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Calleguas Creek Watershed Boron, Chloride, TDS, and Sulfate TMDL

Public Review Technical Report

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Submitted to

LOS ANGELES REGIONAL WATER QUALITY CONTROL BOARD AND THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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List of Acronyms

CCMS	Calleguas Creek Modeling System
CCW	Calleguas Creek Watershed
CMWD	Calleguas Municipal Water District
CWA	Clean Water Act
LA	Load Allocation
POTW	Publicly Owned Treatment Works
SSO	Site-Specific Objective
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
WLA	Wasteload Allocation
WQCP	Water Quality Control Plant
WQO	Water Quality Objective
WRP	Water Reclamation Plant
WTP	Wastewater Treatment Plant

Definitions

Imported Water-	Water supplied to the watershed from State Project Water (or Colorado River water if used in future)
Introduced Salts-	Salts that are imported into or added to the area of the watershed upstream of Potrero Road on Calleguas Creek and upstream of Laguna Road on Revolon Slough. Imported sources include imported water, Santa Clara River water, and confined groundwater pumping. Added salts come from atmospheric deposition, urban water use, water softeners, and pesticide and fertilizer applications.
Pumped Groundwater-	Discharges of unconfined groundwater that are directly pumped to the receiving water (i.e. the Simi Valley dewatering wells).
Salts-	Chloride, Boron, Total Dissolved Solids (TDS), Sulfate
Salt Export-	Mass of salts transported to the ocean through either surface water flows or brine line discharges.
Salt Balance-	An equal mass of salts is introduced to the watershed as is exported out of the watershed. Compliance determined on an annual basis using dry weather flow days only.
Stranded Salts-	Introduced salts that are not exported out of the watershed during dry weather.
Unconfined Groundwater-	Groundwater that is directly recharged by surface water or irrigation returns.

Section 1. Introduction

The Calleguas Creek Watershed Salts Total Maximum Daily Load (TMDL) document presents the required elements for addressing impairments to Calleguas Creek and its tributaries caused by chloride, total dissolved solids (TDS), sulfate and boron. The TMDL determines the causes of these impairments, allowable loadings for the various sources, and measures required to remove these impairments.

Eleven of fourteen reaches in the Calleguas Creek Watershed (CCW), in southern Ventura County, are identified on the 2002 Clean Water Act Section 303(d) list of water-quality limited segments as impaired due to elevated levels of salts in water. The 303(d) listings, which were approved by the State Water Resources Control Board (State Board) in February 2003, require the development of TMDLs to establish the maximum amount of pollutants a water body can receive without exceeding water quality standards. The CCW reaches identified as impaired on the 2002 303(d) list are presented below in Figure 1 and summarized in Table 1. This TMDL addresses analytical units 3 and 4 of the Consent Decree. The State-adopted TMDL will supercede the chloride TMDL previously established by EPA.

The Clean Water Act requires development of TMDLs to restore impaired water bodies, and the Porter-Cologne Water Quality Act requires that an Implementation Plan be developed to achieve water quality objectives. This document fulfills these statutory requirements and serves as the basis for amending the Water Quality Control Plan for the Los Angeles Region (Basin Plan) to achieve water quality standards in Calleguas Creek for salts. The CCW Salts TMDL addresses the requirements prescribed by Section 303(d) of the Clean Water Act (40 CFR 130.2 and 130.7) and USEPA guidance (USEPA, 1992)

Larry Walker Associates provided the analysis to determine the TMDL for salts in the CCW under contract to the Calleguas Creek Watershed Management Plan Steering Committee (Steering Committee) with support from the California Regional Water Quality Control Board, Los Angeles Region (Regional Board or LARWQCB), and the United States Environmental Protection Agency, Region 9 (USEPA).

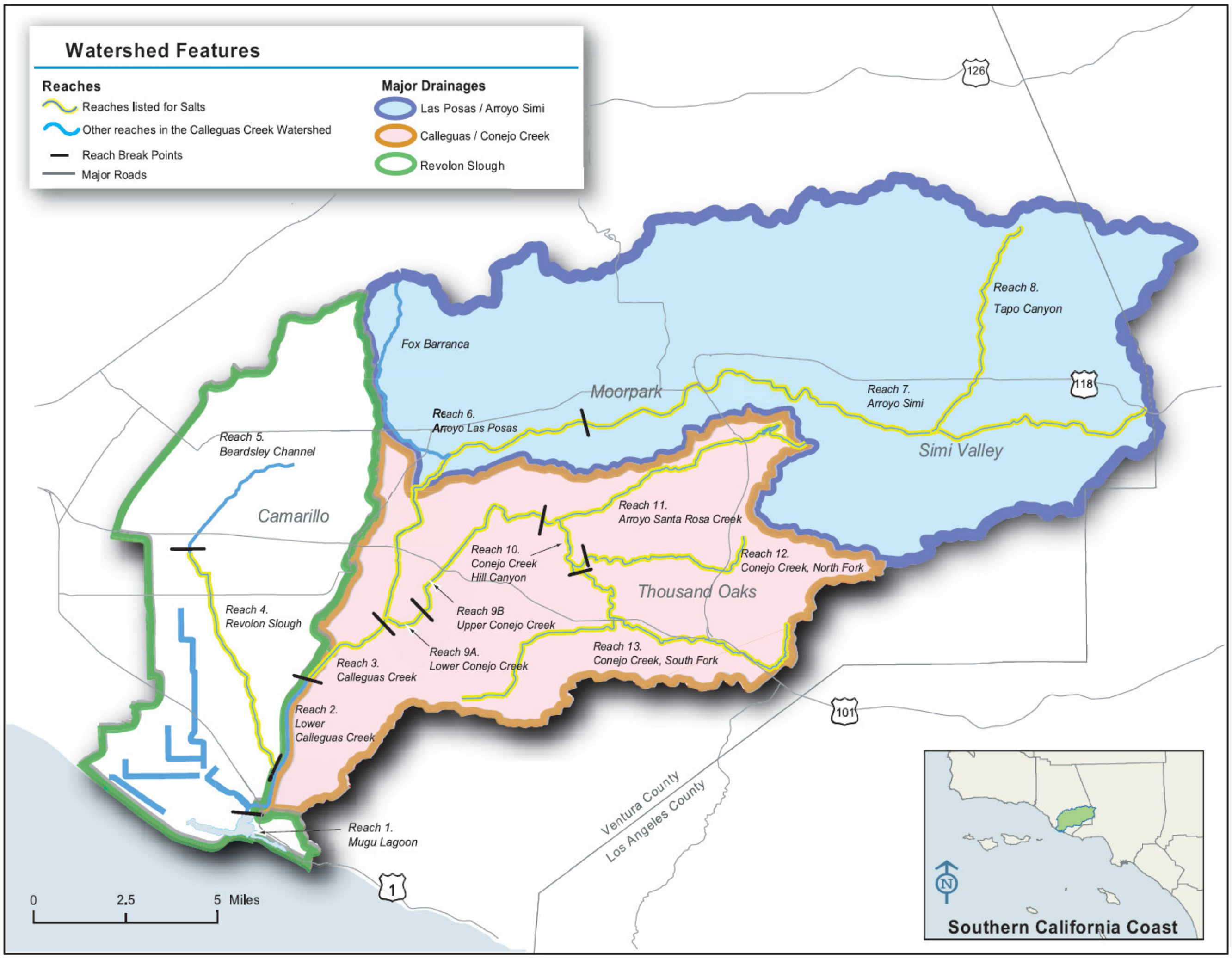

Figure 1. Map of Calleguas Creek Watershed, showing reaches impaired for salts

Table 1. 2002 303(d) Listings

Reach No.	Reach Name	Boron	Chloride	Sulfates	TDS
7	Arroyo Simi	X	X	X	X
6	Arroyo Las Posas		X	X	X
8	Tribs to Arroyo Simi	X	X	X	X
13	South Fork Conejo Creek		X	X	X
12	North Fork Conejo Creek			X	X
10	Conejo Creek Hill Canyon		X	X	X
11	Arroyo Santa Rosa			X	X
9B	Conejo Creek Main Stem		X	X	X
9A	Camrosa Diversion			X	X
3	Calleguas Creek Upper Main Stem		X		X
2	Calleguas Creek Lower Main Stem				
4	Revolon Slough	X		X	X
5	Beardsley Wash				
1	Mugu Lagoon				

Blank cells indicate no listings for that constituent in the reach.

1.1. REGULATORY BACKGROUND

Section 303(d) of the Clean Water Act (CWA) requires that "Each State shall identify those waters within its boundaries for which the effluent limitations are not stringent enough to implement any water quality standard applicable to such waters." The CWA also requires states to establish a priority ranking for waters on the 303(d) list of impaired waters and establish TMDLs for such waters.

The elements of a TMDL are described in 40 CFR 130.2 and 130.7 and Section 303(d) of the CWA, as well as in USEPA guidance (USEPA, 1992). A TMDL is defined as the "sum of the individual waste load allocations for point sources and load allocations for non-point sources and natural background" (40 CFR 130.2) such that the capacity of the water body to assimilate pollutant loadings (the loading capacity) is not exceeded. TMDLs are required to account for seasonal variations, and must include a margin of safety to address uncertainty in the analysis. The individual TMDL elements are defined below in Section 1.3, along with corresponding sections containing detailed descriptions of the analyses supporting each element.

States must develop water quality management plans to implement TMDLs (40 CFR 130.6). The USEPA has oversight authority for the 303(d) program and is required to review and either approve or disapprove the TMDLs submitted by states. If the USEPA disapproves a TMDL submitted by a state, USEPA is required to establish a TMDL for that water body. The Regional Board identified over 700 water body-pollutant combinations in the Los Angeles Region where TMDLs are required (LARWQCB, 2003). A schedule for development of TMDLs in the Los Angeles Region was established in a consent decree (Heal the Bay Inc., et al. v. Browner C 98-4825 SBA) approved on March 22, 1999. The consent decree combined water body pollutant combinations in the Los Angeles Region into 92 TMDL analytical units. In accordance with the consent decree, the analyses performed for TMDL development are summarized herein and the TMDL addresses waterbodies with salts listings in analytical units 3 and 4.

Based on the consent decree schedule, a TMDL for chloride was adopted by USEPA in March 2002 to address analytical unit 3. According to the consent decree, the remaining salts in analytical unit 4 (TDS, sulfate, and boron) TMDLs must be approved or established by USEPA by March 2012. This TMDL will supercede the chloride TMDL for analytical unit 3 previously established by EPA.

In addition to the 303(d) listings for salts, a number of other regulatory activities have been ongoing in the watershed to address chloride surface water concentrations and objectives. The following section summarizes the other regulatory activities related to chloride that are relevant to the development of this report.

1.1.1. Chloride Regulatory History

During the drought that began in the 1980s and continued through the early 1990s, many dischargers in the Los Angeles Region had difficulty meeting the chloride discharge limits based on the Basin Plan objectives. Although, chloride levels were expected to subside after the drought, many water bodies continued to exceed the chloride objective. In response to these conditions, the LARWQCB adopted Resolution No. 90-04: "Effects of Drought Induced Water Supply Changes and Water Conservation Measures on Compliance with Waste Discharge Requirements within the Los Angeles Region" (Drought Policy). This policy provided temporary relief to dischargers by raising chloride limits in waste discharge requirements to the lesser of: 1) 250 milligrams/liter (mg/l), or (2) the chloride concentration in the water supply plus 85mg/l. These temporary limits were applied to dischargers whose water supply had high concentrations of chlorides due solely to the increased mineralization of supply waters imported to the Region. The Drought Policy expired on February 27,1997, and the Chloride Policy was adopted as a long-term solution to chloride compliance problems.

Resolution 97-02 (the Chloride Policy) revised the chloride water quality objectives (WQOs) upward to 190 mg/L for specified reaches of the Los Angeles River and 180 mg/L in the San Gabriel River. However, the chloride objectives were not revised in the Calleguas Creek and Santa Clara River watersheds due to concerns for agricultural beneficial uses, which are sensitive to chloride levels. Rather, the Regional Board extended the interim limits in these watersheds and directed staff to carefully determine the chloride WQO that would fully support the agricultural beneficial use (See Table 2). The Regional Board determined that the interim limits expired on March 29, 2002. The Drought and Chloride policies are included as Appendix 1.

Table 2. Interim Chloride Limits for Specified Stream Segments

Calleguas Creek watershed segments for which existing dischargers are subject to Interim Chloride Limits	Interim Chloride Limit
Arroyo Simi and tributaries-upstream of Madera Road	160 mg/L
Arroyo Simi- downstream of Madera Road, Arroyo Las Posas, and tributaries	190 mg/L
Calleguas Creek and tributaries-between Potrero Road and Arroyo Las Posas (including Conejo Creek, Arroyo Conejo, and Arroyo Santa Rosa)	190 mg/L

After the expiration of the interim limits on March 29, 2002, the dischargers in the watershed worked with the State Board to develop a stay that would extend the interim limits for up to three years to allow them to pursue "a watershed planning effort to support determinations of beneficial uses, water quality objectives, and development of total maximum daily loads as necessary" (WQO 2002-0017). The State Board approved the stay in October 2002. The stay requires that a work plan be developed to "re-evaluate water quality objectives for chloride in the Calleguas Creek watershed and/or the beneficial uses currently associated with chloride objectives in the Calleguas Creek watershed (Work Plan)." The Regional Board must then ensure that the work plan provides "an adequate approach to determining appropriate water quality standards and implementation with respect to chloride in the Calleguas Creek watershed."

The Calleguas Creek Watershed Management Plan submitted a work plan to meet the requirements of the stay agreement in January 2003 (*Calleguas Creek Watershed Salts TMDL Work Plan*). The Regional Board approved the work plan in July 2003, thereby fulfilling the requirements of the stay agreement.

Concurrently with the activity surrounding the Chloride Policy, a chloride TMDL was being developed. In December 2001, the Regional Board developed a draft chloride TMDL (Draft Chloride TMDL) for the CCW. Although the Regional Board never adopted the proposed TMDL, the USEPA used it as a basis for developing a chloride TMDL for the CCW to meet the consent decree requirements. The USEPA developed chloride TMDL (EPA Chloride TMDL) was adopted by USEPA on March 2, 2002.

When the discharge permits for three of the POTWs in the watershed were renewed in 2003, the interim limits were placed in the NPDES discharge permits in accordance with the stay agreement. The USEPA objected to the draft orders that were consistent with the stay. USEPA contended that the final orders must include effluent limitations for chloride consistent with waste load allocations (WLA) contained in the EPA Chloride TMDL. As a result, the Regional Board adopted the orders with new chloride effluent limitations and accompanying time schedule orders based upon the EPA Chloride TMDL.

In response, the dischargers appealed their permits to the State Board. Another stay agreement was adopted in October 2003 to address the concerns outlined in the appeal. This agreement stayed the final chloride effluent limitations and time schedule orders associated with the limitations for all of the appealed permits. The stay acknowledged that the Regional Board has approved a work plan and activities related to the work plan were in progress. In December 2003, the Regional Board adopted orders for the remaining two POTWs that included effluent limitations for chloride consistent with WLAs contained in the EPA Chloride TMDL. These permits were also appealed to the State Board and a similar stay of the final chloride effluent limitations was developed.

In addition to the changing regulatory history surrounding salts, the water quality objectives have undergone a number of changes throughout the history of the Basin Plan. In March of 1975, the Los Angeles Regional Water Quality Control Board (Regional Board) adopted the Basin Plan for the Santa Clara River Basin (4A), which includes the Calleguas Creek Watershed. The 1975 Basin Plan included the salts surface water quality objectives for the Calleguas Creek Watershed in Table 4-1, pages I-4-10 and I-4-11 of the 1975 Basin Plan (See Attachment 1). The objectives were set for Calleguas Creek at Potrero Road based on a weighted annual average per footnote (a).[1]

In March of 1978, the Regional Board amended the 1975 Basin Plan to revise certain salts objectives for the Calleguas Creek watershed. Appendix 1 includes the revision pages taken from the Regional Board's Administrative Record that discuss the 1978 revisions to the Basin Plan. As seen in Appendix 1, the objectives were revised because "the current Basin Plan objectives for surface water and groundwater in this portion of the basin are inconsistent in view of the continuity of these waters. The proposed changes correct this inconsistency. In addition, the proposed numbers reflect current water quality. Within this reach there are two controllable point source discharges: Thousand Oaks Hill Canyon and Camarillo STP. Both discharge into Conejo Creek tributary to Calleguas Creek and comply with waste discharge requirements prescribed by this Board. The proposed changes will not have any significant effect upon the existing or potential beneficial uses." The numeric objectives for chloride and sulfate were changed and the reach designations changed from at Potrero Road to above Potrero Road. However, the footnote describing that the objectives are to be applied as weighted averages remained unchanged.

In 1994, the Regional Board again amended the Basin Plan and omitted footnote (a), which described the basis of the salts objectives and how compliance with these objectives would be determined. The Basin Plan as adopted in 1975 and amended in 1978 included weighted annual average objectives as determined at Potrero Road. The current objectives, based on the application of the objective to waters upstream of Potrero Road and the omission of footnote (a), are interpreted as instantaneous maximums that have to be met at any given location within the applicable reach.

1.2. CALLEGUAS CREEK TMDL STAKEHOLDER PARTICIPATION PROCESS

In addition to the federal and state regulations described above, the Regional Board enacted Resolution No. 97-10, *Support for Watershed Management in the Calleguas Creek Watershed* on April 7, 1997. Resolution 97-10 recognized watershed management as an innovative, cost-effective strategy for the protection of water quality. Resolution 97-10 also recognized that the Calleguas Creek Municipal Water District (CMWD) and the Publicly Owned Treatment Works (POTWs) in the Calleguas Creek watershed had worked cooperatively with the Regional Board to develop an integrated watershed-wide monitoring program. The Calleguas Watershed Management Plan has been active since 1996 in the development of a watershed management plan for the Calleguas Creek watershed and has proactively worked with the Regional Board and the USEPA to develop TMDLs in the watershed.

In 2001, the group began discussions with the Regional Board and USEPA to provide assistance in the development of the TMDLs for the watershed. In December 2002, the group developed TMDL work plans for most constituents on the 2002 303(d) list. The Salts TMDL Work Plan, developed with input from the LARWQCB and USEPA, forms the basis of all of the work conducted to develop this TMDL. USEPA Region IX approved the Salts TMDL Work Plan in June, 2003.

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[1] Footnote (a) states: "The objective *at each station* is of the *weighted annual average*. Samples shall be collected at monthly intervals preferably but at least at quarterly intervals. *Flow rate* shall be determined at the time of sampling [emphasis added]."

The purpose of the watershed group assisting with the development of the TMDLs was to incorporate local expertise and reach a broad group of stakeholders to develop implementation plans to resolve the water quality problems within the watershed. Stakeholders include representatives of cities, counties, water districts, sanitation districts, private property owners, agricultural organizations, and environmental groups with interests in the watershed.

A high level of stakeholder involvement has occurred throughout the TMDL development process. There have been no interventions from outside groups, and much of the work has been performed or paid for by members of local government agencies and USEPA grant funding.

1.3. ELEMENTS OF A TMDL

Individual elements of the CCW Salts TMDL are presented as sections in this document, as described below.

- Problem Statement - Section 2: Explanation of environmental setting, beneficial uses, and the basis for listings addressed through this TMDL.
- Numeric Targets – Section 3: Presents appropriate numeric targets that will result in the attainment of water quality objectives as well as the basis for selection of targets.
- Source Analysis - Section 4: Presents an inventory of the sources of the pollutants of concern.
- Linkage Analysis - Section 5: Analysis developed to describe the relationship between the input of the pollutants of concern and the subsequent environmental response with regard to listings.
- TMDL and Allocations – Section 6: Identifies the TMDL allocations for point sources (waste load allocations) and non-point sources (load allocations) that will result in the attainment of water quality objectives.
- Margin of Safety-Section 7: Describes the basis for the margin of safety included in the allocations.
- Future Growth – Section 8: Estimates likely economic and population growth, and the effects of that growth upon water supply and water quality
- Implementation Plan - Section 9: Describes the strategy for implementing the TMDL and achieving water quality objectives, as well as a brief overview of the strategy for monitoring the effects of implementation actions.

Section 2. Problem Statement

This section provides the context and background for the CCW Salts TMDL. The environmental setting provides an overview of the hydrology, climate, and anthropogenic influences in the CCW. In addition, this section includes an overview of water quality standards applicable to the watershed and reviews data used to develop the 1996, 1998, and 2002 303(d) listings.

Since 1999, ongoing discussions about the best mechanisms for managing chlorides in the CCW have clearly demonstrated that two distinct problems exist related to salts. The first is the regulatory defined problems based on the 303(d) list. This problem definition relies solely on the ability of the surface waters to meet Basin Plan water quality objectives to protect beneficial uses. However, the issues with salts are much broader than just surface water concentrations. Therefore, two problem statements were developed. The first deals with the regulatory requirements resulting from the 303(d) listings of salts in the CCW. The second deals with the broader impacts from salts in the CCW. The implementation plan for the TMDL addresses both components of the problem statement.

2.1. ENVIRONMENTAL SETTING

Calleguas Creek and its tributaries are located in southeast Ventura County and a small portion of western Los Angeles County. Calleguas Creek drains an area of approximately 343 square miles from the Santa Susana Pass in the east to Mugu Lagoon in the southwest. The main surface water system drains from the mountains in the northeast part of the watershed toward the southwest where it flows through the Oxnard Plain before emptying into the Pacific Ocean through Mugu Lagoon. The watershed, which is elongated along an east-west axis, is about thirty miles long and fourteen miles wide. The Santa Susana Mountains, South Mountain, and Oak Ridge form the northern boundary of the watershed; the southern boundary is formed by the Simi Hills and Santa Monica Mountains.

Land uses in the CCW include agriculture, high and low density residential, commercial, industrial, open space and a Naval Air Base located adjacent to Mugu Lagoon. The watershed includes the cities of Simi Valley, Moorpark, Thousand Oaks, and Camarillo. Most of the agriculture is located in the middle and lower watershed with the major urban areas (Thousand Oaks and Simi Valley) located in the upper watershed. The current land use in the watershed is approximately 26% agriculture, 24% urban, and 50% open space. Patches of high quality riparian habitat are present along the length of Calleguas Creek and its tributaries.

Three major subwatersheds characterize the watershed: the Arroyo Simi/Las Posas in the north, Conejo Creek in the south and Revolon Slough in the west. Additionally, several minor agricultural drains in the Oxnard plain also drain the lower watershed. The following sections describe the subwatersheds in more detail. Figure 2 depicts Calleguas Creek with reach names and designations used in this report.

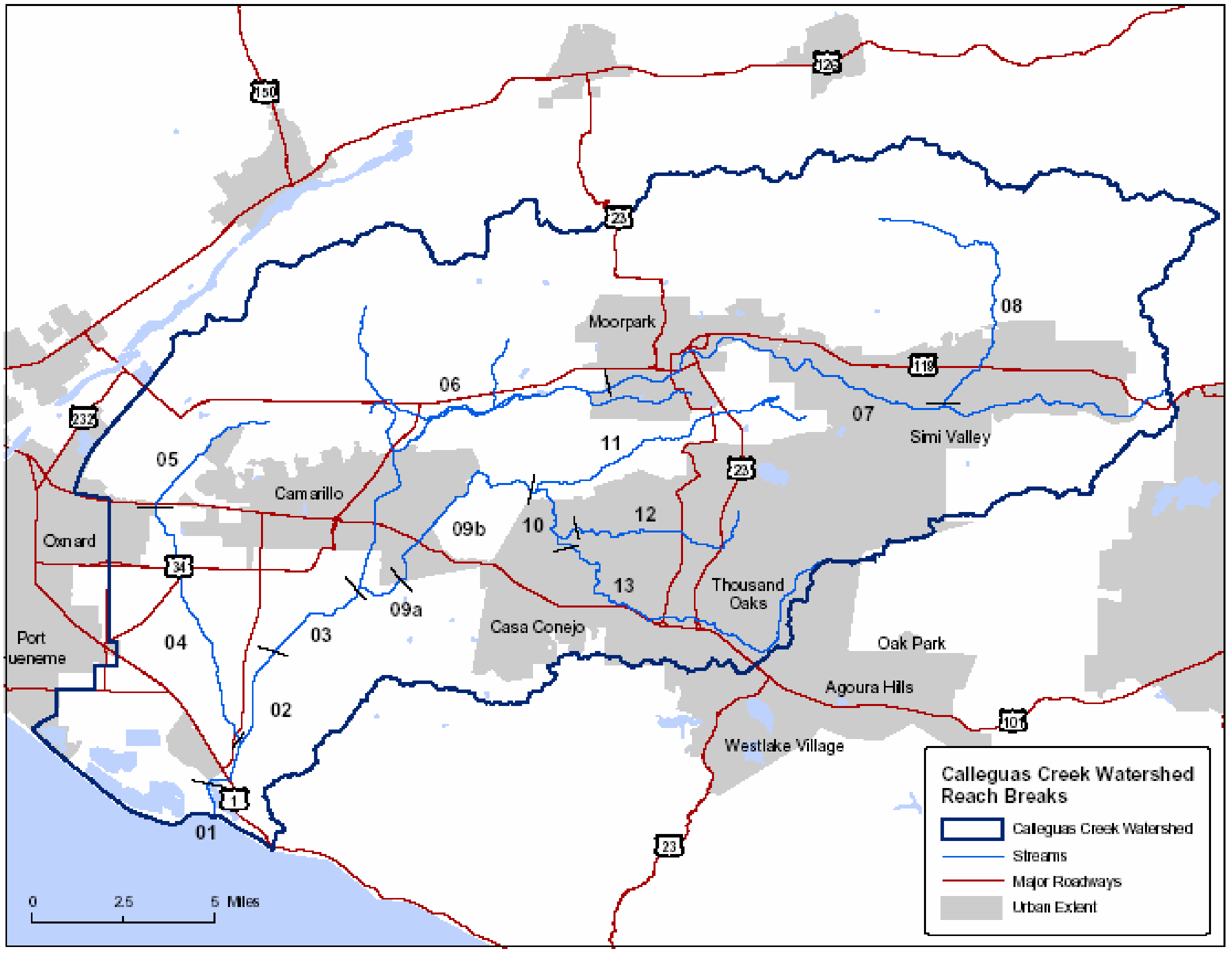

Figure 2. Calleguas Creek Watershed Reaches

2.1.1. Climate and Hydrology

The climate in the watershed is typical of the southern California coastal region. Summers are relatively warm and dry and winters are mild and wet. Eighty-five percent of the rainfall occurs between November and March with most of the precipitation occurring during just a few major storms. Annual rainfall in Ventura County averages 15 inches and varies from 13 inches on the Oxnard Plain to a maximum of 20 inches in the higher elevations (USDA, 1995). About 15 to 20 discrete storm events occur per year and are concentrated in the wet-weather months. Storm events produce runoff that can last from one-half day to several days (USGS, 2000). Discharge during runoff from storm events is commonly 10 to 100 times greater than at other times. Storm events and the resulting high stream flows are highly seasonal, grouped heavily in the months of November through February, with an occasional major storm as early as September and as late as April. Rainfall is rare in other months, and major storm flows historically have not been observed outside the wet-weather season.

2.1.2. Land Use

There are about 344 square miles in the Calleguas Creek Watershed, approximately 51% of which is utilized by some form of human activity (DWR, 2000). About one fourth of the land is urban or urban landscape and about one fourth is used for agriculture (Figure 3). The non-utilized land is comprised almost completely of native vegetation (96%), but also includes some water areas and barren or idle lands (the terms ‘native land’ and ‘non-utilized land’ are used interchangeably in this document to describe undeveloped open space). The category ‘urban landscape’ includes cemeteries, golf courses, and other urban lawn areas. Agricultural lands primarily yield truck crops and citrus; with lemons, avocados, strawberries, green beans, celery, and onions being the most common crops. The term “truck crop” describes vegetables grown in furrows that go straight to market when harvested (e.g. green beans, peppers, celery, tomatoes), and the term “field crop” indicates crops such as cotton, flax, hops, and sugar beets that do not necessarily go straight to market. In recent decades the CCW has experienced dramatic growth in urban residential and commercial development, but historically a much larger percentage of land was used for farming (Figure 4 through Figure 6).

