/L, respectively.

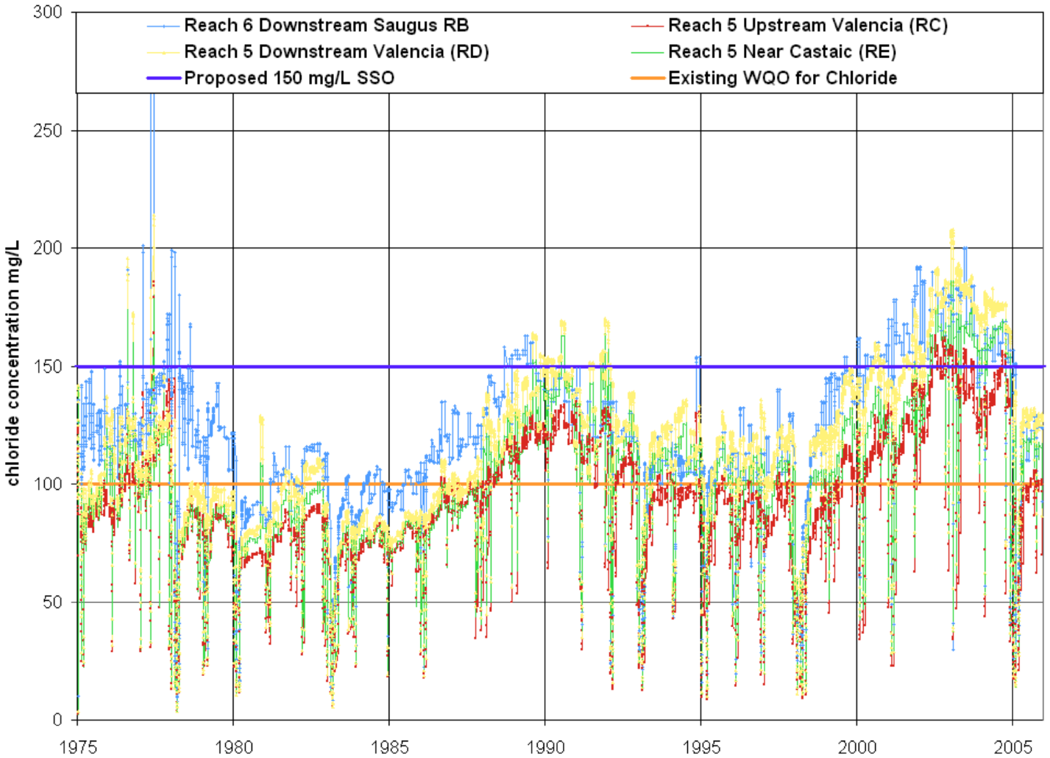

Figure 1. GSWIM Historical Chloride Concentrations in Reaches 5 and 6

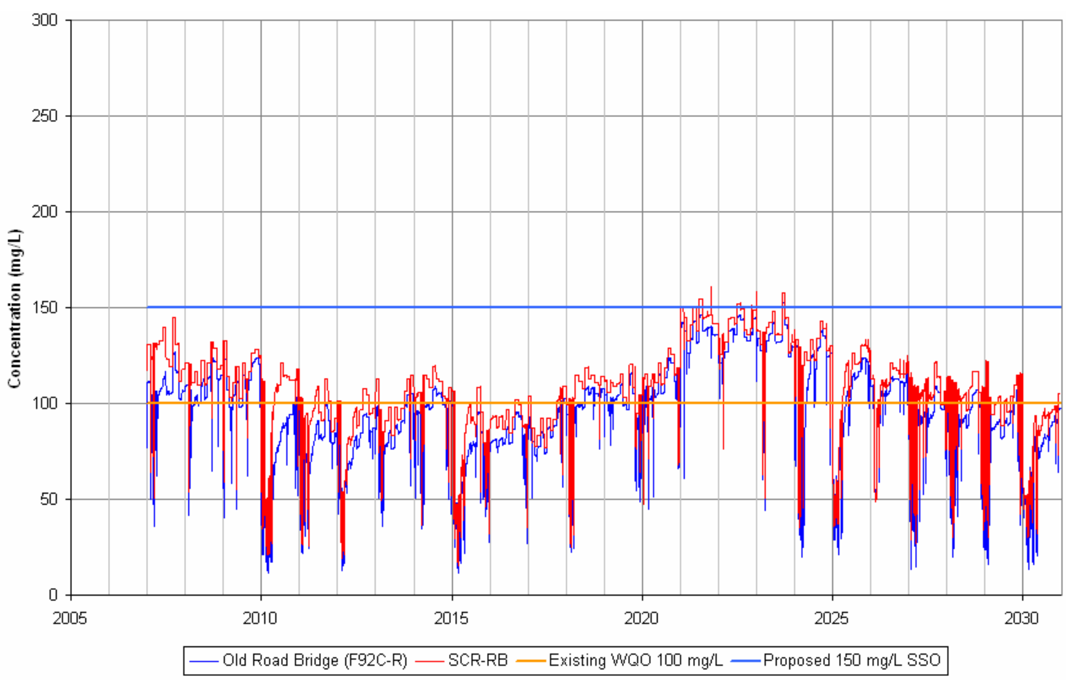

Figure 2. GSWIM Projected Chloride Concentration at Old Road Bridge and SCR-RB (AWRM)

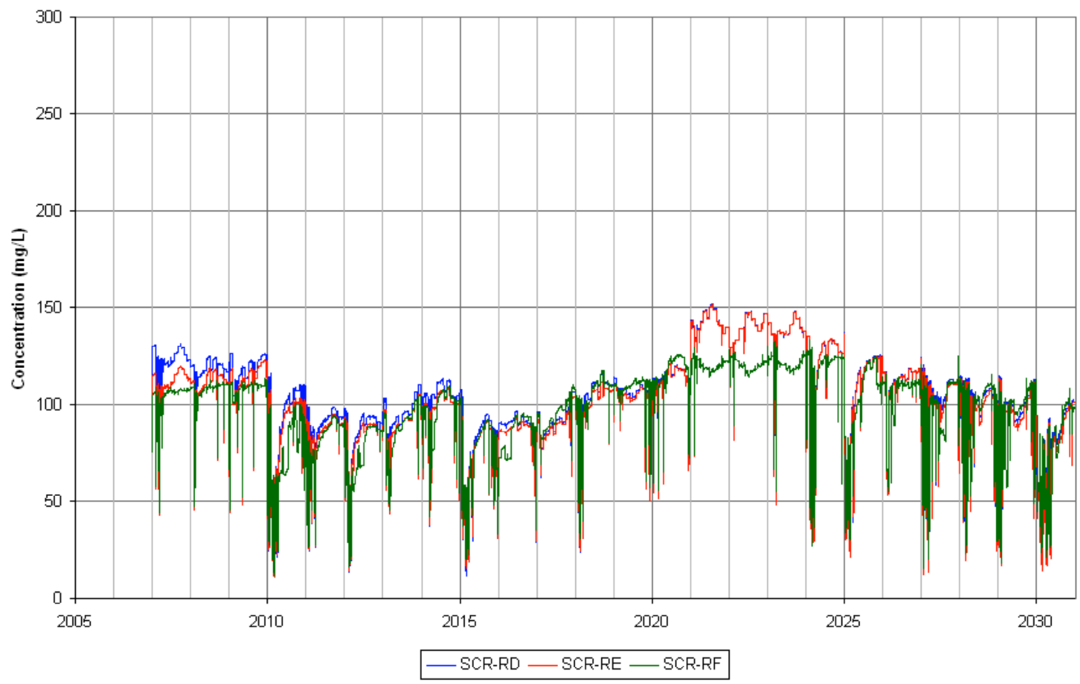

Figure 3. GSWIM Projected Chloride Concentration at Receiving Water Monitoring Stations RD, RE, and RF (AWRM)

In conclusion, the analysis shows that the 100 mg/L water quality objective and the proposed 150 mg/L SSOs have been exceeded historically, especially during dry and critically dry periods. Additionally, there are periods in the more recent historical record (e.g., in 2003 time period), where chloride concentrations in the receiving waters in Reaches 5 and 6 have exceeded the proposed SSO of 150 mg/L for these reaches. As a result, increasing the objective to 150 mg/L will not result in poorer water quality than has already existed previously in this waterbody.

Additionally, as shown in Section 3.1.2, discussion of compliance with historic limits, the effluent water quality from Valencia and Saugus WRPs has exceeded 150 mg/L on numerous occasions historically. As a result, compliance with 150 mg/L SSO will require actions (as discussed in the description of the AWRM compliance option) to reduce the chloride in effluent discharges. The AWRM compliance option results indicate that this is a feasible option that will comply with the proposed SSOs for Reaches 5 and 6.

2.1.4 Reaches 5 and 6 Surface Water Objective Averaging Period

As discussed above, the use of surface water from Reaches 5 and 6 or groundwater that could be impacted by surface waters from Reaches 5 and 6 for irrigation of salt sensitive crops is not a past, present, or probable future use. As a result, the primary beneficial use being protected by these water quality objectives is the groundwater recharge (GWR) use. The use of instantaneous objectives is not necessary to protect the surface water agricultural uses or the GWR use for a number of reasons:

- Instantaneous peaks near 150 mg/L do not cause harm, even to salt sensitive agriculture. In the LRE averaging period study, exposure periods of weeks to months were necessary to see impacts, at higher concentrations (Newfields, 2007). Because salt sensitive agriculture is not a beneficial use in this reach, instantaneous objectives are not needed and averaging periods longer than necessary to protect salt sensitive agriculture may be warranted.
- The GWR beneficial use is utilized to ensure groundwater quality is protected for other purposes. In this case, the objectives are being developed to ensure recharge of groundwater does not impact the use of the groundwater basin for agricultural uses. As discussed above, the AGR beneficial use does not require instantaneous objectives. As a result, an averaging period is appropriate to protect the GWR use as well.

Based on this information, an averaging period is appropriate to protect the AGR and GWR beneficial uses in Reaches 5 and 6.

Given that instantaneous objectives near 150 mg/L are not necessary to protect the AGR or GWR beneficial uses, an appropriate averaging period to protect these uses needs to be defined. To define an appropriate averaging period for surface water quality objectives for Reaches 5 and 6, the following approach was utilized:

1. Evaluate historical and current regulatory approaches to determining averaging periods to protect AGR and GWR beneficial uses.
2. Evaluate impacts of surface water discharges on GWR and groundwater basin AGR uses.
3. Ensure potential peak discharges under proposed averaging periods will not result in exceedances of the aquatic life objectives for chloride or impact other beneficial uses.

Each of these analyses is discussed in detail in the following sub-sections.

2.1.4.1 Historical and Current Regulatory Approaches

The use of averaging periods for water quality objectives is consistent with USEPA and state guidance. USEPA develops recommended criteria that include a duration which is "the period of time (averaging period) over which the instream concentration is averaged for comparison with criteria concentrations" (USEPA, 1991). To determine an appropriate averaging period for salts, an evaluation of averaging periods that have been used historically in the Los Angeles Region was conducted. The evaluation looked at previous Basin Plans, technical work used to support changes to the Basin Plans and permitting practices in the region. The review also considered regulatory practices utilized by other Regional Boards.

2.1.4.1.1 Los Angeles Region Basin Plan

The Water Quality Control Plan for the Santa Clara River Basin adopted in March 1975 (1975 Basin Plan) established chloride surface water and groundwater quality objectives for the Santa Clara River Watershed that included an annual averaging period. The surface water objectives established in 1975 (included in Table 4-1 of the 1975 Basin Plan) corresponded to the end of each reach and were based on a "weighted annual average" according to footnote "a" of that table.[16] Although the reach designations changed pursuant to the 1978 amendments to the Basin Plan, footnote "a/" remained in the Basin Plan until removed in the 1994 Basin Plan amendments. For groundwater, the 1975 Basin Plan provided that the groundwater mineral objectives, which included chloride, were interpreted as flow-weighted annual averages during the water year (October 1 through September 30).[17]

In 1994, surface water and groundwater objectives for salts in the Santa Clara River were revised based on a DWR report entitled *Investigation of Water Quality and Beneficial Uses: Upper Santa Clara River Hydrologic Area* (DWR, 1993). The purpose of the project was to (1) determine current mineral water quality conditions, (2) develop new objectives for tributaries and reaches not addressed in the Basin Plan and (3) recommend additions or revisions to the beneficial uses and mineral objectives for the USCR (DWR, 1993). All of the analyses to evaluate revisions to the surface water objectives for the USCR in this report are conducted as annual average weighted concentrations. Although the footnote discussing the application of the objectives was not included in the 1994 Basin Plan, all recommended changes to the water quality objectives presented in the DWR report were as annual average weighted concentrations. The 1993 DWR report was the last comprehensive review of the water quality objectives for the USCR.

Based on the initially established application of the salts water quality objectives and the fact that the report recommending changes to the water quality objectives in 1994 did not recommend an alternative averaging period, the use of an annual or weighted annual averaging period would be consistent with historic regulatory approaches in the Los Angeles Region.

2.1.4.1.2 Los Angeles Region Permitting Practices

Effluent limits for salts in the Los Angeles Region have been established as daily maximums, monthly averages and 12 month rolling averages at various times for dischargers in the Santa Clara and Calleguas Creek watersheds. Currently, the interim effluent limits in the current Time Schedule Orders for the Saugus and Valencia Water Reclamation Plants (based on the interim wasteload allocations in the Chloride TMDL) are expressed as twelve-month rolling averages for both plants. (See Table 7-6.1 in Attachment A to Resolution No. 04-004 and Section 3.1.2).

[16] The averaging period language stated "The objective at each station is the weighted annual averages. Samples shall be collected preferably at monthly intervals and at least at quarterly intervals. Flow rate shall be determined at the time of sampling." (LARWQCB, 1992). See also footnote "a" to Table 7 Water Quality Control Plan Los Angeles Region (4) Abstracts and Appendices of 1975 Plans (Reprinted with 1978, 1990, 1991, 1992) changes.)

[17] See 1975 Basin Plan, p. I-4-15.

2.1.4.1.3 Averaging Periods Used in Other Regions

Other Regional Water Quality Control Boards have adopted water quality objectives using averaging periods for salts for water bodies outside of Region 4. A summary of the averaging periods used for salts in other regions is shown in Table 9.

Table 9. Basin Plan Salts Averaging Periods by Regional Water Quality Control Board

Region	Salt Averaging Period
1. North Coast	In the North Coast Basin Plan, water quality objectives based on preventing degradation for TDS, chloride, and sulfate shown in Table 3-1 and are interpreted as follows (footnotes 2 and 3): [2] 50% upper and lower limits represent the 50 percentile values of the monthly means for a calendar year. 50% or more of the monthly means must be less than or equal to an upper limit and greater than or equal to a lower limit. [3] 90% upper and lower limits represent the 90 percentile values for a calendar year. 90% or more of the values must be less than or equal to an upper limit and greater than or equal to a lower limit.
2. SF Bay	No averaging periods specified for most waterbodies. Specific objectives for TDS and chloride are established for Alameda Creek Watershed above Niles that include 90-day arithmetic means, 90th percentile 90 day average, and daily maximum objectives.
3. Central Coast	In the Central Coast Basin Plan, water quality objectives based on preventing degradation for TDS, chloride, and sulfate shown in Table 3-7 are annual mean values (as referenced in footnote a).
4. Los Angeles	No averaging periods are currently assigned for the salts objectives. Historically, weighted annual averages were used.
5. Central Valley	The Sacramento-San Joaquin River Basin Plan does not include averaging periods for salts. The Tulare Lake Basin Plan contains waterbody specific objectives for electrical conductivity in surface waters in Table III-2. The objectives in the table do not include averaging periods. However, some reaches have a footnote that designates a maximum 10 year average objective in addition to the objectives in the table. The groundwater basin objectives for electrical conductivity are a maximum annual average increase in EC.
6. Lahontan	In the Lahontan Basin Plan, water quality objectives based on preventing degradation for TDS, chloride and sulfate shown in Tables 3-7 through 3-21 are either annual averages or the mean of the monthly mean for the period of record (as referenced in footnote 1 or 2).
7. Colorado River Basin	The Colorado River Basin includes a flow-weighted annual average objective for TDS at three points in the Colorado River.
8. Santa Ana	No averaging periods specified for most waterbodies. A five year moving average is used for TDS in Reach 2 of the Santa Ana River.
9. San Diego	In the San Diego Basin Plan, water quality objectives based on preventing degradation for TDS, chloride, and sulfate are shown in Table 3-2 and cannot be exceeded more than 10% of the time during any one year period.

Based on review of regulatory approaches to averaging periods for salts in other regions, the use of annual averaging periods is the most common with some regions having no averaging periods, some with averaging periods of three months, and some with longer periods (5 to 10 years).

2.1.4.2 Surface Water Impacts on GWR Beneficial Use

In addition to the regulatory approaches, consideration of the impacts of surface water recharge on groundwater basins was evaluated. Given that salt-sensitive agriculture is not a past, present or probable future use of the surface water, the agricultural beneficial uses of groundwater recharged by surface water needs to be protected. In this section, flow information was reviewed to determine if groundwater recharge is occurring in Reaches 5 and 6.

Results from the GSWIM provide insight into the flow characteristics of the Upper Santa Clara River. "Reach 6 of the SCR to near the beginning of Reach 5 marks a transition from losing to gaining stream conditions. Reach 5 is predominantly gaining. Groundwater discharge to the SCR increases in a westerly direction along Reaches 6 and 5 as the SCR channel decreases in elevation and intersects the groundwater table. So, stream infiltration in the SCR decreases in a westerly direction along Reaches 6 and 5" (CH2M Hill email, 2008).

A USGS Study also demonstrated that Reach 5 was a gaining reach. Tracer and flow studies conducted in 1999 and 2000 showed that the Santa Clara River was gaining groundwater from the Valencia WRP discharge to approximately the Blue Cut gauging station (USGS, 2003). Discussion in the 1993 DWR report also states that the Santa Clara River has rising groundwater from Old Road Bridge to Blue Cut (DWR, 1993).

An analysis of the flow results from the model was used to assess the typical flow conditions in the stream. Between the Old Road Bridge and Blue Cut, the modeled flow indicates a general increase in flows in the reach. For greater than 99% of the modeled period, the flows at Blue Cut were greater than the flows downstream of the Valencia WRP. As such, this reach can be considered to be a gaining reach and the groundwater recharged by overlying surface water is minimal. Hence, an averaging period for Reach 5 is not expected to impact the GWR beneficial use in this reach, because there is minimal recharge occurring. Considering the finding that salt sensitive agriculture is also not present in this reach, any averaging period could be used for Reach 5.

The flow analysis for Reach 6 indicates that this reach is transitioning from a losing to a gaining reach. Depending on the height of the water table, incidental groundwater recharge from surface water may occur in this reach. A comparison of the modeled flows from the Saugus WRP to the gauging station at Old Road Bridge for model calibration period (1975-2005) shows that for 21% of the modeled period, the flows at Old Road Bridge are less than the flows at the Saugus WRP. The flow loss was up to 3.3 cfs on one occasion, but the remainder of the time was below 2.5 cfs. The average flow loss was 1.2 cfs. Incidental groundwater recharge appears to occur during some periods in this reach. As a result, any averaging period must consider groundwater recharge beneficial uses for Reach 6.

2.1.5 Reaches 5 and 6 Chloride Surface Water SSO Averaging Period Alternatives and Recommended Averaging Periods

A number of alternatives were considered as averaging periods for the chloride surface water objectives for Reaches 5 and 6 of the Santa Clara River:

1. Maintain current instantaneous averaging period.
2. Use annual averaging period.
3. Use flow-weighted annual averaging period.

As discussed in the rationale for developing an averaging period, instantaneous objectives are not necessary to protect beneficial uses in Reaches 5 and 6. Based on the evaluation presented above, Alternative 1 was not selected as the preferred alternative.

Alternative 2 is the preferred alternative. Annual averaging periods have been used historically in the Los Angeles Region and throughout California for salts objectives. Given that annual averages were also used historically for the groundwater basins in the USCR, an annual average would protect the GWR beneficial use in Reach 6.

Alternative 3 was also considered because a weighted annual average was used historically in the Los Angeles region. However, sufficient information is not available to ensure that a flow-weighted annual average would be protective of the GWR beneficial use in Reach 6. Additionally, a flow-weighted annual average could mask peak concentrations during dry weather, which is the critical condition for agricultural beneficial uses.

2.1.5.1 Evaluation of Protection of Aquatic Life Beneficial Uses

Using an annual average chloride objective of 150 mg/L results in the potential for short term higher chloride concentrations to occur in the river. An evaluation of historic and predicted future chloride concentrations from the GWSIM was used to determine if the one-hour aquatic life criteria of 860 mg/L or the 4-day average chloride criteria of 230 mg/L were likely to be exceeded. As shown in Figure 1through Figure 3 and as discussed in Section 2.1.3.1, compliance with the 150 mg/L objective will require reductions in chloride discharges. As a result, if historic and predicted future model results do not show exceedances of the aquatic life criteria, then a 150 mg/L objective with an annual averaging period will be protective of aquatic life

beneficial uses. Figure 4 through

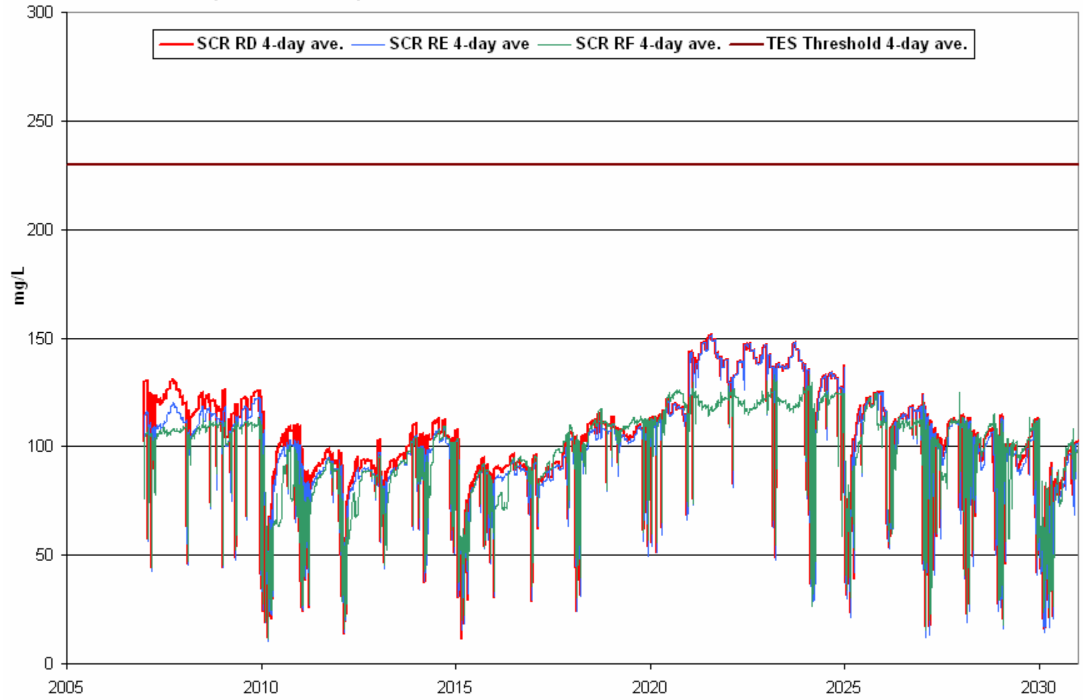

Figure 6 show the 4-day average historic and predicted future chloride concentrations respectively.

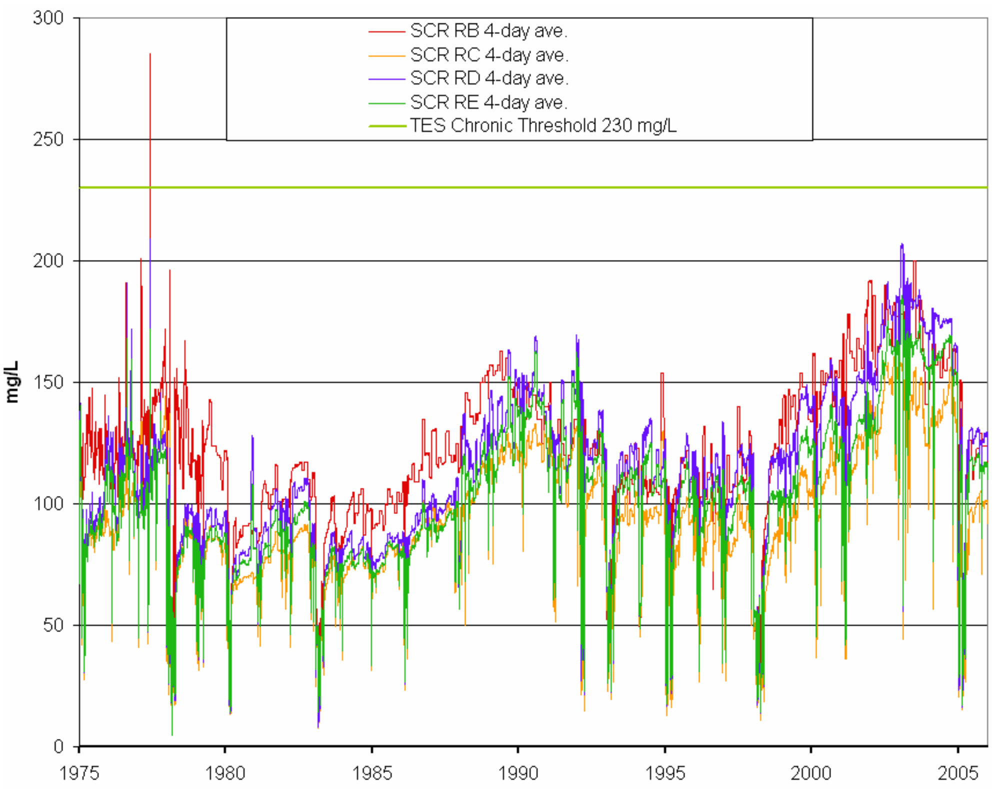

Figure 4. Four-day Averages of GSWIM Historical Chloride Concentrations at Monitoring Stations RB, RC, RD, and RE (AWRM)

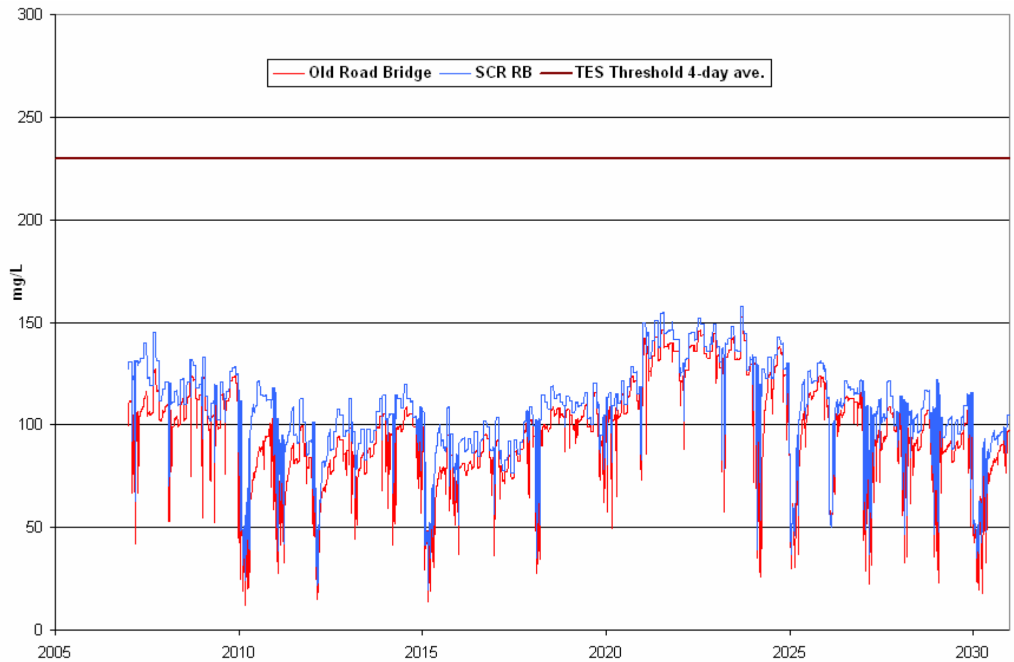

Figure 5. Four-day Averages of GSWIM Projected Chloride Concentration at Old Road Bridge and SCR-RB (AWRM)

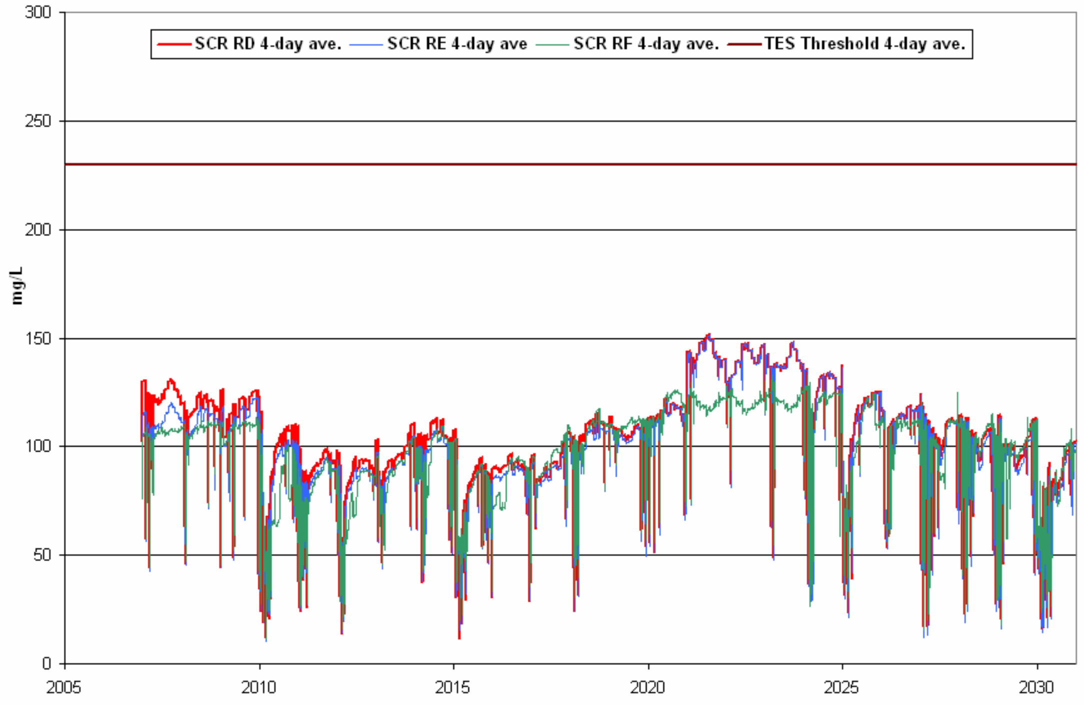

Figure 6. Four-day Averages of GSWIM Projected Chloride Concentration at SCR-RD, RE, and RF (AWRM)

The 4-day average GSWIM predicted chloride concentrations in the figures above do not exceed the TES chronic level with the exception of one four-day period in 1977 when the 4-day averages on each day exceeded the threshold. Based on Figure 1 through Figure 3 in Section 2.1.3.1, the 860 mg/L one-hour acute threshold was never exceeded in the historic or projected modeling periods. Therefore, an annual averaging period is protective of aquatic life and TES in Reaches 5 and 6.

2.2 REACH 6 GROUNDWATER OBJECTIVES

The rationale for developing groundwater SSOs for the groundwater basin underlying Reach 6 of the USCR (Santa Clara-Bouquet and San Francisquito Canyons and Castaic Valley) is as follows:

- As discussed in White Paper No. 2A, salt sensitive agricultural beneficial uses are not a past, present, or probable future use of the groundwater in Reach 6. The only salt-sensitive agriculture currently in the vicinity of Reach 6 that could be impacted by groundwater recharged by surface water is irrigated using State Water Project water.
- Historic water quality objectives for this groundwater basin were established in 1975 at salt levels that are higher than current water quality objectives and were reflective of historic and current basin water quality.
- Consistency between surface water and groundwater objectives is justified based on GSWIM results that indicate that overlying surface water incidentally recharges groundwater underlying Reach 6. Both historic and current surface water quality are consistent with the proposed water quality objectives for groundwater and surface water in Reach 6.

To define appropriate SSOs for groundwater quality objectives for Reach 6, the following approach was utilized:

1. Evaluate concentrations necessary to protect beneficial uses in the groundwater basins.
2. Evaluate current and historic water quality in groundwater basin, and the interactions of surface water with groundwater.
3. Evaluate historical and current water quality objectives for the basin.

Each of these analyses is discussed in detail in the following sub-sections.

2.2.1 Water Quality Necessary to Protect Beneficial Uses in Reach 6

As discussed in White Paper No. 2A salt sensitive agricultural beneficial uses are not a past, present, or probable future use of the groundwater in Reach 6. As discussed in Sections 3.2.2.3 and 3.2.2.4, with the exception of a commercial nursery, no agricultural operations currently exist in Reach 6 and none are likely to exist in the future given the changing land use pattern in the area. The commercial nursery located in the Reach 6 area is served exclusively with State Water Project water, served by a local water purveyor, so there would be no potential impact on this nursery. (See Section 3.2.2.3). Based on the analysis conducted for the surface water objectives, a chloride concentration of 150 mg/L for groundwater in Reach 6 would be protective of agricultural beneficial uses of the groundwater basin and consistent with the existing groundwater objectives underlying Reach 5, where cultivation of non-salt sensitive agriculture occurs.

The other potential beneficial use of the groundwater basin that needs to be considered is the municipal potable supply. The "recommended" secondary maximum contaminant level (MCL) for chloride is 250 mg/L.

2.2.2 Current and Historic Groundwater Quality and Groundwater-Surface Water Interactions in Reach 6.

The data used to develop the GSWIM provides insight into the historic and current water quality present in the Reach 5 and 6 groundwater basins for chloride. Figure 4-17 in the Task 2B-1 Report shows measured and modeled chloride concentrations in alluvium wells underlying Reach 6 of the Santa Clara River. The graphs show that measured concentrations in the wells vary over time by as much as 60 mg/L. Additionally, for several wells, the concentrations of chloride in 1989/90 represented a low concentration period. Concentrations increased over the next few years, likely as a result of the continued drought, then decreased and then increased again in the early 2000's when drier conditions returned. The majority of the wells had concentrations above 100 mg/L at some point in the period of record and many had concentrations of at least 140 mg/L (CH2M Hill, 2008).

For TDS and sulfate, as presented in the 1993 DWR Report (discussed in more detail below), the following range of historical TDS and sulfate concentrations has been observed in groundwater underlying Reach 6.

Table 10. Groundwater Ranges for TDS and Sulfate from 1938-1990 (taken from DWR, 1993 Table 11)

Reach	Location	Range TDS Concentrations (mg/L)	Range Sulfate Concentration (mg/L)
6	Above Castaic Creek to Bouquet Canyon	330-5150	37-3167

As shown in this table, the concentrations of TDS and sulfate vary spatially and over time in the groundwater underlying Reach 6. Additional historical TDS data collected for specific alluvial wells within the vicinity of Reach 6 (a subset of the wells presented in the DWR report above), was gathered as part of the GSWI Task 1A Report (CH2M Hill, 2006; Appendix L). The data for these alluvium wells used for the modeling effort indicate historical TDS concentrations that have exceeded the current TDS objective of 700 mg/L, with maximum measured TDS concentrations in some wells ranging from 750 mg/L to as high as 1300 mg/L. Lastly, as indicated in Sub-section 3.1.4.2, an analysis of the flow results from the model was used to assess the typical flow conditions in the stream in Reach 6. The flow analysis for Reach 6 indicates that this reach is transitioning from a losing to a gaining reach. Depending on the height of the water table, incidental groundwater recharge may occur in this reach. A comparison of the modeled flows from the Saugus WRP to the gauging station at Old Road Bridge for model calibration period (1975-2005) shows that for 21% of the modeled period, the flows at Old Road Bridge are less than the flows at the Saugus WRP. The flow loss was up to 3.3 cfs on one occasion, but the remainder of the time was below 2.5 cfs. The average flow loss was 1.2 cfs. Because incidental groundwater recharge with overlying surface water appears to occur during some periods in this reach, consistency between overlying surface water and groundwater salt objectives would appear appropriate.

2.2.3 Historic Water Quality Objectives

In preparation for revisions to the Basin Plan in 1994, the Regional Board contracted with the Department of Water Resources (DWR) to conduct a study of the Upper Santa Clara River hydrologic area. The purpose of the project was to (1) determine current mineral water quality conditions, (2) develop new objectives for tributaries and reaches not addressed in the Basin Plan and (3) recommend additions or revisions to the beneficial uses and mineral objectives for the USCR (DWR, 1993). The results of the study were presented in a final report (*Investigation of Water Quality and Beneficial Uses: Upper Santa Clara River Hydrologic Area*) with recommendations for changes to the surface water and groundwater objectives in the Upper Santa Clara River. For each constituent and reach for which a change was recommended in the DWR report, the water quality objectives were changed in the 1994 Basin Plan. In some cases, the recommended objectives from DWR were used and in other cases the objectives were lowered below the recommended values from DWR. This section provides a summary of the basis of analysis conducted in that report and the recommended objective changes.

For the groundwater basin analysis, water quality data was gathered from wells in each subarea of the groundwater basin. Data were reviewed using the entire period of record. Additionally, a large data collection effort was undertaken in 1989/90 to gather data from wells that either had never been monitored or had limited data. Two different analyses were conducted based on the data sets:

1. Data were compared to existing Basin Plan objectives.
2. Trends in chloride concentrations were evaluated for wells with long periods of record.
3. If the trends indicated improved water quality over time or if the measured data from 1989/90 were below the existing Basin Plan objectives, then recommendations were made to lower the water quality objectives.

For the subarea underlying Reach 6 (Castaic Creek to Bouquet Canyon), the measured data for 1989/90 were below the TDS, sulfate and chloride objectives. Additionally, a decreasing trend in chloride was observed in seven wells with long periods of record (approximately 10 mg/L between 1975 and 1989). However, the report also noted that annual variations in quality from each well were observed. Figure 52 in the report demonstrates consistent annual chloride concentration fluctuations of 10 mg/L in most of the wells with fluctuations of 25 mg/L observed at some times in some wells.

In response to the results of the analysis, changes were recommended to the water quality objectives for the groundwater underlying Reach 6. "The evaluation found quality conditions to be better than the existing objectives for TDS, sulfate, and chloride constituents. Trend evaluation of chloride concentrations showed a statistically significant improvement had occurred over time. To protect this quality and the beneficial uses, revised objectives are recommended that are 100 mg/L less than the current TDS objective and 50 m/L less than the current sulfate and chloride objectives." (DWR, 1993).

Similar analyses were conducted for the groundwater underlying Reach 5 of the Santa Clara River. For this reach, the quality of the basin was found to be better than the Basin Plan objectives for TDS and sulfate. In this case, the improvement in water quality was attributed to the increased use of imported State Water Project water. "A probable cause of this improvement has been the increased use of imported State Water Project waters in the study area and the improvement in the quality of effluent from the two major waste water reclamation plants that discharge upgradient of this subdivision." (DWR, 1993). Chloride objectives changes were not recommended for this groundwater subdivision.

The report also included the following information that is relevant to the consideration of the revisions:

1. The groundwater data set contained some wells that had been consistently sampled over the period of record, but about 85% of the data were from wells sampled only once or a few times in the 50-year period of record.
2. The bulk of the analysis was conducted based on the 1989/90 sampling done by the RWQCB.

The analysis presented in the DWR report for Reaches 5 and 6 relies on a few key assumptions:

1. The quality of the imported water brought into the basin will continue to be of better quality than the more "natural" conditions of the groundwater basins observed in 1975 when the objectives were originally set.
2. Imported water will continue to be a primary source of water for the region.
3. Water quality observed in 1989/90 is representative of groundwater quality over time in the basins.

Analysis conducted for the GWSIM, current understanding of potential future water supplies for the USCR and their quality, and additional data collection that has been done since 1993 reveals some potential issues with these assumptions.

1. The decreasing trends that are attributed to the introduction of imported water may not continue in the future. Imported water concentrations can vary over time and relying on imported water quality to dilute salt concentrations that existed historically may not be feasible in the future.
2. The increased use of recycled water and groundwater in the region could reduce the amount of imported water brought into the area and change the characteristics of the water recharging the groundwater basins.
3. The analysis only considers data through 1990, before the end of the drought period in the late 1980's. Figures in the DWR report show that chloride concentrations were increasing at the end of the time period analyzed, but TDS and sulfate were not. Higher concentrations were observed in the DWR report in the late 1970s during the earlier drought (though imported water was not present during this period). The GSWIM model results show that during the 1987-92 statewide drought, the chloride concentrations in Reach 6 groundwater increased substantially beyond 100 mg/L and continued to increase after the drought until around to the beginning of 1996, then began to decline. Subsequently, according to the chloride analysis, chloride levels began to increase again around 2002 (reflecting the end of another dry period) and a return to nearly the same previous 1995 high in around 2008. (See Figures in the Task 2B-1 report).
4. Potentially significant fluctuations in groundwater quality have been observed from year to year as a result of outside factors. This fluctuation is acknowledged in the DWR report and shown in more detail in the Task 2B-1 report.

Given that more recent information indicates that some of the assumptions in the DWR report may no longer be supportable, consideration should be given to the water quality objectives that are more consistent with the ones developed in the 1975 Basin Plan. Because these objectives were set based on historic water quality, prior to the introduction of State Project Water and significant development in Reaches 5 and 6, they more closely represent the "natural" conditions of the groundwater basins. Additionally, because the objectives were set during a dry period, the values consider the impacts of droughts and meet the requirements of the Chloride Policy. Finally, the 1975 objectives represent observed water quality in the groundwater at the time the Basin Plan was developed prior to significant development. Consequently, using the 1975 objectives does not result in concerns for degradation of the groundwater basins below levels that would have existed without development in the USCR and should be protective of the beneficial uses for the groundwater basin. In summary, the 1975 Basin Plan objectives better represent the conditions found historically in the USCR and are consistent with beneficial use protection and the anti-degradation policy.

Table 5 summarizes the previous objectives in the 1975 and 1978 Basin Plans followed by the current water quality objectives in the Basin Plan resulting from the 1994 amendments.

Table 11. Reach 6 Groundwater Objectives Pre-1994 and 1994 Basin Plans

Eastern Subarea			TDS	Sulfate	Chloride	Boron
Reach	**1994 Description**	**1975/78 Description**	**(mg/L)**			
6	Santa Clara--Bouquet & San Francisquito Canyons	Above Castaic Creek to Bouquet Canyon	900	300	150	1
1994 Revisions to Basin Plan Objective						
Eastern Subarea			**TDS**	**Sulfate**	**Chloride**	**Boron**
Reach	**1994 Description**	**1975/78 Description**	**(mg/L)**			
6	Santa Clara--Bouquet & San Francisquito Canyons	Above Castaic Creek to Bouquet Canyon	~~900~~ 700	~~300~~ 250	~~150~~ 100	1

2.2.4 Reach 6 Groundwater SSO Alternatives and Recommended SSOs

A number of alternatives were considered for groundwater SSOs for Reach 6 of the Santa Clara River:

1. Maintain current groundwater quality objectives.
2. Use the 1975/1978 groundwater quality objectives.
3. Define new groundwater quality objectives that are consistent with overlying surface water quality and objectives, and which support the use of supplemental water releases to the USCR.

Alternative 1 was not considered to be appropriate given the finding that salt-sensitive agriculture is not a past, present or probable future use of the groundwater basin, that historic and existing water quality exceeds the current Basin Plan objectives during dry periods and additional data analysis available since the development of the DWR report refutes some of the key assumptions of the analysis.

Alternative 2 is a potential alternative that can be considered. The 1975 Basin Plan objectives are representative of conditions found historically in groundwater underlying Reach 6 of the USCR and are consistent with beneficial use protection and the anti-degradation policy. The use of the 1975 objectives also considers the influence of imported water concentrations that may be observed in the future and the impacts of drought conditions. However, the 1975 objectives do not reflect the interactions between groundwater and surface water and recent assessments conducted through the GSWIM study that found that incidental recharge of groundwater occurs from overlying surface water in Reach 6. Additionally, adjustment of the groundwater objectives to these levels would not be consistent with the mineral quality of supplemental water discharges to Reach 6, as contemplated for the AWRM Program, and discussed in Subsection 3.3.1.

Alternative 3 is the preferred alternative, because the proposed SSOs are protective of all beneficial uses and given the unique groundwater-surface water interactions that exist in this reach, where overlying surface water incidentally recharges groundwater in Reach 6, are consistent with historical overlying surface water quality and proposed mineral water quality objectives. Furthermore, Alternative 3 supports supplemental water releases to the USCR, which will improve downstream water quality with respect to chloride, increase flows in the river, and protect slat-sensitive agricultural beneficial uses.

Additionally, as explained below in Section 3.2.7, adjustment of the groundwater objectives to these levels would support the expansion of recycled water uses in the Santa Clarita Valley, which is consistent with projected increases in recycled water demand, as well as California's statutory goal of increasing the use of recycled water to help meet the state's growing demand for potable water.

Table 12 shows the proposed site-specific objectives for Reaches 5 and 6.

Table 12. Proposed SSOs for Groundwater Basins in Reach 6

Reach	1994 Description	1975/78 Description	Proposed SSOs (mg/L)		
	Eastern Subarea		TDS	Sulfate	Chloride
6	Santa Clara--Bouquet & San Francisquito Canyons	Above Castaic Creek to Bouquet Canyon	1000	450	150

2.3 REACH 6 SULFATE SURFACE WATER OBJECTIVES

As discussed in Section 2.2.3, changes to the surface water and groundwater salts objectives in the USCR were proposed in 1994 based on the results of analysis in a 1993 DWR report. More recent information and analysis conducted as part of the Chloride TMDL implementation plan has resulted in the need to reevaluate the analysis conducted in the report. Additionally, the proposal to use Saugus aquifer groundwater as supplemental water as part of the AWRM solution requires the consideration of the impact that these groundwater discharges will have on sulfate concentrations in Reach 6. Finally, sulfate is a naturally occurring constituent in groundwater that is not known to impact agricultural beneficial uses (LWA, 2007). Therefore, the consideration of SSOs for sulfate need only consider historic and current water quality and the potential for degradation of groundwater basins.

To define appropriate SSOs for Reach 6 sulfate surface water quality objectives, the following approach was utilized:

1. Consider the impacts to beneficial uses from implementing the AWRM
2. Evaluate current and historic water quality in surface water.
3. Evaluate historical and current water quality objectives for the surface water.

Each of these analyses is discussed in detail in the following sections.

2.3.1 Impact to Beneficial Uses from Implementing the AWRM

Revisions to the surface water objectives for sulfate in Reach 6 are necessary to support the use of supplemental water as part of the AWRM program. The use of supplemental water provides a mechanism for reducing the chloride concentrations in Reach 4B, where salt-sensitive crops are grown, in the near future while the other facilities outlined in the AWRM are constructed. The use of supplemental water provides a significant benefit to downstream users in Reach 4B and protects the quality of the East Piru groundwater basin more quickly than the other components of the project that require planning and facility construction. Providing supplemental water to Reach 6 of the USCR prior to construction of AWRM Program facilities was evaluated with the GSWIM. This scenario contemplated the use of existing Saugus aquifer wells that could deliver low chloride supplemental water to Reach 6, using infrastructure that already exists, and would not need to be constructed. Figure 7 shows the location of the existing Saugus aquifer wells (VWC-201/205) and the discharge point of this supplemental water, through existing infrastructure, while Table 13 summarizes the historical TDS, sulfate, and chloride concentrations for these wells.

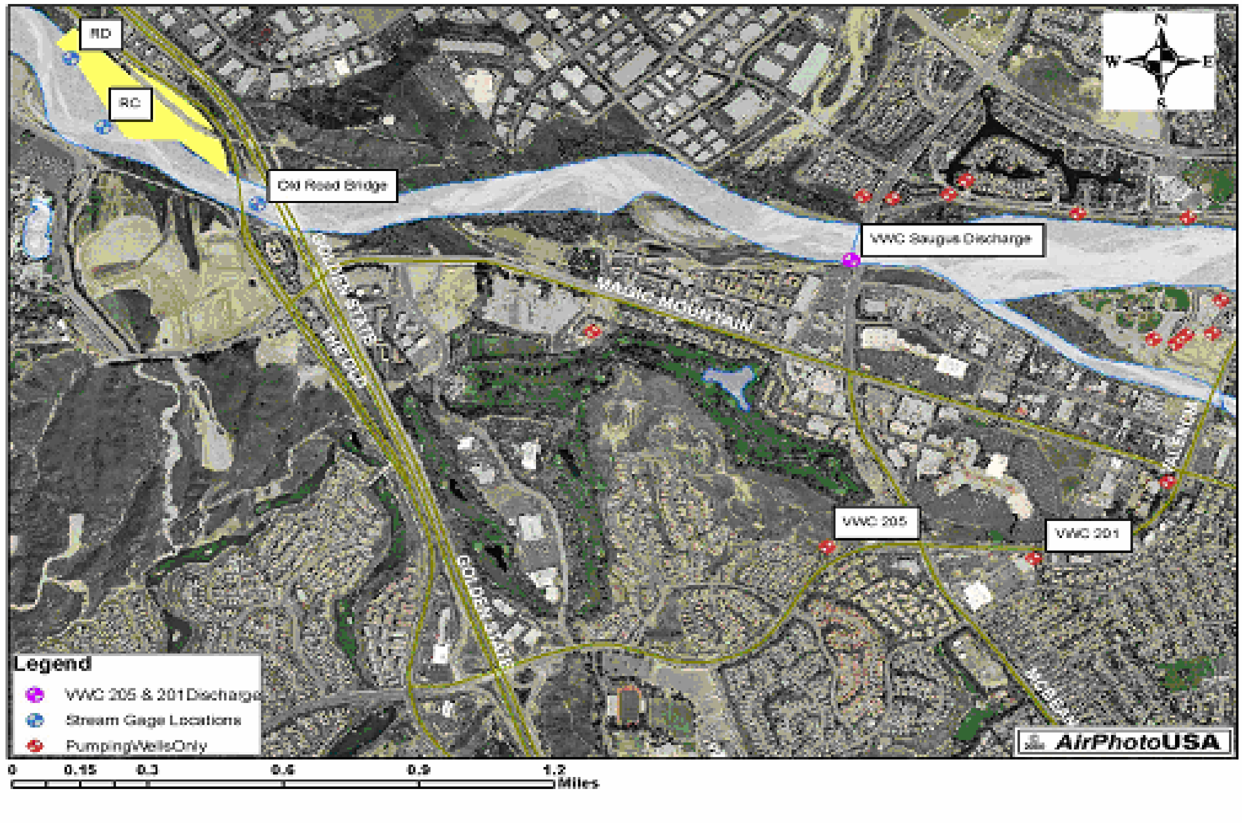

Figure 7. Existing Saugus Aquifer Wells (VW-201/205) and Discharge Point of Supplemental Water

Table 13 Data Summary of Mineral Water Quality Data for Saugus Aquifer Supplemental Water (Wells VWC-201/205)

	2007-2008 Mineral Quality of Saugus Aquifer Groundwater (VWC-201/205)		
	Sulfate	**Chloride**	**TDS**
No. of Samples	16	16	16
Average	298 mg/L	30 mg/L	720 mg/L
Range	210 – 412 mg/L	20 – 42 mg/L	520 – 1020 mg/L
Standard Deviation	70 mg/L	5 mg/L	153 mg/L
Upper Limit (Avg. + 2Stdev)	438	40	1025

As seen in Table 13, although chloride concentrations in these alternative supplemental water wells are very low (20 to 42 mg/L), sulfate concentrations consistently exceed the existing surface water quality objective of 300 mg/L for Reach 6, and have been measured as high as 412 mg/L. The upper limit of water quality based on the mean plus 2 standard deviations of the historical water quality data, shows TDS levels consistent with the existing

1,000 mg/L WQO for Reach 6, and historical 450 mg/L sulfate WQO originally established in the 1975 Basin Plan, as discussed in Subsection 3.3.3. The GSWIM evaluated the use of this potential source of supplemental dilution water in advance of construction of the AWRM Program facilities, and found that use of this source of supplemental water would assure chloride levels do not exceed the proposed Reach 4B chloride SSO of 117 mg/L during non-drought conditions, and actually improve receiving water chloride concentrations in Reaches 5 and 6, because of the introduction of this supplemental water upstream of the Valencia WRP. **Figure 8 and**

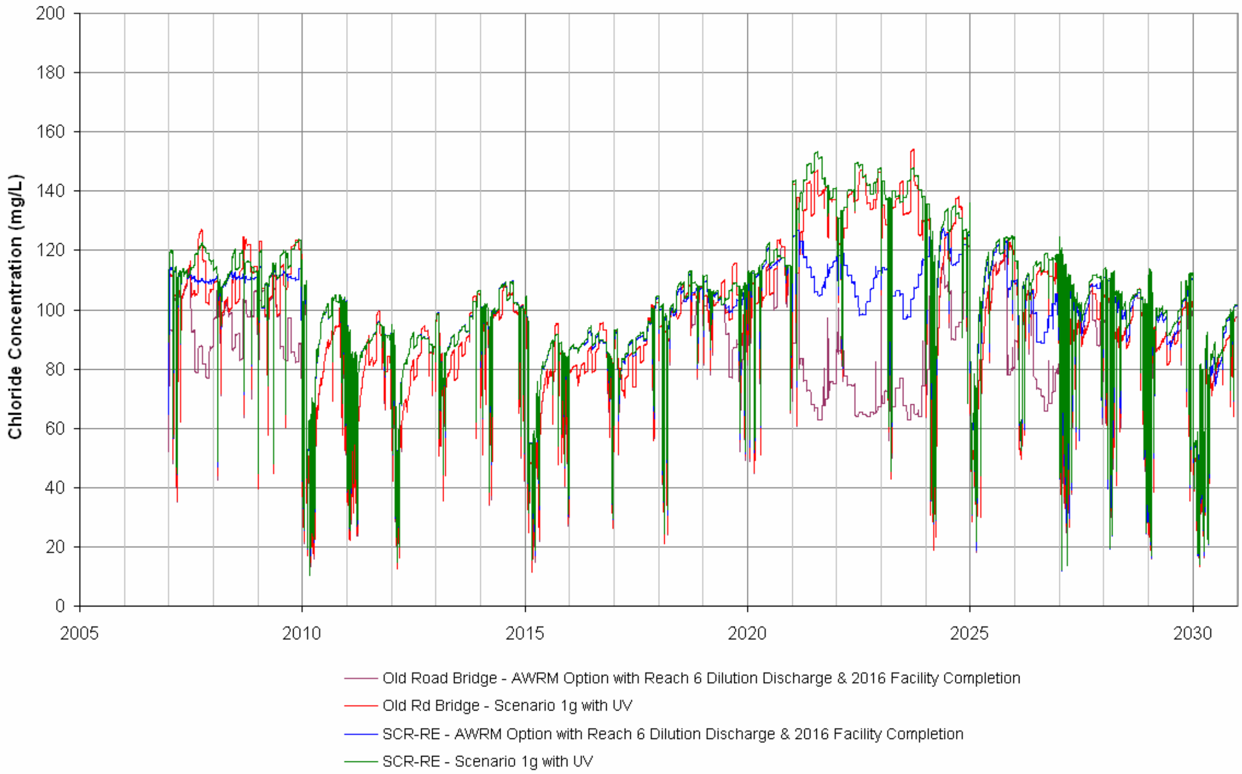

Figure 9 show the projected chloride concentration in Reach 4B as well as in receiving water in Reaches 5 and 6.

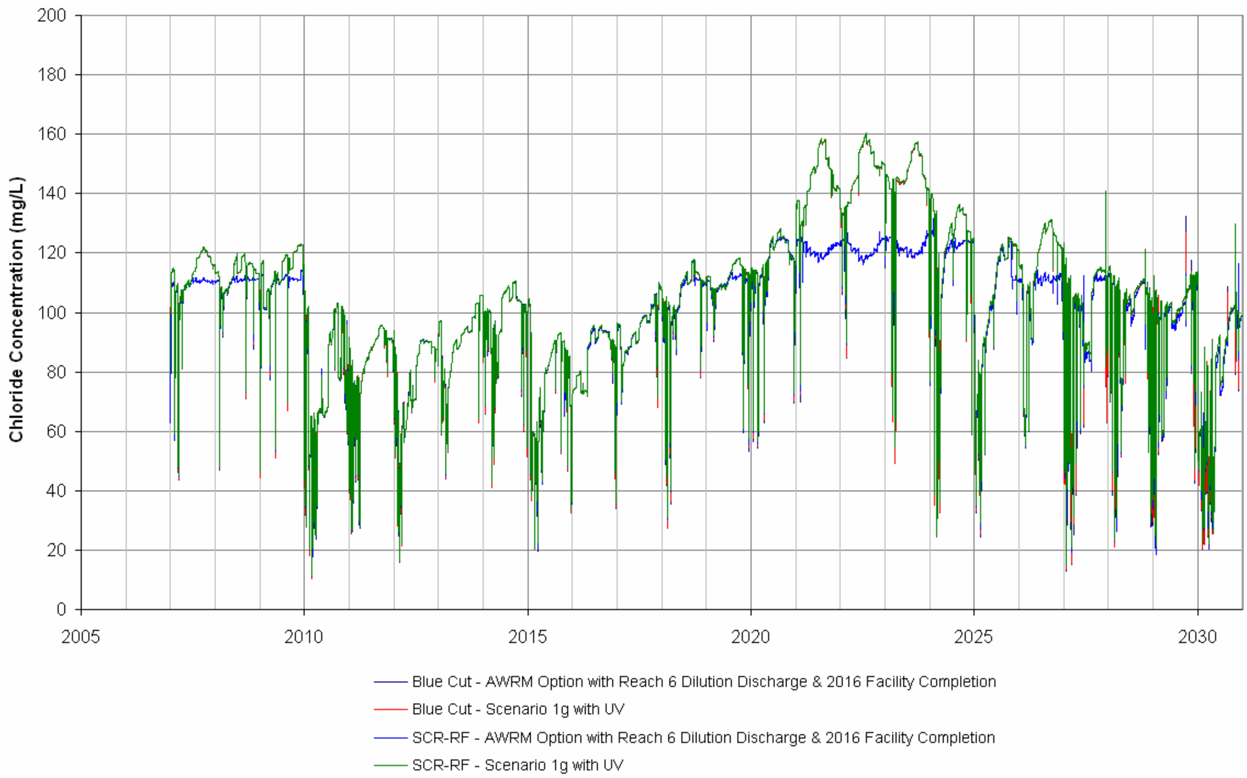

Figure 8. Chloride Concentrations in Reach 4B at Blue Cut and SCR-RF with Supplemental Dilution Water as Compared to Base Case Scenario 1g UV

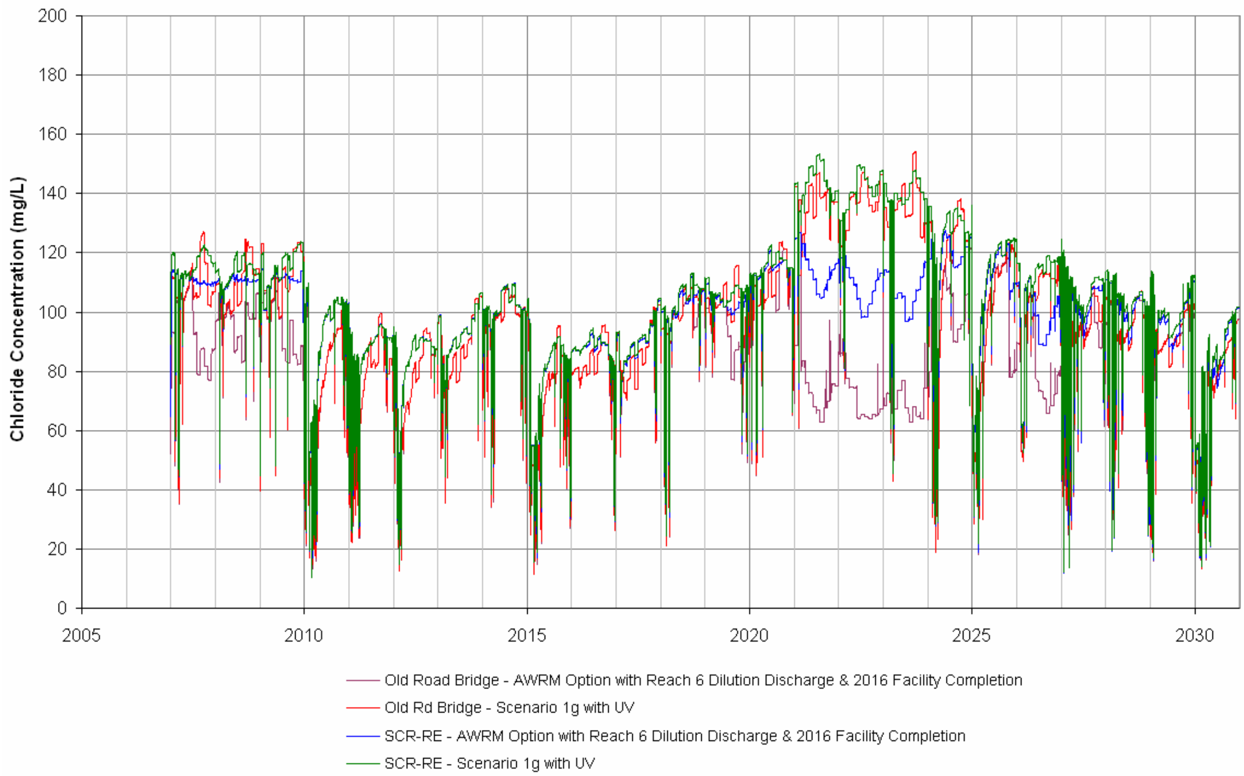

Figure 9. Chloride Concentrations in Reach 5 at SCR-RE and Reach 6 at Old Road Bridge with Supplemental Dilution Water as Compared to Base Case Scenario 1g with UV

Furthermore, as noted by the 1993 DWR report, sulfate concentrations generally increase from east to west in the groundwater and surface water of the USCR most likely as a result of the geology of the area. As a result, discharges of groundwater with higher sulfate concentrations will not impact downstream beneficial uses, but will improve water quality and increase protection of agricultural beneficial uses from elevated chloride concentrations.

2.3.2 Current and Historic Sulfate Water Quality in Reach 6

The DWR report contains information on the range of sulfate concentrations observed in Reach 6 at the Old Road Bridge from 1951 to 1990. The range of sulfate concentrations observed during that period was 20 to 989 mg/L. However, since 1980, a decreasing trend in annual weighted average sulfate concentrations was observed. During the 1980's the sulfate concentrations were "rarely above 300 mg/L" (DWR, 1993).

Historical data collected from the Santa Clara River at the Old Road Bridge/Highway 99, the downstream end of Reach 6, and at the Valencia WRP receiving water station RC, the upstream end of Reach 5 (see Figure 10) shows sulfate concentrations have ranged from levels as low as 20 mg/L to 560 mg/L, since 1972. However, more recent data collected since 1990, shows that there have been consistent exceedances of the existing 300 mg/L WQO, and data measured in 2004, showed sulfate concentrations as high as 472 mg/L.

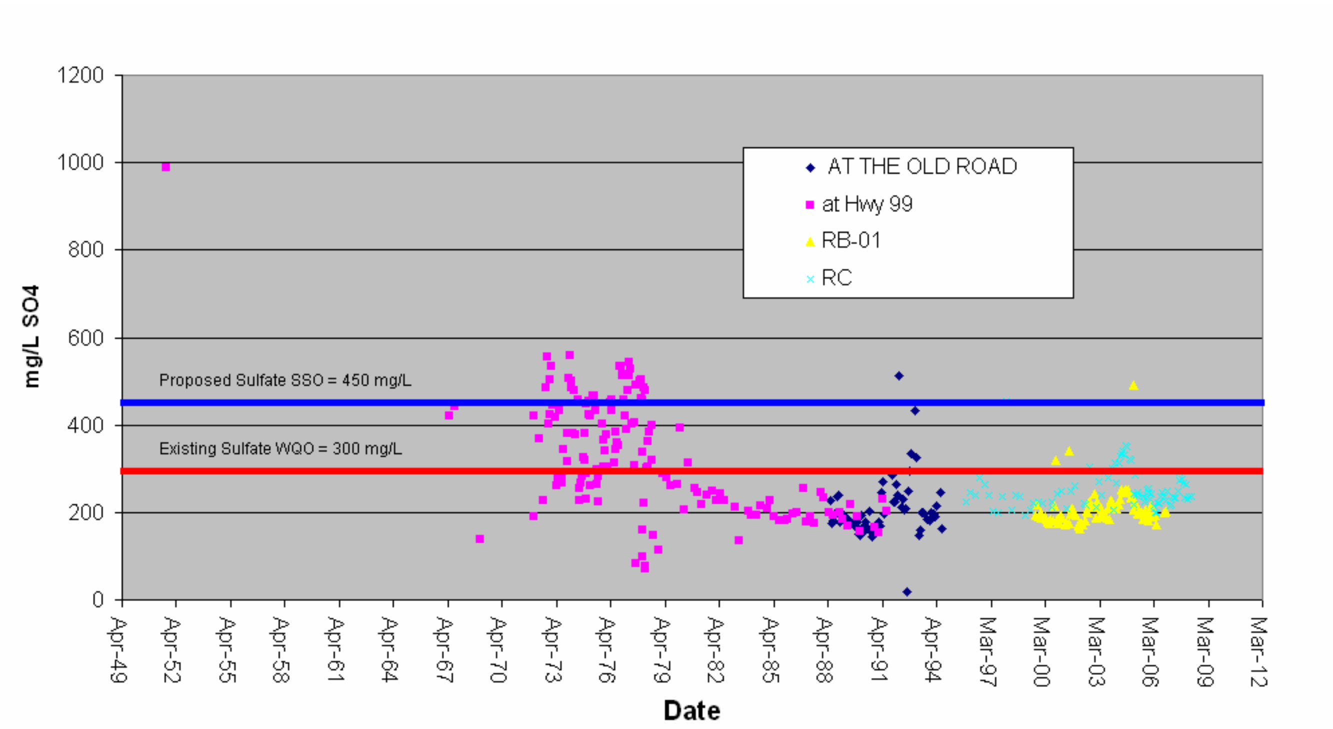

Figure 10. Historical sulfate concentrations at the downstream end of Reach 6 and upstream end of Reach 5 of the Santa Clara River

The supplemental water discharges into Reach 6, as contemplated in the AWRM, will not increase sulfate concentrations above the historic and existing concentrations for Reach 6.

2.3.3 Historic Water Quality Objectives

As discussed in Section 2.2.3, changes were made in 1994 to the Basin Plan surface water and groundwater quality objectives in the USCR based on analysis in a DWR report. This section discusses the analysis in that report that is specific to the recommended Reach 6 surface water sulfate objective change.

For the surface water analysis in Reach 5, data collected at Old Road Bridge from 1951 to 1990 were obtained. For each year, the annual average weighted concentrations were calculated using between 3 and 4 samples. The DWR draws the following conclusions from the analysis.

1. Even though the adjustments were made based on discharge, sampling bias was observed in the analysis. For some years such as 1972, "one sample with a high instantaneous discharge and of good quality greatly influences the calculated annual values."
2. The data shows an apparent trend of decreasing TDS and sulfate concentrations over time.
3. The trend likely reflects the greater use of imported water over time.
4. During the 1980s, concentrations were below the Basin Plan objective of 450 mg/L and rarely above 300 mg/L.

It is important to note that similar observations were made for Reach 5. However, in this reach, the concentrations were more variable and exceeded the Basin Plan objectives on occasion. This reach receives inputs from other sources (such as groundwater and tributary inflows) that are not currently present in Reach 6. However, with implementation of the AWRM project, higher sulfate groundwater flows will be introduced into Reach 6.

In response to the results of the analysis, changes were recommended for the sulfate and TDS surface water objectives in Reach 6 based on the surface water quality conditions observed at Old Road Bridge, for data collected through 1990.

As discussed above, the analysis presented in the DWR report for Reach 6 relies on a few key assumptions:

1. The quality of the imported water brought into the basin will continue to be of better quality than the more "natural" conditions of the groundwater basins observed in 1975 when the objectives were originally set.
2. Imported water will continue to be a primary source of water for the region.

A current understanding of potential future water supplies for the USCR and their quality, additional data collection that has been done since 1993 and consideration of potential compliance measures for the Chloride TMDL reveals some potential issues with these assumptions.

1. The decreasing trends that are attributed to the introduction of imported water may not continue in the future. Imported water concentrations can vary over time and relying on imported water quality to dilute salt concentrations that existed historically may not be feasible in the future.
2. The increased use of recycled water and groundwater in the region could reduce the amount of imported water brought into the area and change the characteristics of the water recharging the groundwater basins.
3. The analysis only considers data through 1990, before the end of the drought period in the late 1980's. More recent data collected since 1990 shows sulfate concentrations exceeded the existing 300 mg/L WQO, and went as high 472 mg/L.
4. Inputs of groundwater from the AWRM to protect agricultural beneficial uses downstream could impact sulfate concentrations in this reach.

Given that more recent information indicates that some of the assumptions in the DWR report may no longer be supportable, consideration should be given to the water quality objectives that are more consistent with the ones developed in the 1975 Basin Plan. Because these objectives were set based on historic water quality, prior to the introduction of State Project Water and significant development in Reaches 5 and 6, they more closely represent the "natural" conditions of the surface water. Additionally, because the objectives were set during a dry period, the values consider the impacts of droughts and meet the requirements of the Chloride Policy. Finally, the 1975 objectives represent observed water quality in the surface water at the time the Basin Plan was developed prior to significant development. Consequently, using the 1975 objectives does not result in concerns for degradation of the surface water below levels that would have existed without development in the USCR and should be protective of the beneficial uses. In summary, the 1975 Basin Plan objectives better represent the conditions found historically in the USCR and are consistent with beneficial use protection and the anti-degradation policy.

2.3.4 Reach 6 Sulfate Surface Water SSO Alternatives and Recommended SSOs

A number of alternatives were considered for sulfate surface water SSOs for Reach 6 of the Santa Clara River:

1. Maintain current surface water quality objectives for sulfate.
2. Use the 1975/1978 surface water quality objectives for sulfate of 450 mg/L.
3. Define new water quality objectives based on existing water quality

Alternative 1 was not considered to be appropriate given that additional data analysis available since the development of the DWR report refutes some of the key assumptions of the analysis, the need to support development of the AWRM project, and the need to protect agricultural beneficial uses using the AWRM.

Alternative 2 is the preferred alternative. The 1975 Basin Plan objectives better represent the conditions found historically in the USCR and are consistent with beneficial use protection and the anti-degradation policy. The use of the 1975 objectives more accurately considers the influence of imported water concentrations that may be observed in the future and the impacts of drought conditions. Additionally, adjustment of the sulfate surface water objectives to these levels would support the use of supplemental water under the AWRM program to protect downstream salt-sensitive agricultural users in the near future.

Given the availability of historic Basin Plan objectives that represents historic and current water quality for Reach 6 surface water and meets the considerations required in the Chloride Policy, utilizing the 1975 Basin Plan objectives for sulfate was preferred over defining new objectives for the waterbody as required by Alternative 3.