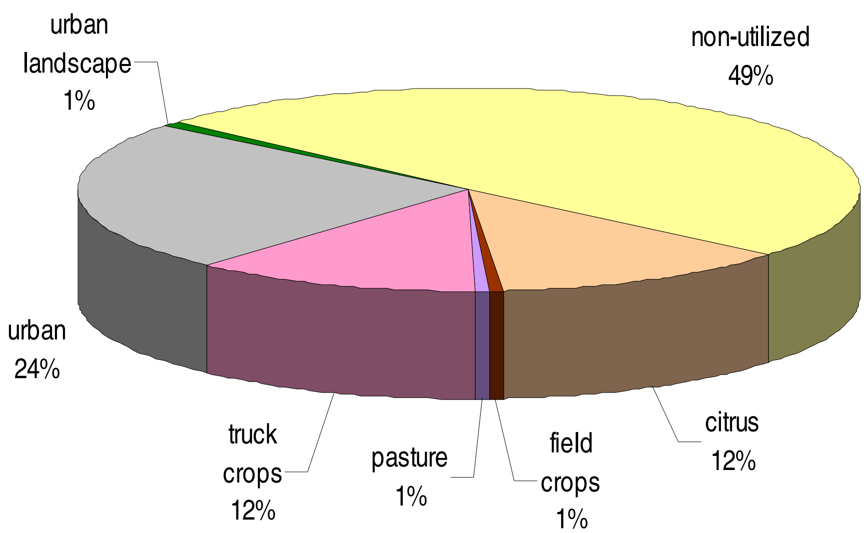

Figure 3. Land Use in CCW (DWR, 2000)

2.1.3. Urban Land Use

About two thirds of the urban land within the watershed is residential, situated mostly in the central to upper portions of the watershed (Table 3, Figure 7). Less than 3% of all land in the watershed is dedicated to industrial and commercial purposes combined. Since 1932, the cities of Thousand Oaks, Simi Valley, and Camarillo have grown from being isolated small towns to their current extent (Figure 4 through Figure 6).

Table 3. Breakdown of Urban Land Use in CCW (SCAG, 2000)

Urban Land Uses	Acres	% of Urban Land Use	% of Watershed Area
Residential	28,898	68%	13%
Transportation & Utilities	5,003	12%	2%
Public Facilities & Institutions	4,063	10%	2%
Industrial	2,403	6%	1%
Commercial	2,399	6%	1%

2.1.4. Agricultural Land Use

Current agricultural land uses vary spatially according to such factors as coastal proximity, altitude, slope, and soil type. Figure 8 shows specific crop types grown in the area, according to subcategory. 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. The uppermost portions of the watershed are not cultivated extensively.

Agricultural activities in the watershed are somewhat challenging to characterize at a fine scale due to several factors. Although some changes in crop composition occur over many years (such as conversion of field crops to truck crops and the disappearance of walnut groves, both during the period 1932-1969), there are also constant changes in crop selection from year to year as farmers adjust to fluctuating market prices or strive to preserve soil by rotating their crops/fields. Additionally, many fields are used to grow successive crops during a single calendar year. This multi-cropping technique is most common in the lower parts of the watershed, adjacent to Revolon Slough and Lower Calleguas Creek (Figure 9). Fields that are multi-cropped do not always follow a time interval that begins and ends within the course of a calendar year. For example, it is common to grow three crops of strawberries in a two year period with some other crop such as barley following the first two strawberry harvests. Growers of turf often plant celery, cabbage or cauliflower in rotation with turf crops to reduce the negative effects upon soil that occur when turf is harvested (S. McIntyre, pers. comm., 2004). The twenty most common multi-crop combinations in the watershed are shown below, in Table 4. Agricultural activity within the Oxnard Plain is spatially heterogeneous with highly variable multi-cropping activity.

Table 4. Top twenty multi-cropping combinations in the Calleguas Creek Watershed by acreage, "double" and "triple" indicate the number of crops grown per year on a given piece of land (DWR, 2000).

Crop Types	Acres	Crop Types	Acres
Double - strawberries, strawberries	4,005	Double - beans(green), celery	199
Triple - beans(green), celery, beans(green)	474	Double - misc-truck, misc-truck	198
Double - celery, peppers	338	Triple - misc-truck, misc-truck, misc-truck	166
Triple - beans(green), celery, peppers	275	Triple - onions-garlic, celery, beans(green)	160
Double - beans(green), beans(green)	269	Triple - peppers, peppers,iD00 celery	154
Double - peppers, peppers	251	Double - peppers, celery	154
Double - peppers, beans(green)	246	Triple - beans(green), broccoli, beans(green)	148
Double - celery, beans(green)	229	Double - barley, barley	137
Triple - misc-truck, misc-truck, misc-truck	226	Double - celery, onions-garlic	134
Double - celery, celery	217	Double - onions-garlic, celery	130

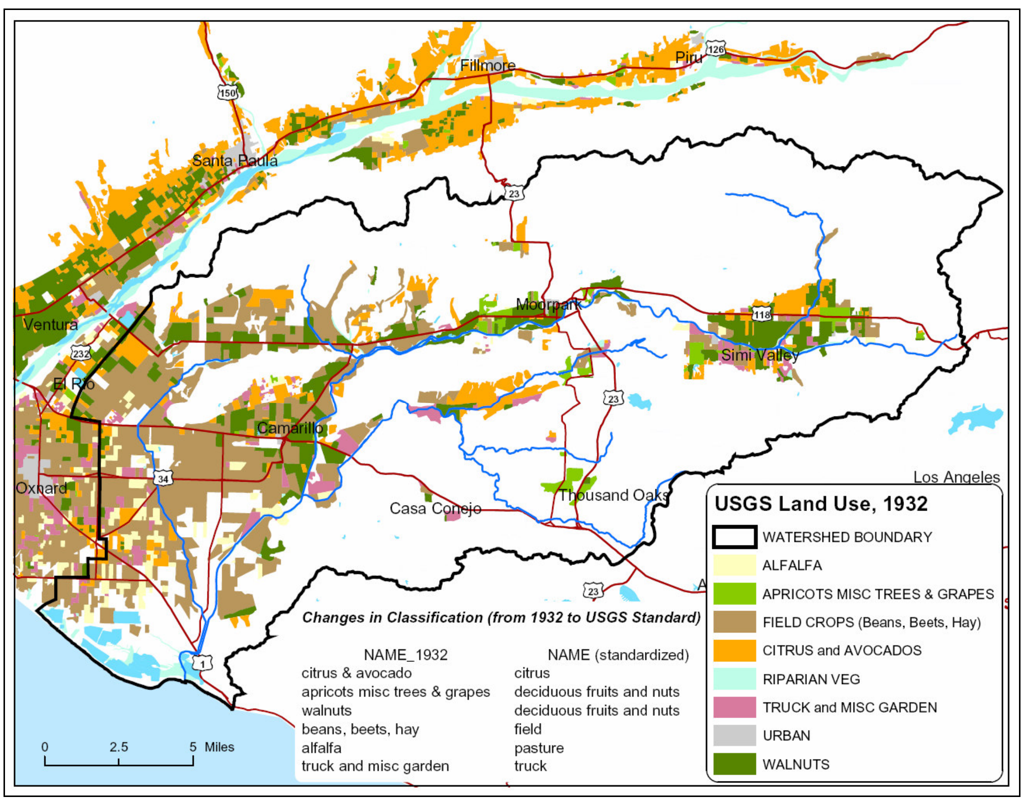

Figure 4. Land Use in the Calleguas Creek Watershed, 1932 (USGS, 2004).

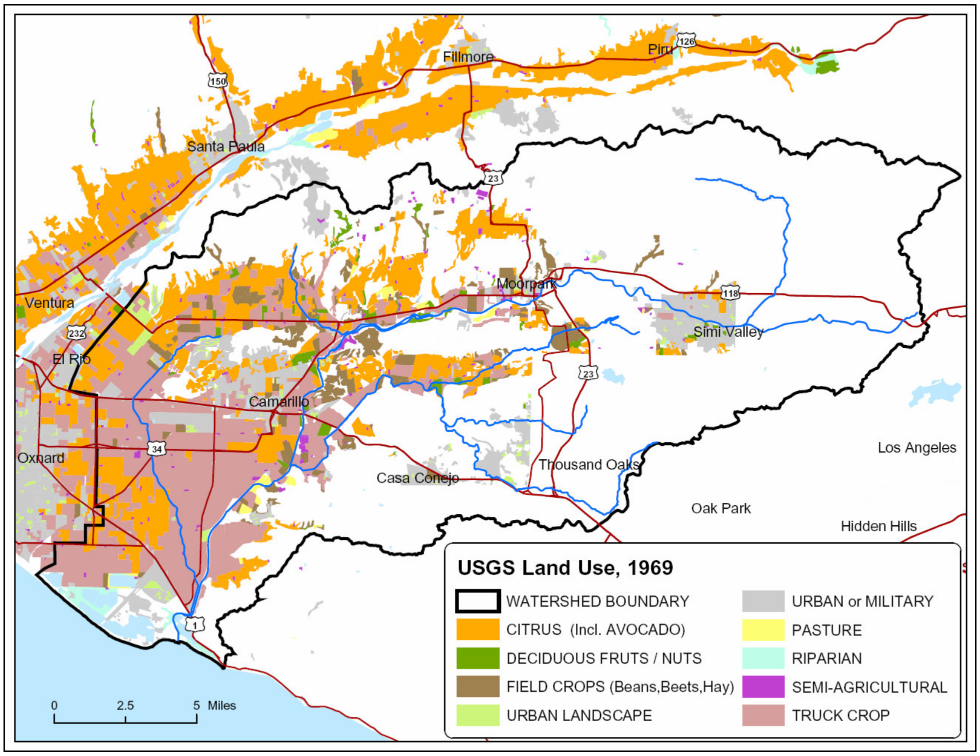

Figure 5. Land Use in the Calleguas Creek Watershed, 1969 (USGS, 2004).

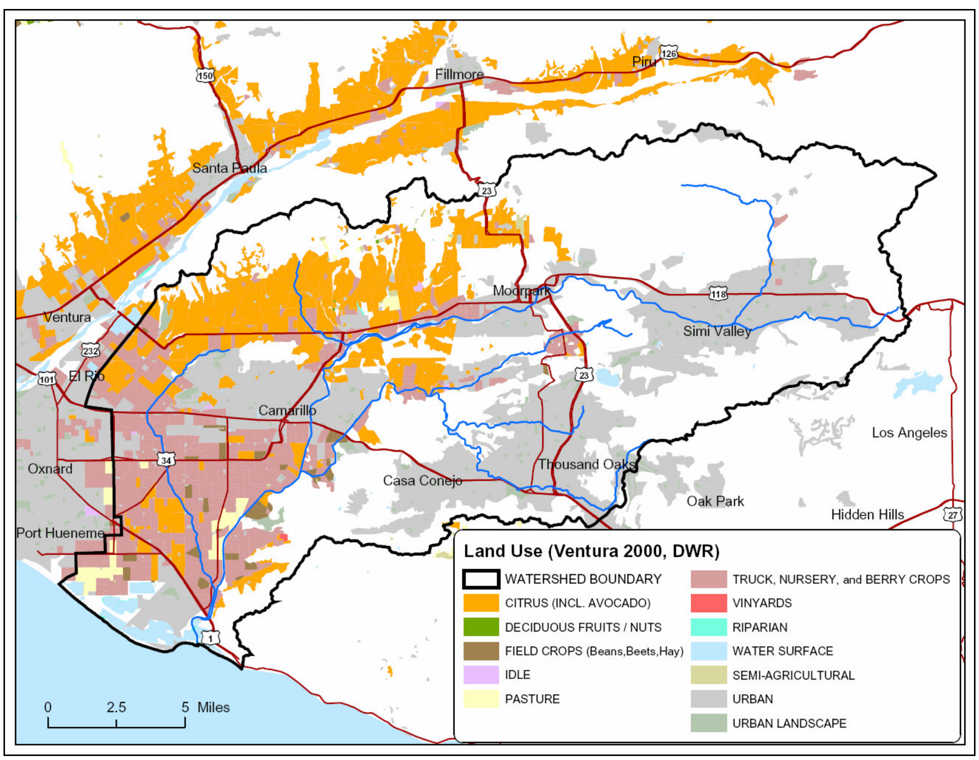

Figure 6. Land Use in the Calleguas Creek Watershed, 2000 (DWR, 2000).

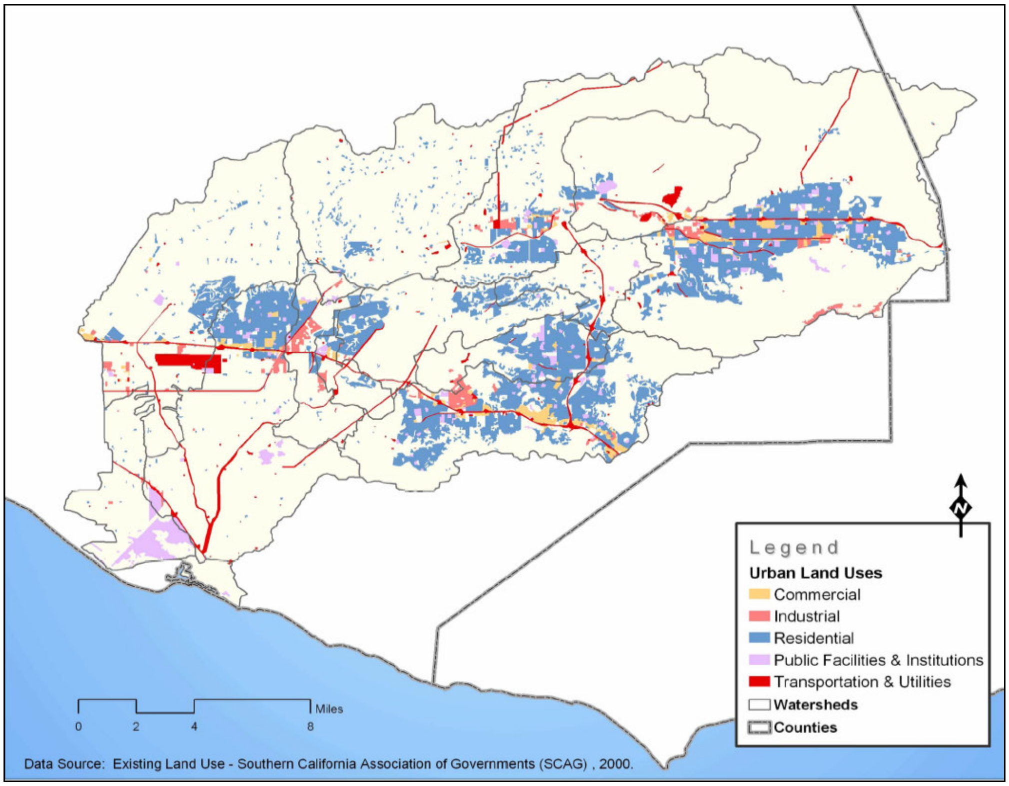

Figure 7. Urban Land Uses in the Calleguas Creek Watershed (SCAG 2000).

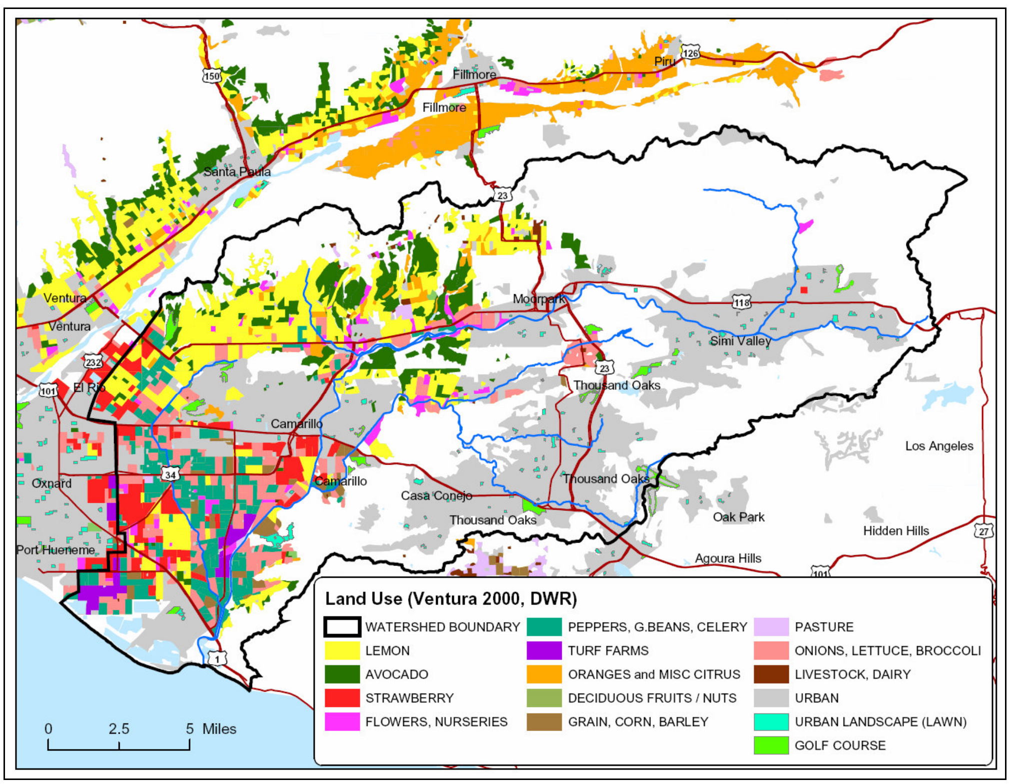

Figure 8. Land Use in the Calleguas Creek Watershed by Specific Crop, 2000 (DWR, 2000).

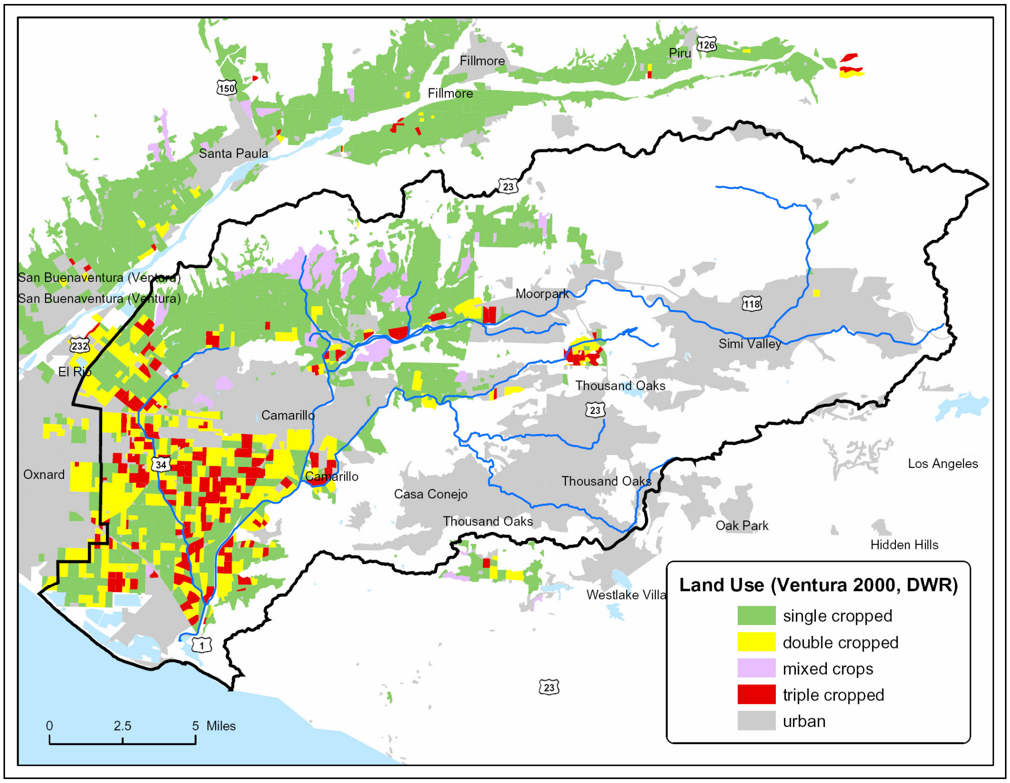

Figure 9. Multi-cropping Activity in the Calleguas Creek Watershed, 2000 (DWR, 2000).

2.1.5. Surface Waters

The main surface water system drains from the mountains toward the southwest, where it flows through the Oxnard Plain before emptying to the Pacific Ocean through Mugu Lagoon. Dry weather surface water flow in the Calleguas Creek watershed is primarily composed of groundwater, municipal wastewater, urban non-storm water discharges, and agricultural runoff. In the upper reaches of the watershed, upstream of any wastewater discharges, groundwater discharge from shallow surface aquifers provides a constant base flow. Additionally, urban non-stormwater runoff and groundwater extraction for construction dewatering or remediation of contaminated aquifers contribute to the base flow. Stream flow in the upper portion of the watershed is minimal, except during and immediately after rainfall. Flow in Calleguas Creek is described as “storm-peaking” and is typical of smaller watersheds in coastal southern California. “Storm-peaking” refers to peak discharges limited to a wet weather season and concentrated into a few days after short-term, discrete storm events, when flow commonly is two to three orders of magnitude greater than non-storm flow (Duke, 2002).

For the purposes of this TMDL, the CCW has been divided into five subwatersheds that will be used for assigning numeric targets, allocations and compliance with the TMDL. The subwatersheds are shown in Figure 10. The five subwatersheds (Simi, Las Posas, Conejo, Camarillo and Pleasant Valley) were developed based on ensuring protection of beneficial uses by defining the base of the subwatersheds (compliance points for the TMDL) at points where beneficial uses occur and at the point of discharge to the tidally influenced portion of the watershed where salts objectives do not apply. Additionally, the subwatersheds were developed specifically for this TMDL to group areas with related beneficial uses, sources of water, and uses of water and to provide consistency with implementation actions planned for the watershed. Finally, the salts objectives only apply upstream of the tidally influenced portion of the watershed; Reach 2 of Calleguas Creek, Mugu Lagoon, and the lower portion of Revolon Slough are not addressed by this TMDL because the salts objectives do not apply. Therefore, the subwatersheds do not consider areas that drain to tidally influenced portions of the watershed.

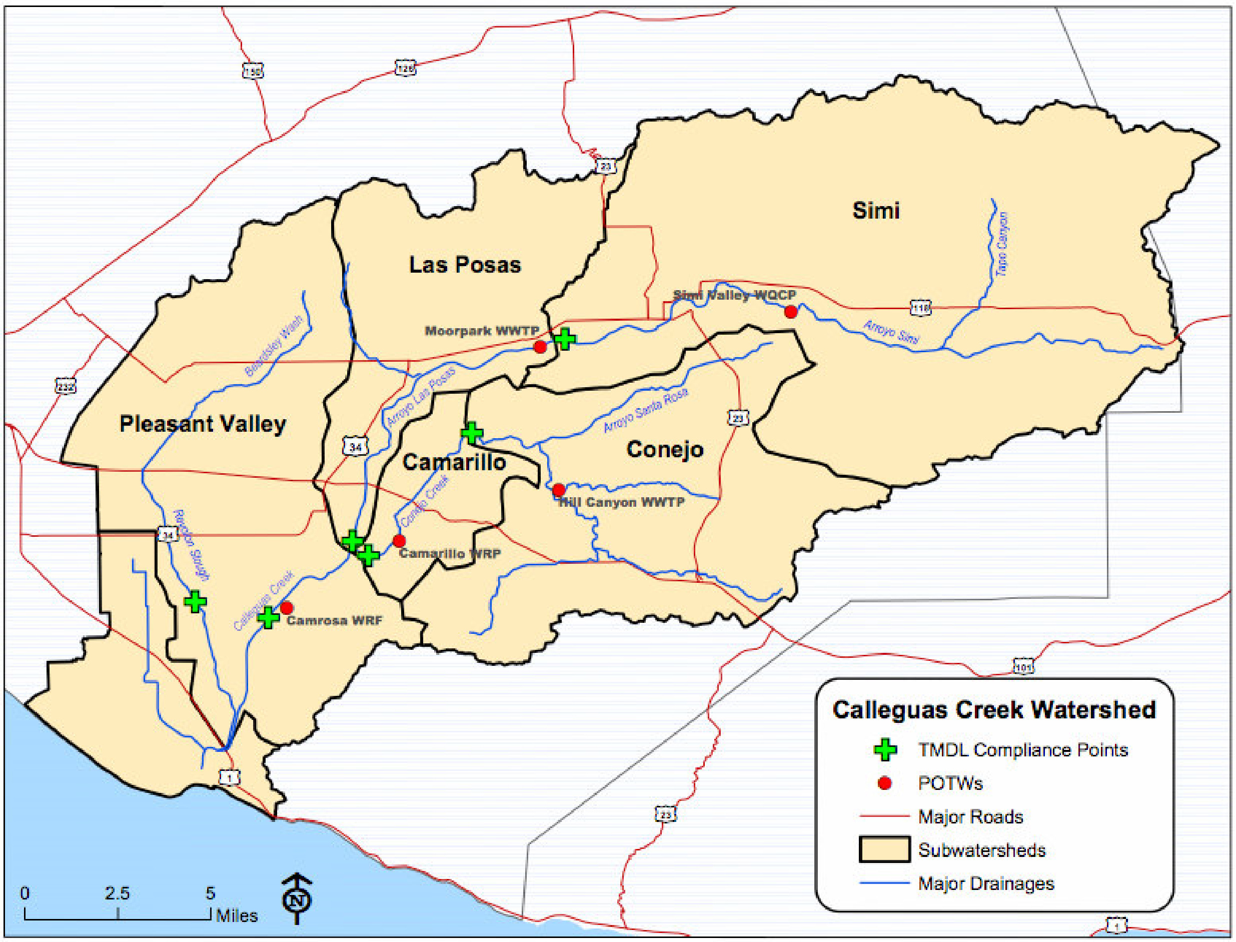

Figure 10. CCW Salts TMDL Subwatersheds

The following sections summarize the characteristics of the subwatersheds and Mugu Lagoon. Additionally, several minor agricultural drains in the Oxnard plain also drain the lower watershed including Mugu Lagoon.

2.1.6. Simi and Las Posas Subwatershed

The Arroyo Simi and Arroyo Las Posas drain the northern portion of the watershed. The northern part of the watershed system originates in the Simi Valley and surrounding foothills. The surface flow comes from the headwaters of the Arroyo Simi at Santa Susanna pass (upper parts of Reach 7) and Tapo Canyon (Reach 8). Arroyo Simi and Arroyo Las Posas flow through the cities of Simi Valley and Moorpark and join with Calleguas Creek, upstream from the City of Camarillo. Upstream of Simi Valley, the creek is unlined and passes through open space and recreational areas. Through the City of Simi Valley, the Arroyo Simi flows through concrete lined or riprapped channels. Between Simi Valley and Moorpark, a distance of approximately 7 miles, the creek is unlined and without riprap forming high quality natural creek and riparian habitats. From the edge of Moorpark to Hitch Boulevard, the creek is once again riprapped on the sides with a soft bottom throughout most of the channel, but in some areas, such as under bridges, the bottom is covered with concrete and riprap. The Arroyo Simi essentially becomes the Arroyo Las Posas at Hitch Blvd. Downstream of Hitch Boulevard, Arroyo Las Posas passes through agricultural fields and orchards in a primarily natural channel. Although the Arroyo Las Posas channel joins with Calleguas Creek near Camarillo, surface flow is typically not present in this portion of the channel due to evaporation and groundwater recharge upstream of Seminary Road.

Two POTWs discharge in the subwatershed. The Simi Valley Water Quality Control Plant (SVWQCP) discharges to the Arroyo Simi on the western edge of the City of Simi Valley. The Moorpark Wastewater Treatment Plant (WWTP) discharges primarily to percolation ponds near the Arroyo Las Posas downstream of Hitch Boulevard. Direct discharges to the Arroyo Las Posas from the Moorpark WWTP only occur during extremely wet periods.

2.1.7. Conejo and Camarillo Subwatershed

Conejo Creek and its tributaries (Arroyo Conejo and Arroyo Santa Rosa) drain the southern portion of the watershed. Flow in the southern portion of the watershed originates in the City of Thousand Oaks and flows through the east side of the City of Camarillo before joining Calleguas Creek upstream of California State University Channel Islands (CSUCI). The subwatershed supports significant residential and agricultural land uses. The streams and channels of the Conejo Creek subwatershed are described below, in order from uppermost to lower.