2.4 REACH 4B SURFACE WATER OBJECTIVES

Unlike Reaches 5 and 6, salt-sensitive agricultural uses are present in Reach 4B. As described in Section 1.1.4, an agricultural threshold study, also known as the literature review and evaluation (LRE), was conducted to assess the chloride threshold protective of salt-sensitive agriculture. The development of SSOs for Reach 4B reflects the need to consider the results of this study in evaluating objectives for areas with salt-sensitive agriculture. The development of SSOs for Reach 4B also included the considerations required in the Chloride Policy.

The technical analysis utilized to evaluate the Reach 4B surface water objectives included the following:

- Evaluation of the LRE results to assess the chloride threshold and associated averaging period protective of salt-sensitive agriculture.
- Evaluation of the historic and current water quality in the context of the LRE results.
- Additional technical analysis to determine SSOs that are consistent with the LRE and the Chloride Policy including:
    - Examination of the impact of water supply chloride concentrations
    - Fluctuations in water quality resulting from drought conditions
    - Reasonable loading factors from wastewater treatment facilities
    - Methods to control chloride loading

The LRE and technical analyses are discussed in more detail in the following sections.

2.4.1 Summary of LRE

To address the lack of information on the chloride water quality necessary to protect salt sensitive agriculture, a study was conducted to evaluate the available information on this topic. The Literature Review and Evaluation (LRE) presents an evaluation of the appropriate chloride threshold for the reasonable protection of avocados, strawberries, and nursery crops. These crops have been identified as the most chloride-sensitive crops that are currently grown and that are likely to be grown in the future in Reach 4B. The LRE was competed in September 2005.

Approximately 200 articles were reviewed and evaluated. The LRE presented the criteria, methodology, and results of the literature evaluation. The evaluation included a matrix that ranks each study on its usefulness in developing a chloride threshold for the reasonable protection of salt-sensitive agriculture. Based on the ranking and scientific evaluation of each article, the LRE recommends a threshold value or range for each of the three crop types of concern. The recommendations are summarized in Sections 2.4.1.1 through 2.4.1.3.

2.4.1.1 Avocados

There is no scientific basis or evidence indicating that chloride levels below 100 milligrams per liter (mg/L) are harmful to avocado. Several studies have demonstrated that chloride concentrations between 120 and 178 mg/l can be harmful to avocado. The recommendations for the chloride thresholds concentrations above 100 mg/L converge on approximately 120 mg/L.[18.] There is no valuable evidence suggesting a chloride threshold level between 120 and 178 mg/L. Although there is insufficient evidence in the literature to propose an absolute threshold, the best estimate of a chloride concentration hazardous to avocado ranges from 100 to 120 mg/L.

2.4.1.2 Strawberries

The studies did not provide sufficient data to determine an appropriate chloride threshold for irrigation water. This conclusion was based on the following primary factors:

- Insufficient data correlating chloride uptake to yield and fruit-quality impacts.
- Indications of potential outside factors in the results.
- Limited applicability to the Upper SCR with respect to varieties grown, irrigation methods, irrigation management, climate, and cultural practices.

2.4.1.3 Nursery Crops

There is insufficient evidence supporting a recommendation for a chloride threshold for nursery crops. This conclusion is based on the following primary factors:

- There were relatively few experiments by one research group that showed adverse effects at a specific chloride concentration.
- The studies show salt tolerance levels for soil-planted and surface-irrigated plants but not for sprinkler irrigation systems, which is widely used in USCR nursery crops. Therefore, the value of these studies in setting an irrigation water standard is limited given the difference between root zone and foliar exposure to chloride.
- Suggested thresholds are not clearly tied to experimental data.
- No data is available on chloride standards for nursery crops grown in large containers ("specimen trees"), which is a large component of the regional industry.

2.4.1.4 Critical Review Report

After completion of the draft LRE, the Agricultural Technical Advisory Panel (AGTAP) prepared a critical review report to provide comments on the draft LRE document. The critical review report contained a majority opinion that determined that a conservative upper chloride threshold for avocados is 117 mg/L and limit of 140 mg/L may be protective, but only under ideal, non-restricting conditions (MIG, 2005).

2.4.1.5 LRE Averaging Period Studies

As a supplement to the LRE, an averaging period analysis memorandum was prepared (Newfields, 2008). As part of the analysis, relevant information from the LRE and the responses to Agricultural Technical Advisory Panel's (AGTAP) supplemental request were reviewed to determine what factors should influence a compliance averaging period for chloride. According to the AGTAP responses, the compliance averaging period should be as short as possible, but the

[18] One inherent limitation with this value is that it is derived from sources that are not specific to the project study area.

degree of variability in chloride concentration could be considered in determining the averaging period. Based on the relevant literature in the LRE, a number of findings were identified.

- The period to injury ranged from 2 weeks to 9 weeks, but the concentrations used in the study were generally higher than the avocado threshold from the LRE.
- Injury due to chloride continued past the point of initial exposure.

In addition, the historic variability of the receiving water data was examined. Based on an analysis of the literature and the receiving water variability, a three-month averaging period was recommended.

2.4.2 Water Quality Analysis

Although the LRE provides the technical basis for an SSO for Reach 4B, further analyses of the considerations required in the Chloride Policy, historic and current water quality (as discussed below), and Water Code Section 13241 factors in relation to utilizing the LRE range as a potential SSO, demonstrated the need to further evaluate the Reach 4B SSO. The analyses identified some potential issues with using a value within the LRE range at all times.

1. During periods when water supply concentrations increase (such as during dry and critically dry years), concentrations in the receiving water have exceeded 117 mg/L, including between 1968 and 1978 (the period during which the objectives were developed). (See Figure 12)
2. Model results for the historic period also predict exceedance of 117 mg/L during periods of increased water supply concentrations.
3. The results of the compliance measure analysis utilizing the GSWIM shows that achieving 117 mg/L at all times in Reach 4B can only be achieved by implementing large-scale advanced treatment facilities at the Valencia and Saugus WRPs, and limiting recycled water uses (CH2M Hill, 2008). The implementation of large scale advanced treatment, while complying with the existing 100 mg/L objective in Reaches 5 and 6, will not comply with the existing 100 mg/L objective in Reach 4B, due to the presence of other chloride sources.
4. Implementing alternative compliance measures, such as SRWS removals and conversion to UV disinfection, result in compliance with 117 mg/L in Reach 4B except during periods when water supply concentrations are elevated (CH2M Hill, 2008).

Evaluation of the historic data shows that during some periods, protection of the agricultural beneficial use is not achievable as a result of elevated water supply concentrations. Additionally, meeting the LRE guidelines (100-117 mg/L) during periods of elevated water supply concentrations limits the compliance options available because compliance with LRE guidelines in Reach 4B would necessitate the installation of large-scale advanced treatment facilities to comply during dry and critically dry periods, which historically have only occurred approximately 33 percent of the time in the hydrologic record. The installation of large-scale advanced treatment facilities to comply during these relatively infrequent hydrologic conditions could have other environmental consequences and could reduce the availability of recycled water, as compared to other compliance alternatives that are available. As a result, other mechanisms to address periods with increased water supply chloride concentrations were evaluated.

The evaluation of alternative SSOs for the periods when water supply concentrations are elevated was conducted as follows:

1. Evaluate the percentage of time that the water supply concentrations were elevated and define a threshold value to describe dry and critically dry periods.
2. Evaluate alternative SSOs for these periods.
3. Ensure that beneficial uses are protected through the SSOs.

2.4.2.1 Water Supply Concentration Evaluation

Water year classification systems have been developed for several hydrologic basins in California. The Sacramento Valley "40-30-30" Index and the San Joaquin Valley "60-20-20" Index were developed as part of SWRCB's Bay-Delta regulatory activities. Both systems define five water year classifications: one "wet" classification, two "normal" classifications (above and below normal), and two "dry" classifications (dry and critical). Both indices are expressed in million acre-feet (maf) and the classifications correspond to ranges in the classifications.

The Sacramento Valley 40-30-30 Index (SVI) is computed as a weighted average of the current water year's April-July unimpaired runoff forecast, the current water year's October-March unimpaired runoff forecast, and the previous water year's index. In equation form, the SVI Index is:

SVI = 0.4 * Apr-Jul Runoff + 0.3 * Oct-Mar Runoff + 0.3 * Previous Year's Index

A cap of 10 maf is put on the previous year's index to account for required flood control reservoir releases during wet years. Unimpaired runoff is the river production unaltered by water diversions, storage, exports, or imports.[19]

The San Joaquin Valley 60-20-20 Index (SJVI) is the weighted average of the current water year's April-July unimpaired runoff forecast, the current water year's October-March unimpaired runoff forecast, and the previous water year's index.

SJVI = 0.6 * Apr-Jul Runoff + 0.2 * Oct-Mar Runoff + 0.2 * Previous Year's Index

A cap of 4.5 maf is placed on the previous year's index to account for required flood control reservoir releases during wet years. San Joaquin Valley unimpaired runoff is defined as the sum of inflows to New Melones Reservoir (from the Stanislaus River), Don Pedro Reservoir (from the Tuolumne River), New Exchequer Reservoir (from the Merced River), and Millerton Lake (from the San Joaquin River).

The Classifications and assigned indices are shown in Table 14.

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[19] Calculated as the sum of Sacramento River flow above Bend Bridge near Red Bluff, Feather River inflow to Oroville, Yuba River flow at Smartville, and American River inflow to Folsom.

Table 14. Wet Year Classifications for the SVI and SJVI

Wet Year Classification	SV Index (maf) 40-30-30	SJV Index (maf) 60-60-20-20
Wet	≥ 9.2	≥ 3.8
Above Normal	> 7.8 & ≤ 9.2	> 3.1 & ≤ 3.8
Below Normal	>6.5 & ≤ 7.8	> 2.5 & ≤ 3.1
Dry	> 5.4 & ≤ 6.5	> 2.1 & ≤ 2.5
Critical	< 5.4	< 2.1

As the majority of the imported water to the Upper Santa Clara River watershed comes from the Sacramento Valley, the SVI was chosen for the analysis. The water year classifications for the Sacramento River are shown in Table 15 below. Water years are October 1 – September 30.

Table 15. Year Classifications

Year	Year Type	Year	Year Type	Year	Year Type
1906	Wet	1940	Above Normal	1974	Wet
1907	Wet	1941	Wet	1975	Wet
1908	Below Normal	1942	Wet	1976	Critical
1909	Wet	1943	Wet	1977	Critical
1910	Wet	1944	Dry	1978	Above Normal
1911	Wet	1945	Below Normal	1979	Below Normal
1912	Below Normal	1946	Below Normal	1980	Above Normal
1913	Dry	1947	Dry	1981	Dry
1914	Wet	1948	Below Normal	1982	Wet
1915	Wet	1949	Dry	1983	Wet
1916	Wet	1950	Below Normal	1984	Wet
1917	Above Normal	1951	Above Normal	1985	Dry
1918	Dry	1952	Wet	1986	Wet
1919	Below Normal	1953	Wet	1987	Dry
1920	Critical	1954	Above Normal	1988	Critical
1921	Above Normal	1955	Dry	1989	Dry
1922	Above Normal	1956	Wet	1990	Critical
1923	Below Normal	1957	Above Normal	1991	Critical
1924	Critical	1958	Wet	1992	Critical
1925	Dry	1959	Below Normal	1993	Above Normal
1926	Dry	1960	Dry	1994	Critical
1927	Wet	1961	Dry	1995	Wet
1928	Above Normal	1962	Below Normal	1996	Wet
1929	Critical	1963	Wet	1997	Wet
1930	Dry	1964	Dry	1998	Wet
1931	Critical	1965	Wet	1999	Wet
1932	Dry	1966	Below Normal	2000	Above Normal
1933	Critical	1967	Wet	2001	Dry
1934	Critical	1968	Below Normal	2002	Dry
1935	Below Normal	1969	Wet	2003	Above Normal
1936	Below Normal	1970	Wet	2004	Below Normal
1937	Below Normal	1971	Wet	2005	Above Normal
1938	Wet	1972	Below Normal	2006	Wet
1939	Dry	1973	Above Normal	2007	Dry

With these water year classifications, it is possible to compare water supply chloride concentrations in the Upper Clara River watershed, with respect to various water year classifications to assess an appropriate water supply trigger, where elevated chloride concentrations in the water supply cause exceedances of the upper end of the LRE range (117 mg/L) in Reach 4B. The approach utilized was to assess the water-year classification type with historic chloride measured in surface water at Blue Cut (Reach 4B) and relate that relationship to the water supply chloride concentrations, associated with specific water-year classification types. The following approach was utilized:

1. Water year classification types were compared with surface water chloride concentrations measured in Reach 4B for 1980 through 1997 (years for which water has been imported to the Upper Santa Clara River watershed and for which there was minimal impact of residential self-regenerating water softeners on surface water quality in reach 4B) to determine if certain water year classifications are associated with water quality conditions in Reach 4B that do not support salt-sensitive agricultural uses.
2. The water supply chloride concentrations were evaluated to determine the summary statistics for each water year type for 1980 through 2006 (years for which water has been imported into the USCR watershed).
3. The percentage of time that critically dry years have occurred in the historic record was calculated and the corresponding percentile of water supply chloride concentrations was determined.

The water supply chloride concentration data were classified based on the water year (October to September) in which they occurred. For example, the water year 1976 classification of Wet was considered to apply to all water supply data from October 1975 through September 1976. Once the type of water year was assigned to each data point, the data were separated by type of water year. When the data were evaluated in this manner, there was very little difference between the water supply concentrations during critical, dry, and normal years. Because the water is stored in Castaic Lake and can have a residence time in the lake of 1 to 2 years, the water supply data was also classified based on the previous water year for evaluation. When the water years were offset to account for the Castaic Lake storage, a clear distinction in the water supply concentrations during different water year types emerged. Figure 11 shows the water supply chloride concentration data for each water year when categorized based on the previous years' classification. Above and below normal years were grouped into one category called normal for simplicity.

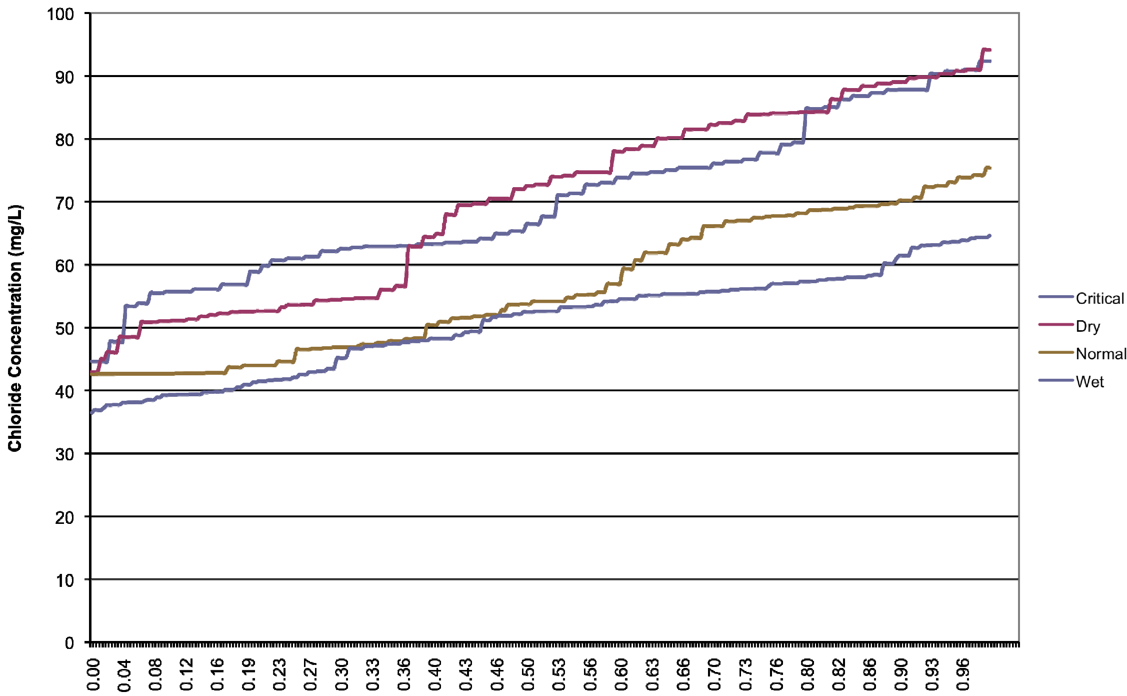

Figure 11. Water Supply Concentrations by Year

When comparing Reach 4B surface water chloride concentrations[20] by water year type classification, percentiles of the water quality data can be evaluated for each specific water year type classification. As shown in Figure 12, during critically dry conditions attainment of the upper end of the LRE range at 117 mg/L was not achieved approximately 25% of the time, reflecting the influence that state-wide hydrologic conditions and the associated elevated water supply chloride concentrations in the Upper Santa Clara River watershed have on surface water quality in Reach 4B.

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[20] Only data from 1980-1997 are used because this time frame represents when imported SWP water began deliveries to the Upper Santa Clara River watershed, and also reflects period when the Santa Clarita Valley Sanitation District had bans on residential SRWS, which prohibited the discharge of softener brines to the wastewater system.

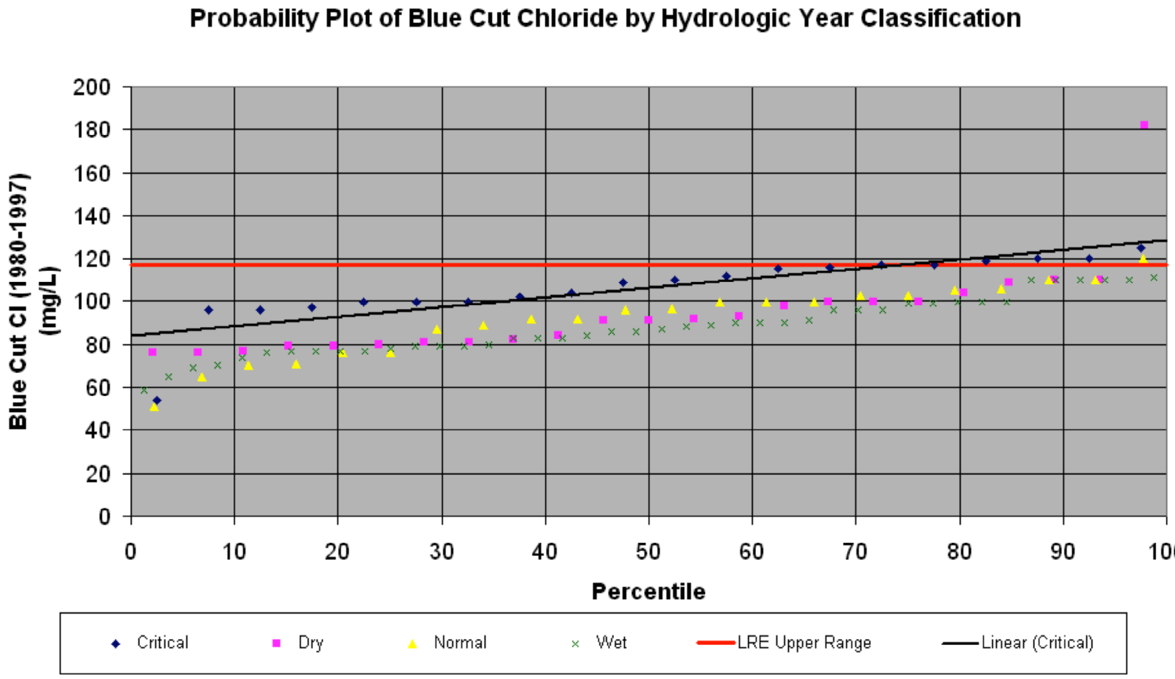

Figure 12. Blue Cut Chloride Concentrations by Water Year Type

The following table describes the summary statistics for each water year with data classified using the previous water year classification.

Table 16. Water Supply Summary Statistics by Type of Water Year

	Critical (mg/L Cl)	**Dry** (mg/L Cl)	**Normal** (mg/L Cl)	**Wet** (mg/L Cl)
Max	92.4	94.1	75.4	64.6
Min	44.6	43.0	42.6	36.4
Average	69.3	69.5	55.7	50.4
Median	65.9	72.0	53.7	52.5
90^{th} percentile	87.8	89.0	69.8	61.0

As shown in Table 16 and Figure 11 the maximum chloride concentration during wet, above normal, and below normal years does not exceeded 76 mg/L when Castaic Lake storage time of 1 year is taken into account. During dry and critical years, the water supply concentration can exceed 76 mg/L and go as high as 94 mg/L. Based on this initial analysis, a water supply concentration greater than 76 mg/L corresponds to dry and critically dry water years.

To further evaluate the water supply chloride concentrations, the concentration that occurs at the same frequency as the number of critical years in the historic record was calculated. Based on the historical record, critically dry years have occurred during 12.75% of the historic record

(1906 to 2007). To estimate the water supply concentration that would be expected to occur approximately 12.75% of the time, a frequency graph was generated and the 87.25 percentile value of the historic water supply data was determined. The following graph shows the frequency distribution of the water supply concentrations with the 87.25th percentile concentration highlighted. The 87.25th percentile water supply concentration for the period of 1980 to 2006 is 79 mg/L.

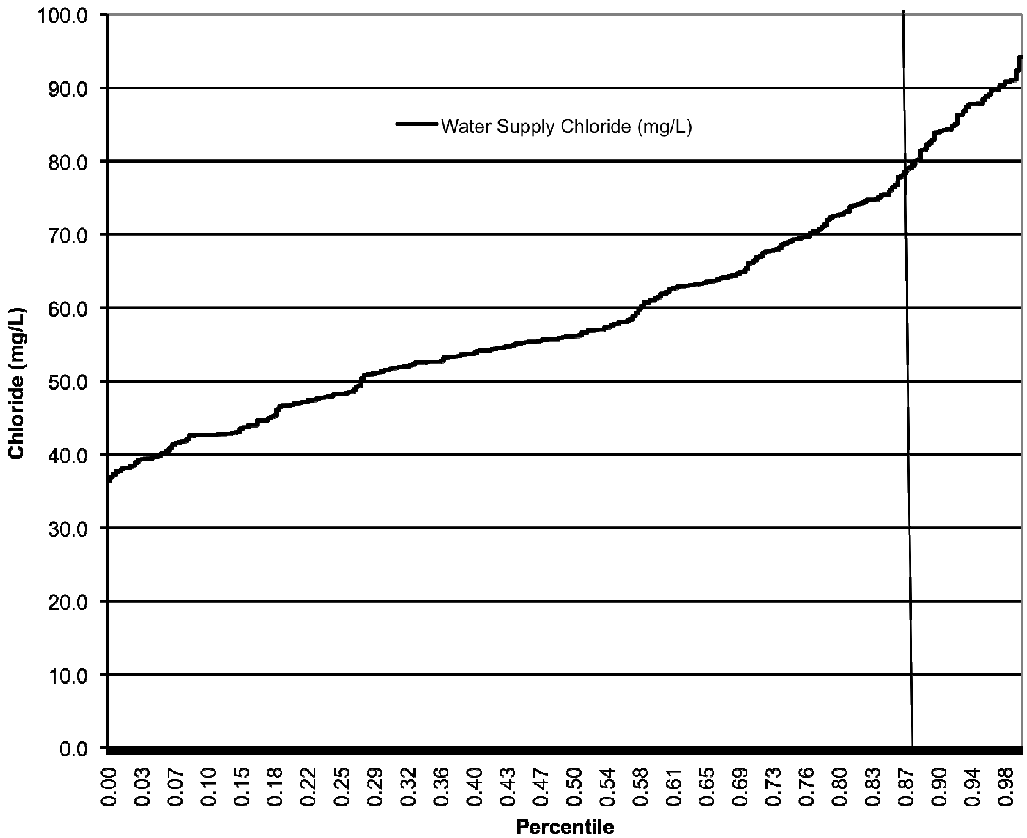

Figure 13. Frequency distribution of water supply chloride concentrations

The analyses above demonstrate that elevated water supply concentrations occur as a result of dry and critically dry years and that a water supply trigger can be developed to capture these types of conditions. Additionally, critically dry years have only occurred 12.75% of the time in the past 100 years. Therefore, addressing these types of critical dry years separately will likely not result in adjustments to the objectives during the vast majority of the years. As a result, potential Reach 4B SSOs that exceed the LRE range, when water supply concentrations are above a "trigger" concentration, would appear to be appropriate for addressing the relatively infrequent periods of time when water supply concentrations cause elevated concentrations of chloride in the receiving water.

Two different calculation methods, using a statistical summary that characterizes when dry and critically dry conditions are linked to water supply chloride concentrations in the Upper Santa Clara River watershed, and estimating the percentile water supply chloride concentration associated with critically dry conditions over the historical record, resulted in water supply trigger recommendations of 76 and 79 mg/L, respectively. Consequently, a water supply trigger calculated through either approach would appropriately capture critically dry conditions and would not result in the relaxation of water quality objectives during non-critical periods. Based on this analysis, the proposed water supply trigger is 80 mg/L. This value is slightly higher than the results of the two analyses above so it provides some level of conservatism.

2.4.2.2 Water Quality Data Analysis – Historic and Projected Water Quality

To evaluate the potential critical period SSO, the historic water quality and predicted water quality resulting from the implementation of the AWRM compliance option were analyzed to determine the concentrations observed during critical periods. First, the historic water quality in Reach 4B during critically dry years was evaluated using historically measured water quality data and model results. Second, the best water quality that can be achieved through the discharge of all of the reverse osmosis treated water and the utilization of supplemental water releases to the Santa Clara River that is planned under the AWRM compliance option during critical periods was determined (using the GWSIM). The following subsections discuss the results of these analyses.

2.4.2.2.1 Historical data analyses during 1975-1978

The time period of 1975 to 1978 was selected as the historic time period for consideration in the analysis. The period between 1968 (establishment of the California anti-degradation policy) and 1978 when the current numeric values of the Basin Plan objectives were established was considered for the analysis. Basin Plan objectives for chloride were originally set in 1975 and revised slightly in 1978. The period of 1975 to 1978 was a period of dry and critically dry years. However, imported water was not yet being delivered to the USCR during this period. As a result, this period represents dry and critically dry periods, but does not include the influence of imported water supply concentrations.

Other time periods were considered for the analysis, but none were identified that could be considered truly historic and without other influences. The presence of oil drilling and corresponding brine discharges into the mid to late 1970s resulted in artificially elevated chloride concentrations. Therefore, using data prior to 1975 would artificially elevate the chloride concentrations as compared to current conditions and there were no periods of dry or critically dry periods between 1968 and 1975. The next dry period in the USCR occurred in the late 1980s. Although this period captures the influence of elevated water supply concentrations, this period cannot be considered “historic” because it was ten years after the original Basin Plan objectives were developed and twenty years after the California anti-degradation policy was established. Because another appropriate time period could not be identified and 1975-1978 also corresponds to the period in which the original Basin Plans were being developed, that period was selected to represent historic critical conditions.

Monitoring data from Blue Cut was utilized for the analysis. Blue Cut represents the reach break between reach 4B and 5 and has served as a flow and water quality monitoring station since 1951. Therefore the historic record is very complete for this site and using data from this site is appropriate for a historic water quality analysis. Both the data and the model results were used to evaluate historic water quality conditions. The following figure shows the measured water quality and modeled water quality at Blue Cut from 1975 through 1978.

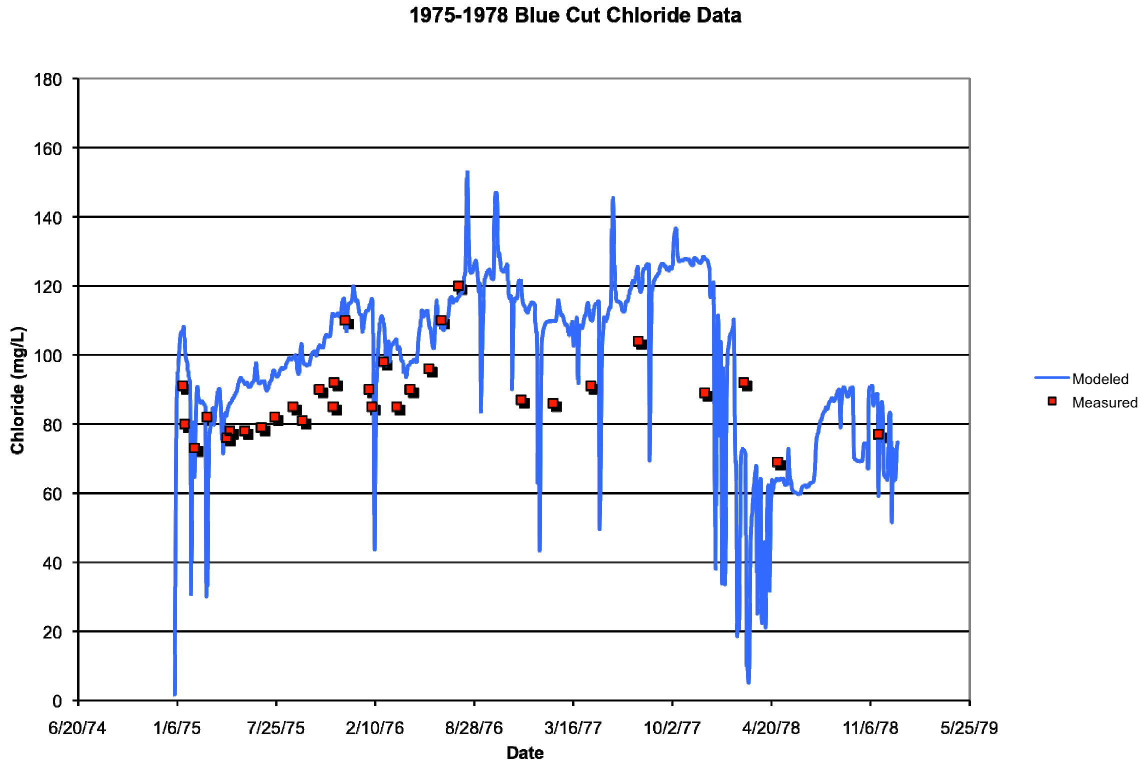

Figure 14. 1975 through 1978 Measured and Modeled Chloride Concentrations at Blue Cut

As discussed previously, a 3-month averaging period has been determined to be appropriate for Reach 4B. Therefore, a 3-month averaging period was used to evaluate the data. The following data summarizes the measured and modeled water quality data for 1/1/1975 through 12/31/1978.

Table 17. 1975 through 1978 Chloride Concentration Summary Statistics at Blue Cut

	Measured (mg/L)	Modeled (mg/L)	Measured 3-month average (mg/L)	Modeled 3-month average (mg/L)
Max	120	153	120	128
Min	69	2	69	49
Average	88	98	89	99
Median	87	102	89	105
90th percentile	103	125	104	122
95th percentile	110	127	115	124
99th percentile	117	137	120	127
Mean +2 std deviations	110	146	112	139

Based on the model, concentrations at Blue Cut during this period were predicted to go as high as 153 mg/L with a maximum three-month average of 128 mg/L. The maximum measured data point and three-month average during this period was 120 mg/L. The measured data from 1975 through 1978 contains 36 data points, several of which were collected on the same day or within a few days of each other. The samples were collected approximately monthly during 1975, but were collected less frequently during the following years. For 1977 and 1978, the two critically dry years, only 7 data points exist and only two of those samples were collected during the dry season. As a result, the modeled data provides a better estimate of the range of water quality conditions that were likely to have occurred during the 1975 to 1978 period.

The historic water quality analysis shows that the water quality exceeded 117 mg/L in both the measured and modeled data, during the historical period from 1975 to 1978. The modeled data during this period showed that the upper threshold values for the 3-month average were between 128 mg/L and 139 mg/L. Given that this period does not include the influence of elevated imported water supply, considering an SSO within this range is appropriate.

2.4.2.3 Alternative Water Resources Management Compliance Option

The Chloride Policy requires the consideration of potential chloride control measures in determining the SSOs for chloride. As discussed in Section 1.2.1, the Alternative Water Resources Management (AWRM) compliance option has been developed to provide additional benefits to the USCR. As discussed in the technical report "Alternative Water Resources Management Plan: Effects in Ventura County" included as Appendix 8, the AWRM option provides significant water quality and water resource benefits in Reach 4B and downstream as compared to the other compliance options. Following is a summary of the benefits determined from the analysis in that report:

- The AWRM option will result in lower chloride concentrations in the river than existing and projected baseline conditions, and consequently better-quality recharge to the east Piru basin and lower chloride concentrations in groundwater as a result.
- The AWRM also improves groundwater chloride concentrations in the Piru Basin by pumping and removing poorer quality water from the East Piru Basin to allow for greater recharge during wet periods when concentrations are lower in the stream.
- The amount of water that could be beneficially diverted at the Freeman Diversion is 11,500 AFY greater than the minimum flows compliance option.
- The increased modeled diversions from the AWRM option has the potential to reduce the saltwater intrusion in the Oxnard Plain by at least 6000 tons/yr as compared to the minimum flows compliance option.

Based on the benefits that are provided by the AWRM as compared to the other compliance options, the SSOs necessary to support implementation of the alternative were evaluated. The AWRM compliance option includes the construction of smaller-scale advanced treatment facility at the Valencia WRP, consisting of a three million gallon per day (MGD) microfiltration and reverse osmosis (RO) system, and the use of supplemental water releases to Santa Clara River. The AWRM compliance option contemplates a combination of the use of advanced treatment chloride removal technologies and supplemental water releases to the river to reduce chloride concentrations, recognizing that the use of either of these approaches, alone, is limited by a number of practical constraints.

The use of reverse osmosis to remove chloride is constrained by the amount of brine waste, a by-product of the desalination process, that can be disposed of locally. The 3 MGD RO facility at the Valencia WRP is projected to produce approximately 500,000 gallons per day of brine waste, which the District believes is the practical limit of the amount of brine waste that can disposed of locally, either through the use of deep well injection, or zero-liquid discharge technologies. As shown in Figure 15, the projected amount of RO capacity necessary to consistently meet a Reach 4B SSO of 117 mg/L is 20 MGD, which would require brine disposal capabilities at approximately 3 MGD. As shown in Figure 12, this amount of RO capacity and brine disposal is needed only during the critically dry conditions, when SWP Cl is > 80 mg/L. Brine disposal rate of 3 MGD would exceed the amount of brine that can be disposed of locally, through deep well injection, and would require the construction/use of a brine line and ocean outfall for ocean disposal.

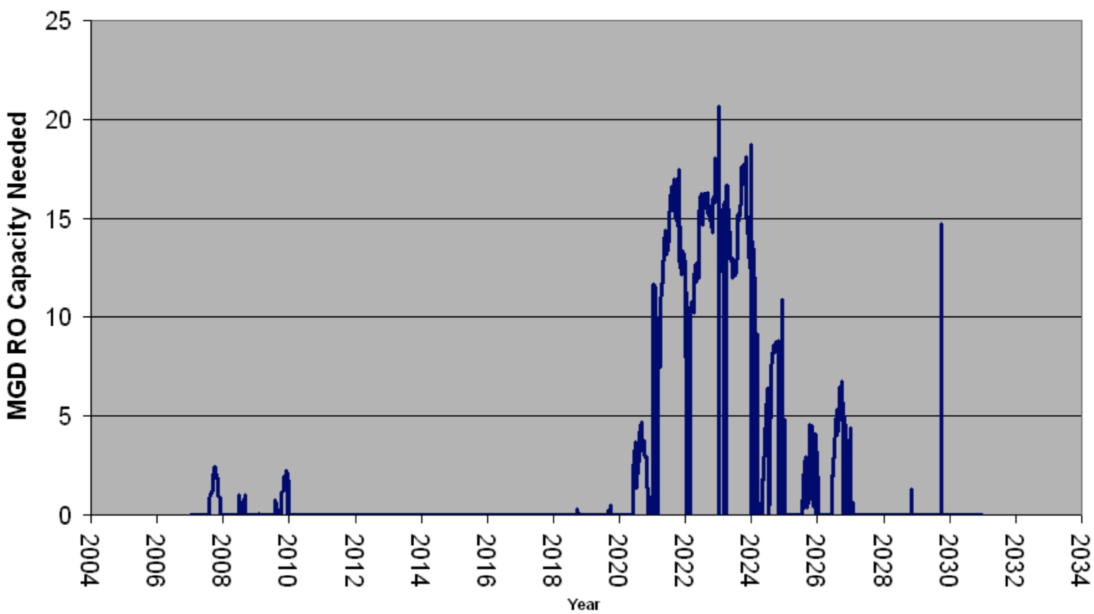

Figure 15. Projected amount of RO needed to meet Reach 4 B SSO of 117 mg/L.

Conversely, the use of supplemental water releases to the Santa Clara River is constrained by the amount of groundwater from the Saugus aquifer that can be extracted for release to the Santa Clara River to dilute river concentrations in an exchange program with banked imported water. Based on the operational capacity of existing and planned supply wells contemplated for the AWRM program, the maximum pumping rate of the existing/planned Saugus aquifer wells is estimated at ~7.5 million gallons per day.[21] As shown in Figure 16, the projected amount of supplemental water necessary to consistently meet a Reach 4B SSO of 117 mg/L is approximately 33 MGD, which exceeds the operational constraints of the aquifer wells. In addition, this amount of supplemental water would exceed the pumping rates projected to

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[21] Personal communication with Bob Diprimio, General Manager, Valencia Water Company.

provide long term utilization of the Saugus aquifer, which is between 7500 and 15,000 AFY with intermittent short term pumping up to 20,000 AFY in dry years.[22]

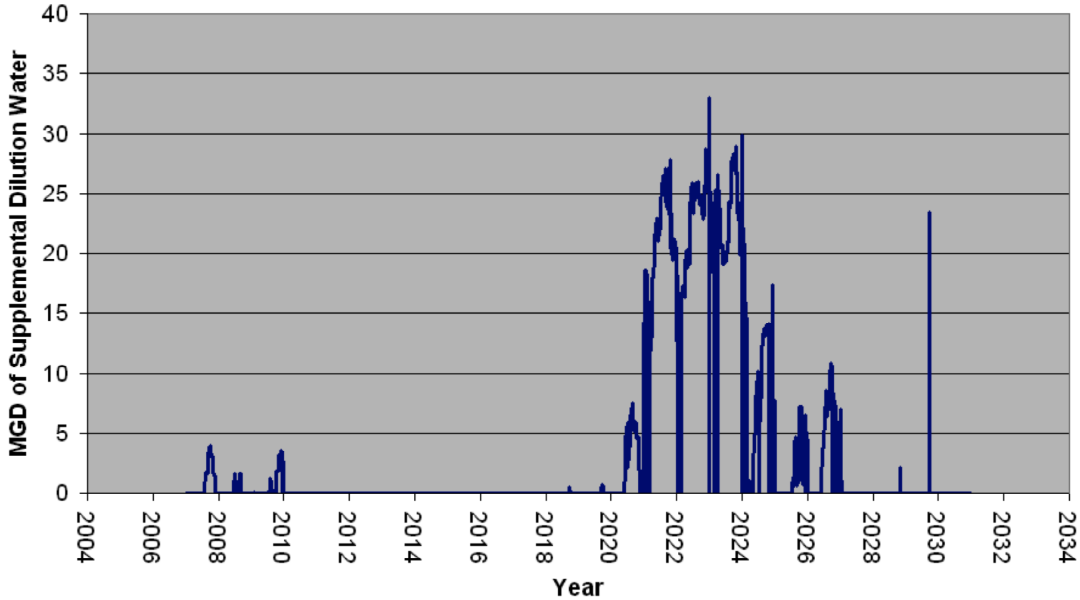

Figure 16. Projected amount of supplementation water needed to meet Reach 4 B SSO of 117 mg/L.

Given the practical constraints associated with each compliance approach, a combination of reverse osmosis and supplemental water releases was evaluated to assess the water quality achieved in Reach 4B SSO through implementation of the compliance option. The evaluation was used to determine if the AWRM would achieve concentrations that are consistent with historical measured and modeled chloride concentrations observed in the 1975-1978 time frame, as discussed in Section 2.4.2.2.1, when the surface water quality objectives for the Santa Clara River were established.

The GSWIM simulated water quality at various receiving water and groundwater locations based on implementation of the AWRM compliance option to achieve these site-specific objectives. The GSWIM scenarios predict water quality in the future based on a number of factors (see Task 2B-2/Task 9 report for a full discussion).

The AWRM compliance option envisions that during critical dry periods, all of the 3 MGD RO water produced at the Valencia WRP, as well as the release of supplemental water as necessary would be discharged to the Santa Clara River reduce chloride concentrations in Reach 4B. Through the implementation of the AWRM compliance option, better water quality could be achieved in Reach 4B. The GSWIM model results were utilized to determine the best water quality that could be achieved during critical dry periods based on two scenarios:

[22] See Groundwater Management Plan – Santa Clara River Valley Groundwater Basin, East Subbasin, Castaic Lake Water Agency, December 2003

Scenario 1. All 3 MGD of the RO water was discharged to the river above Reach 4B

Scenario 2. All 3 MGD of the RO water was discharged to the river and supplemental water releases were used as necessary to achieve the potential objectives.

During the worst-case critical periods, the discharge of 3 MGD of RO water, without supplemental water, results in a maximum concentration of 139 mg/L. Under the worst-case critical periods, the discharge of 3 MGD of RO water, with supplemental water results in a maximum concentration of 135 mg/L, and a maximum 3-month average of 127 mg/L. Figure 17 shows the projected chloride concentrations at Blue Cut between the base case (no RO or supplemental water), AWRM Scenario 1 (3 MGD RO to the river only), and AWRM Scenario 2 (3MGD RO plus supplemental water) to the river.

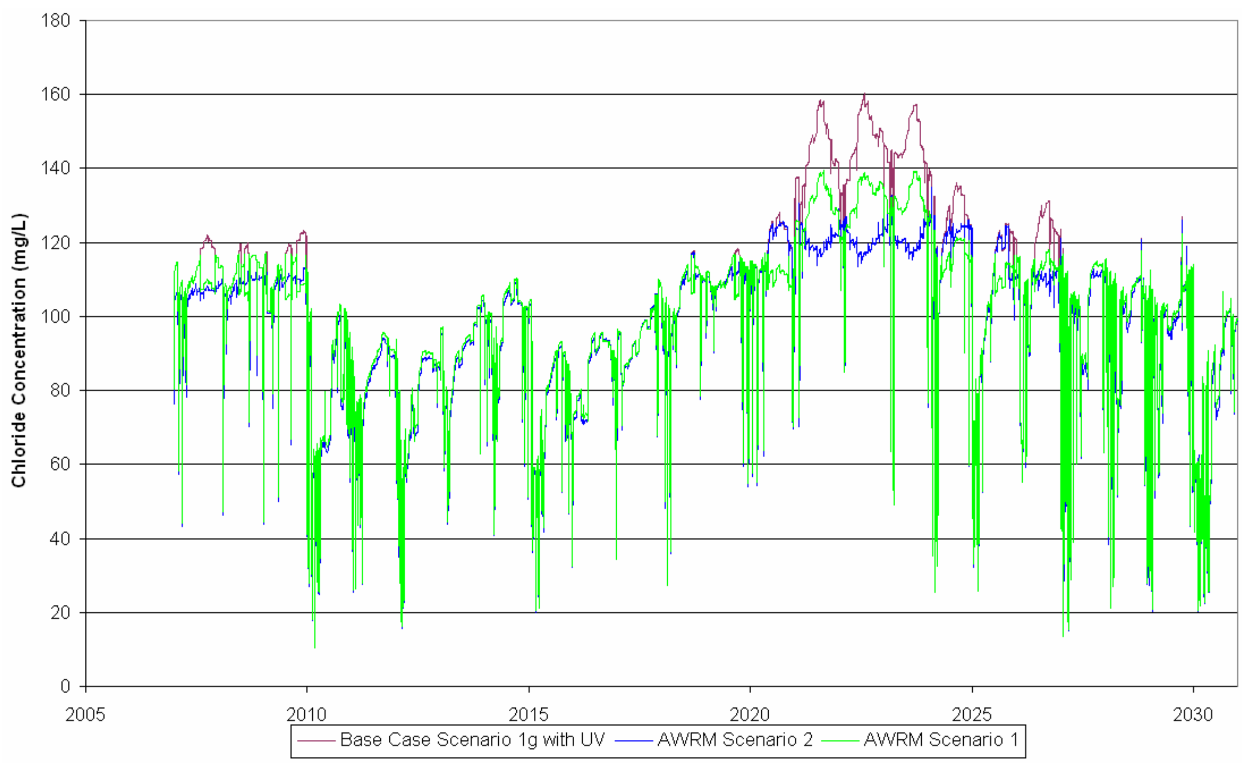

Figure 17. Projected Chloride Concentrations at Blue Cut Resulting from the Base Case (Scenario 1g with UV), AWRM Scenario 1, and AWRM Scenario 2

The results of the evaluations show that during critical dry periods, simulated as the time period between 2021 – 2025, when water supply concentrations exceed 80 mg/L, an appropriate site-specific water quality objective is between 128 mg/L and 137 mg/L for AWRM Scenario 1 and between 127 mg/L and 135 mg/L for AWRM Scenario 2, as 3-month averages. The GSWIM results indicate that the AWRM scenarios would comply with an SSO of 130 mg/L approximately 93% and 100 percent of the time, for AWRM Scenarios 1 and 2, respectively.

Based on the historic water quality analysis and the AWRM analysis, an SSO of 130 mg/L during critical dry conditions is an appropriate SSO that balances the practical constraints related to local brine disposal generated by RO technologies, with the amount of supplemental water from the Saugus Aquifer that can practically be delivered to the river, and still be consistent with historical water quality for this reach, when the original surface water quality objectives for this reach were established in 1975-1978.

2.4.2.4 Chloride Additions

Given that the imported water supply is a major contribution to the concentrations of chloride observed in the receiving waters and consistent with the Chloride Policy, the proposed SSO of 130 mg/L was compared with a reasonable increment over the water supply trigger to account for the addition of chloride during use. When water is used for residential, commercial, and industrial purposes, some amount of chloride is added as a result of that use.

A comparison of the water supply concentrations with concentrations measured in the WRP effluent over time allows for the estimation of chloride concentrations that are added through residential, commercial, and industrial use as well as through chloride historically contributed by various wastewater treatment processes (i.e. disinfection by bleach and primary sedimentation enhancements with ferric chloride). Additionally, the impact of self-regenerating water softeners (SRWS) on the chloride increment can be observed. The underlying chloride increment above water supply at the Saugus and Valencia WRPs was estimated by taking, the difference of historical WRP effluent chloride concentrations and water supply chloride concentrations, and also subtracting the historical estimated chloride contribution from chemical uses associated with disinfection and primary sedimentation. A time series graph, displaying the calculated underlying increment above water supply for available data is shown in Figure 18. Prior to 1997, SRWS were banned in the USCR. However, between 1997 and 2003, the prohibition on SRWS was removed as a result of court decisions that invalidated the District's long-standing ordinances and installation of these devices proliferated. As shown in Figure 18, the average underlying chloride increments for Saugus and Valencia WRPs for the period between 1980-1997, which is assumed to be representative of conditions with no influence from SRWS, and adjusted to reflect no contribution from disinfection and coagulation processes (part of the proposed compliance measures), is approximately 50 mg/L. However, the increment has gone as high as 110 mg/L after 1997.

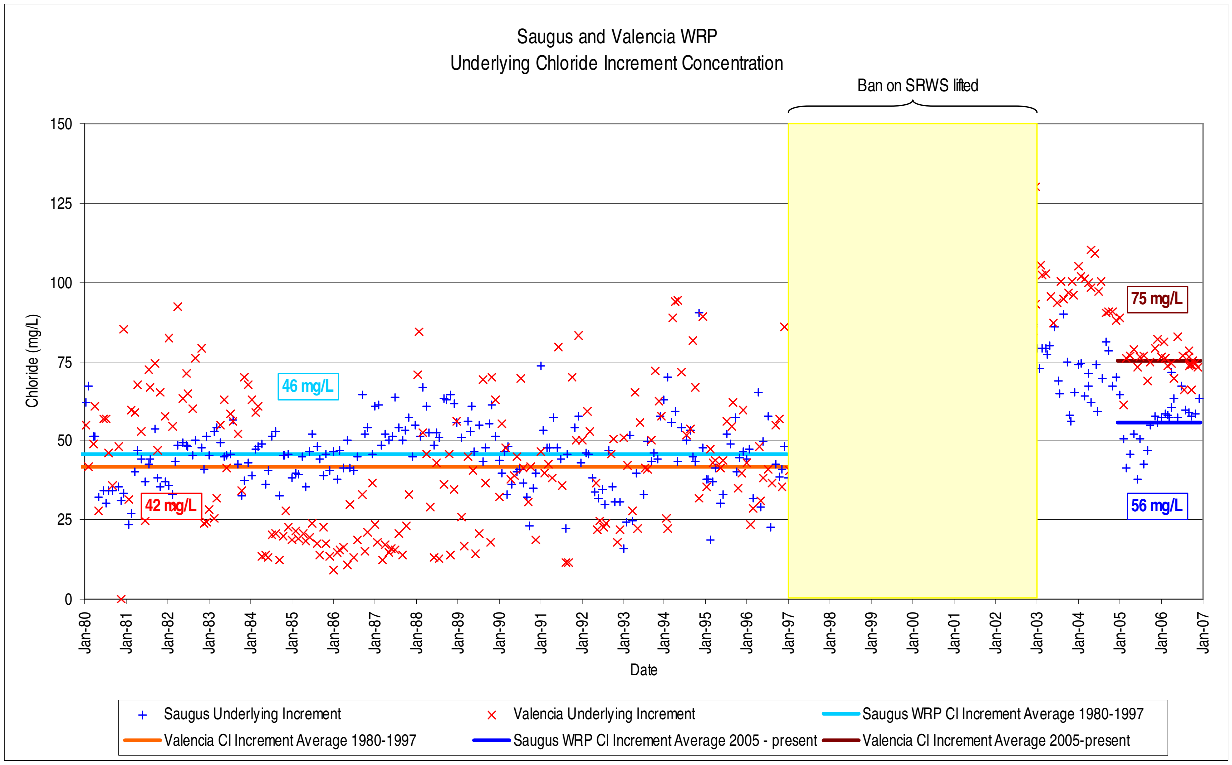

Figure 18. Increment chloride in wastewater over water supply

The long-term average underlying increment over water supply of 50 mg/L is predicted to be achieved in the WRP effluent when SRWS are removed and UV disinfection is added as part of the AWRM compliance option. An underlying chloride increment of 50 mg/L above water supply represents the historic conditions prior to 1997, is within the range of typical chloride additions prior to 1997, and can be achieved through implementation of source control actions to eliminate the residential use of SRWS. As such, 50 mg/L represents a reasonable loading factor (as discussed in the Chloride Policy) for wastewater.

Using the 50 mg/L increment over water supply combined with the water supply trigger of 80 mg/L, developed in Section 2.3.3, as well as the use of supplemental waters, discussed in Section 2.3.1, indicates that 130 mg/L would be an appropriate SSO during critical periods.

2.4.2.5 Critical Condition Averaging Period for Reach 4B Alternatives and Proposed Averaging Period

Two alternatives exist for the averaging period in Reach 4B during periods of elevated water supply concentrations:

1. Use the same averaging period, three months, as the regular Reach 4B objective.
2. Use the annual averaging period determined for Reaches 5 and 6 surface water objectives.

The use of a three-month averaging period provides consistency with the 117 mg/L objective, but is not necessary to protect beneficial uses during periods when water supply concentrations are elevated. During critical conditions, the salt-sensitive agricultural beneficial uses in Reach 4B are being protected through alternative water supplies. As a result, the averaging period for Reach 4B during critical periods does not need to meet the requirements of the LRE averaging period study and salt-sensitive agriculture does not need to be protected by the surface water concentrations and averaging periods. Therefore, the annual averaging period that is proposed for Reaches 5 and 6 can be applied to Reach 4B during critical periods.

2.4.2.6 Reach 4B Critical Condition Implementation Provisions

In order to ensure the protection of beneficial uses, the second tier water quality objectives only apply under the following conditions:

1. Water supply concentrations measured in Castaic Lake are ≥ 80 mg/L.

2. Salt-sensitive agricultural uses that are irrigated with surface water are protected during periods when Reach 4B surface water exceeds 117 mg/L. Beginning May 4, 2016, the cumulative net chloride loading above 117 mg/L ($CNCl_{117}$) to Reach 4B of the SCR from the SCVSD WRPs is zero or less, where:

$$CNCl_{117} = Cl_{(Above\ 117)} - Cl_{(Below\ 117)} - Cl_{(Export\ Ews)}$$

Where:

$Cl_{(Above\ 117)}$ = ([WRP Cl Load[1]/Reach 4B Cl Load[2]] * [Reach 4B Cl Load>117]) $_{Cumulative}$

$Cl_{(Below\ 117)}$ = ([WRP Cl Load[1]/Reach 4B Cl Load[2]] * [Reach 4B Cl Load<117]) $_{Cumulative}$

$Cl_{(Export\ EWs)}$ = [Cl Load Removed by Extraction Wells]$_{Cumulative}$

[1] WRP Cl Load is determined as the monthly average Cl concentration multiplied by the monthly average flow measured at the Valencia WRP.

[2] Reach 4B Cl Load is determined as the monthly average Cl concentration at Receiving Water Station RF multiplied by the monthly average flow measured at USGS Gauging Station 11109000 (Las Brisas Bridge).

2.4.3 Alternatives for Reach 4B Surface Water SSOs and Proposed SSO

1. Remain at 100 mg/L and add averaging period
2. Use two-tiered SSO, 117 mg/L with an adjustment to 130 mg/L when water supply concentrations exceed 80 mg/L.
3. 130 mg/L at all times

As in Reach 5 and 6, alternative 1 was determined to be overly protective given the results of the LRE study that show that 117 mg/L is protective of salt-sensitive agricultural beneficial uses. Additionally, a 100 mg/L objective would not be attainable, even with the installation of large-scale advanced treatment and brine disposal facilities, due to the presence of other chloride sources. Alternative 1 would not allow for an AWRM compliance option that provides additional water resource and other benefits to the watershed.

Alternative 2 is the preferred alternative. The approach provides for a set water quality objective of 117 mg/L with a three-month averaging period during all periods of time. However, when water supply chloride concentrations exceed 80 mg/L, and objective of 130 mg/L with a 12-month averaging period applies if steps are taken to ensure protection of the beneficial use and export of excess salt (see Implementation Procedures above). The two-tiered objective is consistent with the requirements of the Chloride Policy in that it considers the quality of the imported water and the costs and benefits of the compliance measures. Additionally, the implementation measures ensure the protection of the beneficial uses in Reach 4B.

The use of 130 mg/L at all times was determined to be under-protective and not necessary during all periods.

2.5 REACH 4B GROUNDWATER OBJECTIVES

The rationale for developing groundwater SSOs for the groundwater basin underlying Reach 4B of the USCR (Eastern Piru) is as follows:

- Salt-sensitive agricultural beneficial uses are a beneficial use of groundwater in portions of the groundwater basin.
- Current water quality objectives may be higher than existing and predicted future concentrations in some areas of the basin.

Based on this information, SSOs were considered for the groundwater underlying Reach 4B.

To define appropriate groundwater SSOs for the groundwater underlying Reach 4B, the following approach was utilized:

- Evaluate historic and current water quality in the groundwater basin.
- Evaluate predicted water quality in the groundwater basin after implementation of compliance measures.

Each of these analyses is discussed in detail in the following sections.

2.5.1 Historic and Current Water Quality Analysis

The groundwater underlying Reach 4B is comprised of two distinct regions. In the eastern portion of the basin, upstream of Las Brisas Bridge, the groundwater basin is comprised solely of thin alluvium, with no underlying groundwater aquifer. In this region, saturated thicknesses decrease to 5 feet or less near the river (Geomatrix, 2008). In the western portion of the basin, the San Pedro formation underlies the alluvium and the alluvium becomes thicker, to a maximum of approximately 200 feet (DWR, 2003). A conceptual cross section of the groundwater basin in this reach is shown in Figure 19, from the Task 2A Report (CH2M Hill, 2006).

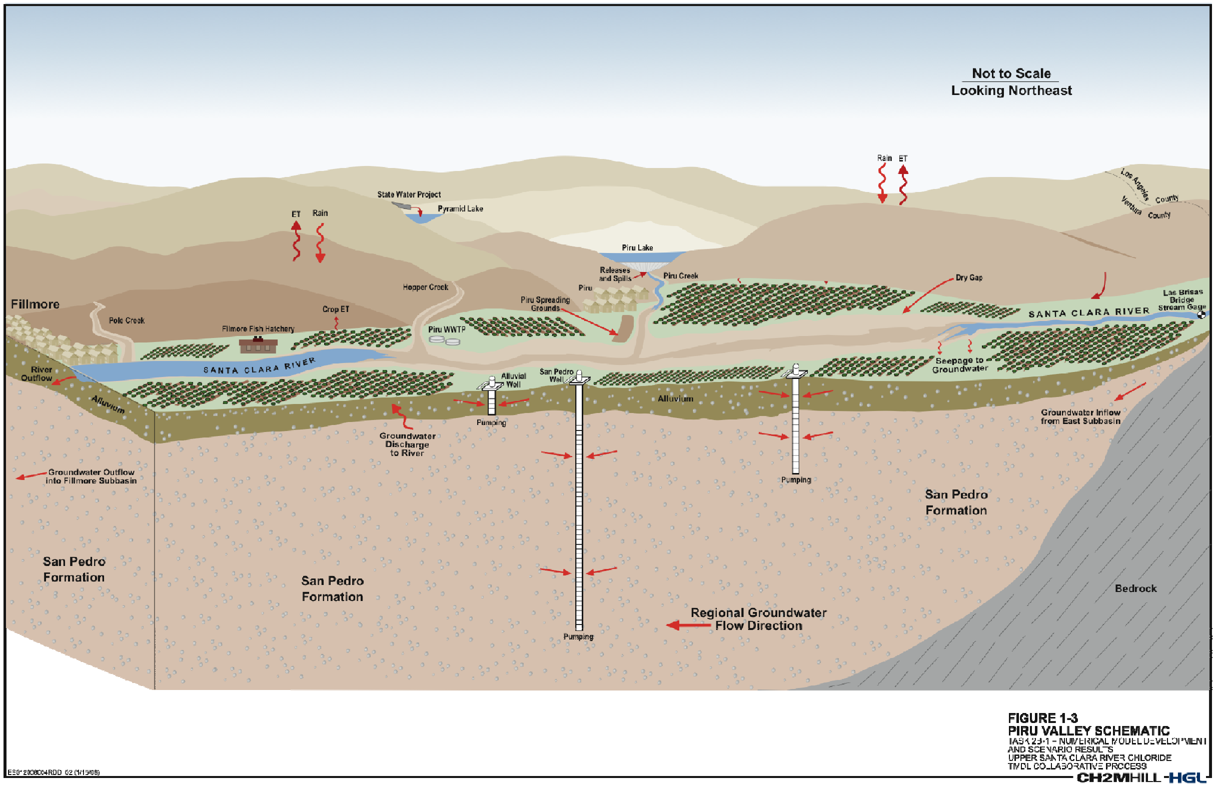

Figure 19. Conceptual Cross Section of the Piru Basin

Through the development of the GSWIM and special studies conducted in support of the modeling effort, additional information was gathered on the characteristics of the different areas of the Eastern Piru basin.

Characterizing groundwater flow in the alluvial system through Blue Cut was recognized as a key data gap in the GSWI study. This data gap was addressed using a three-phased field program. In the first phase, Geomatrix drilled exploratory borings in the Blue Cut area to gain a better understanding of the nature and extent of saturated alluvium and depth to bedrock in this area. The second phase included performing surface geophysical surveys to evaluate the depth to bedrock, thickness of alluvium, and thickness of saturated alluvium in the Blue Cut area. For the third phase, three wells were installed along the Santa Clara River on NLF property in the Blue Cut area as shown in

Figure 20 (Geomatrix, 2007).

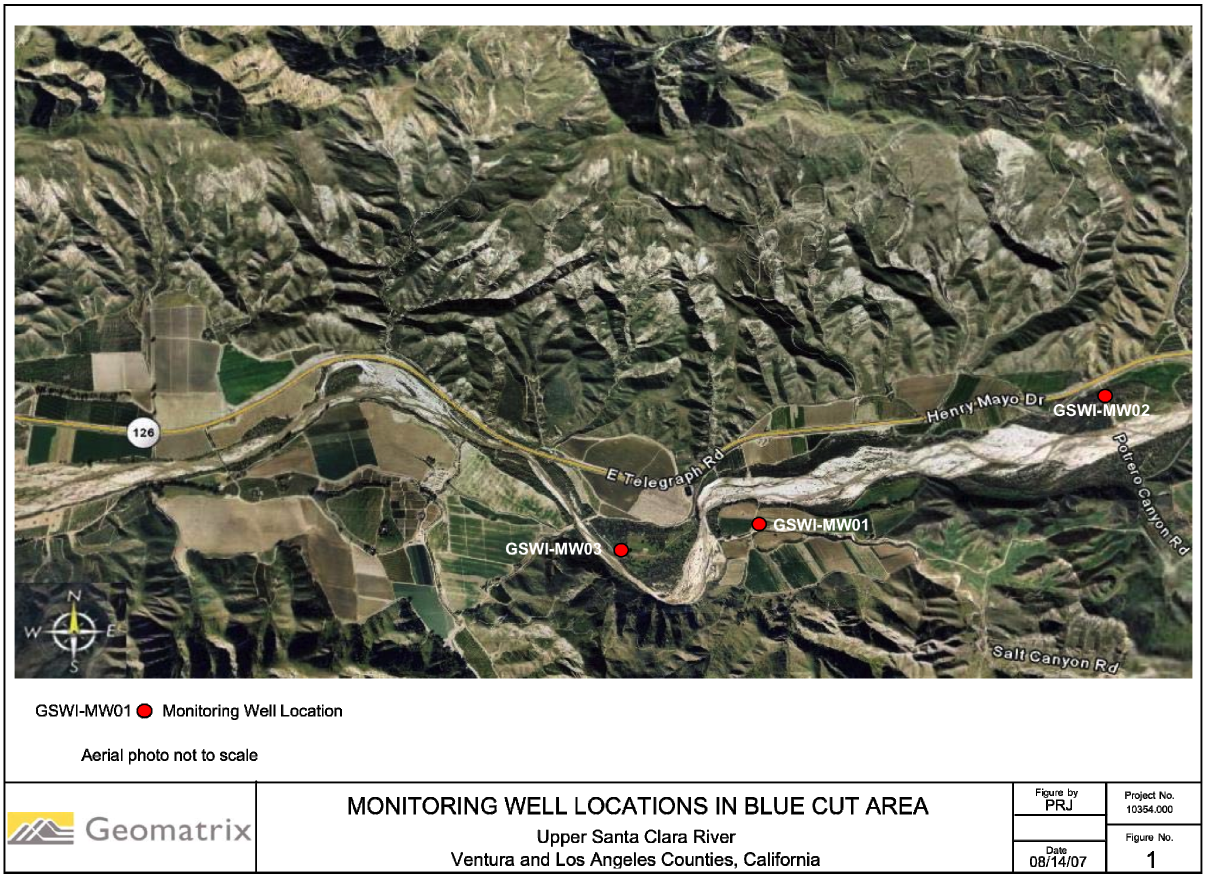

Figure 20. Monitoring Well Locations in Blue Cut Area

The newly installed monitoring wells were constructed in the shallow alluvium, and recent monitoring data collected in 2007 and 2008, indicates TDS, sulfate and chloride concentrations that are consistent with the existing WQOs for these constituents at 2,500 mg/ TDS, 1,200 mg/L SO4, and 200 mg/L Cl, respectively. It should be noted, however, that the majority of the other wells in the Eastern Piru Basin are in the San Pedro Formation. The results from the monitoring and the GSWIM modeling show that chloride concentrations in the shallow alluvium wells are consistent with the current chloride groundwater objectives in the Basin Plan and during droughts could go higher than the current 200 mg/L objective. A detailed discussion of the measured and modeled concentrations in the alluvium in the Blue Cut area is presented in Geomatrix, 2008 (Appendix 10). The key findings in the memo were:

> "The calibrated GSWI model predicts relatively high alluvial groundwater concentrations in the vicinity of Blue Cut during drought periods, with predicted chloride concentrations as high as 350 mg/L or greater near the downstream portion of SCR Reach 5 and the upstream portion of Reach 4B. Recent analysis of chloride concentrations in the Blue Cut area from the newly installed GSWI monitoring wells demonstrate that generally high chloride concentrations exist in this area. Simulations of potential future conditions also predict relatively high chloride concentrations during drought for the vicinity of Blue Cut. However, there is no current or expected future use of the shallow groundwater for

beneficial uses in this area. Groundwater production occurs downstream of Blue Cut where the aquifers yield more water with greater saturated thicknesses."

Discussion in the 1993 DWR report supports the conclusions that higher salts concentrations may be found in the Blue Cut area. Higher concentrations of minerals were typically found in groundwaters produced from Tertiary marine sediments (DWR, 1993). Tertiary marine sediments underlie the river in the Blue Cut area.

The results of the analysis indicate that the current Basin Plan groundwater quality objectives for the alluvium wells in the Blue Cut area are consistent with current monitoring data and GSWIM results.

The GSWIM model indicates that the chloride concentrations for the San Pedro wells and alluvium west of the Las Brisas Bridge are lower than the current groundwater quality objectives. "Chloride concentrations in alluvial groundwater downstream of Station RF range from a high of approximately 120 mg/L, reducing to less than 50 mg/L downstream of the confluence with Piru Creek." (Geomatrix, 2008). The following figures are excerpts from the GWSIM Task 2B-1 report that summarize the water quality in key wells in the Eastern Piru Subbasin west of Las Brisas Bridge.

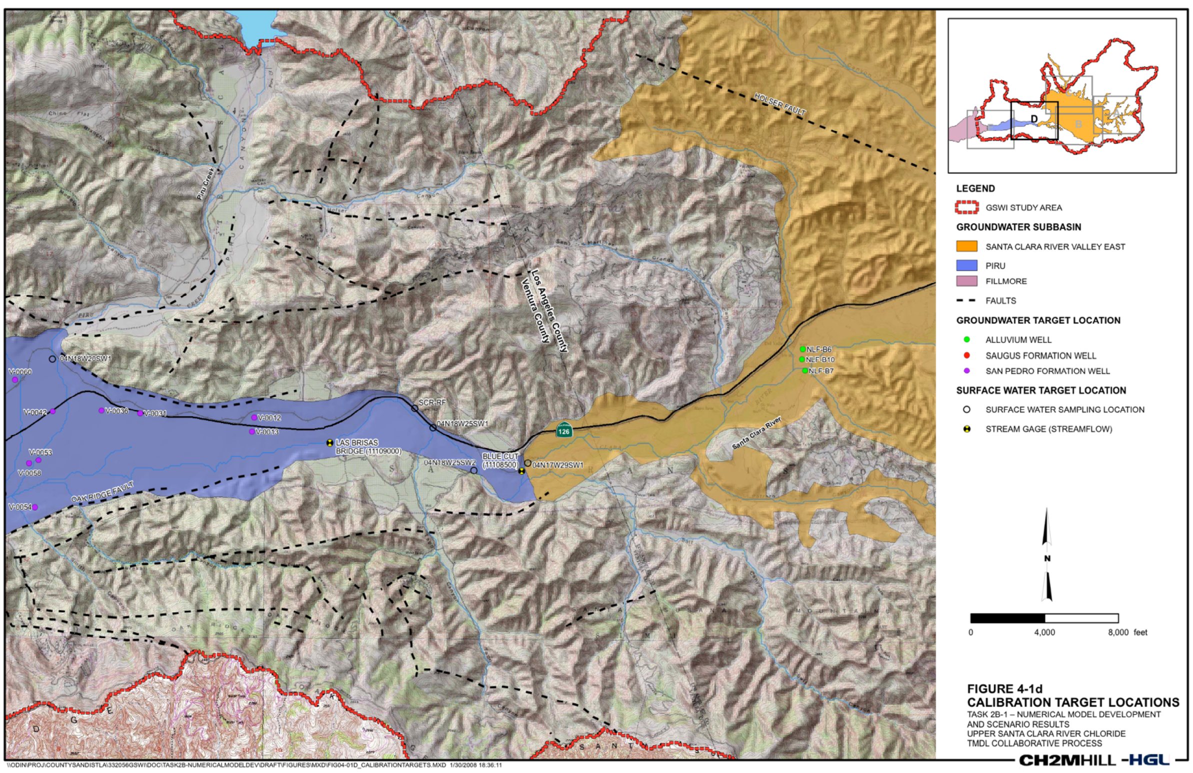

Figure 21. Map of Eastern Piru Subbasin Wells

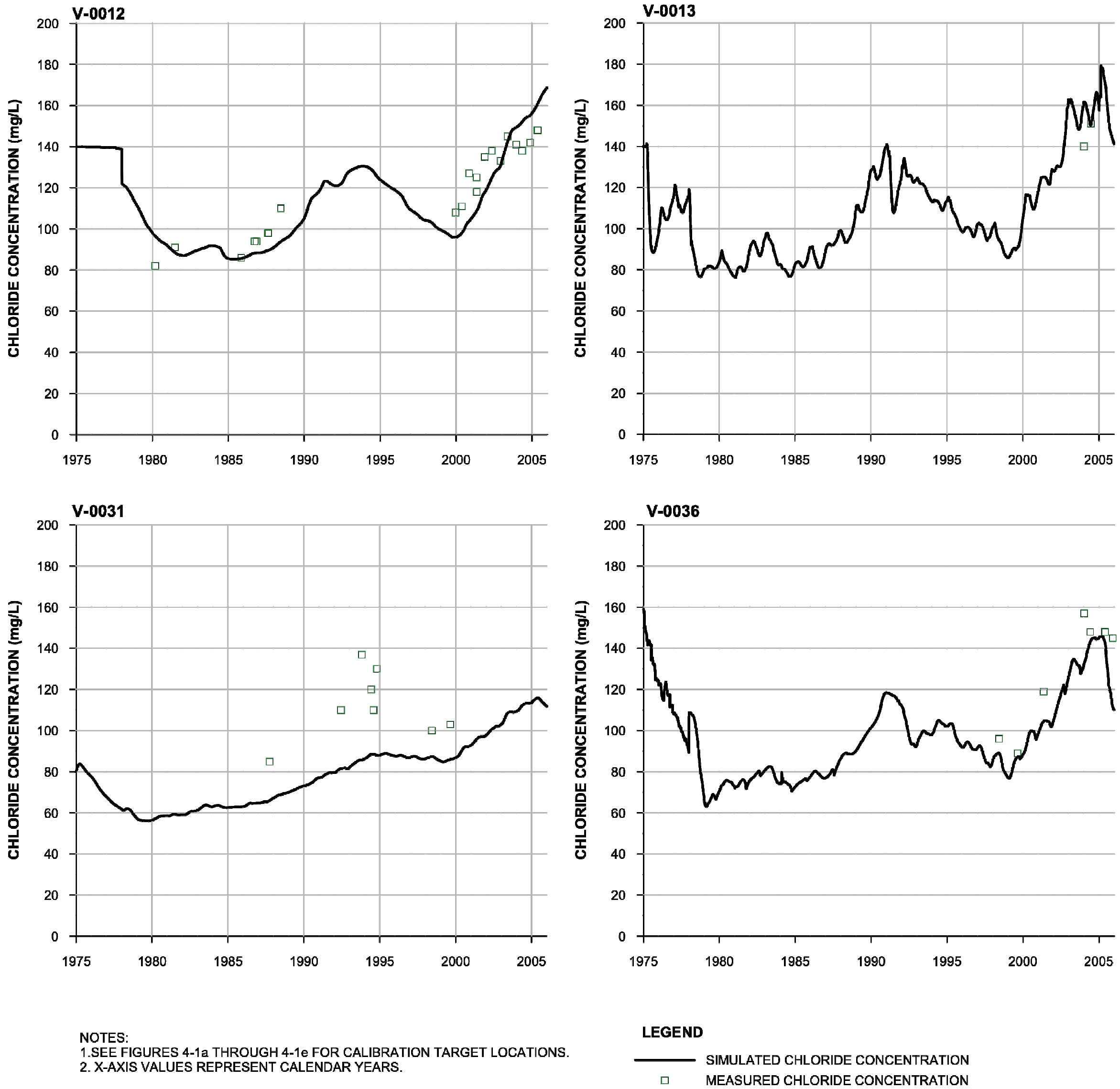

Figure 22. Eastern Piru Wells Modeled and Measured Chloride Concentrations

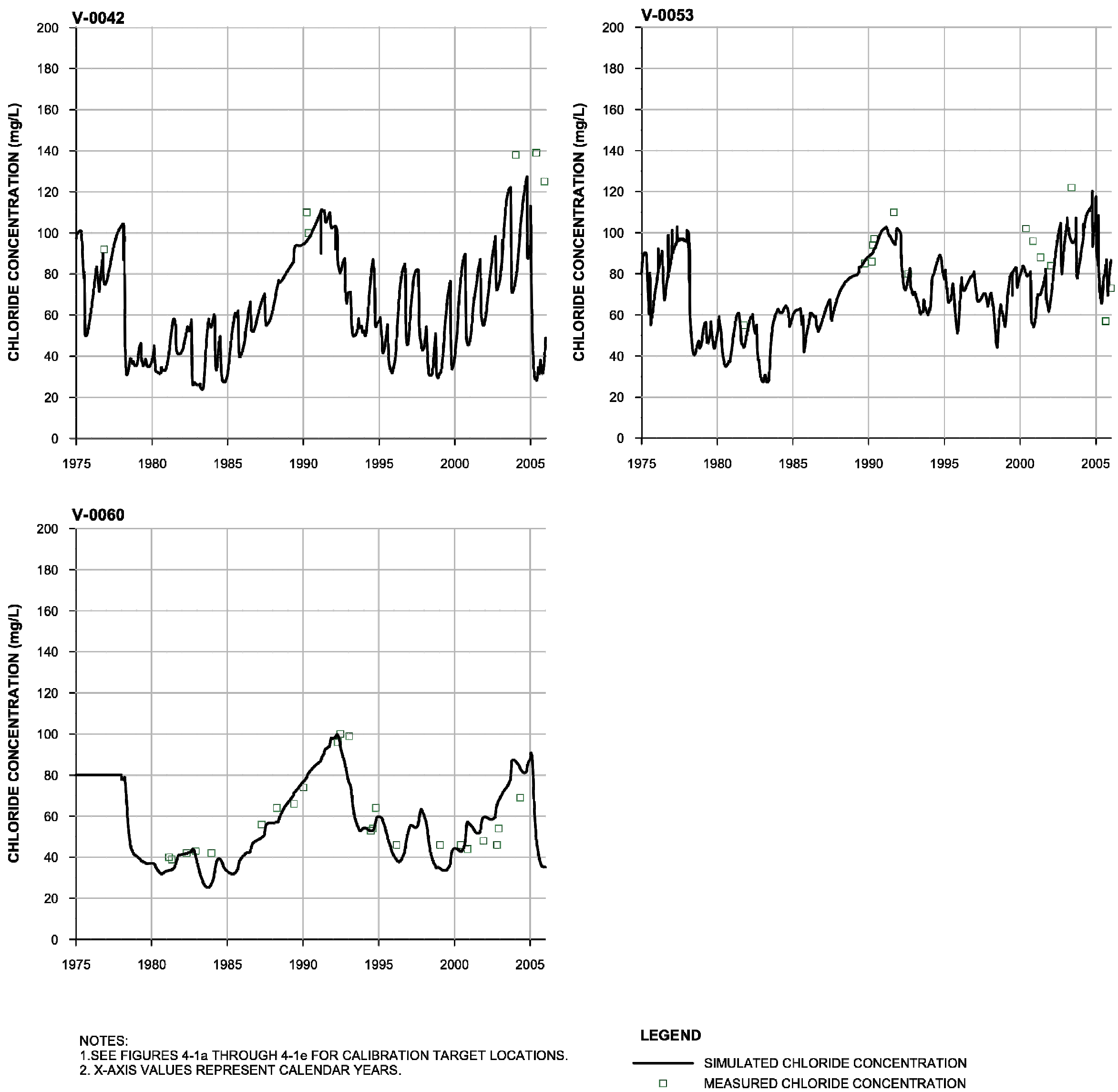

Figure 23. Eastern Piru Wells Modeled and Measured Chloride Concentrations

As shown in the figures, the chloride concentrations can vary significantly over time. Most wells have a 60 to 80 mg/L variation in the concentrations over time. Additionally, The concentrations in the wells tend to go down as you move downstream from V-0012 to V-0042 and wells V-0053 and V-0060 are off the main stream channel a bit and have the lowest concentrations of all of the wells. Three of the four most upstream wells have historic and current measured data above 140 mg/L and modeled data above 160 mg/L.