2.1.7.1. Arroyo Conejo

The Arroyo Conejo runs through Thousand Oaks and has three branches, the main fork, the north fork, and the south fork. The main fork of the Arroyo Conejo runs underground for most of its length, with the portions that are above ground flowing through concrete lined channels until the creek enters Hill Canyon on the western side of Thousand Oaks at the confluence with the South Fork of the Arroyo Conejo. The South Fork runs through the southern and western portions of Thousand Oaks. For most of its length, the South Fork flows underground or through concrete lined channels. The North Fork of the Arroyo Conejo runs through Thousand Oaks upstream of the Hill Canyon Wastewater Treatment Plant (WWTP). The channel is concrete lined for the portion that runs through the city, but becomes unlined when it nears the treatment plant. The Hill Canyon WWTP discharges to the North Fork of the Arroyo Conejo on the western edge of the City of Thousand Oaks. The main fork and the south fork join together about a mile upstream of the treatment plant. The joined flow (usually called the south fork at this point) and the north fork converge approximately 0.4 miles downstream of the Hill Canyon WWTP. The Arroyo Conejo then flows in a natural channel through a primarily open space area until it merges with the Arroyo Santa Rosa to form Conejo Creek at the confluence.

2.1.7.2. Arroyo Santa Rosa

Arroyo Santa Rosa runs on the northern edge of the City of Thousand Oaks and through agricultural land in the Santa Rosa Valley. Arroyo Santa Rosa is a natural channel for most of its length with portions of riprap and concrete lining along the sides and bottom of the channel in the vicinity of homes (such as near Las Posas Road). Prior to 1999, a wastewater treatment plant (Olsen Road) discharged to Arroyo Santa Rosa and maintained a constant surface flow in the reach. Since 1999, the POTW has not discharged and the channel is dry during non-storm events.

2.1.7.3. Conejo Creek

Arroyo Conejo and Arroyo Santa Rosa converge at the base of Hill Canyon to form Conejo Creek, which flows downstream approximately 7.5 miles through the City of Camarillo to its confluence with Calleguas Creek. Just downstream of Camarillo, the Camarillo Sanitary District Water Reclamation Plant (CSD WRP) discharges to Conejo Creek. Conejo Creek provides the majority of the flow in Calleguas Creek. For most of the length of the Conejo and Calleguas Creeks, the sides of the channel are rip-rapped and the bottom is unlined.

2.1.8. Pleasant Valley Subwatershed

2.1.8.1. Calleguas Creek

Calleguas Creek runs along the eastern side of Oxnard Plain to Mugu Lagoon. From the headwaters in the hills north of Camarillo to the confluence with the Arroyo Las Posas through to the confluence with Conejo Creek, Calleguas Creek is typically dry due to rapid infiltration and evaporation. During wet weather storm events, the stretch of Calleguas Creek provides a conduit for transporting storm flows from the upper CCW to the Pacific Ocean. The Camrosa Water Reclamation Facility (WRF) is located near California State University, Channel Islands. The Camrosa WRP only discharges to the creek during extreme storm events. Calleguas Creek is tidally influenced from Mugu Lagoon to approximately Potrero Road.

2.1.8.2. Revolon Slough

Revolon Slough drains the agricultural land in the western portion of the watershed (Oxnard Plain). The slough does not pass through any urban areas, but does receive drainage from tributaries that drain urban areas. Revolon Slough starts as Beardsley Wash in the hills north of Camarillo. The wash is a rip-rapped channel for most of its length and combines with Revolon Slough at Central Avenue in Camarillo. The slough is concrete lined just upstream of Central Avenue and remains lined for approximately 4 miles to Wood Road. From there, the slough is soft bottomed with riprapped sides. Revolon Slough flows into Mugu Lagoon in a channel that runs parallel to Calleguas Creek. The flows from Revolon Slough and Calleguas Creek only converge in the lagoon. In addition to Revolon Slough, a number of agricultural drains (Oxnard Drain, Mugu Drain, and Duck Pond Drain) serve as conveyances for agricultural and industrial drainage water to the Calleguas Creek estuary and Mugu Lagoon. Revolon Slough is tidally influenced to approximately Laguna Road.

2.1.9. Mugu Lagoon

Mugu Lagoon, an estuary at the mouth of Calleguas Creek, supports a diverse wildlife population including migratory birds and endangered species. The Point Mugu Naval Air Weapons Station directly impacts Mugu Lagoon as do the substantial agricultural activities in the Oxnard Plain. The lagoon consists of approximately 287 acres of open water, 128 acres of tidal flats, 40 acres of tidal creeks, 944 acres of tidal marsh and 77 acres of salt pan (California Resources Agency, 1997). The Lagoon is comprised of a central basin that receives the flow from Revolon Slough and Calleguas Creek, and two arms (eastern and western) that receive some drainage from agricultural and industrial drains. In addition, multiple drainage ditches drain into the lagoon. Two of these ditches, Oxnard drainage ditches 2 and 3, discharge urban and agricultural runoff originating beyond the Naval Station's boundaries into the central and western portion of the lagoon. The remaining ditches discharge urban and industrial runoff originating on the Station.

The salinity in the lagoon is generally between 31 and 33 parts per thousand (ppt) (Granade, 2001). The central basin of the lagoon has a maximum tidal range of approximately -1.1 to 7 feet (as compared to mean sea level) with smaller ranges in the eastern and western arms of the lagoon. The western arm of the lagoon receives less tidal volume because of a bridge culvert that restricts the flows in that area. The velocity of water traveling through the narrow mouth of the lagoon is approximately 5-6 knots, which is a high velocity for a lagoon (Grigorian, 2001). The mouth of the lagoon never closes, apparently as a result of a large canyon present at the mouth of Calleguas Creek. The canyon prevents ocean sand from building up to a high enough level to close the mouth and likely accounts for the high velocities in the lagoon (Grigorian, 2001).

2.1.10. Groundwater

Groundwater features of the watershed are dominated by the Fox Canyon Aquifer System, which is linked to the neighboring Santa Clara River Watershed. The Fox Canyon Aquifer System is a series of deep, confined aquifers. The deep aquifers today receive little or no recharge from the watershed. The water quality in these aquifers is very high. However, because there is little recharge to these aquifers they suffer from overdraft. Major groundwater basins within the watershed include the Simi Basin, East Las Posas, West Las Posas, South Las Posas, Pleasant Valley, and Arroyo Santa Rosa Basins. Significant aquifers within the watershed include the Epworth Gravels, the Fox Canyon aquifer, and the Grimes Canyon aquifer in order from shallowest to deepest. In addition, the top 350 feet of sediments within the Pleasant Valley Basin are often referred to as the "Upper Zone", and are thought by some to be equivalent to the Hueneme aquifer zone that is a more well-defined and recognized layer to the west of the Pleasant Valley Basin.

Shallower, unconfined aquifers are located in the valleys of the watershed. In the upper subwatersheds of Simi Valley and Conejo Valley, groundwater collects in the lower areas and overflows into the down-gradient valleys. The Tierra Rejada, Santa Rosa and South Las Posas valley basins are larger than the upper valley basins and are the most significant unconfined basins on the watershed. Areas of perched and unconfined groundwater are also present along the base of the Santa Monica Mountains, and overlying areas of the southeastern Oxnard Plain in the Pleasant Valley.

Water rights have not been adjudicated in many of these basins, and groundwater production is not comprehensively controlled or maintained. However, groundwater extractions are regulated in the Oxnard Plain, Pleasant Valley Basin and the Las Posas Basin by the Fox Canyon Groundwater Management Agency. In some basins, groundwater is being over-drafted and as a result Pleasant Valley has experienced subsidence. In other basins, such as the South Las Posas Basin, groundwater storage has increased significantly in the last several decades.

2.1.11. Anthropogenic Alterations

Historically, the Oxnard Plain served as the flood plain for Calleguas Creek. Starting in the 1850's, agriculture began to be practiced extensively in the watershed. By 1889, a straight channel from the area near the present day location of Highway 101 to the Conejo Creek confluence had been created for Calleguas Creek. In the 1920's, levees were built to channelize flow directly into Mugu Lagoon (USDA, 1995). Increased agricultural and urban land uses in the watershed resulted in continued channelization of the creek to the current channel system. Historically, Calleguas Creek was an ephemeral creek flowing only during the wet season. The cities of Simi Valley, Moorpark, Camarillo, and Thousand Oaks experienced rapid residential and commercial development beginning in the 1960s. In 1957, the Camarillo Water Reclamation Plant came online, followed by the Hill Canyon WWTP in Thousand Oaks in 1961. In the early 1970s, State Water Project supplies began being delivered to the watershed. Increasing volumes of discharges from these POTWs eventually caused the Conejo/Calleguas system to become a perennial stream by 1972 (SWRCB, 1997). When the Simi Valley Water Quality Control Facility began discharging in the early 1970s, the Arroyo Simi/Arroyo Las Posas became a perennial stream that gradually flowed further downstream and currently reaches Seminary Road in Camarillo. However, surface flows from the Arroyo Simi/Arroyo Las Posas do not connect with surface flows in the Conejo Creek/Calleguas system, except during and immediately following large storm events.

2.1.12. Flow Diversion Project

The Conejo Creek Diversion Project (CCDP) in the Calleguas Creek watershed diverts the majority of flow in Conejo Creek to agricultural uses in the Pleasant Valley area. The diversion project is located approximately 7 miles downstream from the Hill Canyon Wastewater Treatment Plant (WWTP). The water rights application allows the diversion of an amount equal to Hill Canyon's effluent minus 4 cfs for in-stream uses and channel losses. An additional amount of water equal to the flow contributed by use of imported water in the region (estimated at 4 cfs) may be diverted when at least 6 cfs of water will remain in the stream downstream of the diversion point (SWRCB, 1997). Natural flows due to precipitation will not be diverted. As a result of this project, flows in the lower reach of Conejo Creek have been reduced to less than half of the previous creek flows. Projects similar to the CCDP may be developed as part of the overall Watershed Management Plan for Calleguas Creek to address water resource, water quality, or flooding/erosion concerns. As such, TMDLs must be developed in a manner that considers the impacts of changing flows in the watershed and does not result in restrictions on the necessary use of the water for other purposes.

2.1.13. Reach Designations

Table 5 summarizes the reach descriptions of Calleguas Creek used in this TMDL and the correlation between these reaches and the 303(d) and consent decree listed reaches. These reach designations provide greater detail than the designations in the current *Water Quality Control Plan: Los Angeles Regional Water Quality Control Plan* (Basin Plan). The reach revisions may provide an appropriate analytical tool for future analyses in the watershed. At this time, though, the reach revisions are not regulatory and do not alter water quality objectives for the reaches in the existing Basin Plan.

Table 5. Description of CCW Reaches on 2002 303(d) List.

Reach Names for Salts TMDL	Reach Names as Listed in 303(d) List and Consent Decree	Geographic Description	Notes: Hydrology, land uses, etc.
1 Mugu Lagoon	Mugu Lagoon	Lagoon fed by Calleguas Creek	Estuarine; brackish, contiguous with Pacific Ocean
2 Calleguas Creek South	Calleguas Creek Reach 1 and Reach 2 (Estuary to Potrero Rd.)	Downstream (south) of Potrero Rd	Tidal influence; concrete lined; tile drains; Oxnard Plain
3 Calleguas Creek North	Calleguas Creek Reach 3 (Potrero to Somis Rd.)	Calleguas Creek from confluence with Conejo Creek to Potrero Rd.	Concrete lined; no tidal influence; Agriculture tile drains; Pleasant Valley Basin. Camrosa WRP discharges to percolation ponds.
4 Revolon Slough	Revolon Slough Main Branch	Revolon Slough from Central Ave. to confluence with Mugu Lagoon.	Concrete lined; tile drains; Oxnard Plain; tidal influence
5 Beardsley Channel	Beardsley Channel	Revolon Slough upstream of Central Ave.	Concrete lined ; tile drains; Oxnard Plain
6 Arroyo Las Posas	Arroyo Las Posas Reach 1 and Reach 2 (Lewis Somis Rd. to Moorpark Fwy (23))	Hitch Road to confluence with Calleguas Creek	Ventura Co. POTW discharge at Moorpark to percolation ponds; discharges enter shallow aquifer; dry at Calleguas confluence
7 Arroyo Simi	Arroyo Simi Reach 1 and Reach 2 (Moorpark Fwy (23) to Headwaters)	Headwaters in Simi Valley to Hitch Blvd..	Simi Valley WQCP discharge; discharges from shallow aquifers; pumped GW; GW discharges from shallow aquifers.
8 Tapo Canyon	Tapo Canyon Reach 1 and Reach 2	Headwaters to confluence w/ Arroyo Simi	Origin near gravel mine, used by nursery, ends in residences.
9A Conejo Creek	Conejo Creek Reach 1 (Confl with Calleguas Creek to Santa Rosa Rd.)	Confluence with Arroyo Santa Rosa downstream to the Camrosa Diversion	Camarillo WWTP discharge; Pleasant Valley Groundwater Basin contains both confined and unconfined perched aquifers. Groundwater and surface water used for agriculture.
9B Conejo Creek	Conejo Creek Reach 1 and Reach2 (Confl with Calleguas Creek to Tho. Oaks city limit)	Camrosa Diversion to confluence with Calleguas Creek.	Pleasant Valley Groundwater Basin contains both confined and unconfined perched aquifers. Camarillo WWTP discharges to percolation ponds near downstream end.
10 Hill Canyon reach of Conejo Creek	Conejo Creek Reach 2 and Reach 3 (Santa Rosa Rd. to Lynn Rd.)	Confluence w/ N. Fork to confluence w/ Arroyo Santa Rosa; and N. Fork to just above Hill Canyon WWTP	Hill Canyon WWTP; stream receives N. Fork Conejo Creek surface water.
11 Arroyo Santa Rosa	Arroyo Santa Rosa	Headwaters to confluence w/Conejo Creek	Olsen Rd. WRP; dry before Calleguas Ck confluence except during storm flow.
12 North Fork Conejo Creek	Conejo Creek Reach 3 (Tho. Oaks city limit to Lynn Rd.)	Headwaters to confluence w/Conejo Creek	
13 Arroyo Conejo (S.Fork Conejo Cr)	Conejo Creek Reach 4 (Above Lynn Rd.)	Headwaters to confluence w/ N. Fork - two channels	City of Thousand Oaks; pumped/treated GW

2.2. REGULATORY BACKGROUND

Federal law requires states to adopt water quality standards, which are defined as the designated beneficial uses of a water segment and the water quality criteria necessary to support those uses (33 U.S.C. §1313). California implements the federal water quality standard requirements by providing for the reasonable protection of designated beneficial uses through the adoption of water quality objectives (CA Water Code §13241). Water quality objectives (WQOs) may be numeric values or narrative statements. For inland surface waters in the Los Angeles Region, beneficial uses and numeric/narrative objectives are identified in the Basin Plan. In addition, federal regulation requires states to adopt a statewide antidegradation policy that protects high quality waters and the level of water quality necessary to maintain and protect existing uses.

2.2.1. Water Quality Objectives

2.2.1.1. Surface Water Objectives

The Basin Plan contains water body specific numeric water quality objectives for salts in Table 4-2. The objectives for the CCW are applicable upstream of Potrero Road and are shown in Table 6. The objectives are currently applied as instantaneous maximum concentrations.

Table 6. Basin Plan Objectives for Salts

Constituent	Objective Upstream Potrero Road (mg/L)
TDS	850
Chloride	150
Sulfate	250
Boron	1.0
SAR	Not enough data

The objectives in Table 6 are water body specific and only apply upstream of Potrero Road. It is unclear based on the reach definitions in Table 3-8 of the Basin Plan whether or not the water body specific values apply to Revolon Slough and Beardsley Wash. Because Revolon Slough enters Calleguas Creek downstream of Potrero Road, it does not appear that the objectives apply to these reaches. However, in the 2002 listing process, USEPA determined that an interpretation of the narrative standards in the Basin Plan results in the application of the objectives to Revolon Slough.

2.2.1.2. Groundwater Objectives

The Basin Plan also includes objectives for groundwater basins as shown in Table 7. A map of the groundwater basins is shown in Figure 11.

Table 7. Groundwater Objectives in Calleguas Creek Watershed

Basin	TDS	Chloride	Sulfate	Boron
GWR Arroyo Simi/ Simi Valley Basin	1200	150	600	1
GWR Arroyo Simi/ South Las Posas	2500	400	1200	3
GWR Arroyo Las Posas/ South Las Posas	1500	250	700	1
GWR Arroyo Las Posas/ North Las Posas	500	150	250	1
GWR Arroyo Santa Rosa and Conejo/ Arroyo Santa Rosa Basin	900	150	300	1
GWR Arroyo Santa Rosa/ Tierra Rejada Basin	700	100	250	0.5
GWR Arroyo Conejo/ Thousand Oaks area	1400	150	700	1
GWR Arroyo Conejo/ Conejo Valley	800	150	250	1
GWR Conejo and Calleguas/ Pleasant Valley	700	150	300	1

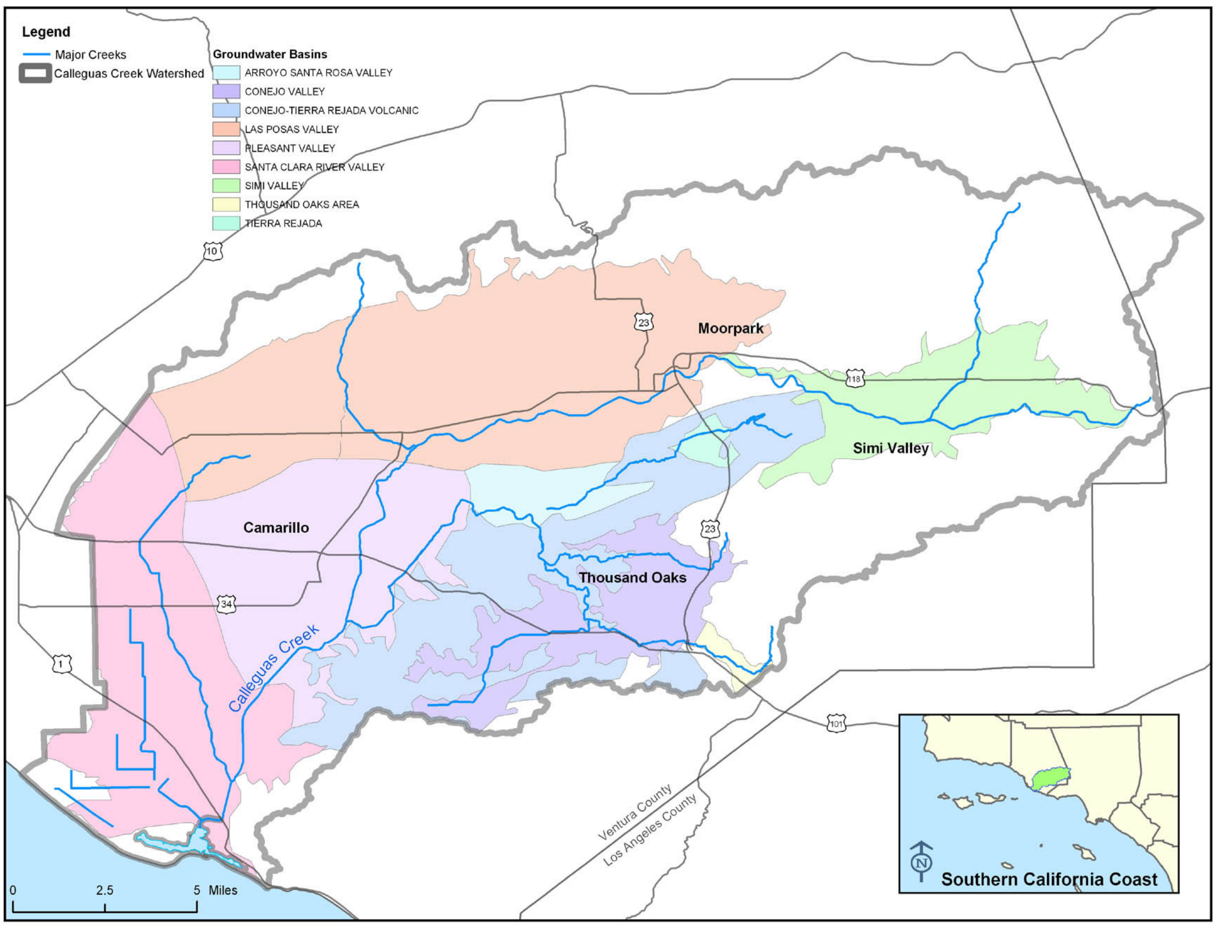

Figure 11. CCW Groundwater Basins

2.2.2. Antidegradation

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. The Antidegradation

Policy states that water quality in surface and ground waters of California must be maintained unless it is demonstrated that a change will be consistent with the maximum benefit of the people of the state, not unreasonably affect present and anticipated beneficial use of such water, and not result in water quality less than that prescribed in water quality plans and policies. In addition to meeting state Antidegradation Policy, any actions that may result in a reduction of water quality of a water of the United States are subject to the federal Antidegradation Policy provisions contained in 40 CFR 131.12, which allows for the reduction in water quality as long as existing beneficial uses are maintained and that the lowering of water quality is necessary to accommodate economic and social development in the area.

2.2.3. Water Reclamation Policy

Another important component of addressing salts impacts and the watershed salt balance is water reclamation. Several portions of the California Water Code establish goals and guidelines supporting water reclamation that should be considered as part of the analysis of projects to address salts. The Legislature has established a goal of recycling 1 million acre feet of water by 2010. (Water Code §13577.) The Legislature has declared that the people of the State have a "primary interest" in the development of recycled water facilities, and that the State should "take all possible steps" to encourage the development of such facilities in order to meet the State's water needs. (Water Code §§13510, 13512.) The Water Code defines recycled water not as a waste but as "water, which, as a result of treatment, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource." (Water Code §13050(n).)

2.2.4. Beneficial Uses

Salts primarily impact two beneficial uses: agriculture irrigation and groundwater recharge. In addition, chloride has the potential to impact aquatic life, there are secondary drinking water standards for some salts, and industrial processing can be impacted by high salts concentrations. The following table summarizes the locations of these beneficial uses as listed in the Basin Plan.

Table 8. Beneficial Uses Potentially Impacted by Salts in Calleguas Watershed

Reach	Reach No.	Hydro Unit	WARM	MUN	IND	PROC	AGR	GWR
Mugu Lagoon	1	403.11						
Calleguas Creek Estuary	2	403.11						
Calleguas Creek	2, 3	403.11	E	P*			E	E
Calleguas Creek	3, 9A	403.12	E	P*	E	E	E	E
Revolon Slough	4	403.11	E	P*	P		E	E
Beardsley Wash	5	403.61	E	P*				
Conejo Creek	3, 9A	403.12	E	P*	E	E	E	E
Conejo Creek	9B	403.63	I	P*				I
Arroyo Conejo	9A, 9B,10	403.64	I	P*				I
Arroyo Conejo	13	403.68	I	P*				I
Arroyo Santa Rosa	11	403.63	I	P*				I
Arroyo Santa Rosa	11	403.65	I	P*				I
North Fork Arroyo Conejo	12	403.64	E	P*			E	E
Arroyo Las Posas	6	403.12	E	P*	P	P	P	E
Arroyo Las Posas	6	403.62	E	P*	P	P	P	E
Arroyo Simi	7	403.62	I	P*	I			I
Arroyo Simi	7	403.67	I	I*	I			I
Tapo Canyon	8	403.66	I	I*		P	P	I
Tapo Canyon	8	403.67	I	I*		P	P	I

E- Existing Beneficial Use, P-Potential Beneficial Use, I-Intermittent Beneficial Use

* Asterixed MUN designations are not to be put into effect until a study has been done to confirm the presence of the beneficial use.

Table 9. Benefical Uses of Groundwater Basins in the Calleguas Watershed

DWR Basin	DWR Basin No.	Groundwater Basin	MUN	IND	PROC	AGR
Ventura Central[1]	4-4	Oxnard Plain				
		Oxnard Forebay	E	E	E	E
		Confined aquifers	E	E	E	E
		Unconfined and perched aquifers	E	P		E
	4-6	Pleasant Valley				
		Confined aquifers	E	E	E	E
		Unconfined and perched aquifers	P	E	E	E
	4-7	Arroyo Santa Rosa	E	E	E	E
	4-8	Las Posas Valley				
		South Las Posas area				
		NW of Grimes Cyn Rd and LA Ave & Somis Rd	E	E	E	E
		E of Grimes Cyn Rd and Hitch Blvd	E	E	E	E
		S of LA Ave. between Somis Rd and Hitch Blvd	E	E	E	E
		Grimes Cyn Rd and Broadway area	E	E	E	E
		North Las Posas area	E	E	E	E
Simi Valley	4-9	Simi Valley Basin				
		Confined aquifers	E	E	E	E
		Unconfined aquifers	E	E	E	E
		Gillibrand Basin	E	E	P	E
Conejo Valley	4-10	Conejo Valley	E	E	E	E
Tierra Rejada	4-15	Tierra Rejada	E	P	P	E
Thousand Oaks Area	4-19	Thousand Oaks Area	E	E	E	E
Conejo-Tierra Rejada Volcanic Area	4-21	Conejo-Tierra Rejada Volcanic Area	E			E

E-Existing Beneficial Use, P-Potential Beneficial Use

[1] The Santa Clara River Valley (4-4), Pleasant Valley (4-6), Arroyo Santa Rosa (4-7), and the Las Posas Valley (4-8) Ground Water Basins have been combined and designated as the Ventura Central Basin (DWR, 1980).

A more detailed discussion of sensitive agricultural beneficial uses and groundwater recharge is included below.

2.2.4.1. Crops Grown in the Calleguas Creek Watershed

Crops are grown in several areas of the watershed including the Oxnard Plain, the Pleasant Valley Plain, the Las Posas Valley (East and West) and the Santa Rosa Valley. Specific crops grown in the areas are shown in Figure 12. Of the crops shown in the figure, avocado, berry, citrus, strawberry, and, to some extent, nurseries are the most salt sensitive crops. In general, avocados and citrus are grown in the northern part of the watershed, specifically the Las Posas Valley. Strawberries and row crops are grown in the Oxnard and Pleasant Valley Plains. Some avocado and citrus are grown in the lower portion of the Pleasant Valley Plain. In the Santa Rosa Valley, crops are avocados, row crops and citrus.

Agriculture is limited or not existent in the upper portions of the watershed because urban land uses have replaced agricultural fields in those areas. Agriculture is not likely to return to those areas.

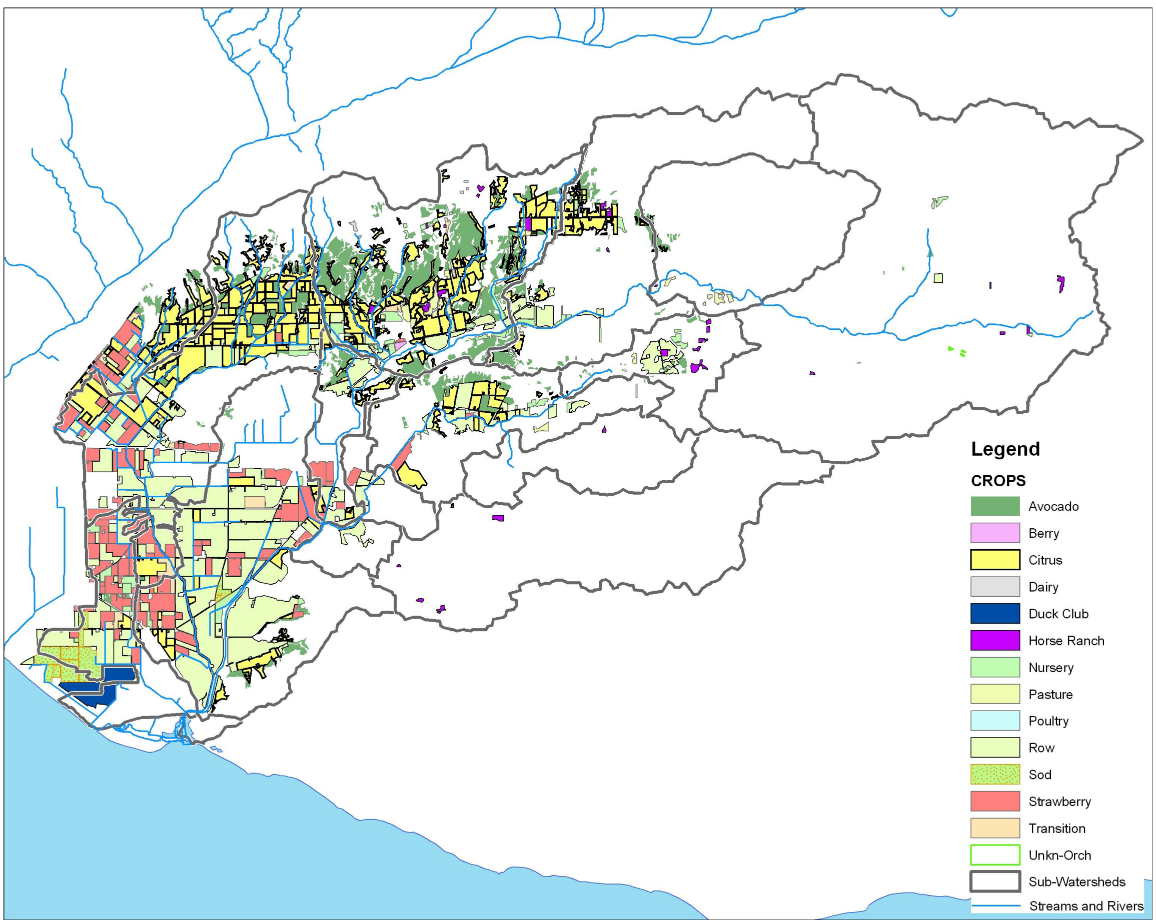

Figure 12. Crops Grown in Calleguas Creek Watershed

2.2.4.2. Current Sources of Water for Crops

Most growers in the Calleguas Creek Watershed rely on groundwater delivered through local mutual water companies as their primary water supply. Growers in the Arroyo Simi/Las Posas and Conejo Valleys also utilize imported water supplied by CMWD through a variety of purveyors including Ventura Water Works District and Camrosa Water District. United Water supplies growers in the Oxnard and Pleasant Valley Plains through the Pleasant Valley Water Conservation District (PVWCD) or the Pumping Trough Pipeline (PTP). United Water is a combination of local groundwater and water imported from the Santa Clara River at the Freeman Diversion. Growers in this area also receive water from the Conejo Creek Diversion Project. Growers in the Santa Rosa Valley receive water from Camrosa Water District. Water sources include local groundwater, Conejo Creek water and imported water from Calleguas Municipal Water District. These water supplies are blended to provide a consistent water quality to meet the growers' needs. In the Las Posas Valley, water sources include imported water or groundwater supplied through Ventura Waterworks Districts #1 and #19 and local groundwater supplied by Arroyo Las Posas Mutual Water Company, Zone Mutual Water Company and Berylwood Heights Mutual Water Company. Many growers also have private wells on their property.