Following is an analysis of the current and historic modeled water quality in the above wells. The water quality analysis covered the historic period (1975-1978), the current period (2000-2005) and all periods (1975-2005). Summary statistics for individual wells and all of the wells considered together were developed. Table 18 summarizes the analysis using the model results.

Table 18. Eastern Piru Basin Chloride Concentration Summary Statistics

	V-0013	V-0012	V-0031	V-0036	V-0042	V-0053	V-0060	All Data
Min	76	85	56	63	24	27	25	24
Max	179	169	116	159	127	120	100	179
Average	108	113	79	97	64	71	57	84
Median	102	109	78	94	58	70	54	84
90th percentile	144	140	102	129	101	97	84	122
95th percentile	159	153	112	142	106	101	88	139
99th percentile	144	140	102	129	101	97	84	122
Mean + 2 Standard deviations	155	155	111	138	113	108	96	142
1975-1978 Average	104	134	70	112	74	76	74	92
2000-2005 Average	141	133	104	120	74	85	63	103

The current water quality objectives for the Eastern Piru Subbasin are 200 mg/L for chloride, 2500 mg/L for TDS, and 1200 mg/L for sulfate. The measured and modeled data for the San Pedro formation wells indicate that the current objectives may be high for the San Pedro aquifer downgradient of Las Brisas Bridge. However, modeled maximums show data approaching 200 mg/L (179 mg/L).

2.5.2 Predicted Future Water Quality Analysis for Chloride

As discussed in the AWRM Benefits Report (Appendix 8), water quality improvement is expected in the wells west of Las Brisas Bridge after implementation of the AWRM project. As a result, the values shown above may be reduced in the future. Predicted concentrations after implementation of the AWRM for the wells shown above are presented in the Task 2B-2/Task 9 report. The results from that report for the well with the highest predicted groundwater concentrations (V-0013) are shown below.

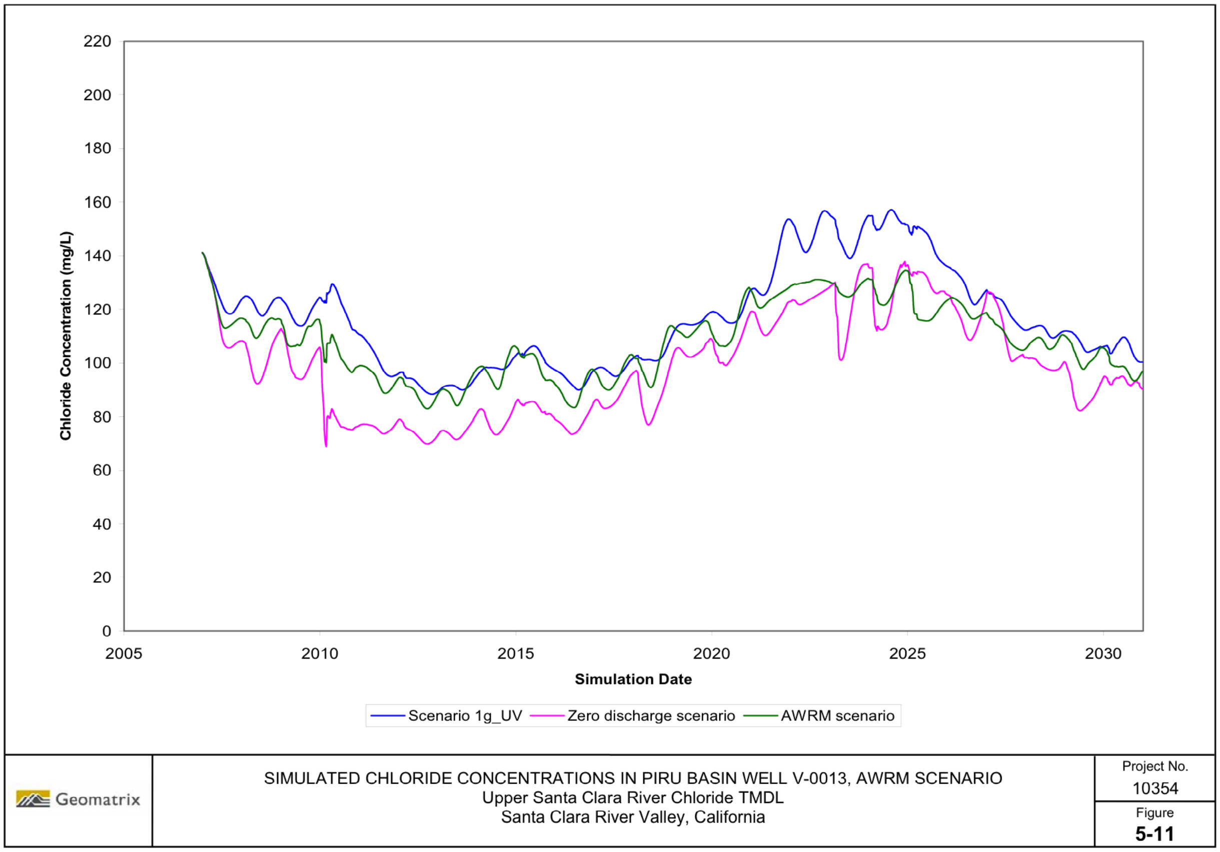

Figure 24. Predicted Water Quality in V-0013 under Different Compliance Scenarios

As shown in the figure, with implementation of source control and UV disinfection at the WRPs but no other compliance measures, concentrations in this well would reach approximately 160 mg/L during critically dry periods. However, with the AWRM, concentrations start out near 140 mg/L, but over time are lower than base case, and would comply with the 130 mg/L Reach 4B groundwater SSO.

As a result, predicted water quality in the Piru Basin is likely to be lower than the current water quality objectives for wells west of Las Brisas Bridge, but are still likely to be higher than the proposed surface water SSO of 130 mg/L initially. Over time, the groundwater will likely approach 130 mg/L after implementation of the AWRM.

2.5.3 Reach 4B Groundwater SSO Alternatives and Proposed SSOs

The data analysis presented above suggests four alternatives for consideration for the groundwater objectives underlying Reach 4B.

- Alternative 1. No change to the groundwater objectives for the Eastern Piru Basin.
- Alternative 2. Keep the current groundwater objectives the same for the alluvium and add new groundwater objectives for the San Pedro formation.
- Alternative 3. Divide the basin into two regions, east and west of Las Brisas Bridge. In the eastern portion of the basin, keep the existing groundwater objectives. In the western portion of the basin, develop new groundwater objectives.
- Alternative 4. Determine compliance points with differing groundwater objectives based on the location in the basin.

For both alternative 2 and 3, the revised groundwater objectives should be based on concentrations that will likely be observed during drought periods, but also ensure that degradation of the basin does not occur. The development of site-specific objectives based on historic water quality to prevent degradation can be established as an upper limit using a statistical procedure. Upper limit values have been determined in a number of ways including the mean plus two standard deviations (Dunn, 1989) and the 90^{th} percentile value (Breidt et al., 1991). Using the mean plus two standard deviations, a possible chloride objective for the wells shown in Table 18 would be 155 mg/L. This value is in the same range as the chloride objectives that have been proposed for protection of agricultural beneficial uses in Reaches 5 and 6 (150 mg/L), where no salt-sensitive crops are cultivated, and in the Calleguas Creek watershed, where salt-sensitive crops, such as strawberries, avocados, and nursery crops are cultivated. The proposed chloride objective for areas west of the Las Brisas Bridge is 150 mg/L. For TDS and sulfate objectives, the existing WQOs of 2,500 mg/L and 1,200 mg/L, respectively, can be revised to be consistent with existing surface water quality and overlying surface water objectives of 1,300 and 600 mg/L, respectively, for these constituents. Figure 25, shows historical existing surface water quality for TDS, sulfate and chloride, which incidentally recharge San Pedro formation groundwater in Reach 4B.

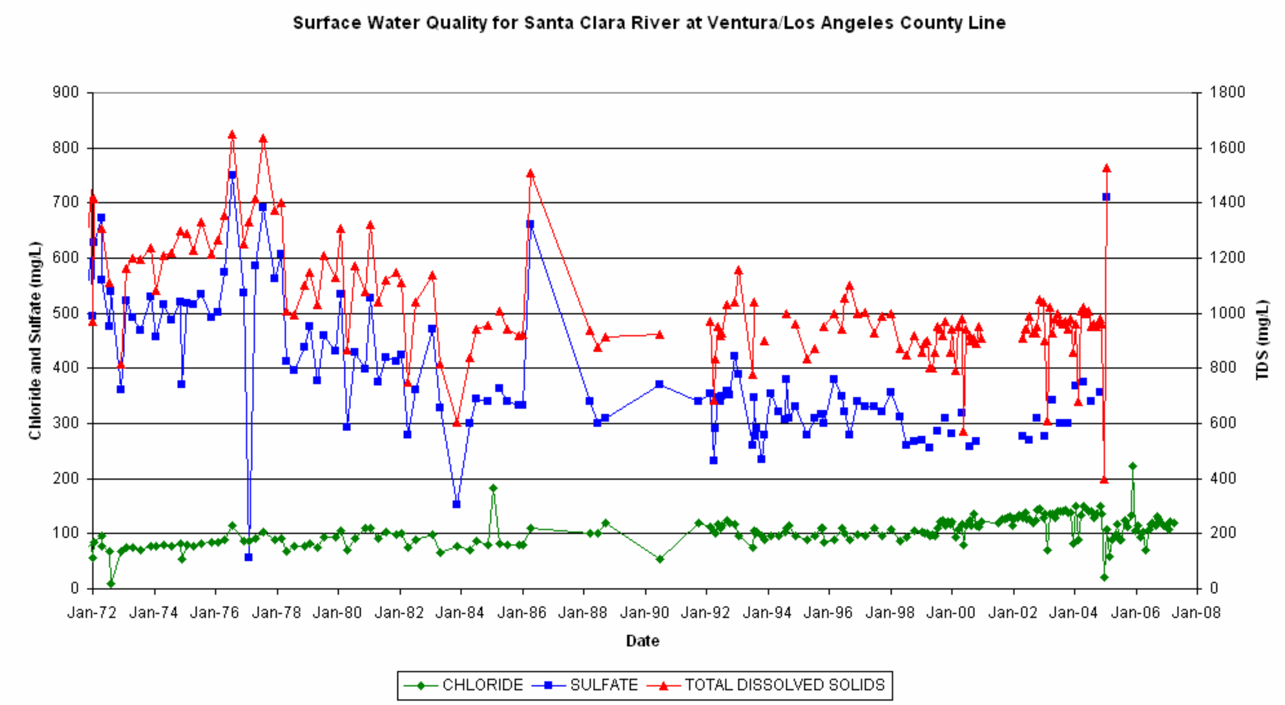

Figure 25. Surface Water Chloride, TDS and Sulfate Concentrations at Ventura/Los Angeles County Line

For alternative 4, compliance points would be established at well GSWI-MW03 east of Las Brisas Bridge and V-0013 west of Las Brisas Bridge. Each of these wells has shown the highest observed and predicted concentrations in the respective subareas. Use of these wells as compliance points would indicate that other wells in the subareas were in compliance with the proposed objectives. For GSWI-MW03, the objectives would not be changed from the current Basin Plan objectives. For V-0013, the revised objectives should be selected in the same manner as discussed for alternatives 2 and 3.

Alternative 1 is not recommended because it does not recognize the improved water quality in the groundwater basin west of Las Brisas Bridge.

Alternatives 2, 3 and 4 all result in the same water quality objectives for the different portions of the groundwater basin. The difference between the alternatives comes in how the objectives are applied.

Alternative 2 recognizes the differences between the characteristics of the shallow alluvium and the San Pedro formation. Additionally, there is no current or expected future use of the shallow alluvium groundwater for beneficial uses in the Blue Cut area. Groundwater production occurs both upstream and downstream of Blue Cut where the Saugus and San Pedro aquifers yield more water with greater saturated thicknesses. Separating the groundwater basin into the alluvium and deeper San Pedro aquifer and distinguishing the water quality characteristics of the two is consistent with the mechanism for setting objectives in other basins in the Los Angeles Region. For both the Oxnard Plain and Pleasant Valley basins, different objectives are assigned for the unconfined and perched aquifers and the lower aquifers. As shown in Appendix 10 (Geomatrix, 2008), the high chloride levels in the alluvium near Blue Cut do not appear to have a downgradient impact on the deeper groundwater. Additionally, the proposed SSO is to lower the objectives in the deeper aquifers, not to raise the objectives for the alluvium. So, no degradation of the groundwater basins is expected as a result of this SSO.

Alternative 3 requires a subdivision of the groundwater basin. Given that USGS and the DWR do not recognize subdivisions in the Eastern Piru Basin, this alternative is not the preferred alternative. However, consultation with these agencies could be considered.

Alternative 4 does not require any changes to the definition of the groundwater basin in the Basin Plan. As such, it may be the preferred alternative. However, use of compliance points in the groundwater basin may result in confusion as to which objectives should be applied if other wells are found to be higher than either of the proposed objectives.

2.6 SUMMARY OF PROPOSED SSOS

Table 19 summarizes the proposed surface water objectives and averaging periods resulting from the analysis provided in the previous sections. Table 20 summarizes the recommended SSOs and averaging periods for groundwater.

Table 19. Proposed Surface Water SSOs

Reach	Proposed Chloride Objective (mg/L)	Proposed Sulfate Objective (mg/L)	Proposed Averaging Period
6	150	450	Annual
5	150		Annual
4B	117[a]		3-month
4B Critical Conditions	130[b]		Annual

a. The Reach 4B WQO of 117 mg/L applies at all times unless the following conditions and implementation requirements are met:
   1. Water supply concentrations measured in Castaic Lake are ≥ 80 mg/L.
   2. Salt-sensitive agricultural uses that are irrigated with surface water are protected during periods when Reach 4B surface water exceeds 117 mg/L.
   3. Beginning May 4, 2016, the cumulative net chloride loading above 117 mg/L ($CNCl_{117}$) to Reach 4B of the SCR from the SCVSD WRPs is zero or less, where:

$$CNCl_{117} = Cl_{(Above\ 117)} - Cl_{(Below\ 117)} - Cl_{(Export\ Ews)}$$

Where:

$Cl_{(Above\ 117)}$ = ([WRP Cl Load[1]/Reach 4B Cl Load[2]] * [Reach 4B Cl Load>117]) $_{Cumulative}$

$Cl_{(Below\ 117)}$ = ([WRP Cl Load[1]/Reach 4B Cl Load[2]] * [Reach 4B Cl Load<117]) $_{Cumulative}$

$Cl_{(Export\ EWs)}$ = [Cl Load Removed by Extraction Wells] $_{Cumulative}$

[1] WRP Cl Load is determined as the as the monthly average Cl concentration multiplied by the monthly average flow measured at the Valencia WRP.

[2] Reach 4B Cl Load is determined as the monthly average Cl concentration at Receiving Water Station RF multiplied by the monthly average flow measured at USGS Gauging Station 11109000 (Las Brisas Bridge).

b. The critical condition objective and receiving water limit applies if all of the conditions listed in note a are fulfilled and a letter is submitted to the LARWQCB documenting the fulfillment of these conditions.

Table 20. Proposed Groundwater SSOs

Basin	Santa Clara--Bouquet & San Francisquito Canyons (mg/L)	East Piru San Pedro Formation[1] (mg/L)
Chloride (mg/L)	150	TBD (150)
TDS (mg/L)	1000	1300
Sulfate (mg/L)	450	600
Averaging period	Annual	Annual

1. West of Las Brisas Bridge (at a certain well?)

3 Regulatory Analyses

The technical analysis above supports the development of SSOs. As noted in the technical analysis, required regulatory analyses support some of the decisions that were made in developing the proposed SSOs are based on the required regulatory analyses provided in this section. The first part of the analysis meets the requirements outlined in the Basin Plan Section 3. Water Quality Objectives, page 3-22, for developing site-specific objectives. The second part of the analysis provides information to address the factors in Porter Cologne Section 13241 for developing water quality objectives. The final portion of the analysis discusses the consistency of the proposed SSOs with the state and federal anti-degradation policies.

3.1 BASIN PLAN REQUIREMENTS

The Upper Santa Clara River Chloride TMDL authorizes the Sanitation Districts to develop technical analyses supporting a Basin Plan amendment incorporating a site-specific objective (SSO) for chloride. The Basin Plan provides that several elements should be addressed to justify the need for an SSO. These include in part:

- A thorough review of current technology and technology-based limits to comply with existing WQO, which can be achieved at the facilities on the study reach.
- A thorough review of historical limits and compliance with these limits at all facilities in the study reach;
- A detailed economical analysis of compliance with existing and proposed objectives.
- An analysis of compliance and consistency with all federal, state, and regional plans and policies.

3.1.1 Current Technology and Technology-Based Limits to Comply with Existing WQO, Which Can Be Achieved at the Facilities on the Study Reach

Compliance with the existing water quality objective would require point sources in Reaches 5 and 6 of the USCR to meet the final waste load allocation in the Chloride TMDL of 100 mg/L. This limit is expressed as a daily maximum on Waste Discharge Orders No. R4-2005-0031 (Saugus WRP) and R4-2005-0032 (Valencia WRP), and will become effective upon the expiration of the interim effluent limits on May 4, 2016 (unless extended), barring action approving a site-specific objective for chloride.

In response to the Chloride TMDL, Dr. David Jenkins evaluated historical chloride data from the Saugus WRP effluent to determine whether advanced treatment would be required to meet the chloride effluent limit.[23] The Jenkins report recommended the Saugus WRP be retrofitted with a microfiltration system followed by reverse osmosis (MF/RO) to meet the chloride effluent limit. RO has been identified as the best available technology (BAT) by EPA for salt removal, and has been used in other water reclamation facilities. RO removes dissolved solids by forcing

[23] See Dr. David Jenkins (April 2003). *Treatment Methods for Meeting Proposed Effluent Permit Limits Criteria at the Saugus Water Reclamation Plant (WRP)*

pressurized water through a membrane permeable to water but impermeable to dissolved solids. Approximately 95% of chloride ions are removed in a two stage RO system.

In addition to the Jenkins report, Montgomery Watson Harza (MWH) prepared a series of reports for the District to evaluate alternative compliance technologies and estimate the cost of compliance with the recommended technology. After identifying and evaluating various treatment technologies available for chloride removal, MWH determined that reverse osmosis is the most feasible treatment technology for chloride removal to achieve compliance with the Chloride TMDL's waste load allocation. To provide the necessary quality of feedwater to an RO process, MWH recommended the installation of a membrane microfiltration (MF) system based on previous studies conducted in San Diego. Based on this information, MWH proceeded with the design and cost of an MF/RO system for both Valencia and Saugus.

MWH also investigated the feasibility of various brine reduction technologies to minimize the expense of disposing of the brine waste stream generated during RO treatment. In its analysis, MWH determined that each of the brine reduction technologies reviewed (including solar evaporation, crystallization, chemical precipitation, brine concentrating membranes, and freeze drying) had significant disadvantages related to land and energy requirements and unproven technology. Therefore, direct disposal of the RO reject stream was deemed most practical. Four disposal options were examined:

- A gravity pipeline to a new 3-mile dedicated ocean outfall that would be located in Ventura County;
- A pipeline and pump station to the Districts' Joint Water Pollution Control Plant (JWPCP) facility in the City of Carson, which has an existing discharge tunnel and ocean outfall; and,
- Trucking brine waste to JWPCP; and,
- Disposal via deep well injection.

In the 2002 and 2008 MWH studies, deep well injection and the two brine pipeline options were each considered feasible in concept with the understanding that further detailed investigation of the projects is necessary to determine the actual feasibility. Project constraints were identified for each of the options. The option of trucking brine waste was considered infeasible due to the quantity of brine that would be produced.

It should be noted that Trussell Technologies, Inc. has also evaluated technologies for desalination of reclaimed water as part of the District's efforts to comply with the TMDL.[24] Similar to MWH's conclusions, this firm has recommended that the best treatment train for chloride removal at the Saugus and Valencia WRPs would include a microfiltration or membrane bio-reactors (MBR) followed by reverse osmosis or nanofiltration.

In summary, a number of studies have been completed that demonstrate compliance with the current water quality objective of 100 mg/L at the point of discharge would require

[24] See Trussell Technologies, Inc. Technical Memorandum No. 6.002 – 008 (TM 8), Analysis of Treatment Costs for Chloride for the Santa Clarita Valley Joint Sewerage System (SCVJSS) (March 23, 2007). R. Shane Trussell, Ph.D., P.E. and Ramesh R. Sharma, Ph.D.

implementation of reverse osmosis. Recent modeling from the GWSIM demonstrates that 100 mg/L will not be achieved through source control alone (CH2M Hill, 2008). Although the installation of reverse osmosis is an available technology, treating to allow full discharge at 100 mg/L from the two WRPs would be costly and brine disposal options, such as construction of a pipeline and disposal off the Ventura County coast could have unintended environmental and political consequences.

3.1.2 A thorough Review of Historical Limits and Compliance with These Limits at all Facilities in the Study Reach

The Saugus and Valencia WRPs are the most significant point source dischargers of chloride into Reaches 4, 5, and 6 of the Santa Clara River. Therefore, the historical limits discussed below concern only these facilities. The chloride effluent limits that appear in the historical waste discharge orders for Saugus and Valencia are shown below in Table 21 and Table 22. Further explanation of these limits and compliance with them is explained below

Table 21. Current and Historical Chloride Effluent Limits for the Valencia Water Reclamation Plant

Order No. (Adoption date)	Monthly Ave	Daily Maximum	12-Month Rolling Ave	
R4-2003-0145 (As amended by R4-2005-032 05/5/2005).	100[1]	100[2] 230[3]	SWP treated water supply concentration + 134 mg/L.[3]	[1] This is the chloride objective in Basin Plan. This limit applied from the effective date of the Order until EPA approved Res. R04-004 (Revising *Re. 03-008)* on 4/28/05. The limit no longer applies and has been superseded by the interim limit (note [3]), which became effective May 4, 2005 under Res. R4-2006-016. [2] This is the WLA under Res. R04-004. This limit will serve as the effluent limit barring action approving an SSO. The limit became effective when EPA approved the Chloride TMDL on May 6, 2005, but is not enforceable until the interim limit expires. [3] This Interim limit is currently effective. It equals the SWP treated supply chloride + 134 mg/L not exceeding 230 mg/L as a daily maximum. The interim limit became effective upon EPA approval of *Chloride TMDL* and superseded the Basin Plan limit. The interim limit will remain until superseded by the chloride WLA unless extended. (See Res. R4-2006-016, Attachment A Task 14.)
R4-2003-0145 (11/6/2003)	100[4]	100[5]	None	[4] This is the chloride objective in the Basin Plan. Interim limits of 187 mg/L (monthly avg) and 196 mg/L (daily max) would have superseded this limit upon EPA approval but never became effective because they were revised prior to EPA approval. [5] This is the wasteload allocation adopted in the Chloride TMDL.
	187[6]	196[6]	None	[6] These were the interim limits in the Chloride TMDL adopted 10/24/02. These interim limits never became effective because they were revised prior to EPA approval. The interim limits were amended on 5/6/04 (Res. 04-04). EPA approved the revised TMDL on 4/28/2005.

Order No. (Adoption date)	Monthly Ave	Daily Maximum	12-Month Rolling Ave	
95-081 as revised by 98-027 (04/13/1998)	None	190 mg/L to January 8, 2001, thence 100 mg/L[7]	None	[7] According to Order 98-027, this interim limit would expire on January 9, 2001.
95-081 (6/12/1995)	None	100	None	
89-129 (12/04/1989).	None	100[8]	None	[8] This limit was based on monthly 24-hr composites. The limit applied until Res. 90-004 was adopted. The limit was not considered violated unless the effluent chloride exceeded 250 mg/l or exceeded the water supply concentration plus 85 mg/l, whichever was less. (Res. 90-004; See Footnote 4/ on p. 7 of Order 95-081).
84-76[9] (09/17/1984)	None	None	None	[9] This Order accommodated the joint operation of the Saugus and Valencia WRPs; Subsequent Order 87-48 added limits for reclaimed water use.
79-126[10] (7/23/1979)	None	None	None	[10] Resolution 81-36 changed this permit to incorporate a Basin Plan amendment. The permit changes did not add chloride limitations for effluent discharged to the river.
74-181[11] (07/15/1974)	None	250 mg/L	None	[11] This Order accommodated the fact WRP's discharge to the SCR percolated into the groundwater and added requirements pertaining to use of reclaimed water.
74-114 (5/20/1974)	None	250 mg/L[12]	None	[12] This limit was a "Maximum" monitored using a 24-hour composite with a minimum weekly frequency of analysis.
72-27 (07/19/1972)	None	175 mg/L[13] (monthly sampling)	None	[13] 8-hr composite with monthly monitoring.
Resolution 65-48 (11/15/1965)	None	"125 ppm, or the average weighted value of the domestic water supply, plus 50 ppm, whichever value is greater."[14]	None	[14] Compliance was determined based on composite sampling with monthly sampling.

Table 22. Current and Historical Chloride Effluent Limits for the Saugus Water Reclamation Plant

Order No. or Res. No. (adoption date)	Monthly Ave	Daily Maximum	12-Month Rolling Ave	
R4-2003-0143 (as amended by R4-2005-031, 05/5/2005).	100[1]	100[2]		[1] This is the chloride objective in Basin Plan. This limit applied from the effective date of the Order until EPA approved Res. R04-004 (Revising *Re. 03-008)* on 4/28/05. The limit no longer applies and has been superseded by the interim limit (note [3]), which became effective May 4, 2005 under Res. R4-2006-016. [2] This is the WLA under Res. R04-004. This limit will serve as the effluent limit barring action approving an SSO. The limit became effective when EPA approved the Chloride TMDL on May 6, 2005, but is not enforceable until the interim limit expires.
		230[3]	SWP treated water supply concentration + 114 mg/L[3]	[3] Interim limit is the SWP treated supply chloride + 114 mg/L not exceeding 230 mg/L as a daily max. Interim limit became effective upon EPA approval of *Chloride TMDL* and superseded the Basin Plan limit. Interim limit will remain until superseded by the chloride WLA unless extended. (See Res. R4-2006-016, Attachment A Task 14.)
R4-2003-0143 (11/6/2003)	100[4]	100[5]	None	[4] This is the chloride objective in the Basin Plan. Interim limits of 200 mg/L (monthly avg) and 218 mg/L (daily max) would have superseded this limit upon EPA approval but never became effective because they were revised prior to EPA approval. [5] This is the WLA adopted in the Chloride TMDL.
	200[6]	218 [6]	None	[6] These were the interim limits in the Chloride TMDL adopted 10/24/02. These interim limits never became effective because they were revised prior to EPA approval. The interim limits were amended on 5/6/04 (Res. 04-04). EPA approved the revised TMDL on 4/28/2005.
95-080 as revised by 98-027 (04/13/1998)	None	190 mg/L to January 8, 2001, thence 100 mg/L[7]	None	[7] According to Order 98-027, this interim limit would expire on January 9, 2001.
95-080 (6/12/9195)	None	100	None	[8] This limit is based on monthly 24-hr composites. The limit was not considered violated unless the effluent chloride exceeded 250 mg/l or exceeded the water supply concentration plus 85 mg/l, whichever was less. (Res. 90-004; See Footnote 4/ on p. 7 of Order 95-080)

Order No. or Res. No. (adoption date)	Monthly Ave	Daily Maximum	12-Month Rolling Ave	
89-130 (12/4/1989)	None	100[9]	None	[9]Limit applied until Res. 90-004 was adopted on March 23, 1990. Under Res. 90-004, exceedances of the 100 mg/L limit were not considered violated unless the discharge exceeded 250 mg/l or the water supply concentration plus 85 mg/l.
84-077 (09/17/1984)	None	None	None	
79-127 (07-23-1979)	None	None	None	
74-113[10] (May 20, 1974)	None	250	None	[10] Order No. 74-113 appears to have been the first "permit" issued to the Saugus facility. Subsequent orders were adopted in 1974, which did not alter the 250 mg/L effluent limit for chloride.
Resolution 61-26[11] 04/19/1961)	None	"125 ppm or the average weighted value of the domestic water supply, plus 50 ppm, whichever value is greater."[12],	None	[11] This was the first instrument establishing waste discharge requirements. The Resolution was "not a permit" and did not "legalize [the] proposed waste disposal facility." [12] Compliance was determined based on composite sampling (p. 5 of permit). The language in the permit is slightly unclear as to the limit, but based on the wording in the Valencia WRP order, the effluent limit was construed to be 125 mg/L or the water supply chloride level plus 50 mg/L.

3.1.2.1 Initial Water Reclamation Plant Resolutions

The first Regional Board Resolutions in effect for the Saugus and Valencia Water Renovation Plants[25] established concentration-based chloride effluent limits for Saugus (Resolution 61-26) (04/19/1961) and Valencia (Resolution 65-48) (11/15/1965) as shown in Table 21 and

Table 22. Based on the absence of any reference to a chloride water quality objective for the Santa Clara River in these initial resolutions, these are the only concentration-based chloride limits applicable to the Saugus and Valencia facilities that existed at that time.[26]

The chloride effluent limit for Saugus, the first of the two plants to operate, was phrased as "125 ppm or the average weighted value of the domestic water supply, plus 50 ppm, whichever value is greater." Chloride data for the domestic water supply is unavailable for gauging compliance with this limit. However, assuming 125 mg/L represented the applicable limit, the Saugus WRP exceeded the limit only once in December 1970, as shown in Figure 26. The Valencia WRP's initial permit (Resolution 65-21) had a similar variable limit, but was more clearly defined as the greater of 125 mg/L or the supply water concentration plus 50 mg/L. Figure 27 shows that the Valencia WRP consistently complied with the 125 mg/L effluent limit.

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[25] The Saugus and Valencia facilities were formerly known as "Water Renovation Plants."

[26] Resolutions 61-26 and 65-48 were adopted prior to the Porter Cologne Water Quality Control Act (1969), which initiated the basin planning process. At this time, the Regional Board adopted water quality objectives independent of basin plans. With adoption of the Interim Water Quality Control Plan on June 10, 1971, the Regional Board compiled all existing water quality objectives into one document. At that time, the two WRPs were subject to their original resolutions, which contained chloride effluent limits but no apparent chloride objective for the Santa Clara River.