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.

The quality of groundwater used as irrigation supply in the Calleguas Creek Watershed is shown in Figure 13 (chloride) and Figure 14 (TDS). In addition, water quality for both groundwater and imported water is summarized in Table 10. In general, the water quality data are from between 1990 and 2003. In some cases, very little data were available during that time frame, so data collected from 1970 were also used.

Table 10. Calleguas Creek Watershed Water Quality

Water Source	Average Chloride (mg/L)	Average TDS (mg/L)	Average Sulfate (mg/L)	Average Boron (mg/L)	Time Frame	Number of Samples
Oxnard, Pleasant Valley						
UWCD(Freeman Diversion - Imported Water)	57	880	495	0.71	1990-2003	433
CMWD(Jensen plant- Imported Water)	64	870	86	0.27	1993-2003	130
Pumping Trough Pipeline groundwater (Oxnard)	44	871	306	0.42	1990-2003	60
Pleasant Valley Water Conservation District groundwater	119	910	312	0.40	1990-2002	49
Camrosa Water District Conejo Creek Project	159	822*	n/a	0.27		86
Las Posas Valley (North)						
CMWD(Jensen plant- Imported Water)	64	870	86	0.27	1993-2003	130
Ventura County Waterworks District #19	48	589	193	0.08	1990-2002	16
Ventura County Waterworks District #1	25	452	129	0.13	1990-2002	27
North Las Posas basin (miscellaneous wells)	56	631	219	0.12	1990-2003	50
South Las Posas Basin						
CMWD(Jensen plant- Imported Water)	64	870	86	0.27	1993-2003	130
Ventura County Waterworks District #19	48	589	193	0.08	1990-2002	16
Berylwood MWC	23	420	n/a	n/a	1993-2003	1
Zone MWC Location 1	14	535	89	0.06	1990-1999	4
Zone MWC Location 2	200	1544	649	0.64	1971-2000	19
Arroyo Las Posas MWC	345	1950	890	1.1	1991	2
Miscellaneous wells	213	1600	581	0.58	1975-1999	10
Santa Rosa Valley						
CMWD(Jensen plant- Imported Water)	64	870	86	0.27	1993-2003	130
Camrosa Water District Well #3	135	918	229	0.41	1991-2000	108
Camrosa Water District Woodcreek Well	119	753	162	0.25	1993-2001	6
Camrosa Water District Conejo Creek Project	159	822*	n/a	n/a	1996-2003	90

* TDS average for Conejo Creek based on 12 data points in 2003

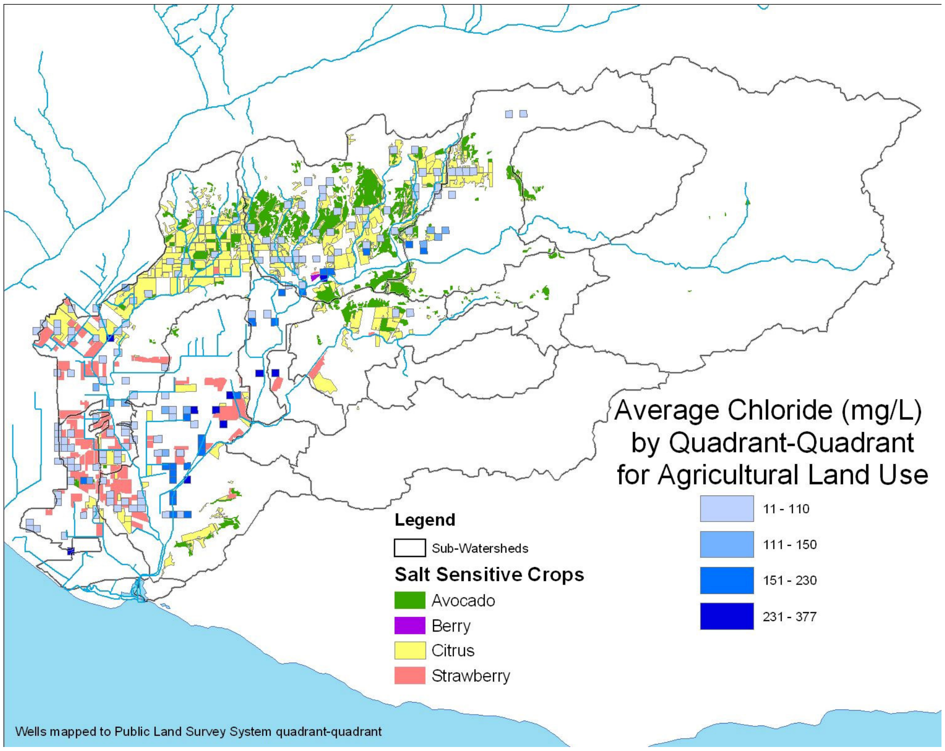

Figure 13. Average groundwater chloride levels in Calleguas Creek Watershed

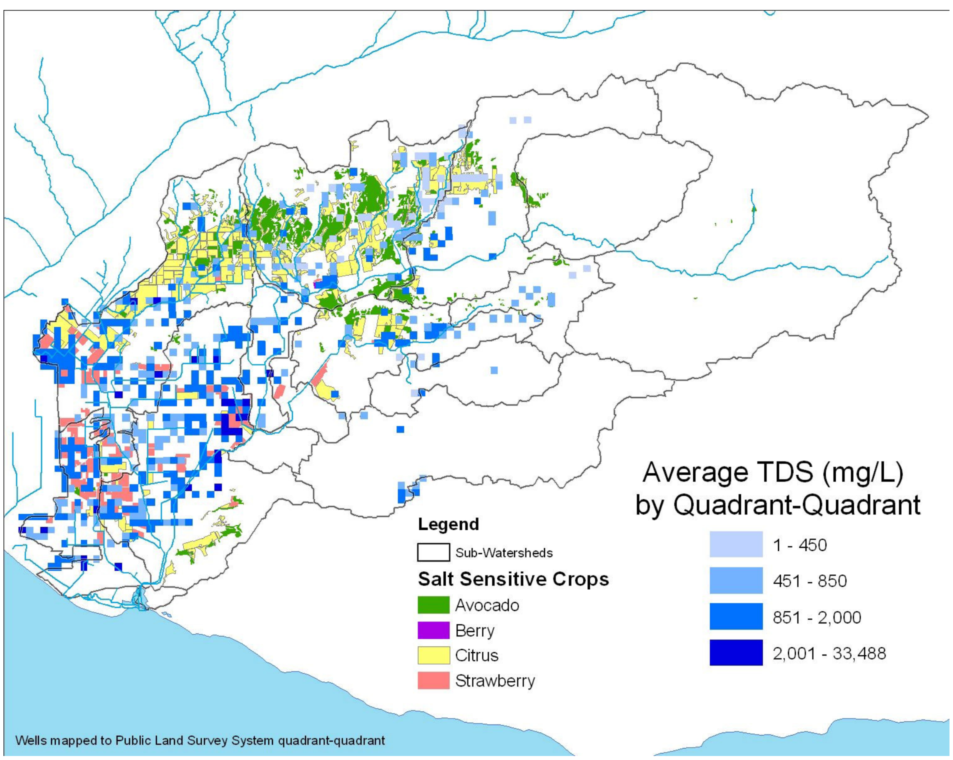

Figure 14. Average groundwater TDS levels in Calleguas Creek Watershed

The information presented above demonstrates that irrigation water supplies are well below surface water and groundwater objectives in most areas and that direct use of surface water has not been documented as an irrigation source for any sensitive agricultural users.

2.2.4.3. Groundwater Recharge

As discussed above, groundwater is the primary water supply for agriculture in the CCW. Additionally, groundwater is used as a municipal supply in several areas of the watershed. Finally, the CMWD stores imported water in the North Las Posas groundwater basin. To prevent these uses from being impacted from poor quality groundwater, the groundwater recharge beneficial use needs to be protected.

Impacts on groundwater occur through infiltration of surface water and potentially through irrigation in the watershed. The beneficial use of groundwater recharge only addresses the surface water infiltration component of the impacts of salts on groundwater. As a result, this is the only impact discussed here.

2.2.4.3.1. Locations of Groundwater Recharge

Groundwater infiltration primarily occurs in the South Las Posas and Santa Rosa Basin. Although most reaches of the watershed have the GWR beneficial use, the only areas where significant recharge occurs are these two reaches and upper Revolon Slough/lower Beardsley Wash. This is clearly demonstrated by the fact that groundwater exfiltration occurs in most other reaches in the watershed.

The amount of recharge is predicated on the depth and width of the underlying stream channel deposits, the depth and nature of the geologic materials underlying the stream channel deposits, the depth to groundwater, and the quantity and timing of water flowing into the streams.

Recharge to the shallowest aquifers occurs by subsurface infiltration through streambed deposits. Soil surveys conducted by the USDA/NRCS show permeability of streambed deposits within the watershed to be greater than 20 inches/hour. Based on this number, water can easily percolate through the streambed deposits and recharge the shallow aquifers.

In some areas of the watershed (Pleasant Valley and the Oxnard Plain), recharge beneath streams is limited due to a shallow perching layer. The perching layer is of low permeability and severely limits the amount of recharge passing through it. As a result, the shallow soils above the perching layer become saturated, thus preventing more water from percolating through them. Drainage in the southern portion of the watershed is a large enough problem that local farmers have been forced to install drains to prevent problems such as root rot and to keep salts from accumulating in the groundwater.

2.2.4.3.2. Impacts from Surface Water Recharge of Groundwater

The impacts of surface water quality recharge on groundwater basins occur over time and are not instantaneous. Although localized impacts can occur over a few months to years, widespread impacts on groundwater basins take years to occur. Groundwater mixing occurs very slowly as groundwater gradually moves through the basins.

The impacts of surface water recharge on groundwater basins were clearly demonstrated with the beginning of importation of State Water Project water into the basin. Salts concentrations in groundwater were impacted by the importation of water and development of the watershed beginning in the 1970s. However, since the importation of State Water Project water, the groundwater salt concentrations have remained relatively stable in most areas of the watershed (Hajas, 2004). The exception is the South Las Posas Basin where salts concentrations have been increasing over time.

Because all water discharged to the Arroyo Simi during dry weather infiltrates into the South Las Posas groundwater basin, this basin is most significantly impacted by surface water recharge. A number of studies have been conducted to examine the quality of the groundwater and the impacts of surface water recharge on this basin. A significant amount of the analysis is presented in *Water Quality in the East and South Las Posas Basin: Problems and Solutions* (Bachman, 2002).

As described in this report, the South Las Posas Basin is completely full as a result of constant discharges to the Arroyo Simi/Las Posas. The fact that the basin is full prevents recharge of higher quality storm water flows. Additionally, the higher water levels appear to be impacting the quality of water in the basin. The increase in water levels is strongly correlated with an increase in salts concentrations in many of the wells near the Arroyo Las Posas. The salts concentrations in those wells are higher than the concentrations in the surface water. Therefore, other mechanisms appear to be contributing to the increasing salts levels in the groundwater.

Salts on the watershed have a number of geological origins. The watershed has remnants of significant volcanic activity, large multi-layered sediment deposits, and evidence of ancient marine influence. All of these geologic characteristics indicate the presence of salts that dissolve into solution following rain events and remain dissolved in the watershed's groundwater and surface waters. It is widely believed that these salts have been a part of the nature of the watershed for thousands of years (Hajas, 2004). Increases in groundwater levels may cause saturation of soil previously above the water table, allowing additional salts to dissolve into the groundwater.

The combination of increased groundwater levels that leach background salts from the soils and surface water concentrations is the likely cause of the increased groundwater salts concentrations in the South Las Posas Basin. Consequently, protection of the groundwater recharge beneficial use is linked to both the quality and quantity of the water in the stream and to natural background conditions that contribute to the increasing concentrations.

2.2.5. 303(d) Listings

As discussed previously, the CWA requires water bodies that do not meet water quality standards be listed on the 303(d) list. The Basin Plan water quality objectives listed above were used to assess the surface water bodies in Calleguas Creek for listing on the 303(d) list. Eleven out of fourteen reaches in the CCW are identified on the 2002 Clean Water Act Section 303(d) list of water-quality limited segments as impaired due to elevated levels of salts (Table 11).

Table 11. 2002 303(d) Listings

Reach No.	Reach Name	Boron	Chloride	Sulfates	TDS
7	Arroyo Simi	X	X	X	X
6	Arroyo Las Posas		X	X	X
8	Tribs to Arroyo Simi	X	X	X	X
13	South Fork Conejo Creek		X	X	X
12	North Fork Conejo Creek			X	X
10	Conejo Creek Hill Canyon		X	X	X
11	Arroyo Santa Rosa			X	X
9B	Conejo Creek Main Stem		X	X	X
9A	Camrosa Diversion			X	X
3	Calleguas Creek Upper Main Stem		X		X
2	Calleguas Creek Lower Main Stem				
4	Revolon Slough	X		X	X
5	Beardsley Wash				
1	Mugu Lagoon				

Blank cells indicate no listings for that constituent in the reach.

2.2.6. Basis of 303(d) listings

This section presents the data used for comparison to the water quality objectives that resulted in the 303(d) listings for salts. Regional Board staff conducted water quality assessments in 1996, 1998 and 2002, with the majority of salts listings first appearing on the 1998 303(d) list. This section discusses the data reviewed for the Water Quality Assessments and the application of the data that resulted in the 1998 303(d) listings. In 2002, changes were made to the 303(d) list based on the changes to the reach designations. Additionally, USEPA added listings on Revolon Slough for TDS, sulfate and boron. The available information on the basis for the 1998 listings is summarized in Table 12.

Table 12. Basis of 1998 303(d) Listings

Reach No.	2002 Reach Name	1998 Reach Name	TDS			Chloride			Sulfate			Boron		
			Max	**Avg.**	**% Exceed**	**Max**	**Avg.**	**% Exceed**	**Max**	**Avg**	**% Exceed**	**Max**	**Avg.**	**% Exceed**
8	Tapo Canyon	Tapo Canyon	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
7	Arroyo Simi	Arroyo Simi R2	2380	1654	86	180	130	57	1040	800	86	1.5	0.9	57
		Arroyo Simi R1	2600	1751	100	1190	277	90	1000	842	86	1.4	1.1	60
6	Arroyo Las Posas	Arroyo Las Posas R2	1280	1194	100	190	171	75	500	438	100	0.91	0.84	0
11	Arroyo Santa Rosa	Arroyo Santa Rosa	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
12	North Fork Conejo Creek	Arroyo Conejo North Fork	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
13	South Fork Conejo Creek	Conejo R4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
10	Conejo Creek Hill Canyon	Conejo R3	1240	888	52	242	172	80	571	286	63	0.5	0.46	0
9B	Conejo Creek Main Stem	Conejo R2	1210	819	35	230	173	84	386	264	56	0.5	0.38	0
9A	Camrosa Diversion	Conejo R1	1210	625	33	236	181	87	414	261	52	0.5	0.38	0
3	Calleguas Creek Upper Main Stem	Calleguas R3	1340	860	54	264	185	92	550	372	59	0.6	0.42	0
2	Calleguas Creek Lower Main Stem	Calleguas R2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Calleguas R1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	Beardsley Wash	Beardsley	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	Revolon Slough	Revolon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1	Mugu Lagoon	Mugu	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N.D. indicates that no data were available for the constituent for the reach.
N/A indicates that objectives were not considered applicable to the reach so no listings were made.

In 2002, the USEPA added listings to Reach 4, Revolon Slough for boron, TDS, and sulfate. In the decision (USEPA, 2003), the USEPA stated:

> "The Los Angeles Region Basin Plan does not contain specific numeric water quality standards for boron, sulfate or TDS for Calleguas Creek Reach 4 (also known as Revolon Slough Main Channel). The State's rationale for not listing-tat there are no water body specific numeric standards in the Basin Plan for these pollutants-is invalid. Federal regulations at 40 CFR 130.7(b) require States to apply narrative water quality standards. The State should have applied the Basin Plan narrative standard for chemical constituents to assess these pollutants. The Basin Plan includes numeric guidelines for these pollutants that are "necessary to protect different categories of beneficial uses", including the beneficial uses designated for Calleguas Creek Reach 4 (Basin Plan, pp. 2-8 and 3-14). EPA concludes that it is appropriate to apply these numeric guidelines to evaluate potential exceedances of the narrative water quality standard for chemical constituents."

Basically, the USEPA determined that the numeric Basin Plan objectives did not exist for Revolon Slough, but that a narrative standard applied. An interpretation of the narrative standard was used to determine exceedances, but the letter from USEPA did not provide information on the values that were used to determine the exceedances. USEPA found that the boron guidelines were exceeded in 11 of 13 samples, the TDS guideline was exceeded in 13 of 15 samples and the sulfate guideline was exceeded in 14 of 15 samples. Additional information is not available on the concentrations of the samples used in the evaluation.

The USEPA listings were for the entire length of Revolon Slough. However, Revolon Slough drains to Mugu Lagoon, and is tidally influenced in the lower portion of the reach, but the extent of the tidal influence is not defined. Calleguas Creek is tidally influenced from Mugu Lagoon to approximately Potrero Road, and is consequently not listed as impaired for salts along these reaches. To determine the extent of tidal influence in Revolon Slough, the same area of tidal influence delineated in Calleguas Creek was applied to Revolon Slough. Using USGS topographic maps, the elevation of Calleguas Creek at Potrero Road was determined to be between the 25 and 30 foot contours at approximately 29 feet. The corresponding elevation on Revolon Slough falls just below Laguna Road. Wood Road is located below Laguna Road at approximately 25 feet, and was determined to be a conservative estimate of the location of tidal influence in Revolon Slough.

To further support the extent of the tidal influence, salinity data measured during 2003-2004 Calleguas Creek Watershed TMDL monitoring was reviewed. 39 salinity measurements were taken at Revolon Slough at Wood Road during the course of the monitoring. The mean salinity measured was 2.2 ppt, and the majority of the samples (28 out of 39) were $\geq$ 2 ppt. It is generally accepted that waters with a salinity < 1 ppt are considered fresh, and waters with a salinity of > 10 ppt are considered saline. The salinity measured in Revolon Slough at Wood Road appears to be slightly brackish, and may be a sign that some tidal influence may still be received at Wood Road, again suggesting that the selection of Wood Road as the extent of tidal influence is conservative. No salinity information is available for Revolon Slough below Wood Road.

As a result of the evaluation for Revolon Slough presented above, the extent of the impairment on Revolon Slough was determined to exist above Wood Road and the tidal influence results in a condition of non-impairment on Revolon Slough below Wood Road.

As shown in the table above, surface water concentrations of chloride, TDS and sulfate exceed the Basin Plan water quality objectives for most reaches in the CCW to which the objectives apply. For boron, exceedances only occur in the Simi subwatershed. Additionally, boron is only listed in the Arroyo Simi and Revolon Slough. As boron is a limited issue in the watershed and the current average boron concentrations are near the water quality objective, the discussion for boron will be limited in the TMDL to the listed reaches and the salt balance discussion will not apply to boron.

2.3. WATER RESOURCES PROBLEM STATEMENT

The regulatory problem statement summarizes the necessary information for the development of a TMDL to address surface water concentrations of salts. However, salts impacts are broader and not completely addressed through the 303(d) listing process. Therefore, this additional problem statement was developed to highlight the additional issues surrounding salts management in the CCW.

Large volumes of salts are imported into the watershed to support development in the semi-arid climate of the watershed. The salts are imported from State Water Project imported water, Santa Clara River through the Freeman Diversion, and the pumping of deep aquifers, not directly recharged by surface water or irrigation, within the watershed. Additionally, the watershed contains naturally occurring or background concentrations of salts due to the fact that many of the soils are marine sediments. The watershed's stream systems do not have the capacity to effectively transport these salts off of the watershed and existing transportation processes do not effectively transport the salts to the surface waters on a daily basis. Consequently, salts become stranded on the watershed and accumulate over time. The result is a general salt imbalance on the watershed that manifests itself in higher surface water and groundwater concentrations of salts. The concentrations can increase significantly for prolonged periods following extreme wet periods as years of stranded salts that have built-up on the watershed are flushed into the surface waters.

To address this salt imbalance, the TMDL has been developed to bring the watershed into balance. By reducing the imbalance, surface water and groundwater concentrations are expected to decrease, allowing the waterbodies to attain water quality standards.

Section 3. Numeric Targets

Numeric targets identify specific goals for the Salts TMDL that equate to attainment of water quality standards and provide the basis for data analysis and final TMDL allocations. The Basin Plan numeric water quality objectives are selected as numeric targets for chloride, TDS, sulfate and boron.

Table 13. Salts Numeric Targets

Subwatershed	Chloride Target (mg/L)	TDS Target (mg/L)	Sulfate Target (mg/L)	Boron Target (mg/L)[1]
Simi	150	850	250	1.0
Las Posas	150	850	250	
Conejo	150	850	250	
Camarillo	150	850	250	
Pleasant Valley (Calleguas Creek Reach 3)[2]	150	850	250	
Pleasant Valley (Reaches 4 and 5)[3]	150	850	250	1.0

1. The Boron target only applies to the subwatersheds containing listed reaches. The other subwatersheds do not exceed the boron objective.
2. The targets apply upstream of Potrero Road. Downstream of Potrero Road, the creek is tidally influenced and the salt objectives do not apply.
3. The targets apply upstream of Laguna Road. Downstream of Laguna Road, the creek is tidally influenced and the salt objectives do not apply.

These numeric targets will be applied at the base of each of the subwatersheds defined in the TMDL for allocations.

Although the numeric targets for the TMDL are the Basin Plan water quality objectives, the goal of the implementation plan is to achieve a salt balance in the watershed on an annual basis that will lead to attainment of water quality standards. A salt balance is defined as:

> "The amount of salt introduced to the watershed is exported out of the watershed on an annual basis."

Introduced salts are salts imported into the watershed from State Project Water or Colorado River Water, pumped groundwater from aquifers that are not directly recharged by surface water, and water transferred from the Santa Clara River through the Freeman Diversion. Reclaimed water and directly recharged unconfined groundwater that are used for irrigation or as a water supply are not considered to be introduced salts because the original water source (i.e. imported water or deep confined aquifer groundwater) was already counted as an input to the watershed. Including reclaimed water and directly recharged unconfined groundwater in the input calculations would result in double-counting the mass of salts in those supplies. Salts are exported out of the watershed through discharges to the brine line and surface water flows through the creek to the ocean.

Section 4. Source Assessment

Initial steps in the development of a TMDL include assessing sources and then linking the loads from those sources to concentrations in various environmental compartments. Conceptual models of environmental cycling are presented below for salts; as well as the linkages between sources, pathways, and reservoirs for each constituent. Available information from the literature and watershed specific data useful for assessing sources is also presented. Finally, likely sources of salts specific to the CCW are examined.

4.1. CONCEPTUAL MODEL

A conceptual model is designed to show how the pollutant and water flow through the watershed system. A conceptual model of salts sources and transport is presented diagrammatically in Figure 15. This diagram is meant to provide a generalized conceptual overview of the salts sources and related processes occurring throughout the watershed. Figure 15 is not spatially specific, in that some of the sources and processes may predominate in certain areas of the watershed and be absent from other areas. The squares represent sources of salts to the watershed, the arrows represent the transport of salts, the octagons represented uses of waters containing salts, and the diamonds represent the ultimate fate of salts in the CCW.

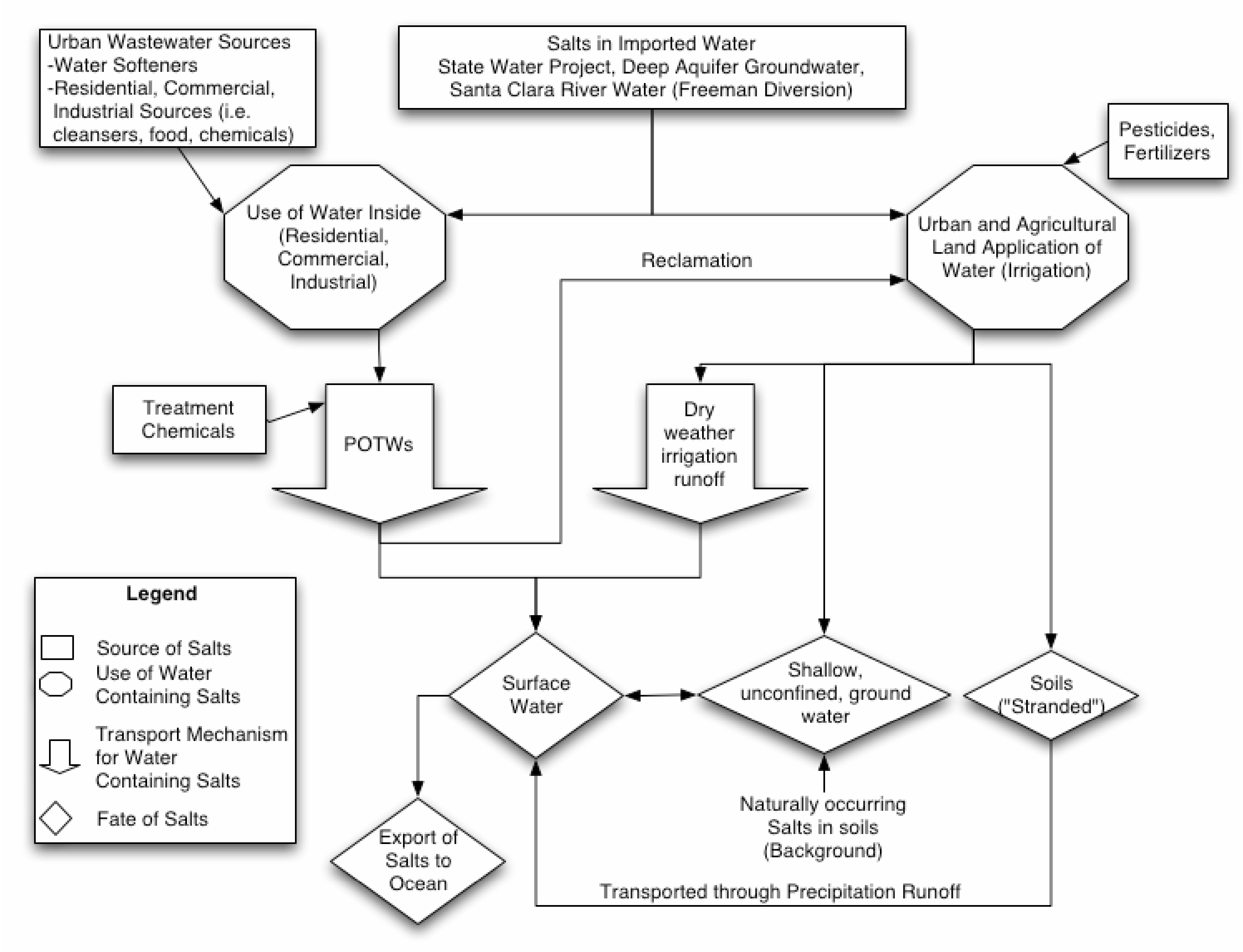

Figure 15: A Generalized Conceptual Model of salts flow for the Calleguas Creek Watershed.