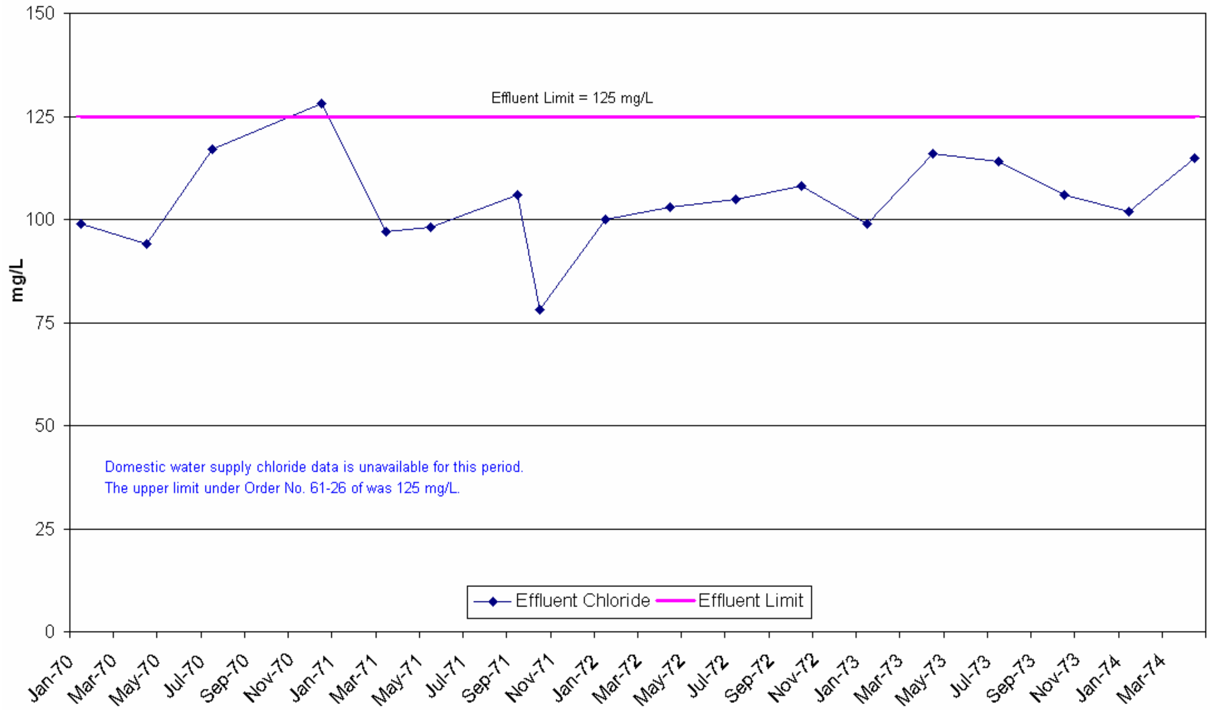

Figure 26. Chloride Concentration in Final Effluent at Saugus WRP (Resolution No. 61-26)

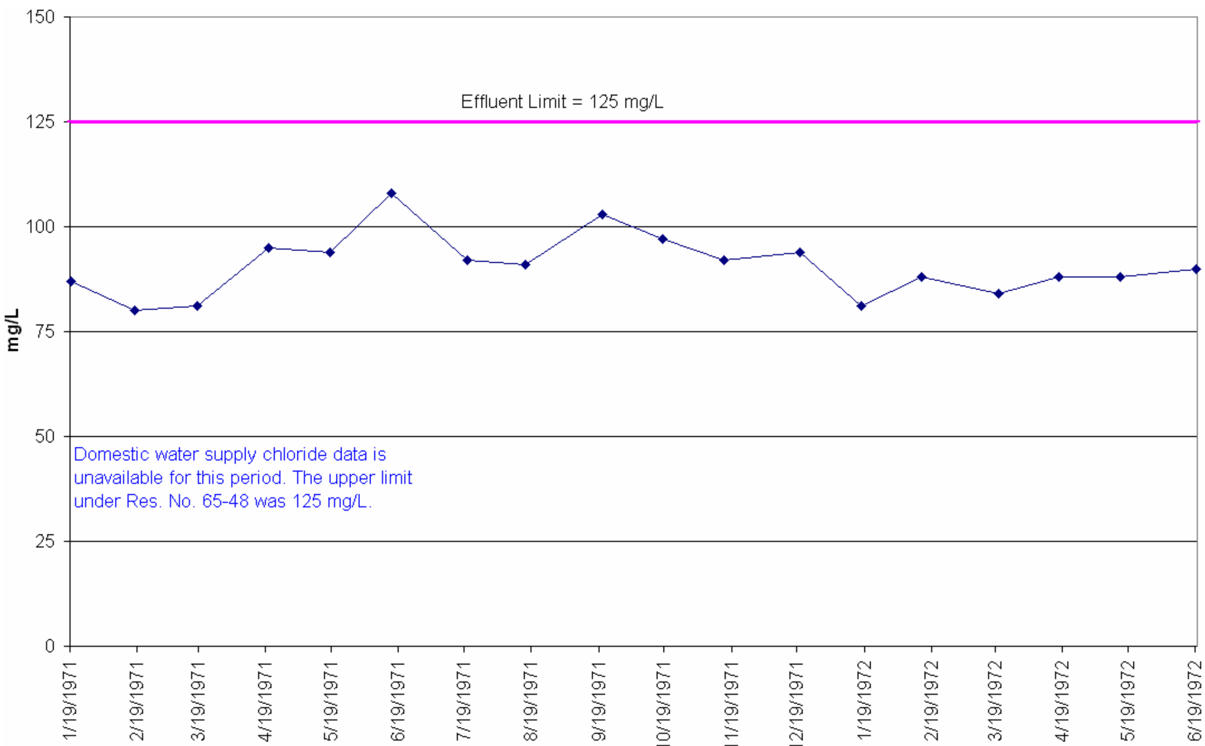

Figure 27. Chloride Concentration in Final Effluent at Valencia WRP (Resolution 65-48)

3.1.2.2 Waste Discharge Orders 72-27 (Valencia) and 74-113 (Saugus)

Order No. 72-27 (Valencia) and Order No. 74-113 (Saugus) were the first two operating permits that followed Resolution 61-26 and Resolution 65-48. These permits established effluent limitations of 175 mg/L (Valencia) and 250 mg/L (Saugus). The Valencia limit was subsequently revised to 250 mg/L in Order No. 74-114. Figure 28 and Figure 29 show the historical compliance with Orders No. 74-113 and 72-27, respectively. During its initial permit, Valencia did not exceed its 175 mg/L limit. During the period when the 250 mg/L limits applied to the facilities, as stated above, Valencia exceeded the limit three times and Saugus exceeded the limit once in 1977 (Figure 28 and Figure 30). The 250 mg/L limits applied until 1979 when the chloride limits were removed from both permits under Order No. 79-126 (Valencia) and Order No. 79-127 (Saugus).

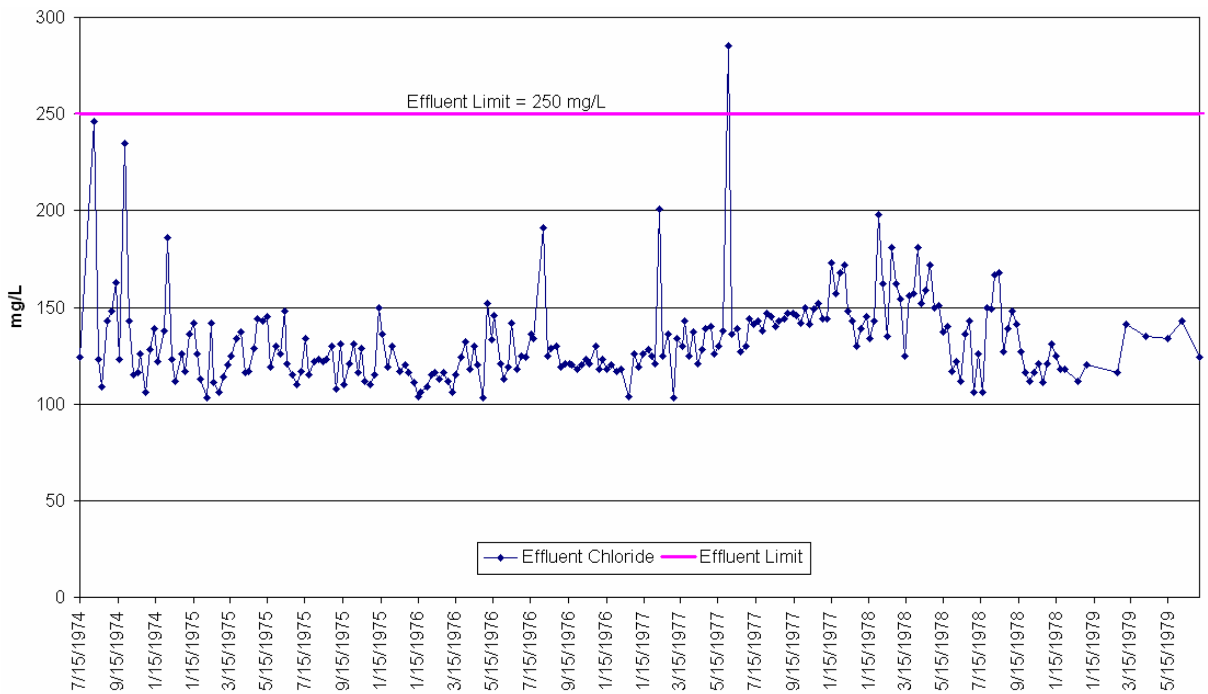

Figure 28. Chloride Concentration in Final Effluent at Saugus WRP (Order 74-113)

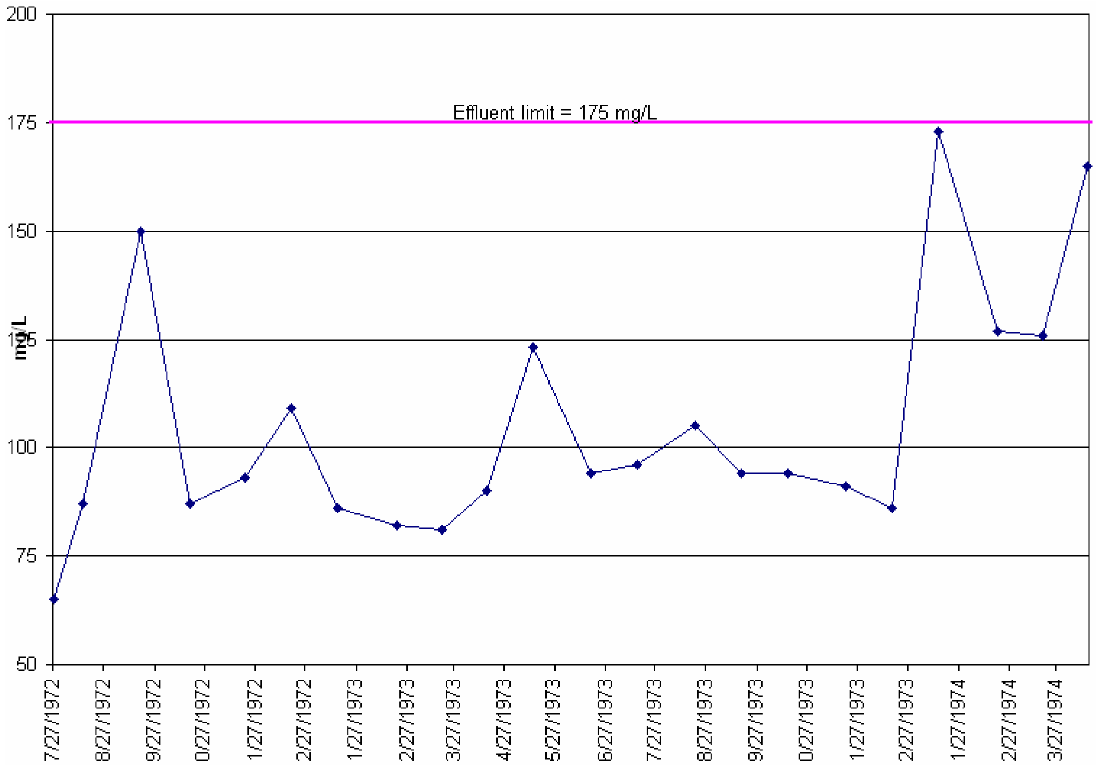

Figure 29. Chloride Concentration in Final Effluent at Valencia WRP (Order 72-27)

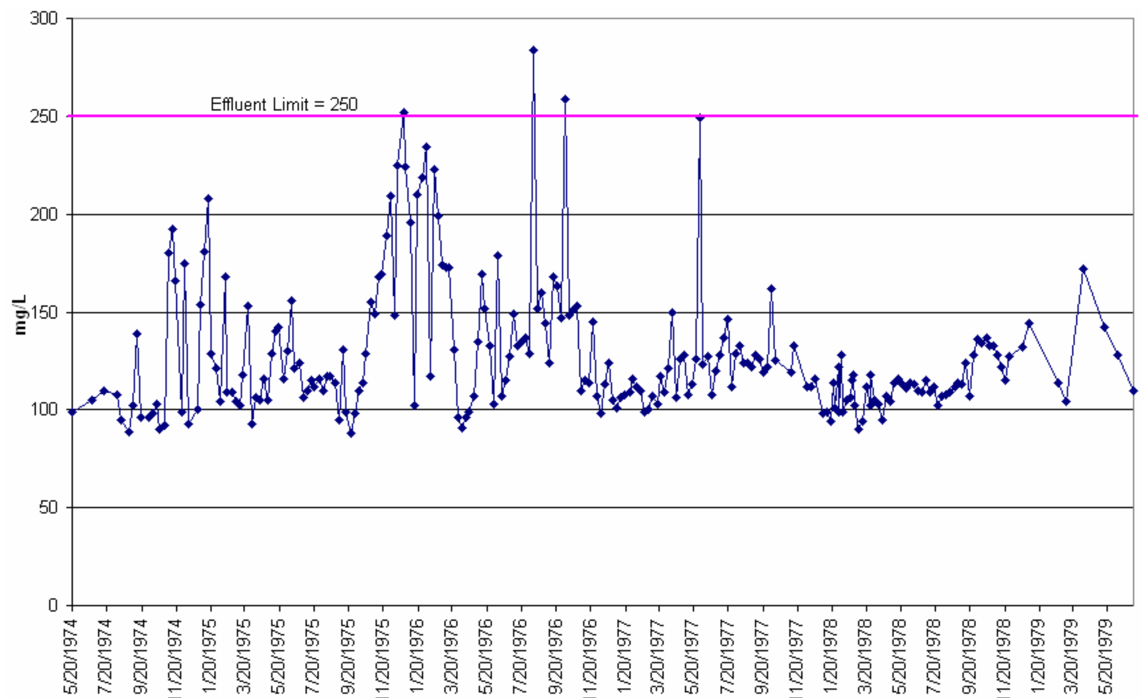

Figure 30. Chloride Concentration in Final Effluent at Valencia WRP (Order 74-114)

3.1.2.3 No Limit for 10 Years

No chloride effluent limit applied during the period July 23, 1979 to December 3, 1989 covering Orders 79-126 and 84-076 for Valencia) and Orders No. 79-127 and 84-077 for Saugus. On December 4, 1989, the Regional Board adopted Orders No. 89-129 (Valencia) and 89-130 (Saugus) rescinding Orders 84-076 and 84-077, respectively. These permits each contained 100 mg/L limits as daily maximums, which neither WRP could meet during the three-month period the limits applied before being preempted by the 1990 Drought Policy as explained below.

3.1.2.4 The Drought Policy (Resolution 90-004)

The state-wide drought that persisted during water years 1987-88 through 1991-92 made compliance with chloride effluent limits difficult for many southern California dischargers due to the increased chloride levels in supply water sources resulting from the drought. In response to this concern, in 1990, the Regional Water Board authorized the Saugus and Valencia WRPs, among other dischargers, to apply for temporary relief. RWQCB Resolution 90-04 (March 26, 1990) known as the "Drought Policy" authorized an increase in effluent chloride limits to the lesser of (1) 250 mg/L or (2) the chloride concentration in supply waters plus 85 mg/L.[27]

The Drought Policy established conditions designed to ensure chloride effluent limitations were beyond the control of local dischargers and that dischargers would take measures to reduce chlorides from sources within their control. For example, the Sanitation Districts had to demonstrate by July1, 1990 and quarterly, thereafter, that the increased chloride concentrations were due solely to changes in the character of the water supply related to drought conditions or water conservation measures or some combination thereof. The record indicates that the Sanitation Districts satisfied the Drought Policy's conditions throughout its duration. Therefore, on March 26, 1990 and until expiration of the Drought Policy, the Valencia and Saugus WRPs were subject only to the chloride limits established in Resolution 90-004.

The Drought Policy resolved that the Regional Board would reconsider the policy within one year after source water supplies returned to pre-drought conditions, or within three years, whichever came first. Although the statewide drought ended in water year 1991-92, in accordance with Resolution 90-004, the Regional Board extended the reconsideration period of the Drought Policy in 1993 and again in 1995 because the chloride levels in supply waters remained higher than the chloride levels before the onset of the drought.[28] The effective permits at the time of the Drought Policy in 1995 were Orders No. 89-129 and 95-081 (Valencia) and Orders No. 89-130 and 95-080 (Saugus). Each of these permits established chloride discharge limits of 100 mg/L, but the Drought Policy governed the compliance.

Figure 31 and Figure 32 show that the Saugus WRP generally met the limits under the Drought Policy except on limited occasions during the policy's seven-year span. The Valencia facility

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[27] The 1990 Drought Policy is unclear as to whether it granted relief for discharges under the existing waste discharge orders for exceedances occurring prior to the policy's adoption. No clear language in the policy suggests the Board intended relief to be granted retroactively.

[28] The Regional Board renewed the Drought Policy on June 14, 1993 at its 365th regular meeting. (See Item 10 – June 14, 1993, "Reconsideration of Resolution 90-004 …") The Regional Board subsequently extended the reconsideration period for another two years on February 27, 1995. (See Item 8 - Reconsideration of Resolution 90-004… 381st Regular Meeting.)

had more difficulty meeting the Drought Policy, with exceedances more frequent than for Saugus as shown in Figure 33 and Figure 35.

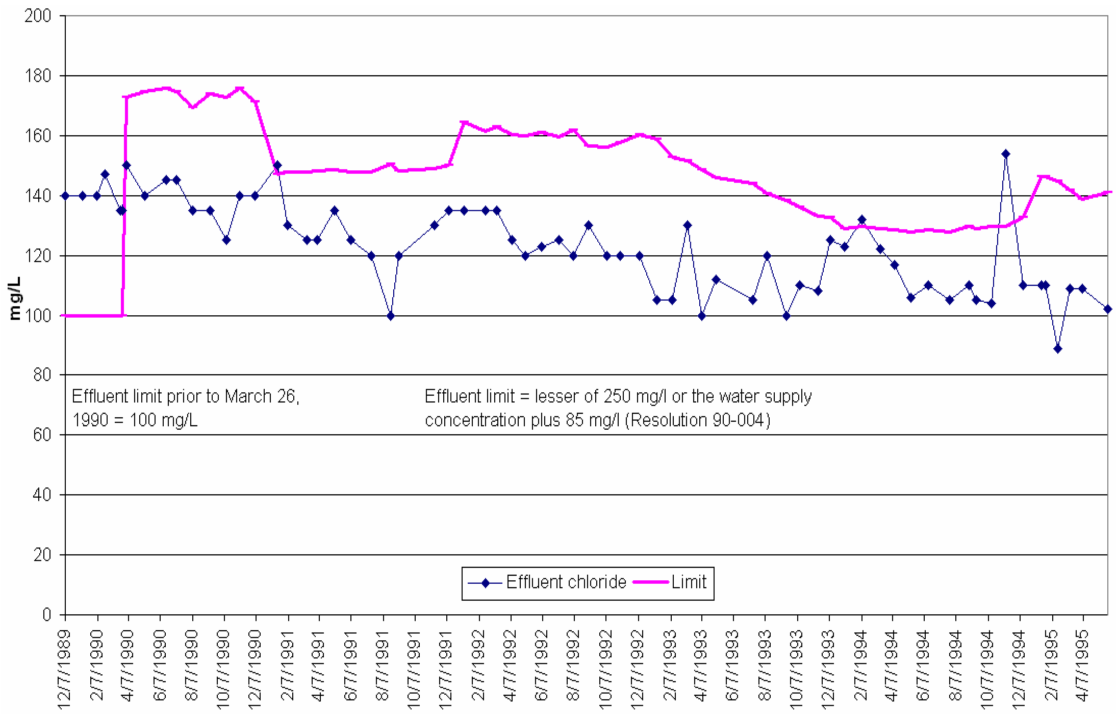

Figure 31. Chloride Concentration in Final Effluent at Saugus WRP (Order 89-130)

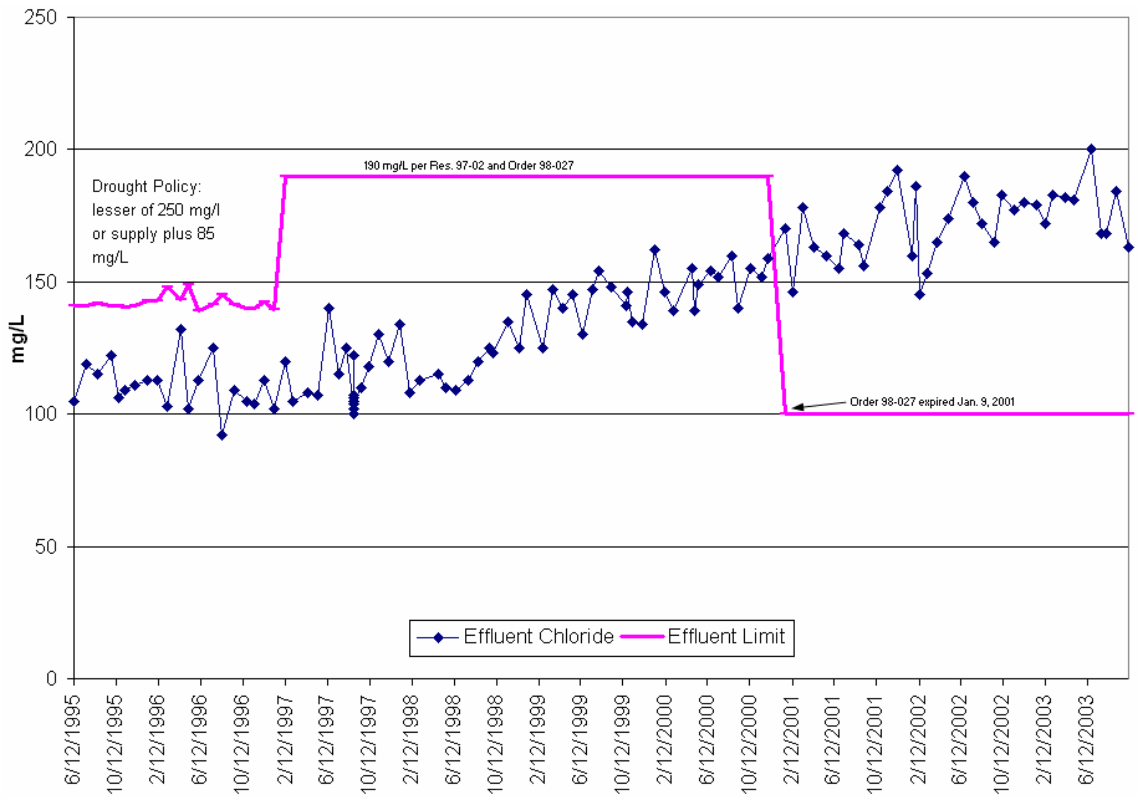

Figure 32. Chloride Concentration in Final Effluent at Saugus WRP (Order 95-80)

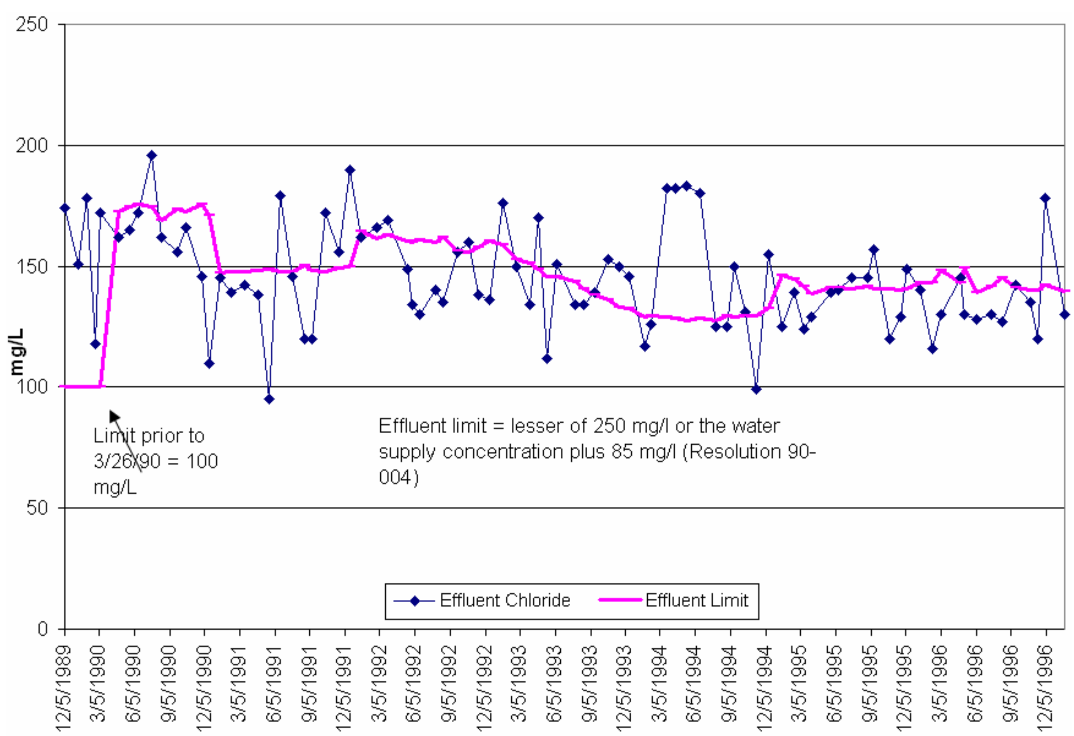

Figure 33. Chloride Concentration in Final Effluent at Valencia WRP (Orders 89-129 & 95-081)

3.1.2.5 Resolution 97-02 (190 mg/L)

The renewed Drought Policy was subject to reconsideration on the earlier of February 27, 1997 or when chloride levels in imported water had returned to pre-drought levels.[29] Accordingly, on January 27, 1997, the Regional Board adopted Resolution No. 97-02, which among other things granted a variance from the existing water quality objectives in the Santa Clara River and directed the Executive Officer to notify dischargers that they were subject to a surface water interim limit of 190 mg/L. This interim limit was to last for three years following final approval of the amendment. The Office of Administrative Law approved Resolution 97-02 on January 9, 1998.[30]

In response to Resolution No. 97-02, on April 13, 1998, under Order No. 98-027, the Regional Board revised the chloride effluent limits for the Saugus and Valencia WRPs to 190 mg/L (daily maximums), which would expire on January 9, 2001 consistent with the terms of Resolution 97-02.[31] Based on language in Resolution 97-02, the 190 mg/L limit applied prior to final approval of Resolution 97-02 on January 9, 1998.[32] Therefore, in summary, the Drought Policy limit (250 mg/L or SWP + 85 mg/L) applied during the period March 23, 1990 to January 26, 1997; and the 190 mg/L limit under Resolution 97-02 is presumed to have applied during the period January 27, 1997 to January 8, 2001. Orders in effect when Resolution 97-02's 190 mg/L limit expired were No. 95-081 (Valencia) and No. 95-080 (Saugus). The 100 mg/L was reinstated on January 9, 2001 presumably because no language in the ensuing permits, R4-2003-0145 (Valencia) and R4-2003-0143 (Saugus) speaks to the contrary. Based on this conclusion, the limit under the remaining periods of these permits was 100 mg/L, which neither WRP could meet on any collected samples.

With one exception, the Valencia WRP consistently met the Resolution 97-02's 190 mg/L limit over the period it applied. The Saugus WRP consistently met the limit with no exceptions. (Figure 31 through Figure 34).

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[29] See Los Angeles Regional Water Quality Control Board Resolution No. 97-02, Finding No. 5.

[30] See LARWQCB Order No. 98-027, which amended chloride effluent limits for 14 municipal treatment plants including the Saugus and Valencia plants. At this time, the "Alaska Rule" as reflected in 40 CFR part 121, had not been adopted by EPA. Thus, "final approval" of regional resolutions was regarded as approval by the state Office of Administrative Law instead of EPA use for Clean Water Act purposes.

[31] *Ibid.*

[32] See Resolved Item 8 in Resolution 97-02, which states "the Regional Board will evaluate compliance consistent with the provisions set forth in this resolution" while the resolution are under review by the State Water Board and Office of Administrative Law.

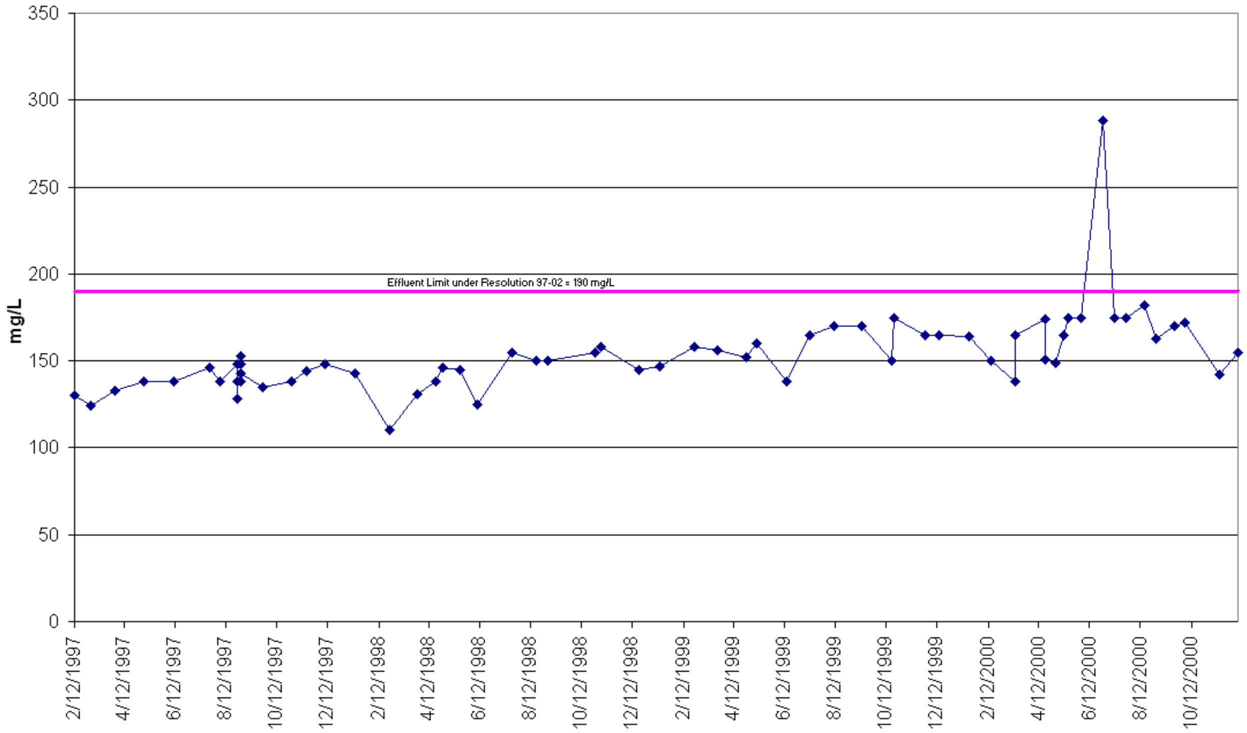

Figure 34. Chloride Concentration in Final Effluent at Valencia WRP (Resolution 97-02)

3.1.2.6 Current Limits

Orders No. R4-2003-0145 (Valencia) and R4-2003-0143 (Saugus) rescinded Orders No. 95-081 and 95-080, respectively. As amended by Resolution R4-2005-031 (May 5, 2005) for Saugus and Resolution R4-2005-032 (May 5, 2005) for Valencia, these permits contain the following chloride effluent limitations:[33]

- 100 mg/L as a monthly average, which no longer applies to either WRP. This limit reflected the water quality objective for chloride in the current Basin Plan and applied from the effective date of Orders R4-2003-0145 (Valencia) and R4-2003-0143 (Saugus) on November 6, 2003 until the day prior to April 28, 2005, when the Chloride TMDL for the Santa Clara River (Resolution No. R04-004) was approved by USEPA.
- Interim chloride effluent limits of the sum of the State Water Project treated water supply chloride concentration plus 114 mg/L for Saugus and 134 mg/L for Valencia, neither to exceed a daily maximum of 230 mg/L and measured as 12-month rolling averages. These limits became effective on April 28, 2005 [May 4, 2005 per Resolution R4-2006-

[33] On May 6, 2004, the Regional Board revised the Chloride TMDL to modify the interim waste load allocations within the TMDL to conform to the effluent limitations reflected in Time Schedule Orders (TSOs), which were adopted concurrently with Orders No. R4-2003-0145 (Valencia) and R4-2003-0143 (Saugus). These TSOs contained the same chloride interim limits subsequently adopted in Orders No. R4-2003-0145 (Valencia) and R4-2003-0143 (Saugus) as amended by R4-2005-031 (May 5, 2005) for Saugus and R4-2005-032 (May 5, 2005) for Valencia.

016] according to the terms of the permit and will remain in effect until superseded by the final effluent limit reflected in the TMDL of 100 mg/L as a daily maximum barring an action adopting a site-specific objective(s).[34] Both WRP consistently meet their interim effluent limits.

- A 100 mg/L limit as a daily maximum reflecting the waste load allocation (WLA) in the Chloride TMDL was approved by EPA on April 28, 2005. Under the terms of the TMDL, this limit will apply upon expiration of the current interim limits 11 years after the effective date of the TMDL (May 04, 2016) unless extended or unless a site-specific objectives derived under the terms of the TMDL is adopted.

In summary, a variety of effluent limitations for chloride have been effective since the WRPs began discharging. During some periods of discharge, the WRPs were in compliance with the limits and during others the limits were not achieved. However, the discharge concentrations have consistently exceeded 100 mg/L over the discharge period reviewed. Figure 35 shows a summary of the effluent limits as compared to discharge quality over time for both Saugus and Valencia.

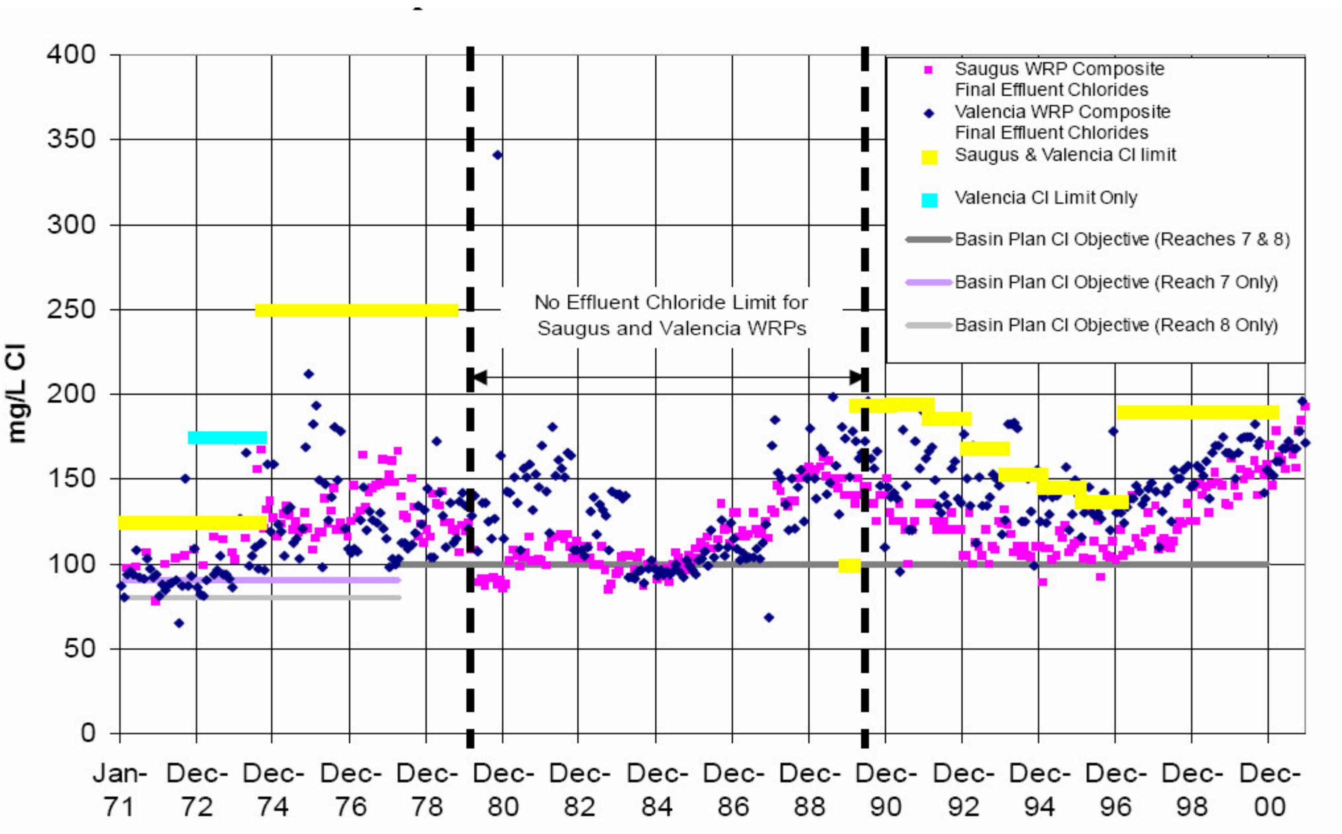

Figure 35. 1971-2001 Saugus and Valencia WRP Final Effluent Chlorides in Comparison to Historical Effluent Chloride Limits

[34] The State Water Resources Control Board Resolution No. 2007-0029 (May 22, 2007), which approved a Regional Board amendment to the chloride TMDL, indicates that the chloride TMDL became effective on May 5, 2005.

3.1.3 A Detailed Economical Analysis of Compliance with Existing and Proposed Objectives.

The Saugus and Valencia WRP are the most significant chloride dischargers to Reaches 5 and 6. Therefore, the discussion below concerns the economic impacts associated with only facility upgrades to the Saugus and Valencia WRPs and other commitments under the AWRM Compliance Option.

3.1.3.1 Economic Analysis of Compliance with 100 mg/L Limit

The GSWIM Task 2B-2 Report (Geomatrix, 2008) identifies two advanced treatment alternatives for compliance with potential final effluent chloride limits of 100 mg/L for the Saugus and Valencia WRPs. One alternative (Maximum Advanced Treatment) involves constructing enough advanced treatment at the Saugus and Valencia WRPs, so that the entire WRP recycled water discharge (blend of tertiary recycled water and desalinated recycled water) at each plant meets 100 mg/L in all conditions. A second alternative (Minimum Advanced Treatment) involves reducing or eliminating the amount of recycled water discharged from each WRP, so that only the minimum amount of discharge necessary to maintain habitat, complies with 100 mg/L under all conditions. In this alternative, advanced treatment on WRP recycled water would only be needed on the portion of minimum flows that are necessary to maintain habitat and achieve 100 mg/L as a final effluent chloride limit. The remaining balance of WRP recycled water flows that are not needed to support habitat are then disposed into an effluent disposal pipeline to the ocean, as opposed to being discharged to the river. This section evaluates the potential costs for implementing each of these compliance options for a final effluent chloride limit of 100 mg/L.

The Saugus and Valencia WRPs provide primary, secondary and tertiary treatment. These conventional treatment processes remove organic compounds and pathogens and produce high quality recycled water, but are not designed for the treatment or removal of dissolved salts such as chloride from wastewater. The District retained engineering consultant(s) to assess the various advanced treatment alternatives for compliance with the Chloride TMDL. The District's consultants evaluated the various alternative desalination technologies that would remove chloride in recycled water at the Valencia and Saugus Plants, including membrane processes (reverse osmosis, nanofiltration, and electrodialysis), thermal process (multi-stage flash distillation (MFD), multi-effect distillation (MED or MEE), and mechanical vapor compression (VC) technologies), and ion exchange processes. Both Montgomery Watson Harza (2002) and Trussell Technologies (2008) evaluated potential chloride reduction technologies and concluded that reverse osmosis treatment achieves a high removal of chloride and is less costly than the other desalination technologies and was therefore the recommended treatment alternative if advanced treatment to remove chloride is necessary for compliance with the Chloride TMDL.

These studies also concluded that reverse osmosis treatment requires appropriate pretreatment of recycled water to prevent fouling of the membranes used in the reverse osmosis process, which would result in loss of treatment efficiency. The conventional treatment processes at the Saugus and Valencia WRPs are not sufficient for the direct treatment of tertiary recycled water with reverse osmosis membranes, without some form of pre-treatment. Both studies concluded that pretreatment, utilizing either micro filtration and/or a membrane bioreactor technology (which provides both biological treatment and low pressure membrane filtration) would be necessary at the Saugus and Valencia WRPs, prior to reverse osmosis treatment.

In addition, reverse osmosis technologies produce a brine waste that also requires disposal. Montgomery Watson Harza (2002, 2008) has identified the use of a brine line and ocean outfall and/or the use of deep well injection as potential means for the disposal of reverse osmosis brines. However, in both reports MWH, indicated that deep well injection disposal options would require extensive field exploration and testing in order to determine if such a brine disposal option was a technically feasible option.

3.1.3.1.1 Maximum Advanced Treatment Alternative

The maximum advanced treatment alternative consists of the installation and operation of advanced treatment facilities (MF/RO and/or MBR/RO) and brine disposal facilities at the Valencia and Saugus WRPs. The District would install sufficient advanced treatment capacity to discharge recycled water with chloride levels that would meet 100 mg/L for the full WRP discharge. Operation of the maximum advanced treatment alternative at the WRPs would result in waste brine that requires disposal. Given the large volumes of brine waste generated by the maximum advanced treatment alternative, and uncertainties that such volumes of brine could be handled by deep well injection, the only feasible brine disposal alternative for the maximum advanced treatment alterative would be through a new 43-mile brine conveyance pipeline and new ocean outfall off the coast in Ventura County.

Trussell Technologies evaluated chloride data for the Valencia and Saugus WRPs and for the potable water supply in the Santa Clarita Valley to determine the size of advanced treatment facilities necessary to achieve compliance with Chloride TMDL WQOs and the estimated brine waste produced as a result of these treatment processes.[35] The size of the advanced treatment required was based on the design flows for the Valencia and Saugus WRP[36] while the brine waste flow was determined based on ultimate buildout flows of the Santa Clarita Valley[37] since construction of a brine conveyance pipeline is considered to be a one-time event. In order to comply with the existing water quality objective, Trussell determined that approximately 13.9 MGD and 3.23 MGD of RO permeate water would be required at the Valencia and Saugus WRPs, respectively, to produce a blended discharge meeting the objectives under all conditions. Assuming a 90% on-line factor for the facility this results in the construction of a 15.4 MGD MF/RO and/or MBR/RO facility at the Valencia WRP and a 3.6 MF/RO facility at the Saugus WRP.[38] Based on these proposed treatment processes at the Valencia and Saugus WRP, Trussell has prepared a construction cost estimate presented in Table 23.

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[35] Trussell, 2007. *Technical Memorandum No. 6.002-010 - Determination of Reverse Osmosis Capacity and Brine Production for Each Scenario*. July 2007

[36] Design flow for the Valencia and Saugus WRPs is assumed to be 26.8 MGD and 6.7 MGD respectively, equivalent to the projected maximum monthly WRP recycled water flows based on the 2015 Santa Clarita Valley Joint Sewerage System Facilities Plan and EIR.

[37] Recycled water flow projections for the ultimate buildout of the Santa Clarita Valley of approximately are determined by the District based on SCAG 2004 data.

[38] Trussell, 2007. *Technical Memorandum No. 6.002-011: Preliminary Design of MF/RO Facilities at Saugus and Valencia WRPs and BMBR for Stave VI Expansion at Valencia WRP*. November 2007.

Table 23: Project Capital Costs for Advanced Treatment

Valencia WRP (15.4 MGD MBR/RO and MF/RO)	
MBR Facility	$28,500,000
	$10,000,000
RO Facility	$32,800,000
Non-Process and General Requirements	$20,100,000
Sub Total Valencia	$91,400,000
Saugus WRP (3.6 MF/RO)	
MF Facility	$7,100,000
RO Facility	$12,500,000
Non-Process and General Requirements	$7,000,000
Sub Total Saugus	$26,600,000
TOTAL ADVANCED TREATMENT	**$118,000,000**

Because construction of brine disposal facilities is considered a one-time event, the facilities would be sized based on ultimate build-out flow projections for the Santa Clarita Valley. Therefore, in addition to the size of advanced treatment required to comply with the WQOs under design flow conditions, Trussell also determined the size of advanced treatment required to comply with the existing WQOs under ultimate buildout flow conditions for the entire Santa Clarita Valley in order to provide an estimate for the brine disposal capacity that would be required. For advanced treatment facilities sized to comply with the existing WQO for the ultimate build-out flow projections for the Santa Clarita Valley and assuming an RO recovery of 85%, Trussell estimates that approximately 5.12 MGD and 0.59 MGD of brine waste would be generated at Valencia and Saugus WRPs, respectively. Based upon these estimates, MWH prepared cost estimates for several brine disposal options including disposal through a new pipeline and ocean outfall in Ventura County disposal by deep well injection in to abandoned oil fields in the Santa Clarita Valley. As noted earlier, because of the large uncertainties over whether deep well injection would be feasible, the most likely brine disposal option for the maximum advanced treatment alternative is through a dedicated brine line and ocean outfall off the Ventura County coast.

As such, brine disposal through a new ocean outfall in Ventura County would require the construction of approximately 43 miles of conveyance pipeline, depending upon the final location of the new ocean outfall, from the Saugus and Valencia WRPs through portions of Los Angeles and Ventura Counties. Due to the elevation drop between the WRPs and the ocean outfall, approximately 1,000 feet, it is assumed gravity flow would be feasible for this alternative. Based on these assumptions, MWH has prepared a construction cost estimate presented in Table 24.[39]. It should be noted that capital costs presented in Table 24do not include the cost of land acquisition, utility relocation, permitting or environmental assessments.

Table 24. Project Capital Costs for Brine Disposal

Facility	Cost
Conveyance Pipeline	$200,000,000
Ocean Outfall	$30,000,000
TOTAL BRINE DISPOSAL COST	**$230,000,000**

Cost estimates for Operations and Maintenance (O&M) for Advanced Treatment and Brine Disposals provided by Trussell and MWH, respectively are summarized in Table 25.

Table 25. Project O&M Costs for Brine Disposal

Facility	Annual Cost
Advanced Treatment	$8,700,000
Brine Disposal	$500,000
AVERAGE ANNUAL O&M Cost	**$9,200,000**

Assuming an interest rate of 5.5% and a period of 20 years, the present worth of the estimated annual O&M costs for advanced treatment and brine disposal is approximately $110 Million. The combined Present Worth of the estimated Capital and O&M Costs for compliance with the existing objectives by providing advanced treatment and brine disposal is approximately $460 Million.

3.1.3.1.2 Minimum Advanced Treatment Alternative

The Minimum Advanced Treatment Alternative involves reduction WRP recycled water discharges to the SCR and conveyance and discharge of the majority of the WRP recycled water through a secondary effluent disposal pipeline and new ocean outfall in Ventura County. A small portion of the WRP recycled water, approximately 10 MGD from the Saugus and Valencia WRP combined, would receive advanced treatment to meet a final effluent chloride limit of 100 mg/L, to maintain sufficient habitat for threatened and endangered species in the SCR. This alternative would require construction of a smaller amount of advanced treatment at both the Saugus and Valencia WRPs, estimated at approximately 6 MGD. In addition, a 43 mile effluent/brine disposal pipeline and ocean outfall would need to be sized with sufficient capacity to convey the remainder of the projected WRP recycled water discharges at ultimate build-out flow conditions for the Santa Clarita Valley, estimated at approximately 62 MGD total. . Separate brine disposal facilities for the brine produced from the advanced treatment facilities would not be required as brine could be discharged with the recycled water discharge to the ocean. Based on these assumptions and cost estimates provided by MWH, the District has prepared a construction cost estimate presented in Table 26. It should be noted that capital costs

[39] MWH, 2008. Analysis of Treatment Cost for Chloride for the Santa Clarita Valley Joint Sewerage System. April 2008

presented in Table 26 do not include the cost of land acquisition, utility relocation, permitting or environmental assessments..

Table 26. Project Capital and O&M Costs for Minimum Advanced Treatment and Ocean Discharge

Facility	Capital Cost	Annual O&M
Minimum Advanced Treatment Saugus	$27,000,000	$2,000,000
Minimum Advanced Treatment Valencia	$22,000,000	$2,200,000
Conveyance Pipeline	$360,000,000	$500,000
Ocean Outfall	$59,000,000	N/A
TOTAL OCEAN DISCHARGE	**$468,000,000**	**$4,700,000**

Assuming an interest rate of 5.5% and a period of 20 years, the present worth of the estimated O&M costs for is approximately $56 Million, resulting in a combined Capital and O&M cost of approximately $524 Million.

Therefore, the range of costs for facilities required to comply with the existing water quality objectives is between $460 Million and $524 Million.

3.1.3.2 Economic Analysis of Compliance with Proposed Objectives

In order to comply with the proposed water quality objectives, an alternative water resources management (AWRM) Program was developed to achieve compliance with SSOs at all times and at all locations, while implementing mitigation measures to protect salt-sensitive agricultural beneficial uses and groundwater, when necessary. The AWRM Program consists of several key elements which include:

- Source control measures at the WRPs to reduce chloride in the recycled water;
- Advanced treatment for a portion of the recycled water from the Valencia WRP;
- Procuring supplemental water (i.e. local groundwater or surface water) for release to the SCR to enhance its assimilative capacity;
- Water supply facilities in Ventura County; and
- Providing alternative water supply when necessary, to protect salt-sensitive agricultural beneficial uses of the SCR

Cost estimates were prepared by the District and its consultants for the various elements of the AWRM Program.

3.1.3.2.1 Source Control Measures at the WRPs

This element of the AWRM Program consists of implementing measures to reduce the chloride levels in the recycled water discharged from the Saugus and Valencia WRPs. The reduction in chloride levels would be achieved through a) enhanced source control, specifically the removal of residential self-regenerating water softeners, which are a significant source of chloride to the District's WRPs, and b) conversion of the disinfection processes at the WRPs form the current bleach based process, which contribute approximately an additional 10 mg/L of chloride to the WRP recycled water, to ultra violet disinfection technology. The District's costs estimates for these elements of the AWRM Program are presented in Table 27.

Table 27. Project Capital and O&M Costs for Source Control Measures

AWRM Element	Capital Cost	Annual O&M
SRWS Removal	$2,400,000	N/A
UV Disinfection Facilities	$13,100,000	$500,000
TOTAL Source Control Measures	**$15,500,000**	**$500,000**

Assuming an interest rate of 5.5% and a period of 20 years, the present worth of the estimated O&M costs for UV Disinfection facilities at the Saugus and Valencia WRP is approximately $6 Million, resulting in a combined Present Worth Capital and O&M cost of approximately $21.5 Million for this element of the AWRM Program.

3.1.3.2.2 Advanced Treatment at Valencia WRP

In order to comply with the proposed water quality objectives, additional chloride reduction beyond that achieved from source control will be required. The AWRM Program contemplates achieving this additional chloride removal through construction and operation of a 3-MGD advanced treatment facility using MF/RO treatment technology at the Valencia WRP. These facilities would remove approximately 58,000 to 96,000 pounds per month of chloride from the WRP recycled water, reduce chloride levels directly in the SCR when necessary to achieve the proposed water quality objectives, and provide salt export from the Piru basin through operation of water supply facilities in Ventura County.

Based on the cost estimates provided by the Trussell Technologies for advanced treatment utilizing MF/RO technology to comply with the existing water quality objectives, the District has estimated the cost for construction and operation of a smaller 3-MGD MF/RO facility. In addition, operation of this advanced treatment facility would produce a waste brine, which would require disposal. CH2M Hill has prepared a preliminary feasibility study and cost estimate for the disposal of waste brine from the proposed 3-MGD advanced treatment facility through deep well injection technology.[40] CH2M Hill assumes disposal of approximately 0.5 MGD of brine waste at an individual well injection rate of 50 gpm. The estimates for the capital and O&M costs for the 3-MGD MF/RO and brine disposal facilities contemplated as part of the AWRM Program are presented in Table 28.

Table 28. Project Capital and O&M Costs for AWRM Advanced Treatment

AWRM Element	Capital Cost	Annual O&M
3 MGD MF/RO Facility	$25,000,000	$2,100,000
Brine Disposal	$53,000,000	$1,600,000
TOTAL AWRM Advanced Treatment and Brine Disposal	**$78,000,000**	**$3,700,000**

[40] CH2M Hill, 2008. *Technical Memorandum: Valencia WRP – Deep Injection Well Disposal of RO Concentrate – Preliminary Feasibility* (April 2008).

Assuming an interest rate of 5.5% and a period of 20 years, the present worth of the estimated O&M costs for the advanced treatment and brine disposal facilities at the Valencia WRP is approximately $44 Million, resulting in a combined Present Worth Capital and O&M cost of approximately $122 Million for this element of the AWRM Program.

3.1.3.2.3 Supplemental Water

During periods of extreme drought and prior to construction and operation of the proposed 3-MGD advanced treatment facility, the AWRM Program contemplates procuring supplemental water of sufficient water quality to reduce chloride levels in the surface water in Reach 4B. In order to ensure a reliable supply of supplemental water during these periods, the AWRM proposes to develop agreements with local water purveyors that would implement a water banking program when supplemental water is not required. The water purveyors would then have this banked water supply available to deliver to their customers when the District requires supplemental water from local groundwater to enhance the assimilative capacity of the river and meet proposed water quality objectives. Through the GSWIM Study, it is estimated that approximately 30,000 AF of supplemental water would be required during the study period. Preliminary discussions with water purveyors indicate costs for banking and delivering SWP water would be approximately $1,000 per AF, resulting in a cost of approximately $30 Million. Additionally, it is assumed some infrastructure for conveyance of the supplemental water (extracted groundwater) would be required at a cost of approximately $7.5 Million.

3.1.3.2.4 Ventura Water Supply Facilities

As indicated above, in order to achieve salt export from the Piru groundwater basin, the permeate from the 3-MGD advanced treatment facilities would be conveyed to water supply facilities in Ventura County. These facilities would blend the RO permeate with saline groundwater from the Piru basin and discharge the blended water supply to the SCR at a point where the water, and therefore salt, would be exported from the basin and utilized in Ventura County. The water supply facilities would be comprised of:

- 10 groundwater extraction wells
- 12 mile RO permeate conveyance pipeline
- 6 mile blended water supply (RO permeate and Piru groundwater) conveyance pipeline

Cost estimates for the proposed water supply facilities are presented in Table 29.

Table 29. Project Capital and O&M Costs for Ventura County Water Supply Facilities

AWRM Element	Capital Cost	Annual O&M
10 Groundwater Extraction Wells	$5,500,000	N/A
12 Mile RO Permeate Conveyance	$34,200,000	$130,000
6 Mile Blended Water Conveyance	$30,400,000	$170,000
TOTAL AWRM Ventura Water Supply Facilities	**$70,100,000**	**$300,000**

Assuming an interest rate of 5.5% and a period of 20 years, the present worth of the estimated O&M costs for the Ventura County water supply facilities is approximately $3.6 Million, resulting in a combined Present Worth Capital and O&M cost of approximately $73.7 Million for this element of the AWRM Program.

A summary of the cost estimate for the AWRM Program is presented in Table 30.

Table 30. Project Capital and O&M Costs for AWRM Program

AWRM Element	Capital Cost	Present Worth O&M	TOTAL
Source Control Measures	$15,500,000	$6,000,000	$21,500,000
Advanced Treatment and Brine Disposal	$78,000,000	$44,000,000	$122,000,000
Supplemental Water	$37,500,000	N/A	$37,500,000
Ventura Water Supply Facilities	$70,100,000	$3,600,000	$73,700,000
TOTAL AWRM Program	**$201,100,000**	**$53,600,000**	**$254,700,000**

Note: All costs are as of September 2007

Therefore, the costs for the AWRM facilities required to comply with the proposed site-specific objectives is estimated at approximately $255 Million.

3.1.4 An analysis of compliance and consistency with all federal, state, and regional plans and policies.

The proposed rulemaking complies with all relevant federal, state, and regional plans, and policies. The proposed water quality objectives are consistent with State and Federal antidegradation policies as discussed below in Section 3.3, Antidegradation Policy. In addition, the elements specified in the Basin Plan that should be addressed for site-specific objectives have been discussed and analyzed above.

3.2 WATER CODE SECTION 13241 REQUIREMENTS

Water Code section 13241 requires the Regional Board to consider the following when establishing a water quality objective:

- The past, present, and probable future beneficial uses of water
- The environmental characteristics of the hydrographic unit under consideration,
- Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area.
- Economic considerations.
- The need for developing housing within the region.
- The need to develop and use recycled water.

3.2.1 Past, present, and probable future beneficial uses of water

Below is a brief discussion of the past, present, and probable future beneficial use designations in the Santa Clara River by the Regional Water Board followed by a more in depth discussion of the past, present, and future use of waters from the USCR for irrigation of agriculture with emphasis on salt-sensitive crops.

Table 2-3. "Present and Potential Beneficial Uses in the Santa Clara River Basin" in the 1975 Basin Plan (p.I.2.7) delineated the present and potential beneficial uses of the Santa Clara River and Tributaries within the Eastern Sub-area of the Upper Santa Clara River Subunit. These 1975 designations included many of the current designations delineated in Table 2-1. "Beneficial Uses of Inland Surface Waters" in the 1994 Basin Plan including the following "existing" beneficial uses:[41]

- Agricultural Supply (AGR)
- Industrial Process Supply (PROC)
- Industrial Service Supply (IND)
- Ground Water Recharge (GWR)
- Freshwater Replenishment (FRSH)
- Cold Freshwater Habitat (COLD)
- Wildlife Habitat (WILD)
- Water Contact Recreation (REC-1)
- Non-contact Water Recreation (REC-2)

Since the adoption of the 1975 Basin Plan, the Regional Water Board has designated an additional six "existing" beneficial uses and one designation classified as Potential (P*) for the Upper Santa Clara River.[42] These include the following as defined in the 1994 Basin Plan, Chapter 2:

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[41] These designations are defined in Chapter 2 of the 1994 Basin Plan

[42] For background information on the P* category, see the Chapter 2 of the 1994 Basin Plan.

Existing Beneficial Water Uses

- Municipal and Domestic Supply (MUN)
- Migration of Aquatic Organisms (MIGR)
- Warm Freshwater Habitat (WARM)
- Rare, Threatened, or Endangered Species (RARE)
- Wetland Habitat (WET)

Asterisked Potential Beneficial Uses (P*)

- Municipal and Domestic Supply (MUN)

The probable future beneficial uses of the surface waters in the USCR is likely to remain consistent with past uses with the exception of agriculture supply (AGR). This beneficial use of water is likely to remain constant in areas of Reaches 4A and 4B where significant lands surrounding the river basin consist of irrigated agriculture. With the exception of commercial nurseries, the use of water for the irrigation of crops is likely to decline in Reach 5 where agricultural lands owned by Newhall Land and Farm adjacent the River on the Los Angeles County portion of Reach 5 are expected to be developed into the residential areas of Landmark Village, Heritage Village, Mission Village and Potrero Village, which will comprise the Newhall Ranch town.

3.2.2 Past, Present, and Probable Future Use of Irrigation in Agriculture around Reaches 4, 5, and 6

The 1975 Basin Plan designated the AGR beneficial use for all of the "Santa Clara River and its tributaries," as well as for the Upper Santa Clara River Subunit (for groundwater), where the present Reaches 4B, 5, and 6 are located. The 1975 Basin Plan did not specify the specific reaches of the river where the AGR beneficial use applied, the specific types of crops that were cultivated within these reaches, and whether surface water diversions were being utilized for irrigated agriculture in these reaches. In particular, there was no specific discussion about whether known salt sensitive crops like avocados were present or were irrigated with surface water within Reaches 5 and 6. The 1975 Basin Plan mentioned the types of crop categories that were grown, based on water supply projections discussed in Chapter 13. Table 13-28 in the 1975 Basin Plan listed alfalfa, pasture, citrus and subtropical, truck crops, field crops, deciduous fruits and nuts, and small grain and provided water supply projections for these crop categories in the USCR subunit. While avocados and strawberries could have been included under the broad categories of "citrus and subtropical" and "field crops," respectively, there was no specific mention that these particular salt-sensitive crops were irrigated with either surface water or groundwater in the Upper Santa Clara River watershed. Nursery crops were not mentioned in the 1975 Basin Plan.

3.2.2.1 Present Agricultural Irrigation in Reach 4

The overwhelming portion of agricultural operations in the vicinity of the SCR upstream of Fillmore are located in the Piru Valley around Reaches 4A and 4B of the SCR near the confluence with the Piru Creek. Land use in this region is predominantly agricultural with extensive citrus and avocado, improved pasture, nursery crops, and row crops. Local growers in this area irrigate crops primarily with groundwater from local aquifers fed by releases from Lake Piru and the Santa Clara River, as well as surface diversions from the Santa Clara River. Agricultural supply water originating from Lake Piru are unaffected by chloride levels in the Santa Clara River because Lake Piru is fed with State Water Project water and local runoff. Camulos Ranch is the only known avocado grower that irrigates crops using water originating from Reach 4B waters.

The proposed water quality objectives in Reach 4B and the underlying groundwater are fully protective of agricultural uses in this area based on the result of the LRE for salt-sensitive crops (a 117 mg/L chloride threshold value) when implemented with the Alternative Water Resources Management (AWRM) Compliance Option. Further considerations of the use of surface water from the SCR and groundwater impacted by this water for agriculture are discussed below in Section 4.2.4 Water Quality Conditions that Could Reasonably be Achieved through the Coordinated Control of all Factors, Which Affect Water Quality in the Area.

3.2.2.2 Present Agricultural Irrigation in Reach 5

Newhall Land and Farm is the only landowner with existing agricultural operations that could potentially be impacted by groundwater-surface water interactions within Reach 5 of the Santa Clara River. All of Newhall Land and Farm's irrigated agricultural operations occur west of the intersection between Interstate-5 and the Santa Clara River, with the vast majority of its operations occurring west of Castaic Creek, where the current groundwater chloride objective is 150 mg/L.[43] This company has historically used only groundwater to grow salt tolerant crops including walnuts, alfalfa; green mixed vegetables, onions, squash, parsley, cilantro, broccoli, artichokes, cauliflower and tomatoes within Reach 5.[44] Due to adverse climatic conditions, Newhall Land and Farm has not historically and does not plan in the future to cultivate salt-sensitive crops in Reaches 5 or 6. Therefore, the proposed 150 mg/L water quality objectives for chloride in Reaches 5 and 6 and the groundwater basins underlying Reach 6, which equals the existing groundwater quality objective in the Castaic Valley underlying Reach 5, are protective of the AGR beneficial use. The proposed water quality objectives for TDS and sulfate are also protective of the AGR use in these areas.

Despite insufficient evidence in the LRE supporting a recommendation for a chloride threshold for nursery crops, the impact of the proposed water quality objectives on nursery crops in the area was considered. A number of commercial and wholesale nurseries are located in the Santa Clarita Valley along the Castaic Creek tributary north of the SCR and between the Antelope Valley Freeway and Interstate 5 south of the Santa Clara River. These nurseries are outside the vicinity of Reaches 5 and 6 and are not likely impacted by river surface water chloride concentrations. This is because the groundwater and surface water flow direction in the Castaic Creek Tributary region is from north to south and towards the main stem of the Santa Clara River, which has a lower elevation than the groundwater underlying tributary regions along Castaic Creek. (See White Paper No. 2A). There is one commercial nursery that is located along the South Fork tributary in Placerita Canyon. However, the groundwater and surface water flow direction for the South Fork tributary is from south to north and towards the main stem of the

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[43] Per phone conversation with Mark Subbotin, Vice President of Newhall Land and Farm (2007).

[44] *Ibid.*

Santa Clara River due to changes in water table elevations. Thus, it very unlikely that surface flows from Reach 6 of the Santa Clara River would impact any groundwater that would affect this particular commercial nursery.

3.2.2.3 Present Agriculture Irrigation in Reach 6

Surface waters from Reach 6 or groundwater potentially impacted by these surface waters are not used as an irrigation supply (LACSD, 2007). Any possible past use of land around Reach 6 for non-nursery type agriculture has terminated due to the changing land use patterns of the region. Green Landscape Nursery is located near the Saugus WRP across Bouquet Canyon Road. This commercial nursery, however, is served exclusively with SWP water by the Santa Clarita Water Division of the Castaic Lake Water Agency. Another commercial nursery is located along the South Fork tributary in Placerita Canyon. However, the groundwater and surface water flow direction for the South Fork tributary is from south to north and towards the main stem of the Santa Clara River. It, therefore, would likely be physically impossible for surface flows from Reach 6 of the Santa Clara River to impact any groundwater that would affect this commercial nursery. Finally, a number of other commercial nurseries are located several miles north east and south east of Reach 6 of the Santa Clara River. These, nurseries, however, would not be impacted by surface flows from the Santa Clara River.

3.2.2.4 Future Agriculture Irrigation in Reaches 4, 5, and 6

Irrigation levels in the area of Reach 4 of the SCR are not expected to change over the next few decades in the Piru Valley (the Piru and Eastern Fillmore Subbasins).[45] The predominantly agricultural community in the Piru Valley is generally opposed to urban sprawl and has an interest in protecting open space and agricultural lands.[46] Available land that could be cultivated to expand local agriculture is limited outside the 100-year flood zone of the SCR in the Piru Valley. Development of agricultural lands in Ventura County is limited by the Ventura County Save Open Spaces and Agricultural Resources (SOAR) measure. This measure requires voter approval of future changes to the open space, agricultural, and rural policies and land use designations in unincorporated areas, which are governed by Ventura County's General Plan. SOAR's provisions will remain in effect until CY 2021, unless repealed by the voters at a general election before CY 2021. Given these circumstances, significant changes in agricultural land uses in Reach 4 will not likely occur in the foreseeable future.

The use of irrigation water for agriculture in Reach 5 is expected to decline due to ongoing changes in land use in the area. In particular, agricultural lands owned by Newhall Land and Farm adjacent the River in Reach 5 on the Los Angeles County portion of Reach 5 are expected to be developed into the residential areas of Landmark Village, Heritage Village, Mission Village and Potrero Village, which will comprise the Newhall Ranch town.

As delineated above, surface waters from Reach 6 or groundwater potentially impacted by these surface waters are not used as an irrigation supply for crops. Based on the changing land use

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[45] See Task 2B – Numerical Model Development Approach for Projecting Water Demands and Supplies in the Piru Subbasin Upper Santa Clara River Chloride TMDL Collaborative Process (September 28, 2007) (Section 4.0), CH2M HILL–HGL

[46] *Ibid.*

patterns around Reach 6 towards residential and commercial development, this finding is not likely to change.

3.2.3 Environmental characteristics of the hydrographic unit under consideration, including the quality of water available hereto

The Regional Water Board considered the impact this rulemaking would have on instream and riparian species and habitat. When implemented, the proposed AWRM Compliance Option will result in reduced chloride discharges from the primary point sources in the USCR. The 150 mg/L surface WQOs in Reaches 4B, 5, and 6 are more stringent than the effluent limitations that have applied to the Saugus and Valencia WRPs over a significant portion of their operating histories. Therefore, it is not expected that this rulemaking will result in actual harm to in-stream or riparian species or habitat.

The discussion below is intended for informational purposes. It describes the Santa Clara River Watershed based on previous characterizations of the watershed environment. Further discussion concerning the degradation of water quality appears in Section Antidegradation Policy.

3.2.3.1 Setting and Physiography

The Santa Clara River is the largest river in southern California. It originates in the northern slope of the San Gabriel Mountains in Los Angeles County, traverses Ventura County and flows into the Pacific Ocean between the Cities of San Buenaventura and Oxnard. The Santa Clara River watershed covers approximately 1,600 square miles over the river's 100 miles in length. The Basin Plan divides the watershed into 11 reaches, eight on the Santa Clara River and three comprised of major portions of significant tributaries including Santa Paula, Sespe, and Piru Creeks.

The Santa Clara River spans over two major regions designated as the Upper and Lower Santa Clara River. The portion of the river within Los Angeles County is generally described as the Upper Santa Clara River, and the portion within Ventura County is generally referred to as the Lower Santa Clara River. The Upper Santa Clara River watershed has approximately 680 square miles of mostly natural land with some mixed developed areas. Developed areas are concentrated in the Santa Clarita Valley, which has a population of over 200,000 mostly within the City of Santa Clarita.[47] The major tributaries to the Upper Santa Clara River watershed include Castaic Creek, San Francisquito Canyon, Bouquet Canyon, Sand Canyon, Mint Canyon and the Santa Clara River South Fork and Piru Creek (where Reaches 4A and 4B meet).

3.2.3.2 Historic and Current Flow

Surface flow levels correspond to seasonal precipitation within the region. Increased surface flows exist typically during winter and spring months followed by a relatively long summer and fall season of lower flows. Winter time flows during periods of significant precipitation have been measured as high as 118,800 cfs at the Blue Cut Gauging Station, which is located near the

[47] The City of Santa Clarita is comprised of the former unincorporated communities of Newhall, Valencia, Saugus, Canyon Country, and portions of Castaic.

Los Angeles-Ventura County Line.[48] In contrast, dry weather flows near Blue Cut Gauging Station have been recorded as low as 3.5 cfs.

Various reaches of the river have continuous flow only during significant storm events with portions having perennial flow and others intermittent. Natural flow in all the major streams and tributaries in the basin is intermittent and ephemeral, with most of the stream flow related to flood flows. In both wet and dry seasons, there is typically no flow upstream of the Saugus WRP (in Reach 7), and in some instances there is very little, if any, flow within the mid portion of Reach 6.[49,50] In Reach 4, there is typically no flow immediately downstream of Piru Creek in both wet and dry seasons (except during conservation releases from Lake Piru). This "dry gap" of varying length persists in the middle portion of Reach 4.

Baseflow in the USCR is comprised of surfacing groundwater, discharges from the Saugus and Valencia WRPs, conservation releases of imported and local waters from reservoirs, and runoff from applied water (agricultural runoff and urban runoff). During the dry months of the year, portions of the river as it currently exist with added WRP discharge completely subsides for some period during the day (usually early morning). These conditions correspond to the Saugus WRP's low flow conditions. These observations indicate that the natural flow of water that would exist in Reach 6 without the Saugus WRP's discharge would be minimal and likely intermittent.

The base river flow between the Valencia WRP and Blue Cut gauging station (near the Los Angeles – Ventura County line), which comprises Reaches 5, is composed of rising groundwater, treated wastewater discharges from the Valencia and Saugus WRPs, releases of water stored in Castaic Lake, bank seepage, and non-point sources, including uncontrolled runoff from agricultural and urban areas not related to storm flows. Based on flow measurements taken near the LA-VC line in Water Year 1999-2000, the total flow discharged from the District's WRPs comprised approximately 42% of the total flow measured.[51] Base flow caused by rising ground water is due to geologic conditions that force groundwater into the streambed. This occurs throughout most of Reach 5 beginning at the Old Road Bridge just east of the Valencia WRP and the upper portion of Reach 4 east of the dry gap.[52] This is part of the reason surface flow in this area is perennial.