4.2. SOURCE ANALYSIS

As shown in the conceptual model, six possible sources of salts to the watershed exist: water supply (water imported from the State Water Project or Freeman Diversion and deep aquifer groundwater pumping), water softeners, POTW treatment chemicals, atmospheric deposition, pesticides and fertilizers, and indoor water use (chemicals, cleansers, food, etc.). These salts are then transported through POTW discharges and dry weather runoff to three possible endpoints: surface water, shallow groundwater, and/or stranded on the watershed in the soils. The salts stranded in the soils are eventually transported to surface water when precipitation mobilizes them and carries them to the creek system. Groundwater pumping and exfiltration move salts from groundwater to surface water and surface water infiltration transports salts from the surface water to groundwater. Additionally, groundwater saturation of historic marine sediments can mobilize existing background salts from previously dry soil and transport them to the groundwater. However, none of these transport mechanisms add salts, they just move salts from one endpoint to another. Salts transported in the surface water to the ocean are currently the only salts that are exported from the watershed.

In the source analysis, the sources of salts to the watershed were quantified. These sources are considered the inputs to the salt balance. Then, the transport mechanisms were utilized to quantify the portion of salts transported to surface waters during typical dry weather conditions. The salts that are not transported to surface waters are stranded in the watershed in soils and shallow, unconfined groundwater areas. These salts can be transported to the surface waters during large precipitation events, but are not mobilized during typical dry weather conditions. Consequently, the dry weather source analysis does not quantify the amount of salts that are mobilized and transported to surface waters during precipitation events.

4.2.1. Sources of Salts to Watershed (Salt Inputs)

The following discussions summarize the estimated loads from the sources of salts to the watershed. The data and calculations used to estimate the loadings are included as Appendix 2 to this report.

4.2.1.1. Water Supply

A major source of salts to the watershed is the load associated with introduced water sources. For the purposes of this report, introduced water includes water imported from the State Water Project, water produced from the watershed's deep confined aquifer system (Las Posas and Pleasant Valley groundwater basins), and Santa Clara River water (Freeman Diversion). While the concentration of salts in the introduced water is low relative to Basin Plan Objectives, the quantity of water brought into the watershed is sufficient to rate introduced water as the number one source of salts to the watershed.

Water supply for all cities except Thousand Oaks is composed of a combination of local groundwater and imported water. Thousand Oaks is supplied exclusively by the State Water Project (SWP). Moorpark is supplied almost exclusively with SWP, but has the option to turn on wells as an additional supply if needed. Agricultural supply is primarily composed of local groundwater or reclaimed water that is supplemented with imported water from the SWP and Santa Clara River.

The introduced water supply load is estimated based on 1993 to 2003 water quality data and 2003 introduced water quantities. All local groundwater pumping was assumed to be from deep aquifers; essentially resulting in salts added to the system. Some shallow groundwater pumping occurs that could include salts that entered the groundwater from introduced water. However, for the purposes of calculating the introduced salts to the watershed, shallow groundwater is not considered a source of introduced salts. Therefore, the assumption that all groundwater pumping is from deep aquifers results in a higher estimated load of introduced salts to the watershed and is conservative. Reclaimed water used for irrigation purposes is not considered as part of the introduced salt load because the salts in reclaimed water were already counted as when they were originally brought into the watershed through the SWP or through deep aquifer groundwater pumping.

Table 14. Average Introduced Water Volumes and Quality Used for Loadings[1]

Water Source	Volume (MGD)	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Boron (mg/L)
State Water Project	74	62	330	86	0.27
Santa Clara River (Freeman Diversion)	10	55	1070	510	0.75
Groundwater from Las Posas Basin	18	56	630	220	0.12
Groundwater from Pleasant Valley Basin	19	50	910	210	0.40

1 Concentrations and volumes are average values used in the salt balance model.

Table 15 summarizes the total water supply loads to the watershed for each of the constituents based on the concentrations and volumes in Table 14.

Table 15. Total Water Supply Loads

Constituent	Load (lb/day)
Chloride	59,100
TDS	531,000
Sulfate	161,000
Boron	310
Volume (MGD)	121

The primary source of salts to the watershed is the water supply. Water introduced into the watershed from the State Water Project comes from the Sacramento/San Joaquin Delta. Consequently, chloride and TDS can vary significantly as a result of northern California hydrology. During the drought, chloride concentrations neared 120 mg/L, but fell to 45 mg/L after El Nino (See Figure 16). Therefore, the amount of salts entering the watershed from imported SWP water is strongly linked to hydrology in northern California and the volume of water imported into the watershed, and can vary significantly over time (Figure 16 and Figure 17).

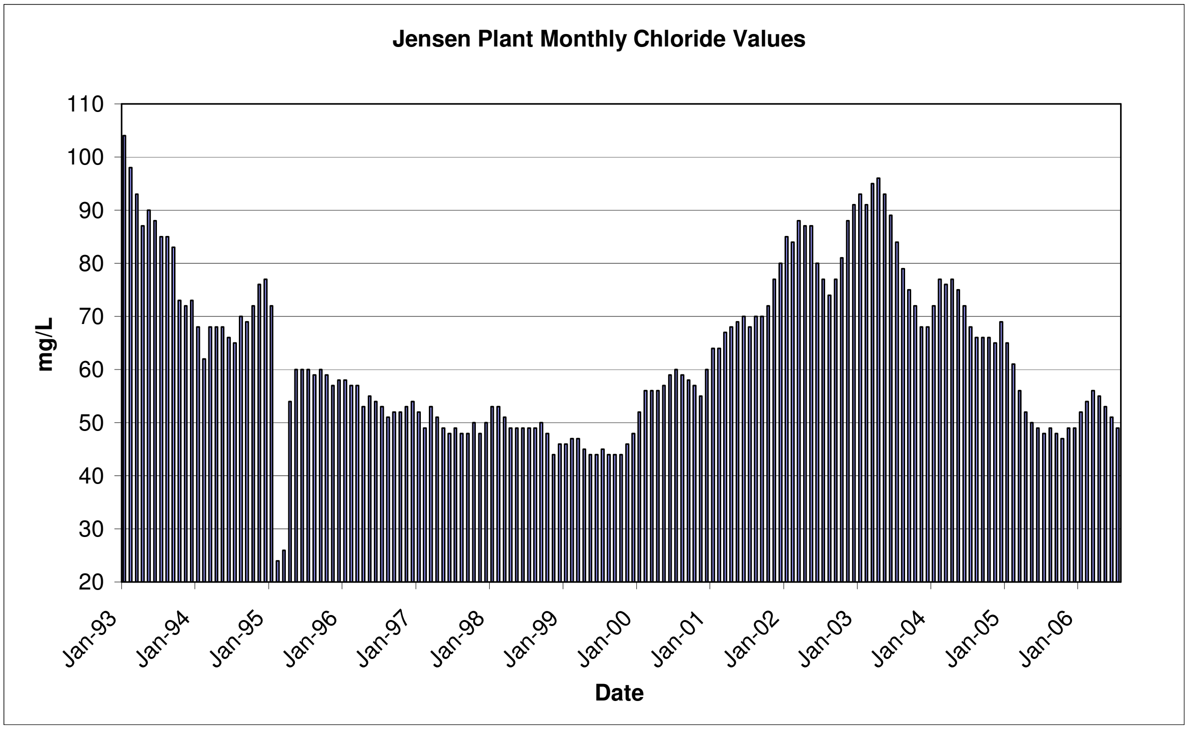

Figure 16. Imported Water Chloride History

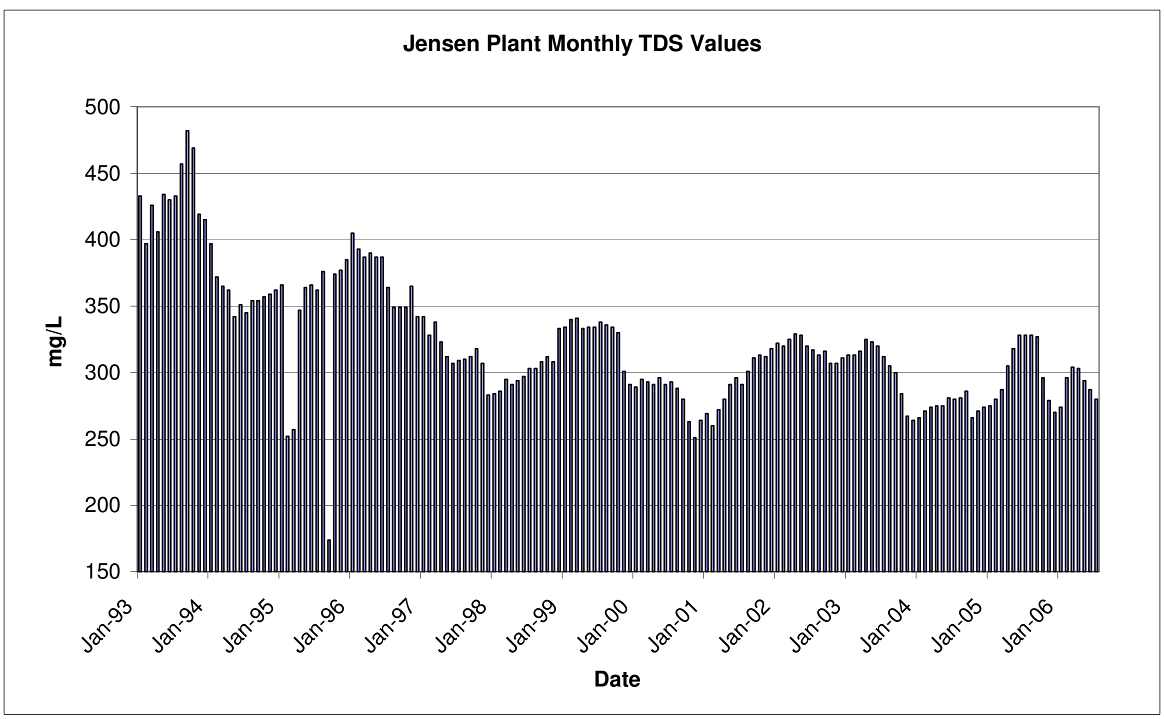

Figure 17. Imported Water TDS History

Because the imported water supply is the largest source of salts to the watershed, local agency's ability to control this source is limited. Actions taken to control salts in the local watershed could be insufficient to address unusual hydrologic conditions in northern California that could significantly impact the mass of salts entering the watershed. As a result, the TMDL includes mechanisms to balance the increased salt inputs with more exports out of the watershed. However, the need to address these unusual conditions for which the local agencies have no control may require consideration of averaging periods or site-specific objectives as part of this TMDL.

4.2.1.2. Urban Wastewater Sources

Water supply and treatment plant influent were compared to assess the overall amount of salts contributed to the watershed through industrial, commercial and residential activities and water softeners. Estimated loadings to the watershed were developed based on information for the urban areas served by wastewater treatment facilities.

Detailed source analyses were developed for TDS, chloride, and sulfate based on information from Simi Valley, Thousand Oaks, and Camarillo. This analysis was extrapolated to account for loadings from urban sources in Moorpark. Unsewered areas were assumed to be all residential sources with the same contribution of salts due to normal use as sewered areas and with the same percentage of water softener use. Population estimates for unsewered areas were estimated based on census data for unincorporated Ventura County in the CCW. Sufficient data were not available to allow an assessment of boron loadings from urban wastewater sources.

4.2.1.2.1. Residential, Commercial, and Industrial Activities

A planning level analysis of sources of salts from residential, commercial, and industrial activities was conducted for TDS, chloride, and sulfate. Insufficient data were available to conduct a similar analysis for boron. For TDS, chloride, and sulfate, data on industrial, commercial and residential activities were available. Industrial chloride and TDS data were available for Simi Valley, Thousand Oaks, and Camarillo. In addition, Simi Valley had conducted some chloride and TDS monitoring for commercial businesses. Simi Valley has also conducted some commercial and industrial sampling for sulfate, but data are not available for Camarillo and Thousand Oaks for sulfate. The Sanitation Districts of Los Angeles County (LACSD) and the City of Burbank have also conducted commercial chloride sampling. Simi Valley's commercial data was used to estimate their commercial loadings. For Camarillo and Thousand Oaks, commercial data from the other communities was corrected for water supply, averaged together where applicable, and adjusted for the number of businesses or business flow in Camarillo and Thousand Oaks. These adjusted values were used to estimate commercial loadings. Other community data were used because the Simi Valley commercial data included information that was very specific to the City of Simi Valley and the other community data were more appropriate for extrapolation to other areas. Loadings from normal residential use were based on literature values. The analysis is based on 2001 data and represents an estimate of the sources to wastewater treatment plants based on available information. The details of the values used and the calculations can be found in the Progress Report on Efforts to Address Salts on the Calleguas Creek Watershed (LWA, 2004).

4.2.1.2.2. Saltwater Swimming Pools and Spas

A recent trend in Southern California has been the installation of saltwater swimming pools and spas. The saltwater pools are estimated to contain 3000 mg/L of TDS and 2000 mg/L of chloride (City of Thousand Oaks, 2007). Discharges from these pools to the sanitary sewer system or the urban stormwater drainage system could be a source of salts to the CCW. At this time, there is insufficient information to determine loadings from this source, but discharges are not considered to be significant as installation of these pools is a recent occurrence. However, the pools are a source of salts that may need to be addressed in the future.

4.2.1.2.3. Water Softeners

Information on contributions from water softeners was available based on work conducted in other nearby communities. LACSD completed a survey in the Santa Clarita Valley to evaluate self-regenerating water softener usage (LACSD, 2002). The study estimated that approximately 10% of homes in the Santa Clarita Valley had water softeners. For this analysis, 10% of the homes in Simi Valley, Camarillo and Moorpark were assumed to have water softeners. For Thousand Oaks, a rough estimate of water softener contributions to the POTW was conducted which estimated that approximately 5% of the homes in the City have water softeners. The contributions from water softeners were estimated based on the water supply hardness for each area of the watershed and mandated water softener efficiency. The following table summarizes the estimated water softener loads to each POTW and unsewered (septic tanks) areas of the watershed.

Table 16. Estimated Water Softener Loads

POTW	Chloride Load (lb/day)	TDS Load (lb/day)
Simi Valley WQCP	1430	2250
Hill Canyon WWTP	740	1,160
Camarillo WRP	990	1570
Camrosa WRF	400	630
Moorpark WWTP	390	610
Unsewered	320	500

4.2.1.2.4. Summary of Urban Wastewater Loads

The following table summarizes the loads to the watershed from water softeners, residential, commercial and industrial activities.

Table 17. Summary of Urban Wastewater Loads to CCW

Source	Chloride Load (lb/day)	TDS Load (lb/day)	Sulfate Load (lb/day)
Water Softeners	4,300	6,700	N/A
Residential Use	7,500	52,700	4,800
Commercial Use	3,100	18,900	5,400
Industrial Use	1,000	4,900	4,200
Total	15,900	83,200	14,400

4.2.1.3. Treatment Chemicals

Another source of salts to treatment plant discharges is chemicals used in treatment plant operations. The most likely sources of salts are sodium hypochlorite that is used for disinfection and ferric chloride and aluminum sulfate (alum) that are used as coagulants. The POTWs in the CCW add approximately 10 mg/L of chloride to the effluent as a result of disinfection. As a result, approximately 2300 lbs/day of chloride and TDS are added to the watershed from treatment chemicals. No information is readily available on the impact of ferric chloride or alum used in the treatment plants on salt levels in the effluent.

4.2.1.4. Pesticides and Fertilizers

Application of chloride in pesticides and fertilizers is unlikely to be significant because of the potential impacts of chloride on plants. On the other hand, sulfur is one of the 17 essential plant nutrients, and is necessary for plant growth (CPHA, 2002). Plants take sulfur up from the soil in the form of sulfate ions, which are readily soluble and seldom accumulate in the top layer of soil. Sulfur is applied in agriculture as both a fertilizer and a pesticide. Sulfur pesticides also supply sulfate to crops. Sulfur is applied in many different fertilizers, such as ammonium sulfate, potassium sulfate, and ammonium polysulfide. Sulfur is also applied in various forms as a pesticide, namely as elemental sulfur and as copper sulfate. Sulfur is currently registered in the U.S. by EPA for use as an insecticide, fungicide, and rodenticide on several hundred food, feed, ornamental, and turf crops (USEPA, 1991b).

As a result, application of pesticides and fertilizers containing sulfur/sulfate may be a significant source of sulfate for the watershed. Because sulfur is considered to be an essential plant nutrient and plants uptake sulfur in the form of sulfate, it is unlikely that sulfate has the same potential beneficial use impacts on agriculture as chloride. As a result, consideration of the sulfate objectives and the beneficial uses they are designed to protect may be evaluated as part of this TMDL.

To estimate the contribution of pesticides and fertilizers to the salt loading to the watershed, the Pesticide Use Reports (PURs) that summarize the amounts of registered pesticides that were used in the county were reviewed. The pounds of registered products that contain sulfate, sulfur, and/or chloride from the 2005 PUR for Ventura County were used to estimate the amount of salts that may be added as a result of pesticide and fertilizer applications in the CCW. The estimate is based on the use of registered pesticides and fertilizers. A review of commonly used fertilizers demonstrated that one commonly used nitrogen fertilizer contains sulfur and no nitrogen fertilizers contain chloride. One potassium fertilizer contains chloride and there are a number of sulfur fertilizers (A&L Great Lakes Laboratories, 2002). As a result, the estimate might not represent all of the fertilizer use in the CCW that could result in the addition of salts.

To estimate registered product use in the CCW from the PUR, a number of uncertainties exist:

1. Information on the percentage of chloride and/or sulfate in the product is not always available.
2. The reported information is for all of Ventura County, not just the CCW.
3. The product may contain sulfate and/or chloride, but the stability of the product and the possibility of the salt being separated into the individual ion/salt cannot be determined.
4. In the case of sulfur-containing pesticides and fertilizers, the sulfur will need to be oxidized to sulfate and most likely only a certain percentage of the applied sulfur will be oxidized.

To provide a rough estimate of the amount of the product that was applied in the CCW, the percentage of the Ventura County agricultural land that resides in the CCW (approximately 50%) was multiplied by the total pounds of product. The following table summarizes the products and amounts estimated to have been applied in the watershed.

Table 18. Estimated amounts of Sulfate and Chloride Applied in the CCW

Compound	Estimated Sulfate applied (lbs)	Compound [a]	Estimated Chloride applied (lbs)
Ammonium sulfate	279	Chlormequate chloride [a]	11.5
Copper sulfate (basic)	13,987	Didecyl dimethyl ammonium chloride [a]	0.65
Copper sulfate (pentahydrate)	631	Dioctyl Dimethyl ammonium chloride [a]	0.65
Alpha-(para-nonylphenyl)-omega-hydroxypoly (oxyethylene) sulfate, ammonium salt [b]	N/A	Methylene chloride [a]	0.08
Streptomycin sulfate [b]	N/A	Octyl decyl dimethyl ammonium chloride [a]	1.3
Urea Dihydrogen sulfate [b]	N/A	Paraquat dichloride	61
Zinc sulfate	0.1	Alkyl (50%C14,40%c12, 10%C16) dimethylbenzyl ammonium chloride	6.3
Lime sulfur [b]	N/A	Alkyl (60% C14, 45% C12, 30% C16, 5% C18) dimethylbenzyl ammonium chloride	0.44
Sulfur	87,972	Alkyl (68% C12, 32% C14) dimethylethylbenzyl ammonium chloride	0.44
	0	Chlorine	100
Total	102,869		181

a. The percentage of chloride could not be determined so an assumption of 100% chloride was used to get a worst case estimate.

b. These compounds represent less than 2% of the total pounds of product applied. The percentage of sulfate and ability of the sulfate to be mobilized from these compounds were not available. As a result, the mass is not included in the mass estimate for sulfate.

With worst-case assumptions for the amount of chloride applied, chloride application is less than 200 lbs. Based on this analysis, it appears that the mass of chloride added from pesticides and fertilizers is minimal.

On the other hand, the analysis demonstrates that a significant amount of sulfate may be added as a result of pesticide and fertilizer applications. The sulfur/sulfate-containing products can be divided into two categories: elemental sulfur and salts that can directly contribute sulfate to the watershed and chemical compounds that might not directly contribute sulfate. The salts and sulfur applications make up 98% of the sulfur/sulfate applied in the watershed. For the salts and sulfur applications, the percentage of sulfur/sulfate can be easily estimated from the chemical formula of the product. For the remaining products, the percentage of sulfur/sulfate in the product is not as easy to estimate. Because the other types of products represent such a small amount of the sulfur/sulfate applied and the ability of these products to directly contribute salts is uncertain, they were not considered for estimating the salt contributions to the watershed from pesticide and fertilizer applications. Therefore, the remaining uncertainty for estimating the sulfate contributions is the amount of oxidation of sulfur to sulfate. Sulfur must be oxidized to sulfate for plants to utilize the fertilizer. As a result, the calculations assume that all of the applied sulfur is oxidized to sulfate.

4.2.1.5. Atmospheric Deposition

Salts may be deposited onto the earth's surface under either dry or wet (precipitation) conditions. Dry deposition occurs as particles settle out of the atmosphere and as gaseous pollutants adsorb onto the earth's surface. Wet deposition occurs when rain falls through contaminated air, scavenging pollutants by impaction and interception of particulate matter and by dissolving gaseous pollutants. Wet and dry deposition occurs directly onto receiving waters, or indirectly by depositing onto the watershed surface and subsequently transported to the surface water in runoff. To quantify the deposition contribution of pollutants to the CCW, available precipitation and deposition monitoring data were used to estimate loadings.

Data from national and local air quality monitoring networks were evaluated to estimate the salts loading to the watershed from atmospheric deposition. For wet deposition, data from the National Atmospheric Deposition Program (NADP) sites were used to determine the typical range of salts concentrations present in precipitation. Dry deposition was estimated from the Clean Air Status and Trends Network (CAST NET) and the California Air Resources Board. A detailed discussion of the calculations is included in Appendix 3.

Average chloride concentrations in precipitation along the California coastline are below 1 mg/L. Results for other constituents are similar. Because of the low average concentration and annual precipitation, the average annual wet deposition loading of chloride is approximately 3 kg/ha. Given that the watershed is some 88,800 ha (343 square miles), wet deposition accounts for approximately 1,610 lbs/day for the entire watershed.

Average depositional velocity for particulate matter (PM) in the southern California area is 0.175 cm/sec. The average particulate chloride concentration measured in Simi Valley is 0.135ug/m^3. Multiplying the deposition rate by the concentration and watershed area, and using the proper unit conversions, leads to calculation of an average 40 lb/day dry deposition over the entire watershed.

Wet and dry deposition of chloride is representative of other salts and the magnitude of loads is similar. Dry deposition of TDS is estimated to be 340 lbs/day, and the sulfate load is approximately 90 lbs/day.

4.2.1.6. Total Estimated Salts Loads to the CCW

The total estimated salts loading to the CCW from water supply; residential, commercial, and industrial activities; water softeners; treatment chemicals; and atmospheric deposition are summarized in Figure 18 through Figure 20.

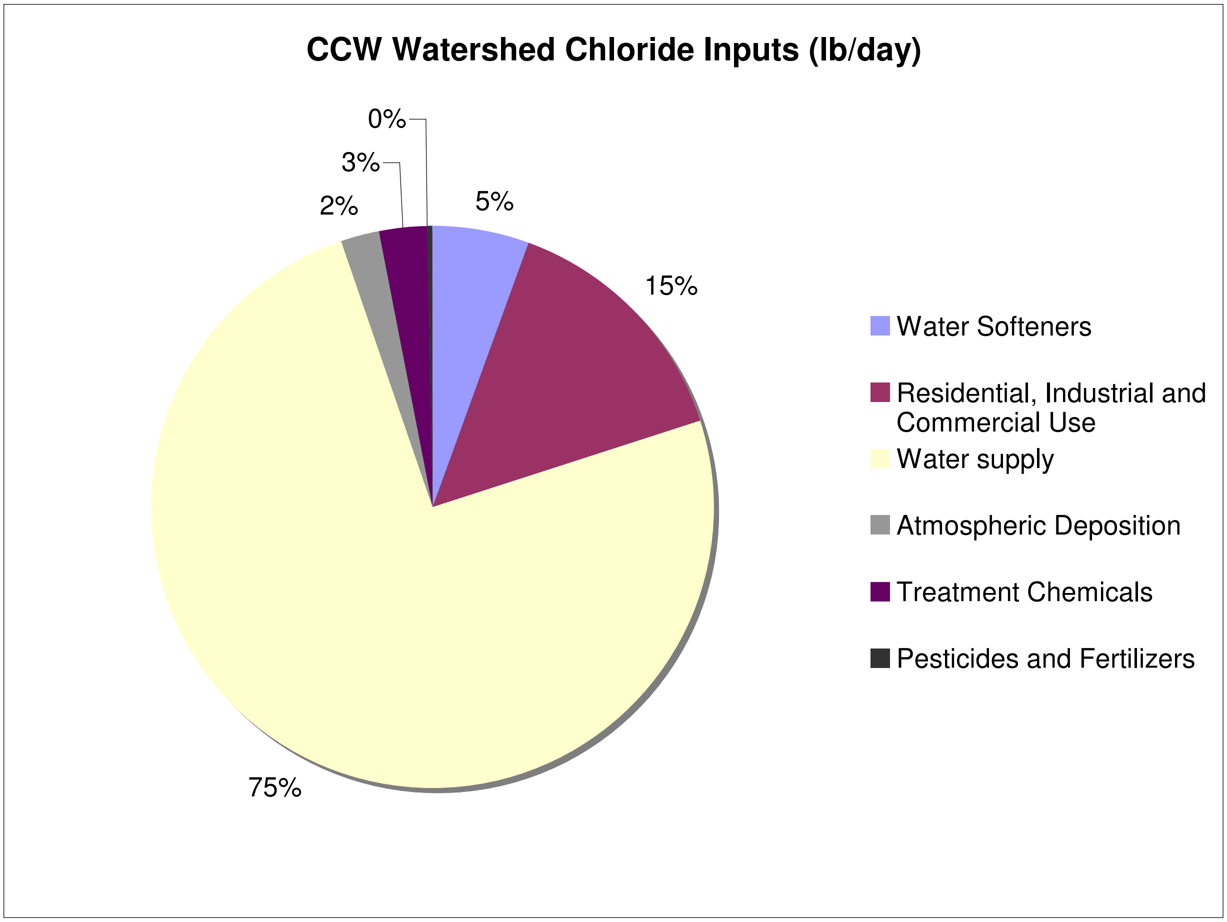

Figure 18. Sources of Total Chloride Load to Watershed of 79,000 lbs/day

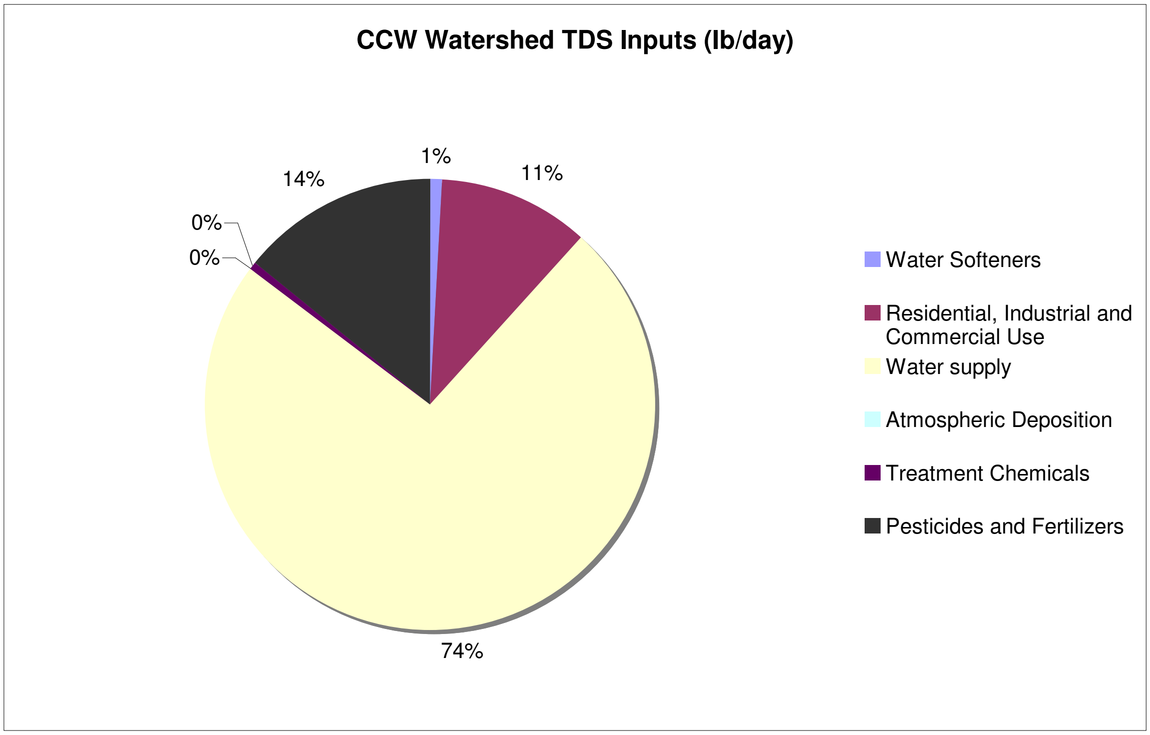

Figure 19. Sources of Total TDS Load to Watershed of 721,000 lbs/day

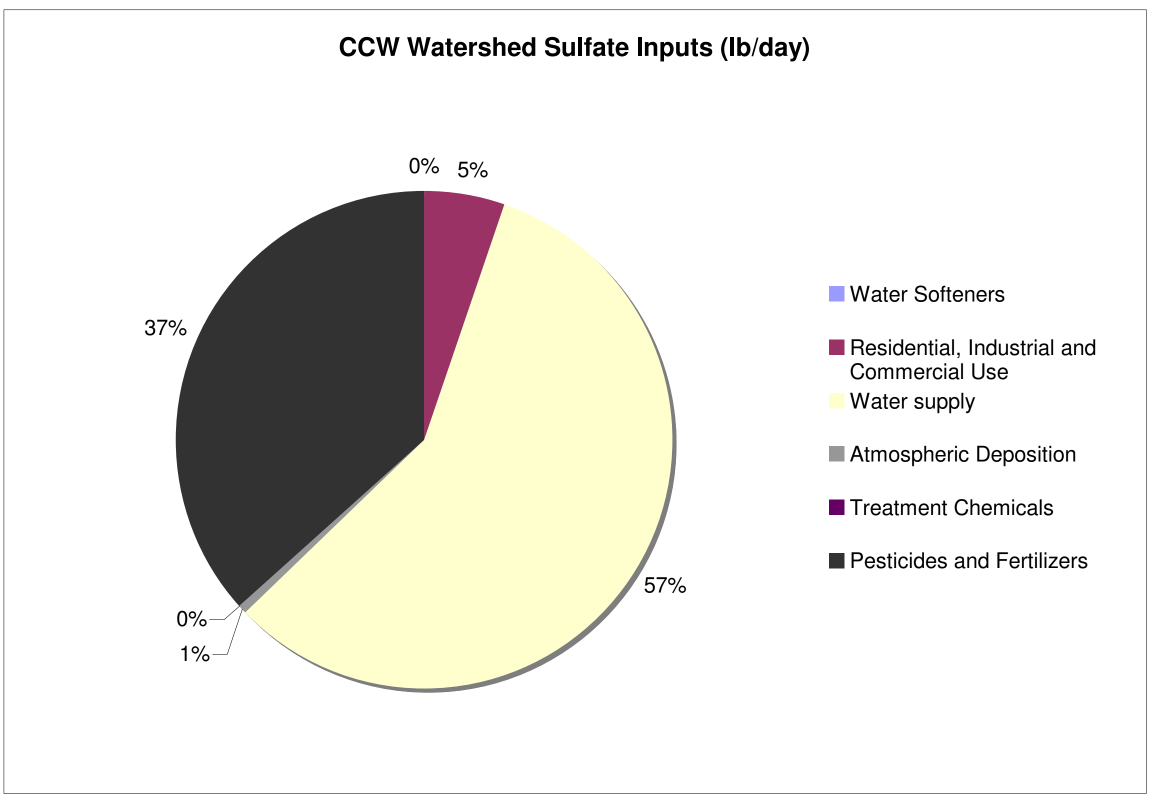

Figure 20. Sources of Total Sulfate Load to Watershed of 280,000 lbs/day

As shown in the figures above, the introduced water supply is the single largest source of salts to the watershed. Depending on the constituent, the introduced water supply is at least 57% of the overall salt load to the watershed.

4.2.2. Transportation of Salts to Surface Waters

Once the salts have been imported and added to the water used in the watershed, they are transported through the watershed to one of three endpoints: surface water, groundwater, or the land surface/soils. The salts can also be transferred between these three endpoints when water flows mobilize the salts (i.e. precipitation events mobilize salts in the soils and transport them to the surface water). This section identifies the mechanisms that transport salts to the surface water from the original use of the water (i.e. POTWs) or between the endpoints (i.e. groundwater exfiltration). The quantities of salts transported during dry weather to the surface water are quantified for the following mechanisms.

- Groundwater Pumping
- Groundwater Exfiltration
- POTWs
- Dry weather urban and agricultural runoff

4.2.2.1. Groundwater Pumping

In the upper Arroyo Simi and the City of Thousand Oaks, groundwater is pumped and directly discharged to the creek system. High groundwater levels in Simi Valley require dewatering to prevent seepage into developed areas. Dewatering flows are typically discharged to the Arroyo Simi and Arroyo Conejo via the two cities' drainage systems. The following table summarizes the estimated loads from the groundwater pumping.

Table 19. Estimated Salts Loads from Groundwater Pumping

Subwatershed	Average Dry Weather Flow (mgd)	Chloride Conc. (mg/L)	Chloride Load (lb/day)	TDS Conc. (mg/L)	TDS Load (lb/day)	Sulfate Conc. (mg/L)	Sulfate Load (lb/day)	Boron Conc. (mg/L)	Boron Load (lb/day)
Simi	1.0	131	1,100	1634	13,600	1158	9,700	0.95	8
Conejo	0.1	130	70	750	400	225	100	0.2	0.1

4.2.2.2. Groundwater Baseflow

Groundwater is a major source of salts to the surface water upstream of the upper POTWs (Simi Valley WQCP and Hill Canyon WWTP). Groundwater exfiltration results in a continuous baseflow upstream of both POTWs. The flow rate of the baseflow depends on dry- or wet-year conditions. While the quantity and quality of the pumped groundwater has been measured, it is difficult to accurately measure groundwater baseflow in the stream because it is mixed with other discharges. The methods used to estimate the baseflow quantity and concentration are as follows:

1. Calculate the mean summer flows at the gaging stations in the watershed.
2. Subtract the known POTW discharges and estimates for urban and agricultural discharges.
3. Develop a relationship for baseflow quantities based on the precipitation during the previous winter.
4. Examine the salts concentrations from groundwater wells in the township-range sections containing the creek.
5. Compare the average well concentrations to estimates of concentrations based on surface water measurements.
6. Calculate an average baseflow concentration for chloride, sulfate and TDS.

Based on this procedure, average baseflow concentrations for salts were calculated and equations were developed to estimate baseflow quantities based on the previous winter's precipitation. A detailed discussion of the analysis is included in Appendix 3. The average loadings estimated based on the analysis of concentrations for groundwater base flow were based on the analysis conducted for the development of the CCMS model and are shown in Table 20. Flow estimates are based on the average dry weather flow rate estimated duringcritical condition years as described in Section 6.2.

Table 20. Average Loadings by Reach from Baseflow

Subwatershed	Average Dry Weather Flow (mgd)	Chloride Conc. (mg/L)	Chloride Load (lb/day)	TDS Conc. (mg/L)	TDS Load (lb/day)	Sulfate Conc. (mg/L)	Sulfate Load (lb/day)	Boron Conc. (mg/L)	Boron Load (lb/day)
Simi	1.0	199	1,680	1197	10,100	1232	10,400	1.40	11.8
Conejo	2.6	195	4,190	1185	25,500	445	9,600	0.20	4.3
Pleasant Valley (Calleguas)	3.2	227	6,110	907	24,400	801	21,500	0.20	5

Subwatersheds not shown in the table do not receive significant loads from groundwater exfiltration.

The high concentrations present in the baseflow most likely result from a number of factors including the presence of naturally occurring salts in the soils and sediments of the watershed. The contribution of these salts to the surface waters is significant in reaches where POTWs do not discharge. Managing these discharges is challenging because groundwater exfiltration occurs slowly along the length of the reach. Additionally, because at least a portion of the concentrations discharged is likely to be contributed by naturally occurring salts that have dissolved into the groundwater, natural background conditions may make it infeasible to reduce the concentrations in the groundwater baseflow. Consequently, in reaches where groundwater baseflow results in higher concentrations in the stream (Reaches 3, 4, 7, 12, and 13), site-specific objectives or natural background exclusions may need to be considered along with the implementation actions.

4.2.2.3. POTWs

For the three POTWs that discharge to surface waters, loadings of chloride, TDS, sulfate, and boron to surface waters were estimated. The total loads from each of the POTWs are shown in Table 21. The loadings were estimated based on the concentration and flow analysis conducted for the development of the CCMS model (See Appendix 3).

Table 21. POTW Salts Loads

POTW	Average Flow (mgd)	Chloride Conc. (mg/L)	Chloride Load (lb/day)	TDS Conc. (mg/L)	TDS Load (lb/day)	Sulfate Conc. (mg/L)	Sulfate Load (lb/day)	Boron Conc. (mg/L)	Boron Load (lb/day)
SVWQCP	9.8	141	11,500	771	63,000	210	17,200	0.7	53
Moorpark WWTP[a]	0	146	0	523	0	115	0	0.5	0
Hill Canyon WWTP	10.1	155	13,000	616	51,900	139	11,700	0.5	42
CSD WRP	3.5	184	5,400	890	26,000	225	6,570	0.7	19
Camrosa WRF[a]	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

a. Moorpark WWTP and Camrosa WRF currently do not discharge directly to the surface water.

4.2.2.4. Land Use Runoff

Estimates of dry weather runoff from urban, agricultural, and open space lands were estimated using information developed for the CCMS model. The model is discussed in the Linkage Analysis section and the details of the calculations are included in Appendix 3. The loadings presented below represent average daily loadings to the reach from land use runoff. In reality, these loads would occur intermittently and in different locations at different times. However, information is not currently available to accurately account for the intermittent nature of these discharges.

4.2.2.4.1. Urban Runoff

Salts are applied to urban areas through irrigation water, fertilizers, and pesticides. Runoff to surface waters occurs during dry weather as a result of over irrigation or applying irrigation water to impervious surfaces. During wet weather, precipitation transports salts that are stranded in the soils from previous irrigation water, fertilizer, and pesticide applications to the surface water. Irrigation water and precipitation have the potential to transport salts into shallow groundwater as well.

Table 22 summarizes the estimated urban runoff loads in each reach.

Table 22. Estimated Dry Weather Urban Loads

Subwatershed	Average Dry Weather Flow (mgd)	Chloride Conc. (mg/L)	Chloride Load (lb/day)	TDS Conc. (mg/L)	TDS Load (lb/day)	Sulfate Conc. (mg/L)	Sulfate Load (lb/day)	Boron Conc. (mg/L)	Boron Load (lb/day)
Simi	1.39	157	1,800	1869	21,700	60	700	0.21	2.4
Las Posas	0.13	157	160	1869	2,000	60	60	0.21	0.2
Conejo	1.26	157	1,600	1869	19,600	60	630	0.21	2.2
Camarillo	0.06	157	70	1869	900	60	30	0.21	0.1
Pleasant Valley (Camarillo)	0.12	157	160	1869	1,900	60	60	0.21	0.2
Pleasant Valley (Revolon)	0.25	157	330	1869	3,900	60	130	0.21	0.4

4.2.2.4.2. *Agricultural Runoff*

Irrigation water, fertilizers and pesticides are also sources of salts to agricultural areas. The volume of runoff to surface waters from agricultural areas depends on the crop type being irrigated and the irrigation practices. Runoff from agricultural fields has been observed in varying quantities during all times of the year. During wet weather, precipitation transports salts that are stranded in the soils from previous irrigation water, fertilizer, and pesticide applications to the surface water. Irrigation water and precipitation have the potential to transport salts into shallow groundwater as well.

Table 23 summarizes the estimated dry weather agricultural runoff loads in each reach.

Table 23. Estimated Dry Weather Agricultural Loads

Subwatershed	Average Dry Weather Flow (mgd)	Chloride Conc. (mg/L)	Chloride Load (lb/day)	TDS Conc. (mg/L)	TDS Load (lb/day)	Sulfate Conc. (mg/L)	Sulfate Load (lb/day)	Boron Conc. (mg/L)	Boron Load (lb/day)
Simi	0.51	156	700	958	4,100	416	1,800	1.70	7.3
Las Posas	1.69	156	2,200	958	13,500	416	5,800	1.70	24
Conejo	0.59	156	800	958	4,700	416	2,100	1.70	8.4
Camarillo	0.05	156	60	958	380	416	160	1.70	0.7
Pleasant Valley (Camarillo)	0.24	156	320	958	2,000	416	850	1.70	3.5
Pleasant Valley (Revolon)	5.79	156	7,540	958	46,200	416	20,100	1.70	82

4.2.2.5. *Surface Water Loading Summary*

The following table summarizes the dry weather loads to surface water from all of the sources listed above for each of the constituents.

Table 24. Summary of Loadings to Surface Waters

Source	Chloride Load (lb/day)	% Total Chloride Load	TDS Load (lb/day)	% Total TDS Load	Sulfate Load (lb/day)	% Total Sulfate Load	Boron Load (lb/day)	% of Total Boron Load
POTWs	29,900	51%	140,900	42%	35,500	30%	110	41%
Groundwater Pumping	1,100	2%	13,600	4%	9,700	8%	8	3%
Groundwater Exfiltration	12,000	20%	60,000	18%	41,500	35%	21	8%
Urban Dry Weather	4,120	7%	49,990	15%	1,610	1%	6	2%
Agriculture Dry Weather	11,600	20%	70,900	21%	30,800	26%	126	46%
Total	58,700	100%	335,000	100%	119,000	100%	271	100%

Wet weather loadings from each of these sources has the potential to be significant, but tend to be lower in concentration and do not occur during the critical conditions for salts. Wet weather loads are significant from the perspective of transporting stranded salts off the watershed and have been included in the modeling and linkage analysis.

4.3. FATE AND TRANSPORT OF SALTS

Table 24 shows the amount of salts transported to surface waters on average. Over 75% of the total watershed salts loads are transported to the surface waters on a daily basis. Because some of the surface water is diverted for irrigation in the lower watershed through the Conejo Creek Diversion Project, and all of the surface water in the upper watershed enters the groundwater, only about 30% of the watershed salts load is exported out of the watershed to the ocean during dry weather. The remaining salts are left “stranded” in the soils or shallow groundwater basins in the watershed until large amounts of precipitation mobilize the salts and transport them off the watershed. Table 25 summarizes the ultimate fate of the imported salts during dry weather.

Table 25. Fate of Salts in CCW during Dry Weather

Constituent	Salts Load To Watershed (lb/day)	Exported to Ocean (lb/day)	“Stranded” in Watershed (lb/day)	Percent Salts Load Exported
Chloride	79,100	25,700	53,400	32%
TDS	721,000	132,300	588,700	18%
Sulfate	280,000	52,600	227,400	19%

Dry season stranded salts are a temporary condition that is remedied by cyclical patterns of wet weather, which wash stranded salts out to the ocean. The cyclical patterns of drought followed by extreme periods of heavy rainfall produce high stream flows on the watershed. These infrequent yet routine wet periods create high stream flows that extend well into the summer and fall seasons carrying large volumes of salts off the watershed. It is this feature of the watershed that has prevented the daily importation of chlorides and other salts to the watershed from accumulating in ever increasing concentrations (Hajas, 2004). Salts accumulate even with average and slightly above average rain years and extreme wet years are needed to flush the stranded salts from the watershed.

The water quality model for the watershed (CCMS) was used to estimate the salt loading exported from the watershed during wet weather. Table 26 summarizes the minimum, maximum and average daily and annual loads exported from the watershed during wet weather flows. Additionally, the annual estimates were used to calculate the percentage of the annual mass of salts introduced to the watershed that is exported out of the watershed during wet weather.

Table 26. Estimated Daily and Annual Salt Exports During Wet Weather for CCW

Total Wet Weather Exports	Chloride (lbs)	TDS (lbs)	Sulfate (lbs)
Estimated Daily Exports			
Minimum Storm Export	10,000	52,000	20,000
Maximum Storm Export	1,450,000	10,370,000	6,950,000
Average Storm Export	136,000	835,000	501,000
Estimated Annual Exports			
Minimum Annual Storm Export	2,580,000	15,320,000	8,590,000
Minimum Percentage of Annual Inputs	9%	6%	8%
Maximum Annual Storm Export	14,380,000	92,940,000	57,620,000
Maximum Percentage of Annual Inputs	50%	35%	56%
Average Annual Storm Export	6,410,000	39,390,000	23,610,000
Average Percentage of Annual Inputs	22%	15%	23%

As shown in Table 26, wet weather is a significant mechanism for exporting salts and on average can export over 15% of the annual mass of introduced salts from the watershed. Additionally, during wet years, salt export out of the watershed through the surface waters can be significant and result in elevated surface water concentrations.

The TMDL implementation plan provides a regional solution that will result in the entire salts load to the watershed shown in Table 25 being exported out of the watershed to the ocean. Correspondingly, the stranded watershed salt load will be reduced to zero. By reducing the stranded salts to zero, surface water and groundwater concentrations will decrease and salts will not accumulate in groundwater basins in the region.

Section 5. Linkage Analysis

The linkage analysis for salts focuses on the surface water concentrations of salts. However, as discussed previously, surface water concentrations are only one component of the watershed salt issue. Because it is difficult to model other aspects of the salt problem (i.e. surface water and groundwater interactions, stranded salts), two simplified approaches have been used to demonstrate that salts will be removed from the watershed and that should have a correspondingly positive impact on surface water and groundwater salts concentrations. First, a surface water model was developed to provide a linkage between sources and surface water quality and to demonstrate the impact of projects on receiving water quality in the watershed. Secondly, a salt balance was developed to quantify the removal of salts from the watershed with the goal of achieving a salt balance. Achieving a salt balance in the watershed will prevent additional build-up of salts in any medium in the watershed and protect water supplies from increasing in salt concentrations.

For the surface water modeling, the CCMS was developed and is summarized below and described in detail in Appendix 3. To estimate the salts balance in the watershed, a simple chloride mass balance was developed by the Camrosa Water District (Hajas, 2003a) and modified to address the other salts. The following section describes the two models and their uses.

5.1. MODEL DESCRIPTIONS

5.1.1. Calleguas Creek Modeling System (CCMS)

The framework for the salts modeling effort is a numerical mass balance water quality model originally developed for use in the Calleguas Creek Nutrient TMDL effort. The spreadsheet-based mass balance model was accepted by State and Federal regulatory authorities for use in the Nutrient TMDL process for the CCW.

The water quality simulation component of the CCMS is built on a spreadsheet mass balance model. To model the CCW, the entire watershed is divided into 15 subwatersheds based on drainages to sampling locations and significant tributaries. A computational element is assigned to each subwatershed for calculating the changes in stream flow and water quality due to processes present along stream reaches circumscribed by the subwatersheds. The model was expanded to accommodate stochastic input, which allows calculation of the likely distribution of in-stream salts concentrations.

5.1.1.1. Computational Element

Each computational element balances the inflow and outflow of water and mass with conservation equations to calculate changes in in-stream flow and concentration across a subwatershed. Over each time step, the stream reach within any subwatershed is assumed to behave as a steady-state complete-mix reactor. Because of the relatively short reach length, stream geometry, and daily time step; flows can be considered in equilibrium on a daily basis, so long as the routing of peak flows is not of critical importance. Assuming that each subwatershed behaves as a complete-mix reactor implies that the in-stream concentration is constant at all locations within a subwatershed (Tchobanoglous and Schroeder, 1985). Because the concentration is modeled as constant for the entire reach, all withdrawals from the reach (except evaporation which has a concentration of zero), including the discharge to the downstream reach, will have the same concentration by definition. A schematic of the computational element is displayed in Figure 21. Each input and output considered in the CCMS is represented in Figure 21 with an arrow pointing into the reach for additions, and pointing out from the reach to represent withdrawals. In Figure 21, flows from upstream reaches enter from the right and flow to downstream reaches exit to the left.

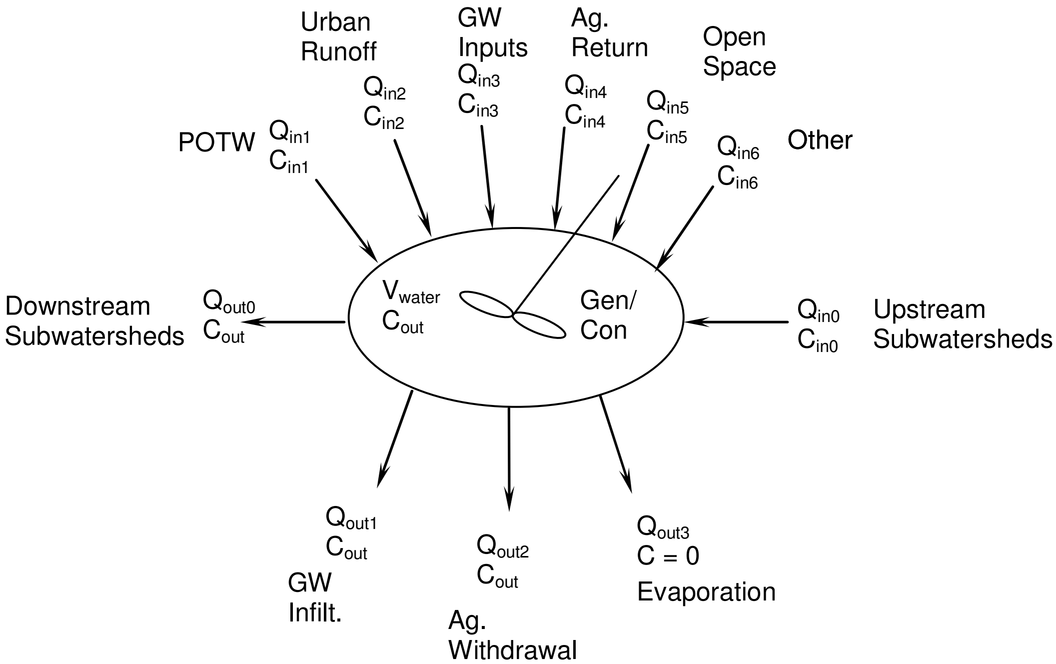

Figure 21: Schematic of Inputs and Outputs for a General Computational Element used in the CCMS Mass Balance Model to Estimate Water Flow and Quality within Surface Water Reaches.

5.1.1.1.1. Mass Balance Calculations

To calculate the stream discharge flow and in-stream concentration for a computational element, all inflow rates and concentrations must be specified along with all of the outflow rates (Tchobanoglous and Schroeder, 1985). Normally, the outflow to the downstream reach will be calculated with the conservation of flow equation. If all inflow rates and concentrations, and outflow rates are known, the in-stream concentration may be calculated. Because of the complete-mix assumption, the concentration in the outflows will equal the in-stream concentration, except in the case of evaporation (Tchobanoglous and Schroeder, 1985), where only water is assumed to be removed from the system by evaporation implying that the concentration of salts in evaporated water is equal to zero. The general conservation law is captured in Equation (1).

$$\text{accumulation} = (\text{in} - \text{out}) + \text{generation} \tag{1}$$

Each of the daily time steps is assumed to be in steady-state. By making the steady-state assumption the ability to model peak flood routing is lost; however because of the relatively small size of the CCW, a smaller time step than one day would be required to capture a flood wave moving through the watershed. The steady-state assumption specifies no accumulation of flow or mass in the surface water within a subwatershed, simplifying the mass balance equation by setting the left hand side of Equation (1) to zero, in effect requiring the sum of the inputs to equal the sum of the outputs plus and generation within the subwatersheds (Tchobanoglous and Schroeder, 1985). However, for the case of salts, the assumption is made that no generation or consumption occurs in any of the subwatersheds, further simplifying (1) to Equation (2).

$$in = out \tag{2}$$

5.1.1.1.2. Upstream Subwatersheds

Inflow and mass loading from the upstream subwatershed are added as inputs to the computational element. If the subwatershed is located at the top of a stream's drainage, there will be no upstream subwatershed and the CCMS will assign a 0.0 for the flow and mass loading. If multiple upstream subwatersheds contribute to the computational element, the sum of the upstream outflows and sum of the mass loadings are inserted in Q_{in0} and $C_{in0}Q_{in0}$.

5.1.1.1.3. Subwatershed Inflows

Possible inflows include: publicly owned treatment works (POTWs), urban runoff, groundwater exfiltration, agriculture returns, open space runoff, and any other flows. Each computational element includes provisions to include a generation component, which would be necessary if the constituents were being generated chemio-physio-biologically in the reach. In the case of salts, the generation component is set to zero as no reactions producing salts are assumed to occur in the CCW surface waters.

5.1.1.1.4. Subwatershed Outflows

Possible withdrawals or outflows from the CCW reaches include groundwater infiltration, diversions, agricultural use, and evaporation. No processes are included in the model that consumes salts. Because of the complete-mix assumption, the concentration in each of the outflows is equal to the concentration calculated in the reach that is discharged to downstream subwatersheds.

5.1.2. Salts Balance Model

Camrosa Water District developed a simple mass balance model that calculates the chloride loading to the watershed from introduced water and water use. Chloride outputs in dry weather surface water flow are compared to the chloride inputs and an estimate of the pounds of salt "stranded' in the watershed is determined. This model was updated to include inputs and outputs of TDS and sulfate based on the loading information presented in the Source Assessment section.

The model provides options for implementing different control measures to develop a salt balance in the watershed. By using the model, the impacts of different implementation actions can be assessed to ensure they do not cause an imbalance and to determine which actions provide the most benefit to the salt balance. Additionally the model has been set up to easily change input parameters, such as water supply concentrations to track compliance with the salt balance.

The model has the ability to examine almost any type of implementation action that could be considered. The currently proposed implementation plan includes five general types of implementation actions: water conservation, water reclamation, reductions in sources to POTWs, unconfined groundwater pumping and discharge to the brine line, unconfined groundwater desalting and reuse. Each implementation action can result in reduced inputs to the watershed, increased exports from the watershed, or a combination of both. Additionally, the model accounts for salts transport through the surface water system and adjusts if implementation actions alter the flow in the stream.

Water conservation contributes to the salt balance by reducing the amount of salts imported to the watershed. The mass of salt inputs reduced from water conservation is equal to the concentration of salts in the water supply multiplied by the volume of water not used as a result of water conservation. The mass of salts will vary depending on the source of the water being offset by the conservation.

Water reclamation is similar to water conservation in that it reduces the amount of salts imported into the watershed. However, the original source of the water and the location of reuse of the water impacts whether or not water reclamation contributes to or adds to the salt imbalance. If the source of reclaimed water is a POTW that currently does not discharge to the stream, then the use of reclaimed water will reduce salts inputs in the same manner as water conservation (concentration of offset water supply multiplied by the volume of water offset). If the reclaimed water is currently discharged to surface water and that surface water transports salts to the downstream subwatershed, the location of reclaimed water use is critical. For example, if the reclaimed water is reused in the same subwatershed, the salt inputs are reduced by the mass of salts offset by not importing salts into the watershed. However, salt exports are also reduced by the mass of salts that would normally have been transported in the stream. Since the concentrations in POTW effluent includes additional watershed sources (water softeners, treatment chemicals, and residential, commercial, and industrial use), the mass that would be exported from the subwatershed through the stream system would likely be greater than the mass offset by not importing new salts. Consequently, reclamation within the same subwatershed results in a greater imbalance for the subwatershed. However, if the reclaimed water is used in a downstream subwatershed, then the salts are still exported from the subwatershed and contributes to a reduction in stranded salts. Additionally, if reclaimed water is treated and salts are exported out of the watershed through the brine line, water reclamation would reduce both salt imports and increase salt exports out of the watershed. Activities that will reduce the contributions of salts to the POTWs result in a reduction of mass introduced into the watershed. The mass reduction is calculated as a percent reduction in discharges from the POTWs to the receiving water.