Further downstream, in Reach 4 between the confluence at Piru Creek and Las Brisas, surface flow is typically present only during parts of the wet season, which varies by water year. This "dry gap" seasonally separates the upper Santa Clara River hydrologically from the lower river,

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[48] Source is US Geological Survey data available at http://waterdata.usgs.gov/nwis. This high flow occurred during a February 1998 storm. The figure is a calculated monthly mean flow at the Blue Cut Gauging Station (USGS 11109000 SANTA CLARA R NR PIRU CA).

[49] The California Department of Water Resources estimates that approximately 10,660 acre-feet per year of rising groundwater discharges to the surface water near the Los Angeles-Ventura County line.

[50] California Department of Water Resources, *Investigation of Water Quality and Beneficial Uses, Upper Santa Clara River Hydrologic Area*, 196 pp., June 1993.

[51] Based on Water year (WY) October 1999 – September 2000 flows measured daily at USGS gauging station 11109000 (Santa Clara River Nr Piru), located approximately 1.5 miles downstream of the LA-VC line.

[52] California Department of Water Resources, *Investigation of Water Quality and Beneficial Uses, Upper Santa Clara River Hydrologic Area*, 196 pp., June 1993.

which, during normal or below normal water years, impedes inter-reach migration and movement of aquatic life. The Vern Freeman Diversion, downstream of Santa Paula, diverts some or all of Santa Clara River flows (depending on the flow conditions) to the El Rio and Saticoy spreading grounds, where the water recharges the underground aquifers and is distributed for agricultural irrigation. The United Water Conservation District has a diversion right of 375 cfs at any given time with a maximum of 144,000 acre-feet per year at the Freeman Diversion. During below average water years, this diversion can create dry river conditions downstream.

3.2.3.3 Watershed Habitats

The Santa Clara River has multiple biological resources. The river has at least six recognized natural communities including the Southern Coastal Salt Marsh, Subtidal Estuarine, Southern Riparian Scrub, Cottonwood-Willow Riparian Woodland, Alluvial Fan Sage Scrub and Riverine. Downstream from the City of Santa Clarita are extensive riparian woodlands of willow and cottonwood primarily in Los Angeles County, which change to riparian scrub in Ventura County. The riparian forest is home to several bird species, including the endangered “Least” Bell's vireo. Overall, 14 resident bird species are listed as endangered or of special concern, and 6 plant species are endangered or candidates for listing. The unarmored threespine stickleback (UTS), a small scaleless, freshwater endangered fish, inhabits the river's upper reaches.

Extensive patches of high quality riparian habitat are present along the entire length of the Santa Clara River. These patches serve as “stepping stones” for migratory birds traveling between riparian areas and wetlands on the south coast. The river is also home to many species in decline throughout the southern California region. The “Least” Bell’s Vireo (Vireo bellii pusillus, a small bird) and the UTS (Gasterosteus aculeatus wiliamsoni) are both listed as endangered, as well as the steelhead trout.

The Santa Clara River serves also as an important wildlife corridor and habitat for several listed and indicator species including the Arroyo Toad, Slender Horned Spineflower, Southwest Willow Flycatcher, Red-Legged Frog, California Gnat Catcher, Plummers Mariposa Lily, Ocelated Humboldt Lily, Prostrand Navarretia, Forest Camp Sandwort, Summer Taninger, Riverside Fairy Shrimp, Nevins Barberry and Loggerhead Shrike.

Larry Walker Associates previously reviewed literature on special status aquatic life species living in the Santa Clara River focusing on the Upper Santa Clara River. Nine special status aquatic species were selected for review based on their listing status by the US Fish and Wildlife Service, as well as the species dependence on the aquatic habitat of the Santa Clara River. The literature review focuses on the status of the Unarmored Threespine Stickleback and Southern California Steelhead, and provides a general summary of ongoing and planned restoration projects affecting aquatic health in the Santa Clara River. This draft report is shown in Appendix 11, and is incorporated into this discussion. The draft summary of findings for the steelhead trout and UTS are summarized below. All references cited can be found in Appendix 11.

The endangered steelhead is known to seasonally occupy the lower section of the Santa Clara River, from the estuary to the mouth of Piru Creek. The lower section of the Santa Clara River serves as a migration corridor for the steelhead to Santa Paula, Sespe, and Piru Creeks and is not typically used for spawning and rearing. Sespe Creek has historically been the greatest spawning grounds for steelhead in the Santa Clara River watershed. Recovery efforts are therefore focused on maintaining access to Sespe Creek. While it is unknown if steelhead occupy the upper section of the river, there remains some potential for them to reach spawning habitat in headwater streams during above normal water years when the dry gap is inundated during the winter migration season (Capelli, pers. comm.). Access to headwater tributaries is impeded by (a) a 20' concrete sill at Saticoy, and (b) an accumulation of sandy substrate known as the 'dry gap' between Piru Creek and Las Brisas (Entrix, 1999; Capelli, 1997). While steelhead may have historically used headwater tributaries above the Piru Creek-Las Brisas dry gap to spawn, observations of steelhead in the upper Santa Clara River have not been recorded in recent years (potentially due to a lack of monitoring) and thus the importance of these spawning grounds to overall species recovery is not fully determined.

The US Fish and Wildlife Service (USFWS) listed the UTS as federally endangered on October 13, 1970. It received full protection under the Endangered Species Act in 1973. Two sections of the upper Santa Clara River and one section of San Francisquito Canyon were listed as critical habitat by the USFWS (USFWS, 1985), but were revoked by a 2002 USFWS rule (Vol. 67, No. 180).

Presently, the UTS is estimated to number in the thousands to ten thousands in the upper Santa Clara River. Critical habitat for UTS in the Santa Clara River has been established by USFWS (1985) as two disjointed sections of the upper Santa Clara River and San Francisquito Canyon. The two sections of the upper Santa Clara River are described as (a) the section near Del Valle downstream of Interstate 5, and (b) the river section at the mouth of Soledad Canyon. These two sections are separated by a small, yet significant, ephemeral dry gap (Bouquet Canyon Road to Highway 14) in the riverbed. This gap separates fish in Soledad Canyon from the main-stem of the Santa Clara River thereby reducing the threat of introgression of this sub-population in the watershed. While these critical habitat areas represent significant habitat for the UTS population, they are not federally protected due to a 2002 USFWS rule to revoke the protective habitat designation.

The decline of the UTS is attributed to the effects of urbanization, mainly the channelizing of low-flow stream habitat so depended on by UTS (USGS, 2001). The introduced mosquitofish (Gambusia affinis) is suspected to compete with UTS for food (Baskin, 1974). Changes to river water quality, including changes in dissolved oxygen, nutrients, suspended sediment, and temperature, are also detrimental to UTS survival. Current threats to the UTS include hybridization with the armored and partially armored sticklebacks (described below) below the ephemeral dry gap, channeling of the river, and two non-native predators, the African clawed frog and the bullfrog.

A stickleback sub-species inhabits the lower Santa Clara River, the partially armored threespine stickleback (Gasterosteus aculeatus microcephalus). This sub-species is seasonally isolated from the UTS by the dry gap between Piru and Las Brisas for most of the year (discussed earlier). G. a. microcephalus and UTS may co-mingle when river flows inundate the dry gap, which raises concerns of potential introgression between the sub-species. The partially armored threespine stickleback is not listed as threatened, endangered, or as a species of special concern. Partially armored threespine sticklebacks were the dominant observed species in Piru Creek during a 2003 survey conducted below Santa Felicia Dam with 90.6 percent of the fish species collected from the Creek being partially armored threespine sticklebacks.

3.2.3.4 Impact of Quality of Water Supplied to the USCR

The largest source of chloride to the Upper Santa Clara River is the water supply. Up to 12.7 tons of chloride per day is imported into the watershed during dry years (CH2M Hill, 2006). Dry and critically dry periods affecting the Sacramento and San Joaquin River Valleys reduce fresh-water flow into the Sacramento-San Joaquin Delta and result in higher than normal chloride concentrations in the SWP supply within the California aqueduct system. Imported SWP water supplies approximately 60% of local water demand in the Santa Clarita Valley. This water has a large influence on the final chloride concentration in the effluent of the Valencia and Saugus WRPs. Figure 36 illustrates the historic fluctuation of SWP water salinity showing the historic chloride concentrations at Check 41 (Tehachapi Pass). Check 41 is a SWP water quality monitoring station, located just upstream of where the California aqueduct splits into the west and east branches and is a good indicator of the water quality that enters the West Branch of the California Aqueduct, which ultimately is the water delivered to the Castaic Lake Reservoir and the Santa Clarita Valley.

The greatest fluctuations can be observed in the period between 1989-1993. Periodically, there have been high chloride spikes, such as the levels observed in the fall of 1994, early winter in 1998, the fall and early winter of 1999-2000, and the winter of 2000-2001. In each of these cases, drier-than-normal conditions were observed, especially at the Sacramento-San Joaquin Delta.[53] Typically, water pumped through the Sacramento-San Joaquin Delta takes approximately 1 to 2 years to show up as deliverable SWP water sold by the Santa Clarita Valley wholesaler, Castaic Lake Water Agency (CLWA), to local retail water purveyors, due to reservoir storage and turnover time.[54] Approximately 30% of the Check Point 41 chloride data show concentrations exceeding 100 mg/L.

The higher chloride concentrations shown on the left side of Figure 36 correspond to statewide dry and critically dry conditions during water years 1987/88 – 1991/92.[55] The rising chloride concentrations depicted for water years 1998/99 to 2001/02 correspond to the Southern California critically dry years 1998/99 – 2001/02.

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[53] Personal communication with David Kimbrough, Water Quality & Laboratory Supervisor, CLWA, June, 2002

[54] *Ibid.*

[55] Tables showing Statewide and southern California drought years and calculated drought indices for the Sacramento and San Joaquin River Valleys are available from the California Department of Water Resources at http://watersupplyconditions.water.ca.gov/pdf/2007precip.pdf.

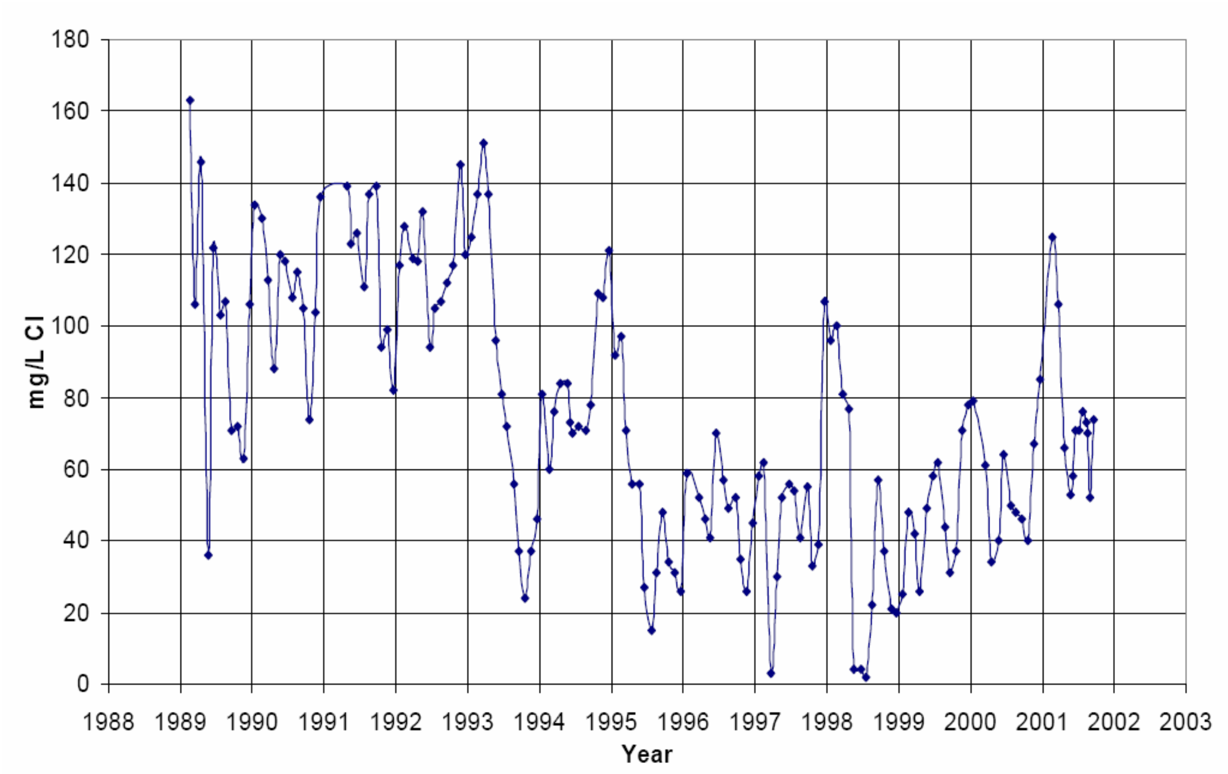

Figure 36. SWP Chloride Concentrations at Check 41 (California Aqueduct)

Figure 37 illustrates the impact that water supply chloride conditions have on WRP effluent quality. This figure shows how effluent quality generally tracks the imported water quality of SWP Water.

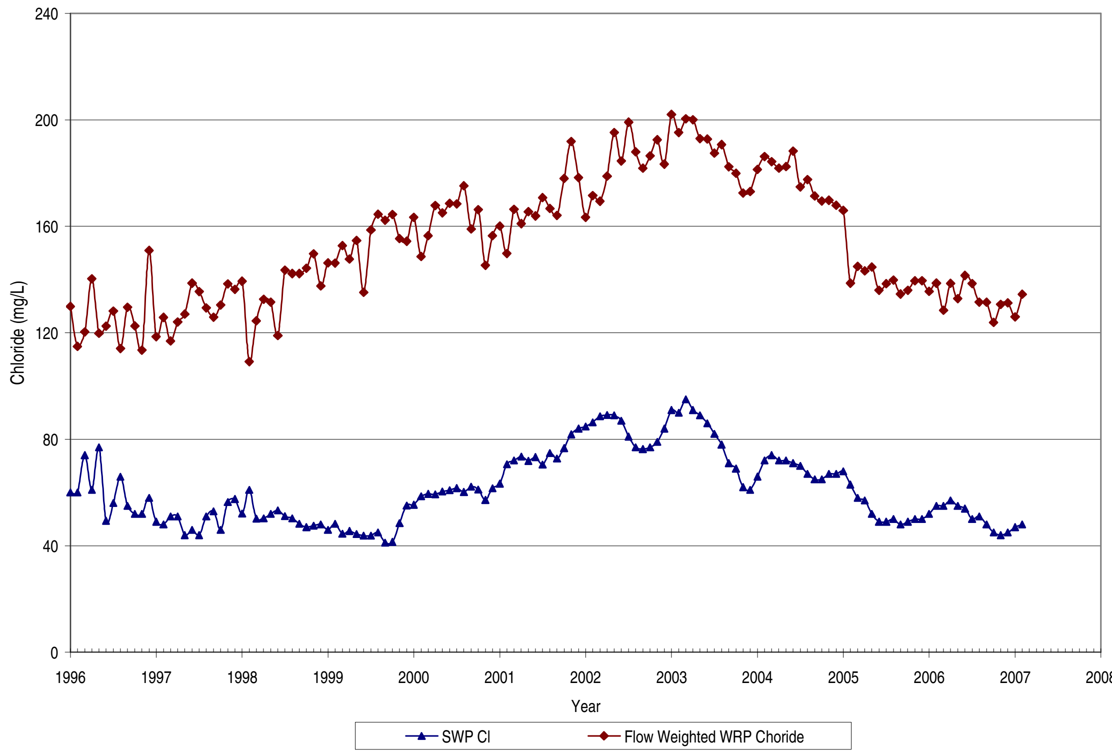

Figure 37. SCVSD WRP Effluent and SWP Chloride

Salinity fluctuations in the SWP water can also be observed in the imported water treated and delivered by the CLWA. The chloride concentrations levels observed in the untreated and treated SWP water sold by CLWA to local retail purveyors are somewhat attenuated from the Check Point 41 levels due to the large storage capacity of the Castaic Lake Reservoir and the influence from captured local stormwater. Nonetheless, they still have regularly exceeded the 100 mg/L chloride objective. As shown in Figure 38, the chloride concentration in the CLWA deliveries to local Santa Clarita Valley retail water purveyors increased during the 1987-1991 critically dry period, and reached 144 mg/L in 1990. It is also important to note that more recent data (2002-2003) for Castaic Lake indicate that the chloride concentrations in water delivered by the CLWA increased by almost 40 mg/L from 1999 to mid-2003. The Castaic Lake chloride concentration observed in March 2003 was 95 mg/L, the highest chloride concentration observed since the last statewide critically dry period of 1987-1991.

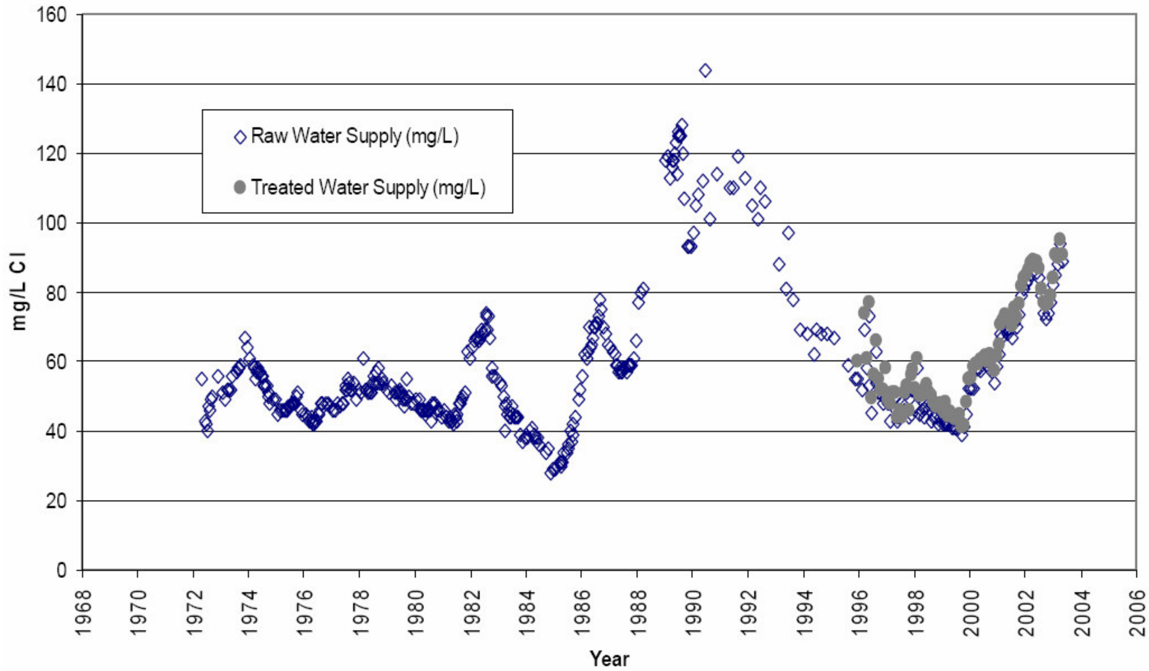

Figure 38. Castaic Lake Discharges – Raw and Treated SWP water Chloride Concentrations

Consequently, the quality of the water available to the Santa Clarita Valley has a significant impact on the receiving water quality and can be high enough to cause or contribute to exceedances of the current water quality objective.

3.2.4 Water quality conditions that could reasonably be achieved through the coordinated control of all factors, which affect water quality in the area.

A detailed discussion of the compliance options and water quality that can be achieved through different approaches to compliance is presented in the Task 2B-1 and Task 2B-2/Task 9 report. As discussed throughout this report, the AWRM compliance strategy will result in compliance with the proposed SSOs in the document. Figure 2 and Figure 3 in this report show the projected chloride concentrations at selected receiving water sites after implementation of the AWRM. These figures show the levels that are expected to be achieved after implementation of the program.

As discussed in the Task 2B-1 report, other compliance measures, such as large scale advanced treatment facilities, could achieve 100 mg/L in Reaches 5 and 6, but would not meet 100 mg/L during all times in Reach 4B. Given the technical constraints on large scale advanced treatment facilities and the environmental and water resource benefits of the AWRM, the AWRM is the preferred compliance measure. As discussed in this report, implementation of the AWRM will protect beneficial uses and improve the water quality in the Eastern Piru groundwater basin.

3.2.5 Baseline Economic Considerations

Baseline economic considerations are construed to mean the economic impacts that would result from compliance with the final effluent limit of 100 mg/L as a daily maximum under the Chloride TMDL. Baseline economic conditions are discussed in above Section 3.1.3.1.

3.2.6 The Need to Develop Housing

In adopting the site-specific objectives for chloride, sulfate, and TDS in the surface waters and groundwaters affected by this proposed action, the Regional Board has considered the need for expanded housing in the region. The proposed water quality objectives would not restrict the development of housing in the area of the reaches of the Santa Clara River affected by the proposed SSOs because they do not result in any increased economic costs related to housing development. Additionally, the proposed SSOs will support water recycling and the use of the AWRM compliance option in the USCR. Both of these factors will provide water resources to support housing that may be lost with other compliance options.

3.2.7 The Need to Develop and Use Recycled Water

Water Code section 13241 requires the Regional Water Board to consider the need to develop and use recycled water when establishing a water quality objective. The proposed water quality objectives will support the expansion of recycled water uses in the Santa Clarita Valley consistent with the California's stated goal of increasing the use of recycled water to help meet the state's growing demand for potable water.[56] The Castaic Lake Water Agency's (CLWA) 2005 Urban Water Management Plan (UWMP) projects that water demand in the area will continue to increase, and that additional sources of water including recycled water will be necessary to meet projected demand.[57] Table 4-8 in CLWA's 2005 UWMP indicates that recycled water use in CLWA's service area is projected to increase from 448 AFY (actual use in 2004) to 17,400 AFY by 2030. This 2030 figure represents 70% of the imported water portion of the ultimate wastewater flow projected for the Santa Clarita Valley Joint Sewerage System of approximately 34 MGD.[58] The increased flow from the WRPs from current flows of 21 MGD to future flows of 34 MGD is expected to accommodate most of the increased recycled water demand in the watershed.

The revised groundwater and surface water quality objectives will support the expansion of recycled water uses in the Santa Clarita Valley consistent with the California's stated goal of

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[56] California has enacted a series of laws designed to bring about increased use of recycled water where appropriate and safe, including the Water Recycling Law (codified at Water Code 13510 et. Seq.), the Water Recycling Act (codified at Water Code (codified at 13575), and related statutes, regulations, and policies of the Department of Public Health and the State Water Board.

[57] See Chapter 4 of the 2005 Urban Water Management Plan (November 2005) prepared for Castaic Lake Water Agency, Castaic Lake Water Agency (Santa Clarita Division), Newhall County Water District, and Valencia Water Company.

[58] See Table 4-2, p. 4-3 in the 2005 UWMP.

increasing the use of recycled water to help meet the state's growing demand for potable water.[59] For groundwater recharge reuse projects, maximum contaminant levels codified in California Administrative Code, Title 22 provide reasonable protection of groundwater quality for the beneficial use of municipal supply. With the exception of the proposed groundwater quality objectives for TDS and sulfate in the East Piru groundwater basin, the proposed groundwater objectives for chloride, TDS, and sulfate in the Santa Clara – Bouquet and San Francisquito Canyons groundwater basin is consistent with Upper Range Secondary Maximum Contaminant Levels for drinking water sources codified in California Administrative Code, title 22, section 64449.[60] The proposed TDS and sulfate objectives in the East Piru basin represent more stringent groundwater quality objectives than the current objectives, and are consistent with the Short Term Secondary MCL delineated in title 22, section 64449.

Given the demonstrated need to expand recycling in the USCR to meet the region's future water requirements, the proposed SSOs are needed to ensure the required compliance mechanisms allow for the recycling to take place. Additionally, the proposed SSOs are consistent with the secondary MCLs in Title 22 and will not result in water quality for chloride, TDS, and sulfate that exceeds these levels.

[59] California has enacted a series of laws designed to bring about increased use of recycled water where appropriate and safe, including the Water Recycling Law (codified at Water Code 13510 et. Seq.), the Water Recycling Act (codified at Water Code (codified at 13575), and related statutes, regulations, and policies of the Department of Public Health and the State Water Board.

[60] Proposed changes to Recycling Criteria codified in title 22, California Code of Regulations, Division 4, Chapter 3, which the CDPH is currently developing, would require recycled water to comply with the Upper Level Secondary MCLs for chloride, TDS, and sulfate (among other constituents), which are 500, 1,000, and 500 mg/L, respectively as delineated in Table 64449-B in title 22, section 64449. Current Secondary MCLs in Table 64449-B are "Consumer Acceptance Contaminant Level Ranges" for which no fixed consumer acceptance level has been established. The CDPH may approve water supply sources exceeding the "recommended range" and "upper range" depending on the situation. (See title 22, section 64449(d)).

3.3 ANTIDEGRADATION POLICY

States are required to develop and adopt an anti-degradation policy and identify the methods for implementing the policy. (40 CFR 131.12). At a minimum, anti-degradation policies must be designed to:

- Tier 1: Maintain and protect existing instream water uses and the water quality necessary to protect the existing uses. (40 CFR 131.12(a)(1)). Uses are "existing" if they were actually attained in the water body on or after November 28, 1975, whether or not included in a water quality standard. (40 CFR 131.3(e).)
- Tier 2: Maintain high quality waters unless the State finds after satisfaction of intergovernmental and public participation provisions of the states continuous planning process that allowing lowering water quality is necessary to accommodate important economic and social development. High quality waters are waters cleaner than necessary to support recreation and the propagation of fish, shellfish, and wildlife. (See 40 CFR 131.12(a)(2))
- Tier 3: Maintain and protect water quality in waters the state has designated as outstanding National resource waters (ONRWs) with no allowance of permanent or long term degradation. (*Ibid*. at § 131.12(a)(3); See also Fed. Reg. 51402 (Nov. 8, 1983))."[61]

[61] ONRW designations are made by and upon the discretion of Regional Water Boards as part of adoption of water quality standards. (See Attwater Memo, *supra*, p.15, generally citing Cal. Wat. Code §13242(b)). To date, no water bodies in Region 4 have been designated as an ONRW. Region 4 staff anticipates including an ONRW designation process on the initial list potential items to be covered in its next triennial review, but further prioritization may preclude an actual Basin Plan amendment incorporating such process. (December 26, 2007 telephone conversation between Renee Purdy of Region 4 and David Martinez of LWA). EPA will not designate a water body as an ONRW where a State does not do so. (See Memorandum from William R. Diamond to Regional Water Management Division Directors (May 25, 1989) and Memorandum from Catherine A Winer Attorney for SWRCB to William Diamond by incorporation into foregoing memo; See also May 8, 2007 letter to Dan Gilnor (Environmental Law Foundation) from Phillip G. Wyels (Assistance Chief Counsel of SWRCB) acknowledging there is no requirement that any water body be designated as an ONRW and citing *National Wildlife Federation v. Browner* (D.C. Cir. 1997 127 F.3d 1126) in stating that the states have discretion not to designate water bodies as ONRWs.

The state's Antidegradation Policy is contained in State Board Resolution 68-16, Statement of Policy with Respect to Maintaining High Quality Water in California. Because Resolution 68-16 was adopted prior to the promulgation of the federal antidegradation rules, on its face, this policy is generally less specific than the federal policy and focuses primarily on "high quality waters," or those waters exceeding water quality standards. Resolution 68-16 resolves the following:

- Waters that have quality that is better than that established in effective policies shall be maintained unless (by demonstration to the State) any change (a) will be consistent with the maximum benefit of the people, (b) will not unreasonably affect present and anticipated beneficial uses, and (c) will not result in water quality less than that prescribed in the policies.

- Activities or proposals that discharge or may discharge waste must meet waste discharge requirements that result in the best practicable treatment or control as needed to (1) preclude a pollution or nuisance and (b) assure the highest water quality consistent with the maximum benefit of the people will be maintained.

Resolution 68-16 is interpreted as incorporating and meeting the federal antidegradation requirements contained in Part 131 for waters of the United States in situations where the federal policy applies.[62] High quality waters are waters cleaner than necessary to support recreation and the propagation of fish, shellfish, and wildlife. (See 40 CFR 131.12(a)(2)).

The adoption of the proposed SSOs would be consistent with the Resolution 68-16, as well as the federal antidegradation policy it incorporates. When implemented with existing efforts to reduce chloride discharges from residences and the commitments delineated in the Alternative Water Resources Management Option, the revised water quality objectives will be protective of all beneficial uses that apply to the affected waters. This assessment is based on the following findings:

1. The SSOs will not result in the lowering of water quality as current water quality exceeds the proposed SSOs. Water Quality will, in fact, improve with implementation of the Alternative Water Resources Management Option.
2. The proposed SSOs are protective of beneficial uses.
3. The proposed implementation activities will offset any increases in chloride discharges with accompanying increases in chloride export from impacted groundwater basins.
4. The proposed SSOs support important economic and social development by supporting water recycling and providing for additional water resources for agriculture and aquatic habitat.
5. Wastewater NPDES permits will require effluent limits and salt export requirements designed to ensure that wastewater dischargers maintain or improve current levels of performance and prevent degradation of the downstream groundwater basins.

[62] SWRCB WQO 86-17 at pp. 16-19; See also Federal Antidegradation Policy (October 7, 1987), Memo from W.R. Attwater, Chief Counsel to SWRCB.

The proposed SSOs will not result in a lowering of water quality as compared to current and historic chloride concentrations in the receiving waters. As discussed in Section 3.1.3.1, the chloride concentrations have exceeded the current Basin Plan objective of 100 mg/L over 50% of the time in most sections of Reaches 5 and 6 since the development of the water quality objectives. The current concentrations that would occur during a drought in Reaches 5 and 6 exceed the proposed SSO of 150 mg/L. Consequently, no increase in loading will occur as a result of the proposed SSOs. Rather, water quality will be improved as a result of the SSOs and associated implementation requirements. Thus, discharges based on the SSO would not appear to be "adverse to the intent and purpose of the state and federal antidegradation policies" because a lowering of water quality is not expected to result from the SSO.[63]

As discussed in the technical analysis sections, the proposed SSOs, combined with the required implementation actions, are protective of the beneficial uses in the USCR. The proposed surface water and groundwater chloride objectives in Reaches 5 and 6 are consistent with Resolution 68-16 because they are fully protective of current and foreseeable uses of water for irrigation of crops in the area, as well as protective of the use of these waters as a potential source of drinking water. The proposed surface water SSOs are substantially below the USEPA acute and chronic aquatic life criteria for chloride. Therefore, even if based on annual averages, the SSOs would be protective of the most chloride-sensitive aquatic organisms for which data are available as well as threatened and endangered species as discussed in Sections 3.1.1 (TES Study) and 3.1.5.1 (Evaluation of Protection of Aquatic Life). Lastly, the proposed groundwater quality objectives for chloride, TDS, and Sulfate in the East Piru sub-basin are more stringent than the existing objectives and, therefore, are protective of the beneficial uses.

The proposed surface water objectives for Reach 4B under the AWRM compliance option are protective of the AGR beneficial uses because they are within the guidelines established for protection of sensitive agricultural uses unless alternative water supplies are provided to agriculture. The proposed water quality objectives are consistent with Resolution 68-16 because (1) the proposed objectives are protective of the MUN P* designation and (2) under the Alternative Water Resources Management Option, any potential adverse affect on salt-sensitive crops due to an exceedance of the 117 mg/L chloride threshold value will be averted by supplying an alternative water source protective of this use. Therefore, any change in water quality that meets the applicable water quality objective could be found to be consistent with the maximum public benefit and not unreasonably adverse to present and anticipated beneficial uses subject to antidegradation review that is consistent with state and federal policy. If higher water quality objectives are in place in Reach 4B due to elevated water supply concentrations, the groundwater basin will be protected from degradation through the required salt export. The AWRM proposal will improve water quality in the basin over time and offset any increase in chloride concentrations that result from the higher objective during some periods.

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[63] See APU 90-004 p. 2.

Modeling indicates that the AWRM compliance option projects the following water quality benefits from the County Line to the area of seawater intrusion on the Oxnard Plain.

- At the County Line, chloride concentrations in the Santa Clara River are lower than existing and projected baseline conditions, especially during the problematic dry periods when the State Water Project delivers more-saline water to the Santa Clarita area. This lowering of chloride concentrations in the river results in better-quality recharge to the east Piru basin, also lowering chloride concentrations in groundwater.

- In Piru Basin, groundwater chloride concentrations are improved with ARWM. By pumping from the east Piru basin, much of the recharge that consequently refills the basin comes during wet years when chloride concentrations are lower. The proposed groundwater and surface water objectives for Reaches 5 and 6 will support the expansion of recycled water uses in the Santa Clarita Valley consistent with the California's stated goal of increasing the use of recycled water to help meet the state's growing demand for potable water. [64] Therefore, any change in water quality in these groundwater sub-basins that meets the applicable groundwater quality objective for chloride, TDS, and sulfate could be found to be consistent with the maximum public benefit and not unreasonably adverse to present and anticipated beneficial uses subject to antidegradation review that is consistent with state policy. The improved groundwater quality in the east Piru basin from the AWRM project is also present down the length of the Piru basin.

- At the downstream end of the Piru basin, modeled surface water chloride concentrations are higher in the river about 40% of the time with the AWRM operating, but still in compliance with the existing water quality objective of 100 mg/L. The discharge of the combined pumped groundwater and reverse osmosis (RO) permeate water that occurs just upstream of this point would be restricted to 95 mg/L, so chloride in the river should not rise much above this concentration.

- Using output from the GSWI model, United Water's Lower Santa Clara River Routing and Percolation Model was used to determine the amount of water that could be beneficially diverted at the Freeman Diversion from the three modeled scenarios. The difference in yield at the Freeman Diversion between the minimum flow compliance option and the AWRM option is 11,500 AFY, which is approximately double the increased yield of 6,000 AFY when the permanent Freeman Diversion was constructed.

- The increased modeled diversions from the AWRM option had a significant effect on saline intrusion by decreasing the modeled onshore groundwater gradient that pulls in saline waters. In fact, the modeling suggests a decrease of 6,000 tons/yr of chloride moving landward through the Lower Aquifer in the Point Mugu lobe alone when the

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[64] See Endnote 59.

AWRM option is substituted for the minimum flow compliance option.

- The modeled drawdown effects of operating the east Piru well field of the AWRM option were within historic drawdown from nearby wells. Additionally, the east Piru basin refilled during wet years and wet seasons, as it does currently. Thus, operation of the well field should not have detrimental effects on the basin.

- The AWRM option has more water quality benefits to Ventura County than do the conventional advanced treatment based compliance options. These conventional advanced treatment based compliance options, if constructed, would likely reduce flows at Freeman Diversion, which in turn would have substantial negative effects on saline intrusion beneath the Oxnard Plain unless groundwater pumping is reduced even further (e.g., FCGMA, 2007).

- The AWRM option does not appear to have a downside in comparison with the conventional advanced treatment based options and appears to be the most favorable compliance option for the Upper Santa Clara River Chloride TMDL.

Finally, the proposed SSOs will be implemented through NPDES permits, including effluent limits and required minimum salt export requirements. The effluent limits will ensure that the current performance of the WRPs continues at a minimum and will most likely require additional actions to achieve the water quality objectives. Additionally, receiving water limits will ensure that downstream water quality is not degraded as a result of wastes discharged. Finally, minimum salt export requirements will be included to ensure that excess salt loadings to the groundwater basin due to periods of elevated water supply concentrations are removed from the groundwater basin through pumping and export.

Based on this analysis, the proposed SSOs are consistent with the state and federal antidegradation policies.

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