Unconfined, groundwater pumping and discharge to the brine line results in an increased salt export out of the watershed. Unconfined groundwater pumping, treatment and discharge of the treatment brine to the brine line, and use of the water to supplement water supplies offsets the mass of salts in imported water and provides increased exports of salts out of the watershed.

The salts balance model provides the basis for determining if the watershed is “in balance.” This model was used to estimate the salts loadings and amount of salt export needed to achieve a salts balance in the watershed and test the proposed implementation plan to ensure it meets a salt balance.

Section 6. TMDL and Allocations

6.1. ALLOCATION APPROACH

As discussed in the source analysis section, there are sources of salts to the watershed and pathways that transport those salts to receiving waters. The pathways that transport salts are the ultimate recipients of the allocations for this TMDL. The implementation measures for the TMDL have been designed to reduce the sources of salts and to increase the export of salts out of the watershed. Source reductions will likely correspond to a reduction in the mass of salts transported through the pathways to the receiving waters. The increased export of salts out of the watershed reduces the amount of stranded salts in the watershed. As will be discussed under critical conditions, these stranded salts appear to be discharged after wet years and result in the highest concentrations observed in the watershed. By reducing the amount of salts stranded in the watershed, less mass will be discharged through the pathways during the critical condition years and over the long term.

The allocation approach has been designed to meet water quality objectives in the stream at the base of each subwatershed and to coordinate with the TMDL goal of achieving a salt balance. Additionally, the allocations need to be connected to the planned implementation actions. The challenge with the allocation process is to capture the increased salts export to allow the allocations to take into account the reduction in stranded salts resulting from the export processes. The following approach was identified to assign allocations for this TMDL and meet all of the goals discussed above.

1. Identify the critical conditions and loading capacity at the base of each subwatershed.
2. Assign loadings to pathways (POTWs, irrigated agriculture, permitted stormwater dischargers, and background) based on the flow multiplied by the numeric target.
3. Include an "adjustment factor" in the POTW loadings to provide a mechanism for decreasing the POTW allocations if background load reductions necessary to meet the loading capacity do not occur and to allow for increased exports from the watershed to compensate for increased POTW loadings when water supply loads to the POTW increase.
4. Include a long term "banking" component to account for any salt exports above the minimum requirements.

The following equations are used to define the loading capacity and allocations based on this approach.

The loading capacity (LC) for each reach in the CCW is the allowable load of each constituent that will result in compliance with water quality objectives. Loading capacity is dependant on in-stream flows and as such is variable. However, by defining a critical condition in the reach, the LC can be calculated as the product of the in-stream flow rate at the defined critical condition, the applicable numeric target, and a margin of safety. The loading capacity is calculated according to Equation 1:

Equation 1. $$\text{TMDL} = \text{LC} = Q * \text{CNT} * \text{MOS} * f$$

Where:

LC = Loading Capacity (lbs/day)

Q = In-stream Flow at Critical Condition (MGD)

CNT = Numeric Target Concentration (mg/L)

MOS = Margin of Safety

f = Conversion factor of 8.34 [(pounds/day)/(mg/L * MGD)]

The LC is allocated to a set of waste load allocations (WLAs) accounting for all identified point sources, a set of load allocations (LAs) accounting for all identified non-point sources, and a background load (BL) accounting for ambient sources not related to human activities; as shown in Equation 2:

Equation 2. TMDL = LC = WLAs + LAs + BL

6.2. CRITICAL CONDITIONS AND LOADING CAPACITY

The critical condition for salts is during dry weather periods. During wet weather, stormwater flows dilute the salt discharges and receiving water concentrations are significantly lower than water quality objectives. Dry weather, defined as days with flows lower than the 86th percentile flow and no measurable precipitation, is a critical condition regardless of the dry weather flows in the stream. Exceedances of water quality objectives can occur under any dry weather flow conditions. The driving conditions for exceedances of water quality objectives are the concentrations in the water supply (which is driven by surface water concentrations in Northern California) and the previous year's annual precipitation and corresponding flows (as described below).

Elevated salts concentrations during dry weather occur when stranded salts are discharged into the surface water after higher than average rainfall years. The elevated concentrations occur during years when the previous annual flow is greater than the 75th percentile of the annual flows for the watershed (critical year). The higher concentrations occur during the dry periods of critical years regardless of whether the annual flow for the critical year is an average flow year, higher than average year, or lower than average year. The key parameter determining a critical year is the total annual flow volume for the previous year. Based on model results, four critical years were defined based on modeled results that resulted in receiving water concentrations greater than the 99th percentile concentration during at least 10% of the dry period. The critical years identified from the model occur with conditions similar to what occurred in 1978, 1979, 1983 and 1998.

The elevated dry weather concentrations likely result from increased groundwater flows that flush the stranded salts into the creek. Because the stranded salts can only be exported out of the watershed through the creek or through the brine line, the additional flows and increased concentrations are benefits to the watershed. The goal of the implementation actions is to reduce the amount of stranded salts during dry periods by exporting the salts out of the watershed through the brine line. If these salts are discharged through the brine line during dry weather periods, they will not be present in the watershed to be discharged after wet years. As a result, the concentrations and loads discharged during these critical years will be reduced.

Because the elevated concentrations occur during dry weather regardless of the flow, the critical condition for this TMDL was defined as the average dry weather flow rate from the four critical years identified above (1978, 1979, 1983 and 1998). The resulting loading capacity is the average dry weather flow rate at the base of each subwatershed multiplied by the numeric target (water quality objectives).

6.2.1. Loading Capacity Calculation

The loading capacity was calculated using the average of the critical condition dry weather flow rates from the four years identified above. The following table represents the current loading capacity of the stream. However, the loading capacity will increase over time as the POTW flows increase to design flow. The loading capacity shown in the table represents all of the flow discharged to the stream. Some of this flow is removed from the stream through groundwater recharge and diversions. However, the flow is available for carrying load prior to its removal from the stream and is therefore considered in the loading capacity.

Table 27. Salt Loading Capacity

Subwatershed	Critical Condition Flow (mgd) [a]	Chloride Loading Capacity (lb/day)	TDS Loading Capacity (lb/day)	Sulfate Loading Capacity (lb/day)	Boron Loading Capacity (lb/day)
Simi	14.1	17,593	99,695	29,322	117
Las Posas[b]	15.8	19,721	111,754	32,869	131
Conejo	15.2	19,073	108,080	31,788	127
Camarillo	18.2	22,756	128,953	37,927	152
Pleasant Valley (Calleguas)	21.8	27,247	154,398	45,411	182
Pleasant Valley (Revolon)	6.0	7,552	42,793	12,586	50

a. The loading capacity presented for all subwatershed represents the amount of flow in the stream if groundwater recharge and diversions did not occur in the reach.

b. All of the surface water flow in the Las Posas subwatershed recharges the groundwater basin and no surface flow is present during dry weather at the base of the subwatershed. The flow shown in the table is the amount of flow that would be present at the base of the subwatershed if no groundwater recharge occurred in the reach.

The loading capacity only applies during dry weather when flows are below the 86th percentile flow in the stream. The current loads from all of the sources receiving allocations are shown in Section 4, Source Assessment. The following table summarizes the percent reductions from average current loads that are necessary to achieve the loading capacity in each subwatershed.

Table 28. Percent Reductions in Current Average Loads to Achieve Loading Capacity

Subwatershed	Chloride % Reduction	TDS % Reduction	Sulfate % Reduction	Boron % Reduction
Simi	0%	14%	28%	0%
Las Posas	0%	14%	28%	0%
Conejo	7%	0%	0%	0%
Camarillo	13%	2%	0%	0%
Pleasant Valley (Calleguas)	12%	3%	4%	0%
Pleasant Valley (Revolon)	4%	15%	38%	39%

6.3. WASTELOAD ALLOCATIONS

Wastewater treatment plants (POTWs) and permitted stormwater dischargers are assigned wasteload allocations (WLAs) for this TMDL. Mass-based wasteload allocations are assigned for these dischargers to allow tracking and coordination with achieving the salt balance in the watershed. The following sections describe the calculation of the wasteload allocations for these dischargers.

6.3.1.1. POTW Wasteload Allocations

At the end of the implementation period, only two of the POTWs in the watershed are expected to have any discharges to receiving waters where the salts objectives apply (i.e. above Potrero Road), Simi Valley WQCP and the Hill Canyon WWTP. However, the remaining POTWs in the watershed will maintain their NPDES permits. Although the Camarillo WRP, Camrosa WRF and Moorpark WWTP are not expected to discharge, dry weather WLAs are included for the rare case when discharges may occur to reaches upstream of Potrero Road. If discharges to receiving waters occur below Potrero Road, the WLAs will not apply because the water quality objectives are not applicable to that reach. Including WLAs for these POTWs ensures that water quality objectives are not exceeded as a result of discharges to reaches upstream of Potrero Road. However, loads from these POTWs are not included in the calculation of loading capacity or the linkage analysis to determine if the allocations meet the water quality objectives. These loads are not included because the flows from the POTWs will not be present in the stream under any likely circumstance. Table 29 summarizes the WLAs for the POTWs likely to discharge to the stream and Table 30 summarizes the allocations for POTWs that are not likely to discharge to the stream at the end of the implementation period.

As discussed in the Problem Statement, boron is only listed in the Simi and Pleasant Valley (Revolon) subwatershed and exceedances of boron do not occur in other portions of the watershed. Therefore, boron allocations are only included for the Simi Valley WWTP and not for the other POTWs that discharge to other subwatersheds. Allocations for the Pleasant Valley subwatershed are discussed in Section 6.3.2 and Section 6.4.

Only dry weather allocations are assigned for all dischargers in this TMDL. During wet weather, receiving water concentrations are below water quality standards and no loading reductions are required. During wet weather, the loading capacity of the stream is significantly increased by stormwater flows with very low salt concentrations. Any discharges from the POTWs during wet weather would be assimilated by these large storm flows and would not cause exceedances of water quality objectives. The allocations apply when the flows in the receiving water are below the 86th percentile flow.

6.3.1.2. POTW Wasteload Allocations

POTW wasteload allocations are calculated as the flow multiplied by the water quality objective and include an adjustment factor (as discussed below). Compliance with final wasteload allocations can be determined by either meeting the mass allocation shown in the allocation tables or by achieving a salt balance, as defined by this TMDL, in conjunction with meeting water quality standards in the stream at the point of compliance for the subwatershed to which the POTW discharges. Wasteload allocations apply to discharges to surface waters and are not applicable to other uses of wastewater (such as reclamation and ground-surface discharge).

Table 29. POTW Wasteload Allocations for Continuous Dischargers[a,c]

POTW	Design Flow (mgd)	Chloride Allocation (lb/day) [b]	TDS Allocation (lb/day) [b]	Sulfate Allocation (lb/day) [b]	Boron Allocation (lb/day) [b]
Simi Valley WQCP	14.5	150*Q-AF	850*Q-AF	250*Q-AF	1.0*Q-AF
Hill Canyon WWTP	14	150*Q-AF	850*Q-AF	250*Q-AF	N/A

a. The allocations shown only apply during dry weather (as defined in this TMDL). During wet weather all dischargers from these POTWs are allowable.
b. AF is the adjustment factor and can increase or decrease the allowable load under certain conditions (described in Section 6.3.1.3). The AF will decrease the allowable load if the minimum amount of salts exported to achieve the salt balance is not greater than the values shown in Table 31. The process for implementing the adjustment factor is shown in Figure 22.
c. Q represents the POTW flow at the time the water quality measurement is collected and a conversion factor to lb/day based on the units of measurement for the flow.

Table 30. POTW Wasteload Allocations for POTWs Without Continuous Discharges[a,b,d]

POTW	Design Flow (mgd)	Chloride Allocation (lb/day) [c]	TDS Allocation (lb/day) [c]	Sulfate Allocation (lb/day) [c]
Moorpark WWTP	5	150*Q-AF	850*Q-AF	250*Q-AF
CSD WRP	6.75	150*Q-AF	850*Q-AF	250*Q-AF
Camrosa WRF	2.5	150*Q-AF	850*Q-AF	250*Q-AF

a. The allocations shown only apply during dry weather (as defined in this TMDL). During wet weather all dischargers from these POTWs are allowable.
b. These POTWs are not expected to discharge after the end of the implementation period. The loading capacity shown above does not account for flows from these POTWs, but any flow discharges will add loading capacity to the stream.
c. AF is the adjustment factor and can increase the allowable load under certain conditions (described in Section 6.3.1.3). The process for implementing the adjustment factor is shown in shown in Figure 22.
d. Q represents the POTW flow at the time the water quality measurement is collected and a conversion factor to lb/day based on the units of measurement for the flow.

Table 31. Minimum Salt Export Requirements for Adjustment Factor [a]

POTW	Minimum Chloride Export (lb/day)	Minimum TDS Export (lb/day)	Minimum Sulfate Export (lb/day)	Minimum Boron Export (lb/day)
Simi Valley WQCP	460	3220	9120	3.3
Hill Canyon WWTP	1060	7920	4610	N/A
CSD WRP	1060	7920	4610	N/A
Camrosa WRF	1060	7920	4610	N/A
Moorpark WWTP	460	3220	9120	N/A

a. Minimum export requirements include a 10% Margin of Safety

6.3.1.3. Adjustment Factor

Reductions in background loads from groundwater are assigned in this TMDL to meet the loading capacity in the stream. To ensure that the loading capacity is achieved in the stream and the reductions in background loads are achieved, an adjustment factor is used to link POTW allocations to the required reductions in background loads. If the background load reductions are not achieved, POTWs will be responsible for providing additional load reductions to achieve water quality standards.

The adjustment factor is also used to address unusual conditions in which the inputs to the POTWs from the water supply may challenge the POTWs ability to meet the assigned WLA. As discussed previously, the allocations serve the dual purpose of meeting water quality objectives and achieving a salt balance in the watershed. The adjustment factor allows for the additional POTW loading to be addressed by increasing salt exports to achieve a salt balance in the subwatershed. In this case, the adjustment factor would increase the allowable loading for POTWs by the amount of additional salt export conducted to achieve a salt balance in the watershed as long as water quality objectives are still achieved at the point of compliance in the receiving water.

The use of the salt balance approach when increased water supply loads are entering the watershed is an appropriate mechanism for addressing the increased loads and meeting water quality objectives for the following reasons. To achieve the mass balance, implementation actions will increase the amount of salts exported from the watershed. These implementation actions remove stranded salts from the watershed to prevent increases in stream concentrations and therefore reduce and/or eliminate violations of water quality standards when these salts are mobilized to the surface water. The implementation actions also remove stranded salts that are adversely impacting groundwater basins used by agriculture and therefore protect the groundwater recharge and agricultural beneficial uses. These actions remove salts from the watershed and are effectively “negative” allocations that balance the increased POTW loads.

Although the POTW allocations include an adjustment factor, it is not necessary to constantly adjust the allocations. The purpose of the adjustment factor is to reduce the POTW WLAs if the implementation actions to achieve a salt balance and export salts are not being conducted and to account for the rare conditions where water supply concentrations are elevated to the point where the POTW allocations cannot be met. Therefore, the use of the adjustment factor will only be triggered by certain conditions. POTW allocations will be reduced if both of the following conditions occur:

1. The calculated annual dry weather salt exports from the subwatershed to which the POTW discharges are below the minimum required exports for the previous year.
2. The annual average receiving water concentration at the base of the subwatershed to which the POTW discharges exceeds water quality objectives for the previous year.

It is not necessary to reduce the allowable load for POTWs if the water quality objectives are being met in the receiving water. Figure 22 describes the process for implementing the adjustment factor.

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

Figure 22. Process for Implementing the Adjustment Factor

At the end of each year, the amount of salt exported will be compared to the minimum required salt export. If the annual requirement is not met and the water quality objectives were exceeded in the receiving water at the base of the subwatershed, the POTW allocations will be reduced for the following year by the difference between the minimum required salt export and the actual amount exported. Compliance with the salt balance is determined on an annual basis and it is appropriate to also adjust allocations annually to correspond with compliance with the salt balance requirements. Finally, changes in discharges from a POTW could take a substantial period of time to implement. Therefore, instantaneous changes to the allocations could not be addressed by the POTW.

If the POTW allocations are reduced, the POTW will need to increase the amount of salt export or reduce the mass of salts discharged from the POTW before the end of the following year when the adjustment will be evaluated again.

POTW allocations can also be adjusted upwards under limited conditions.

1. Imported water supply chloride concentrations exceed 80 mg/L.
2. Discharges from the POTW exceed the allocation.
3. Water quality objectives are met in the receiving waters.

When imported water supply chloride concentrations exceed 80 mg/L, the POTW will monitor the effluent to determine if the wasteload allocation is exceeded. If the wasteload allocation is exceeded and the POTW desires an adjustment to the allocation, the POTW will submit documentation of the water supply chloride concentrations, the effluent mass and evidence of increased salt exports to offset the increased discharges from the POTW to the RWQCB. The adjustment factor will apply for three months and the POTW must submit the evidence outlined above every three months to keep the adjustment factor active. As long as the required information is submitted, the adjustment factor will be in affect unless the POTW is otherwise notified in writing from the RWQCB.

The minimum amount of salt export required to prevent a reduction in POTW allocations is calculated as the difference between the current background load and the background load allocations and is shown in Table 31.

To demonstrate how the adjustment factor will work, the following examples for Hill Canyon were developed.

Example 1.

- Receiving water concentrations downstream of Hill Canyon for year all below water quality objectives.
- Salt export from Conejo subwatershed is below the minimum requirement for export for Hill Canyon
- Adjustment factor NOT applied because the water quality objectives are being met.

Example 2.

- Receiving water concentrations exceed water quality objectives for year.
- Salt export from Conejo subwatershed greater than minimum salt export requirement.

- Adjustment factor NOT applied to Hill Canyon because salt export requirements met.
- Salt export and BMP requirements reevaluated to meet water quality objectives.

Example 3.

- Receiving water concentrations exceed water quality objectives for year.
- Salt export from Conejo subwatershed less than minimum salt export requirement.
- Adjustment factor applied to Hill Canyon effluent for next year.
- Receiving water concentrations, adjustment factor and salt export requirements reevaluated at end of following year.

Example 4.

- Water supply concentrations exceed 80 mg/L chloride.
- Hill Canyon effluent exceeds water quality objectives.
- Salt exports increased out of Conejo subwatershed by 500 lbs/year.
- Hill Canyon applies and RWQCB approves adjustment factor for effluent limits that are increased by 500 lbs/year for 3 months.
- If necessary, additional steps are taken to maintain receiving water concentrations at or below water quality objectives, such as adding treated water to stream to dilute concentrations.

6.3.1.4. POTW Interim Limits

Interim limits are assigned for Camarillo, Hill Canyon, and Simi Valley to allow time for implementation actions to be put into place. The interim limits are assigned as concentration based limits set to the 95th percentile of the discharger data as a monthly average limit. The interim limits are shown in Table 32.

Table 32. POTW Monthly Average Interim Limits for Salts

POTW	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Boron (mg/L)
Simi Valley WQCP	183	955	298	N/A
Hill Canyon WWTP	189	N/A	N/A	N/A
Moorpark WWTP	171	N/A	267	N/A
Camarillo WRP	216	1012	283	N/A

N/A The 95th percentile concentration is below the Basin Plan objective so interim limits are not necessary.

6.3.2. Permitted Stormwater Dischargers

Permitted stormwater dischargers are assigned a dry weather WLA equal to the average dry weather critical condition flowrate multiplied by the numeric target for each constituent. Because wet weather flows transport a large mass of salts at a typically low concentration and wet weather is not a critical condition for this TMDL, these dischargers are only assigned a dry weather allocation. Dry weather allocations apply when instream flow rates are below the 86th

percentile flow and there has been no measurable precipitation in the previous 24 hours. The WLAs apply in the receiving water at the base of each subwatershed.

Table 33. Permitted Stormwater Dischargers Dry Weather WLAs

Subwatershed	Critical Condition Flow Rate (mgd)	Chloride Allocation (lb/day)	TDS Allocation (lb/day)	Sulfate Allocation (lb/day)	Boron Allocation (lb/day)
Simi	1.39	1,738	9,849	2,897	12
Las Posas	0.13	157	887	261	N/A
Conejo	1.26	1,576	8,931	2,627	N/A
Camarillo	0.06	72	406	119	N/A
Pleasant Valley (Calleguas)	0.12	150	850	250	N/A
Pleasant Valley (Revolon)	0.25	314	1,778	523	2

6.3.2.1. Permitted Stormwater Dischargers Interim Limits

Interim limits are assigned for dry weather discharges from areas covered by NPDES stormwater permits to allow time for implementation actions to be put into place. The interim limits are assigned as concentration based receiving water limits set to the 95^{th} percentile of the discharger data as a monthly average limit. The interim limits are shown in Table 34.

Table 34. Permitted Stormwater Dischargers Monthly Average Dry Weather Interim Limits for Salts

Constituent	Interim Limit (mg/L)
Boron Total	1.3
Chloride Total	230
Sulfate Total	1289
TDS Total	1720

6.3.3. Other NPDES Dischargers

Concentration-based WLAs are assigned at the Basin Plan objectives for other NPDES dischargers to the watershed.

Table 35. Other NPDES Dischargers Concentration-Based WLAs

Constituent	Allocation (mg/L)
Chloride	150
TDS	850
Sulfate	250
Boron[a]	1.0

a. The boron allocation only applies to dischargers in the Simi and Pleasant Valley (Revolon) subwatersheds.

Other NPDES dischargers include permitted groundwater cleanup projects that could have significant salt concentrations as a result of the stranded salts in the shallow groundwater basins being treated. To facilitate the cleanup of the basins prior to alternative discharge methods (such as the brine line) being available. Interim limits for other NPDES dischargers will be developed on a case-by-case basis and calculated as a monthly average using the 95th percentile of available discharge data.

6.4. LOAD ALLOCATIONS

Dry weather load allocations are assigned as a group allocation to irrigated agricultural discharges. Irrigated agricultural dischargers are assigned a dry weather WLA equal to the average dry weather critical condition flowrate multiplied by the numeric target for each constituent. Because wet weather flows transport a large mass of salts at a typically low concentration and wet weather is not a critical condition for this TMDL, these dischargers are only assigned a dry weather allocation. Dry weather allocations apply when instream flow rates are below the 86th percentile flow and there has been no measurable precipitation in the previous 24 hours. The load allocations apply in the receiving water at the base of each subwatershed.

Table 36. Irrigated Agricultural Dischargers Dry Weather Load Allocations

Subwatershed	Critical Condition Flow Rate (mgd)	Chloride Allocation (lb/day)	TDS Allocation (lb/day)	Sulfate Allocation (lb/day)	Boron Allocation (lb/day)
Simi	0.51	641	3,631	1,068	4
Las Posas	1.69	2,109	11,952	3,515	N/A
Conejo	0.59	743	4,212	1,239	N/A
Camarillo	0.05	59	336	99	N/A
Pleasant Valley	0.24	305	1,730	509	N/A
Revolon	5.79	7,238	41,015	12,063	48

6.4.1.1. Agriculture Interim Limits

Interim limits are assigned for dry weather discharges from irrigated agricultural areas to allow time for implementation actions to be put into place. The interim limits are assigned as concentration based receiving water limits set to the 95th percentile of the discharger data as a monthly average limit. The interim limits are shown in Table 37.

Table 37. Irrigated Agricultural Dischargers Monthly Average Dry Weather Interim Limits for Salts

Constituent	Interim Limit (mg/L)
Boron Total	1.8
Chloride Total	230
Sulfate Total	1962
TDS Total	3995

6.4.2. Background Load Allocations

Groundwater exfiltration (baseflow) to the watershed occurs in three subwatersheds: Simi, Conejo, and Pleasant Valley. In the Simi watershed, groundwater is also directly pumped into the receiving water. The baseflow (not the pumped groundwater) is considered to be a background load for the purposes of this TMDL. The background load is calculated as the average dry weather critical year baseflow flows multiplied by the water quality objective. Dry weather allocations apply when instream flow rates are below the 86th percentile flow and there has been no measurable precipitation in the previous 24 hours. Table 38 summarizes the background load allocations for this TMDL.

Table 38. Background Load Allocations

Subwatershed	Critical Condition Flow Rate (mgd)	Chloride Allocation (lb/day)	TDS Allocation (lb/day)	Sulfate Allocation (lb/day)	Boron Allocation (lb/day)
Simi	1.0	1,266	7,175	2,110	8
Conejo	2.6	3,222	18,259	5,370	
Pleasant Valley (Calleguas)	3.2	4,035	22,865	6,725	

The loadings required to be reduced from background sources are shown in the following table. These reductions are used to calculate the POTW WLA adjustment factor shown in Table 31.

Table 39. Required Background Load Reductions (Minimum Salt Export for Adjustment Factor)

Subwatershed	Chloride Allocation (lb/day)	TDS Allocation (lb/day)	Sulfate Allocation (lb/day)	Boron Allocation (lb/day)
Simi	414	2,929	8,289	3
Conejo	967	7,196	4,189	N/A
Pleasant Valley	2,071	1,533	14,822	0

The Camrosa WRP is the only POTW that has the potential to discharge to the Pleasant Valley subwatershed and the plant does not currently have or have future plans for surface water discharges. As a result, the background load reductions in the Pleasant Valley subwatershed cannot be ensured through the use of the adjustment factor. As a result, all dischargers to the Pleasant Valley subwatershed will need to ensure that the required background load reductions are exported if the subwatershed is not meeting water quality objectives.

6.5. DETERMINING COMPLIANCE WITH ALLOCATIONS

Compliance with final wasteload and load allocations can be determined by either meeting the mass allocation shown in the allocation tables or by achieving a salt balance, as defined by this TMDL, in conjunction with meeting water quality standards in the stream at the point of compliance for the subwatershed to which the discharges occur. A salt balance is defined as "the amount of salt introduced to the watershed is exported out of the watershed on an annual basis." Introduced salts are defined as imported water from State Water Project Water, the Colorado

River, the Santa Clara River or any other source imported from outside the watershed, and pumped groundwater from basins not directly recharged by surface water.

The annual salt balance will be calculated based only on dry weather exports of salts out of the watershed. Salt exports are defined as the mass of salts in surface water flows entering the tidal zone at Potrero Road on Calleguas Creek or at Laguna Road on Revolon Slough during dry weather flows (lower than the 86th percentile flow rate) or discharged to the brine line as measured at either the input to the brine line or in the effluent discharge from the brine line.

The loading capacity was determined as a daily load to ensure compliance with the water quality objectives. However, because the impacts to groundwater basins do not occur on a daily basis and the salt exports will vary, compliance with the allocations will be calculated on an annual basis. Each dry day, the difference between the allocation and the actual load will be calculated. The sum of each daily difference for the year will be calculated and if it is zero or less than zero then the subwatershed will be considered to be in balance and if water quality objectives are also achieved, then the discharger or discharge category will be considered to be in compliance with the TMDL. Compliance can also be determined through achieving the wasteload and load allocations and meeting water quality standards in the stream even if the salt balance is not met. If the difference between the total of all the allocations and salt exports and the loading capacity is negative for the year, the negative load will be carried over to the next year and can be used towards meeting the salt balance the following year.

If a salt balance and allocations are met and the receiving water is not meeting the applicable water quality objectives, additional implementation actions will need to be implemented to ensure water quality objectives are met in the receiving waters at the compliance points.

Section 7. Margin of Safety

A margin of safety for a TMDL is designed to address any uncertainties in the analysis that could result in targets not being achieved in the waterbodies. The included margin of safety can be explicit, implicit, or both. The primary uncertainties associated with this TMDL are as follows:

- The flow rates used to determine the loading capacity may change due to TMDL implementation.
- The impact of the salt balance on receiving water loadings is roughly estimated by the model.
- The sources of salts may not be completely known.
- The use of a daily load for allocations may not result in compliance with the instantaneous water quality objective.

The TMDL includes some conservative assumptions that contribute to the margin of safety.

- The salt balance is calculated during dry weather. Wet weather flows will flush salts from the watershed and result in a larger mass of salts being transported from the watershed than necessary to meet the salt balance. The mass of salts transported out of the watershed during wet weather is on average over 15% of the annual mass of salts introduced to the watershed for all constituents. The salt export during wet weather ranges from 7% to 41% for TDS, 9% to 48% for chloride, and 13% to 89% for sulfate of the export required to meet a salt balance in the watershed. However, this mass is not used to determine compliance with the salt balance and represents a significant implicit margin of safety.
- The water quality model was developed using a robust dataset and can model over 50 years of weather conditions to allow a complete understanding of the impacts of the implementation actions and allocations.
- The model contains a component that serves to model the impact of stranded salts in the watershed. The component assumes low irrigation efficiencies and the ability of all salts applied as irrigation water anywhere in the watershed to be discharged to receiving water in critical years. This likely overestimates the impact of stranded salts and results in a higher concentration of salts due to irrigation in the receiving water.

To address these uncertainties, an explicit margin of safety is also included in the TMDL. The largest uncertainty in the TMDL is the impact of achieving a salt balance in the watershed. As a result, the explicit margin of safety is applied to the adjustment factors for the POTWs. The adjustment factors provide a link between the salt balance requirements in the TMDL and the water quality objectives. By applying the margin of safety to the adjustment factor, more salts are required to be exported than are necessary to offset the background loads in the watershed. This additional salt export provides a margin of safety on the salt balance to address uncertainties that the salt balance will result in compliance with water quality objectives. A 10% explicit margin of safety was added to the adjustment factor to address this uncertainty.

Section 8. Future Growth

Ventura County accounts for slightly more than 2% of the state's residents with a population of 753,197 (US Census Bureau, 2000). GIS analysis of the 2000 census data yields a population estimate of 334,000 for the CCW, which equals about 44% of the county population. According to the Southern California Association of Governments (SCAG), growth in Ventura County averaged about 51% per decade from 1900-2000; with growth exceeding 70% in the 1920s, 1950s, and 1960s (Figure 23).

YEAR	POPLN	INCREASE
1900	14,000	--
1910	18,000	28.6%
1920	29,000	61.1%
1930	55,000	89.7%
1940	70,000	27.3%
1950	115,000	64.3%
1960	199,000	73.0%
1970	376,000	88.9%
1980	529,000	40.7%
1990	669,000	26.5%
2000	753,000	12.6%

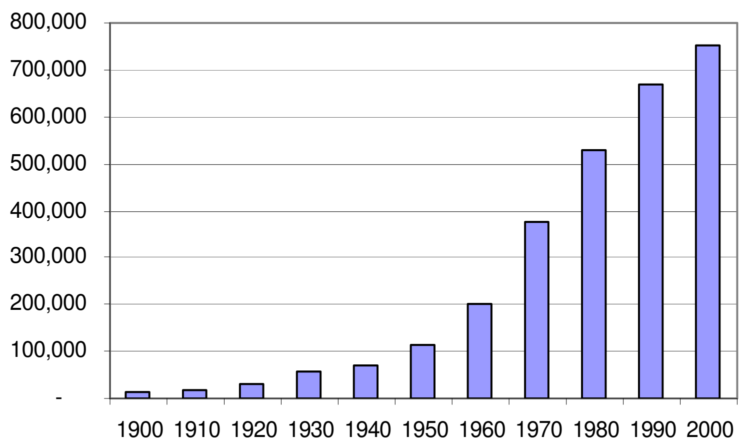

Figure 23. Population growth in Ventura County, 1900-2000 (SCAG, 2004)

Although Moorpark is expected to remain the smallest city based on population, it is also expected to have the highest growth rate from 2000-2020 (Table 40). Both Moorpark and Camarillo are predicted to experience greater than 30% growth in those years. Thousand Oaks is expected to have the lowest growth rate of the CCW cities during that same time period, and is likely to be surpassed by Simi Valley as the most populous city in the watershed by 2020 (SCAG, Minjares, 2004). In general, smaller cities in the watershed are likely to grow faster than larger cities.

Table 40. Growth Projections for CCW Cities and Region, 2000-2020 (SCAG, Minjares, 2004)

City / County / CCW	2000 Popln (July)[1]	2005 Popln	2010 Popln (projected)	2020 Popln (projected)	% Increase 2000-2010	% Increase 2000-2020
City of Moorpark	31,528	37,611	42,618	43,730	35%	39%
City of Camarillo	57,478	63,179	67,507	76,842	17%	34%
City of Simi Valley	112,190	125,456	131,198	140,902	17%	26%
City of Thousand Oaks	117,418	127,112	129,992	132,925	11%	13%
Ventura County	758,054	821,045	865,149	929,181	14%	23%
CCW[2]	336,121	364,051	383,607	411,999	14%	23%

1 Projected values for June 2000. Actual census values from April 2000 were slightly lower (VC population was 753,197).
2 Values in this row represent a rough estimate, calculated as 44% of the value for Ventura County (based upon the fact that current CCW population is approximately 44% of Ventura County total population).

8.1. GROWTH MANAGEMENT EFFORTS

Ventura County has been actively involved in growth management for several decades and continues to implement a range of growth management measures, such as: urban growth boundaries, ballot-initiative approved zoning, and encouragement of higher density and mixed-use development. The Save Open Space and Agricultural Resources ordinance (SOAR) that was passed in 1998 is one such growth management policy. Ventura County's SOAR ordinance aims to preserve farmland, open-space and rural areas by establishing a City Urban Restriction Boundary beyond which urban development is tightly controlled (Figure 24). County voter approval is required before any land located outside the City Urban Restriction Boundary can be developed for non-agricultural purposes. Within Ventura County, there is a county-wide ordinance and a number of city ordinances. The county-wide ordinance and most of the city ordinances expire in 2020, but the City of Ventura and the City of Thousand Oaks ordinances expire in 2025 and 2030 respectively.

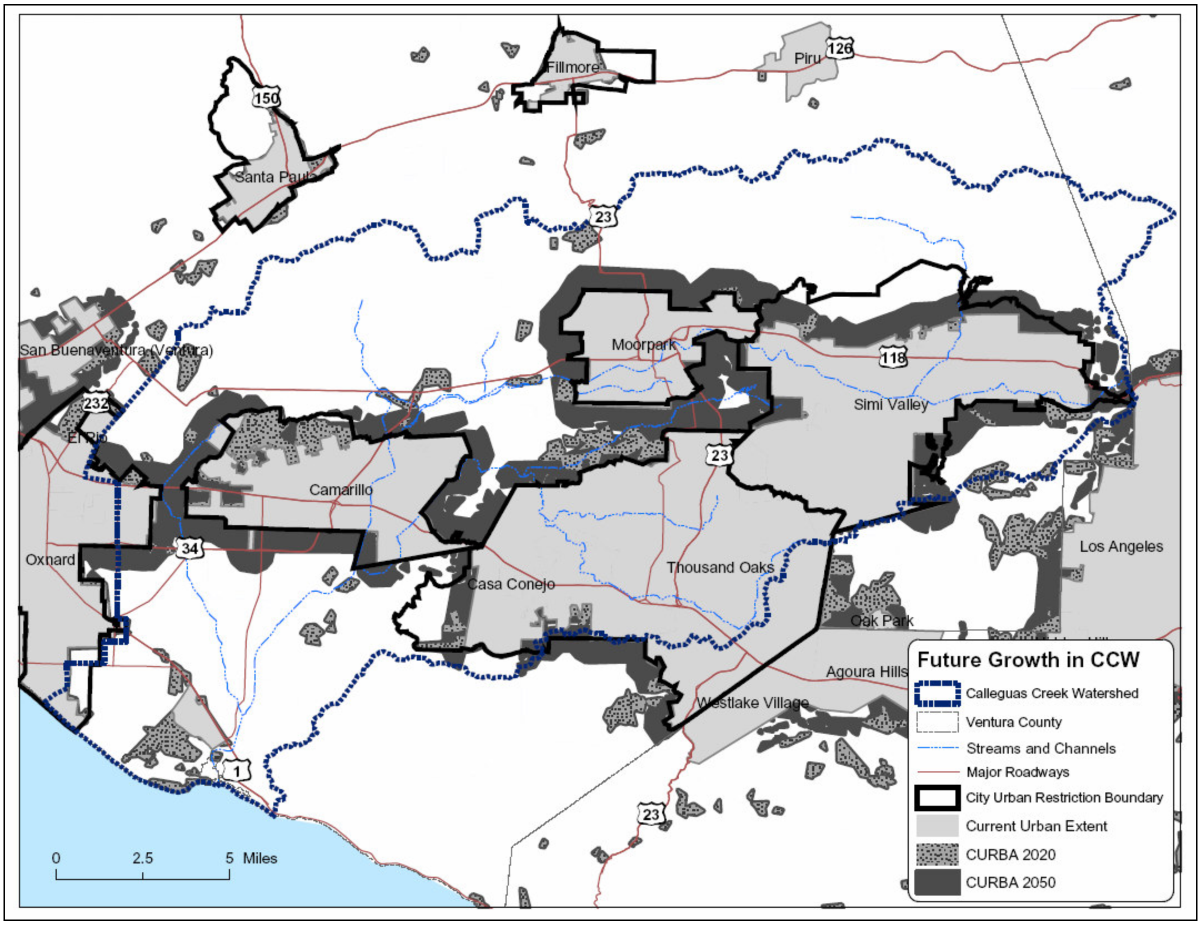

Figure 24. Urban growth in Ventura County (Ventura County CURB, California Urban and Biodiversity Analysis).

The results of California Urban and Biodiversity Analysis (CURBA) for lands within the CCW for the years 2020 and 2050 are also shown in Figure 24 (Landis et al, 1998). CURBA uses an urban growth model to predict future land-use scenarios, and a habitat loss and fragmentation analysis model to estimate the effects of various land use policies upon biodiversity (only results from the urban growth model are considered here). The urban growth model calculates future urbanization probabilities for all undeveloped sites in a given area, according to such factors as: proximity to highways, proximity to city boundaries, site slope, and site development constraints. The CURBA results shown here seem to have been heavily influenced by the "development constraints" variable, as evidenced by the fact that predicted growth is highly correlated with the City Urban Restriction Boundaries established by the SOAR initiative. Since SOAR is due to expire in 2020, it does not provide permanent protection for open space or farmland.

8.2. EFFECTS OF GROWTH ON SALTS LOADING

Increased growth requires additional water. Therefore, future growth could result in increased loads of salts being imported into the watershed. However, the TMDL implementation plan is designed to maintain a salts balance in the watershed. If additional salts are imported into the watershed, a larger volume of salts will also be exported out of the watershed to maintain the balance. Consequently, increased imports from future growth are not expected to result in higher concentrations in receiving waters.

Section 9. Implementation Plan

California Water Code section 13360 precludes the Regional Board from specifying the method of compliance with waste discharge requirements; however California Water Code section 13242 requires that the Basin Plan include an implementation plan to describe the nature of actions to be taken to achieve water quality objectives and a time schedule for action. This section describes the proposed implementation plan to meet numeric targets for chloride, TDS, sulfate and boron in the CCW.

The goal of the TMDL implementation plan is to achieve a salts balance within the CCW, attain water quality standards, and protect salt-sensitive beneficial uses. Through achieving a salts balance, water quality is expected to improve and allow achievement of water quality standards. Through achievement of a salts balance, surface water and groundwater quality within the CCW should improve because salt will no longer build-up in surface soils and groundwater basins. In addition, the implementation actions include elements to ensure the protection of sensitive beneficial uses in the CCW.

A salt balance will be achieved through the implementation of actions to:

1. Reduce the amount of salts imported into the CCW.
2. Reduce the amount of salts added to water in the CCW.
3. Transport salts downgradient and export them out of the watershed.
4. Provide protection to sensitive beneficial uses.
5. Monitor and track achievement of the salt balance and the associated impacts on water quality.

In addition, the strategy for compliance with the TMDL includes a mechanism for revising the implementation actions if additional water quality improvements or beneficial use protections are necessary. For compliance with the TMDL, a salts balance will be calculated on a subwatershed basis with each of the five maintaining a salts balance.

As discussed in Section 4 Source Assessment, the total daily load to the watershed is shown in Table 25. As shown in the table, currently during dry weather less than 35% of the salts are transported out of the watershed and over 65% are "stranded." The goal of the compliance strategy is to export the same mass of salts out of the watershed as is imported into the watershed and reduce the stranded loads to zero.

Wet weather plays a significant role in transporting salts out of the watershed, especially in the Northern reaches. However, the implementation elements strive to achieve a salts balance during dry weather. Any additional flushing that occurs during wet weather will serve to improve the water quality in the watershed after the flushing is completed and is considered to be part of the margin of safety for this TMDL.

The implementation actions described in this plan represent a range of activities that could be conducted to achieve a salts balance in the watershed. The implementation plan has been developed as a phased plan to allow for a review of implemented actions to assess the impacts on the salt balance and water quality. The specific actions taken to achieve the salt balance may vary to some degree from the elements presented here based on this evaluation and future analyses of the most cost effective and beneficial mechanisms for achieving the salt balance. To the extent possible, all ideas being considered as mechanisms for implementing the TMDL have been included in the plan. Future considerations may result in other actions being implemented rather than the options presented. However, any proposed actions will be reviewed using the salt balance model to ensure the action does not adversely impact other implementation actions in the watershed or the salt balance of a downstream subwatershed.

Currently, the plan is presented in phases with a schedule for each phase. The phases represent rough guidelines for how the project will be implemented. However, the implementation of projects may occur earlier than planned. Additionally, to complete the projects within the specified time period, it may be necessary to begin the planning activities for projects earlier than the phase in which they are described below. The schedules represent the dates that work will be completed on each phase, but do not preclude work beginning during an earlier phase nor presume that work needed to meet the schedule does not need to begin during an earlier phase.

The implementation plan for the Salts TMDL includes overarching elements that will be enacted throughout the watershed and subwatershed specific implementation actions. For each implementation element, the discussion includes a description of the action, status and schedule for implementing the action, and a summary of the expected contribution to achievement of the salts balance.

9.1. OVERARCHING IMPLEMENTATION ELEMENTS

The overarching implementation elements will be used in all of the subwatersheds and are therefore included here for clarity.

9.1.1. Regional Salinity Management Conveyance (RSMC)

9.1.2. Description

CMWD is working with other public water and wastewater agencies to construct the Calleguas Regional Salinity Management Conveyance (RSMC), which is designed to help manage high salinity water use and disposal. The RSMC (or brine line) consists of a pipeline system to collect treated wastewater, poor quality groundwater, and brine concentrations from groundwater treatment facilities in the CCW. The brine will be conveyed to a point of use (such as a coastal wetlands) or to an existing ocean outfall. The brine line forms the backbone of all the proposed projects by providing a mechanism for transporting salts downgradient and out of the watershed through direct discharges to the ocean.

The project is divided into three phases. Phase 1 is comprised of the pipeline from the Camrosa Water Reclamation Facility to an existing ocean outfall in the City of Port Hueneme. The remaining portions of the pipeline system extend north and east from the Camrosa plant to the City of Simi Valley. Phase 2 segments will extend the pipeline to the City of Moorpark and Phase 3 will reach the City of Simi Valley.

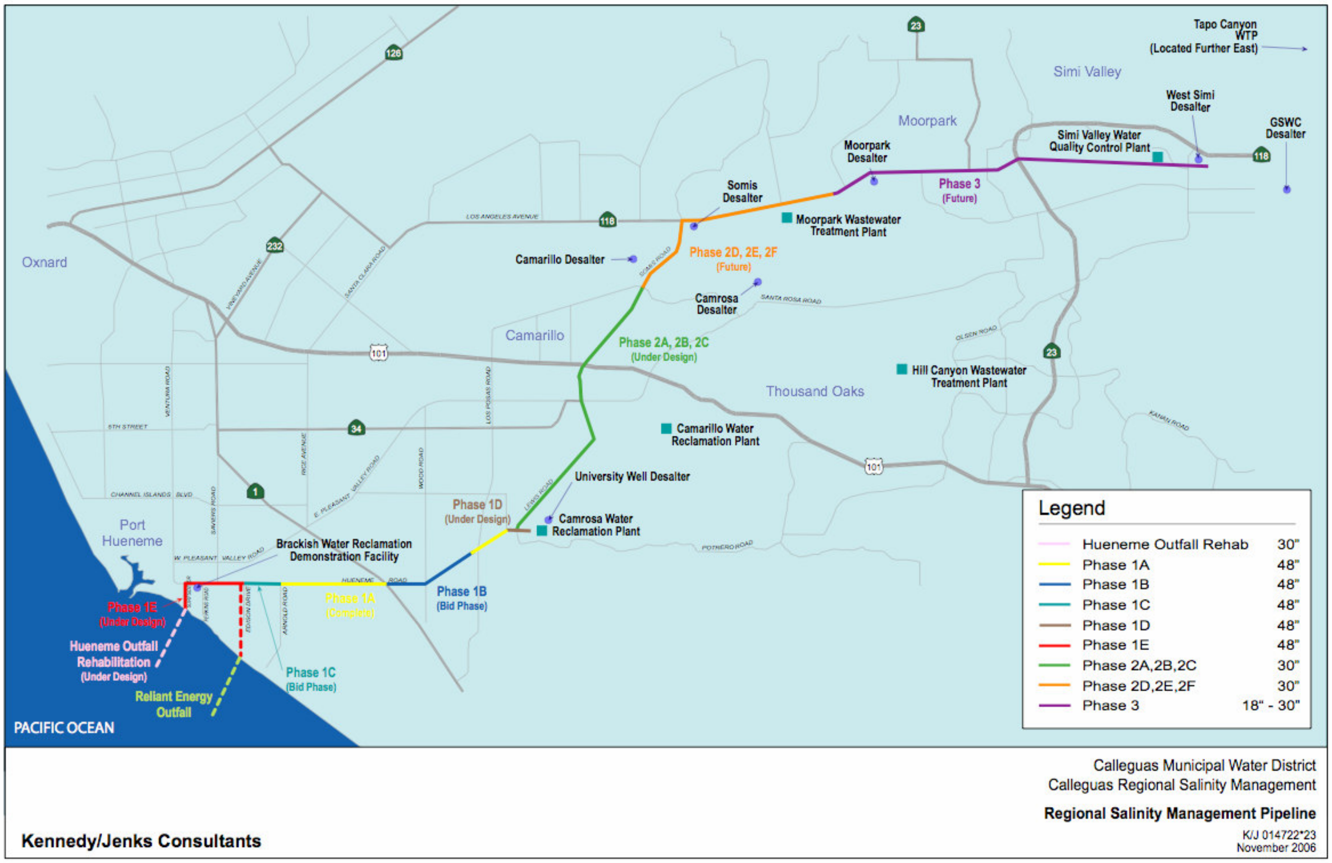

Figure 25. Proposed Phases and Location of RSMC

9.1.2.1. Status and Schedule

Construction of the $107 million project began in 2003 and is expected to continue through 2018. CMWD certified a program environmental impact report in September 2002. Design specifications for the first segment of Phase 1 have been approved, and construction began in February 2003. Phase 2 and 3 components will be designed and constructed incrementally in coordination with POTWs and other potential dischargers. The availability of the line for use will depend on the issuance of a NPDES permit for the discharge point.

Table 41. Schedule for RSMC

Element	Schedule [a]
Phase 1 Pipeline and Outfall	2010
Phase 2 Pipeline	2014
Phase 3 Pipeline	2018

a. The schedule assumes that required regulatory elements, such as the outfall permit, are completed within the timeframe that construction is expected to be completed. If the regulatory elements do not proceed as scheduled, the schedule will be delayed.

9.1.2.2. Salts Balance Contribution

Based on the implementation elements described below, the RSMC will provide transport of approximately 50,000 lbs/day of chloride, over 400,000 lbs/day of TDS and over 180,000 lbs/day of sulfate.

9.1.3. Water Conservation

9.1.3.1. Description

To contribute to reducing the import of salts into the CCW, new programs and enhancements to existing programs for water conservation in both urban landscape and agricultural irrigation will be developed. The programs will result in reductions in imported water use and groundwater pumping from deep aquifers to reduce salt loading to the watershed.

Water conservation programs will target outdoor water applications through the creation and enforcement of water conservation ordinances and other best management practices. Water conservation will be utilized as one of the tools for meeting the salt balance in the watersheds and the degree of implementation of water conservation measures will be dependent on the other actions conducted in the subwatershed.

For the purposes of estimating the contribution of water conservation to the salt balance, a 2% reduction in outdoor water use was used as an approximation of the results of implementing best management practices for conservation in the CCW.

Implementation actions required in other TMDLs that have been adopted in the CCW will likely result in more significant water conservation requirements for irrigated agriculture. For the purposes of estimating the contribution of agricultural water conservation to the salt balance, a 5% reduction in irrigation water use was assumed. Additional water conservation may be necessary to achieve the salt balance and/or water quality objectives in the CCW if site-specific objectives are not adopted.

9.1.3.2. Status and Schedule

Water conservation programs already exist throughout the watershed. This implementation action will expand on the existing programs to provide additional outreach and possibly incentives and/or disincentives to increase water conservation. Implementation of additional water conservation actions will begin on the effective date of the TMDL and the best management practices are expected to be implemented within 3 years of the effective date of the TMDL.

9.1.3.3. Salts Balance Contribution

Implementing the best management practices outlined above reduces the import of salts into the watershed by the amounts shown in Table 42.

Table 42. Contribution of Water Conservation to Salt Balance

Subwatershed	Imported Water Volume Reduced (mgd)	Chloride (lb/day)	TDS (lb/day)	Sulfate (lb/day)
Conejo	0.6	310	1600	430
Camarillo	0.1	90	540	90
Simi	1.3	3700	3700	960
Las Posas	1.3	600	5700	1880
Pleasant Valley	0.5	210	3200	740
Total	3.8	4900	14700	4100

9.1.4. Water Softeners

9.1.4.1. Description

Although the majority of salts are brought into the watershed through the imported water supply and deep groundwater pumping, salts are also added during human use of the water. Many chemicals, cleaning products, and fertilizers can add salts to water, but the additions are fairly minor. Water softeners can add significant amounts of salts to the water during household use. As discussed in Section 4, Source Assessment, water softeners are estimated to contribute 15% of the chloride load and 5% of the TDS load in POTW discharges. Overall, water softeners are estimated to account for about 5% of the chloride load and 1% of the TDS load to the watershed. In the CCW, the water supply is generally of pretty high quality and water softeners are not in universal use throughout the watershed. However, in some areas where the water supply is of poorer quality, water softener contributions may be more significant.

The ability of the local agencies to control water softeners is limited by legislative actions that protect residents right to use water softeners. In the mid-1990s, the California Appeals Courts made several significant rulings regarding the ability of local agencies to enact ordinances to ban or restrict residential SRWS. The Courts ruled that restrictive ordinances prohibiting residential use of SRWS were invalid as the State had statutes in place that regulated SRWS performance. [2]

In 1999, Senate Bill 1006 amended the California Health and Safety Code (Section 116786) to establish conditions under which a local agency could regulate the installation of new SRWS. Local agencies could limit the availability or prohibit the installation of residential SRWS only if

- The local agency is not in compliance with either its NPDES permit or its water reclamation requirements, and
- Prohibiting the installation of SRWS is the <u>only means of achieving compliance.</u>

In 2003, Section 116786 was amended by Assembly Bill 334 eliminate the requirements above and replace them with the following requirements:

1. Limiting the availability, or prohibiting the installation, of the appliances is a <u>necessary</u>

[2] Sanitation Districts of Los Angeles County. Santa Clarita Valley Joint Sewerage System Source Report. October 2002.

means of achieving compliance with waste discharge requirements issued by a California regional water quality control board. In determining a necessary means of achieving compliance, the local agency shall assess both of the following:

   a. The technological and economic feasibility of alternatives to the ordinance.

   b. The potential saline discharge reduction of the ordinance.

2. The local agency has adopted and is enforcing regulatory requirements that limit the volumes and concentrations of saline discharges from nonresidential sources in the community waste disposal system to the extent technologically and economically feasible.

3. Local agency findings shall be substantiated by an independent study of discharges from all sources of salinity, including, but not limited to, residential water softening or conditioning appliances, residential consumptive use, industrial and commercial discharges, and seawater or brackish water infiltration and inflow into the sewer collection system. The study shall quantify, to the greatest extent feasible, the total discharge from each source of salinity and identify remedial actions taken to reduce the discharge of salinity into the community sewer system from each source, to the extent technologically and economically feasible, to bring the local agency into compliance with waste discharge requirements, water reclamation requirements, or a master reclamation permit, prior to limiting or prohibiting the use of residential water softening or conditioning appliances.

4. Any ordinance adopted pursuant to this section shall be prospective in nature and may not require the removal of residential water softening or conditioning appliances that are installed before the effective date of the ordinance.

Demonstration of this link would be difficult to demonstrate for all of the POTWs except for Camarillo. For all the POTWs in the watershed except Camarillo and Camrosa, chloride effluent limitations are only exceeded when water supply concentrations increase. As a result, demonstrating that prohibiting water softeners is a necessary means for achieving compliance would be a difficult link to make. As a result, banning water softeners in most areas of the CCW watershed may not be feasible.

Consequently, the focus of the implementation efforts for water softeners in the CCW will be to improve the quality of the supply water in Camarillo and publicize this information to encourage residents to get rid of self-regenerating water softeners. Additionally, opportunities to work with water softener companies to provide incentives for residents to switch from self-regenerating water softeners to portable exchange softeners that are recharged by softener companies will be investigated. Finally, opportunities to pursue additional legislative remedies will be explored. The goal of the water softener programs will be to reduce the contribution from water softeners by 10% in the CCW.

9.1.4.2. *Status and Schedule*

The water softener programs will be coordinated with existing public outreach and education programs in the watershed and will be linked to the brine line installation for programs coordinated with water softener suppliers. Public outreach will be the first step in the program followed by incentives and/or disincentives as necessary to achieve the goals of the implementation plan. Additionally more information on the locations of water softeners will need to be gathered to allow targeted efforts to remove water softeners. Initial implementation of the program to identify appropriate mechanisms for reducing water softener loadings will begin after the effective date of the TMDL. The minimum goals listed above are expected to be achieved within 10 years of the effective date of the TMDL.

If any ordinances to ban prospective installation of water softeners are necessary to achieve the goals of the implementation plan, additional time may be necessary to develop the information required to implement the ordinance.

9.1.4.3. *Salts Balance Contribution*

Meeting the goal of reducing the contribution of salts from self-regenerative water softeners will reduce the inputs of salts to the water by the amounts shown in Table 43.

Table 43. Contribution of Water Softener Reductions to Salt Balance

Subwatershed	Chloride (lb/day)	TDS (lb/day)
Conejo	73	115
Camarillo	129	230
Simi	132	307
Las Posas	40	61
Pleasant Valley	0	0
Total	373	713

9.1.5. Best Management Practices for Irrigated Agriculture

Under the Conditional Waiver of Discharges from Irrigated Lands and as a result of other adopted TMDLs in the CCW, best management practices (BMPs) are required that will also reduce the discharge of salts to receiving waters in the CCW. BMP implementation under these programs will also consider the reductions necessary to meet the load allocations for agriculture and the salt balance.

Examples of BMPs that will likely be installed in the CCW that will also reduce discharges of salts to the surface waters include:

- Water conservation
- Fertilizer and pesticide application practices
- Filter strips or other mechanisms that prevent irrigation runoff from reaching the stream system

Additionally, agricultural users have suggested that installation of individual wellhead desalters and or smaller, agricultural desalters might be economically feasible and desireable once the brine line is available. As a result, agricultural desalters may be installed throughout the watershed as a mechanism for achieving the salt balance, allocations, and water quality objectives.

9.2. IMPLEMENTATION ELEMENTS-SOUTHERN REACHES OF THE CCW

9.2.1.1. Description

The Renewable Water Resource Management Program (RWRMP) for the Southern Reaches of the CCW is an integrated set of facilities to reduce reliance on imported water supplies while improving water quality through the managed transport of salts out of the watershed. There are three major elements to the project: water resource reclamation, salts management, and adaptive management. While either water resource reclamation or salts management could be optimized without reference to the other, this project seeks to increase water resources while moving toward a net daily salts balance.

The overall goal of the project is to provide an adaptive management plan and the facilities to improve the reliability of local water resources and reduce dependence on imported water. Objectives of the project include:

- Recycle and reuse wastewater to the greatest extent possible;
- Reclaim abandoned unconfined groundwater resources;
- Provide a reliable, high-quality, water supply to support the existing environmental value of the riparian corridor;
- Increase agricultural water quality options to promote agricultural sustainability;
- Manage recycled and reclamation projects in a manner that contributes to the salt balance;
- Reduce the salt load to surface waters; and
- Achieve a salts balance within each subwatershed.

The RWRMP will be implemented as a four-phase project with information from each phase being used to inform the implementation of the next phase. The project will be adjusted as necessary based on information gained during each implementation phase.

Phase 1 of the RWRMP includes elements to reduce the amount of salts imported into the watershed and transport salts downgradient through the Conejo Creek/Calleguas Creek reaches. Phase 1 includes the following elements:

1. Expansion of the recycled water transmission and distribution system to allow the transport and use of more recycled water and to facilitate moving salts downgradient.
2. Pumping and treatment of unconfined aquifers in the Pleasant Valley Basin near Channel Islands University (CSUCI) that currently contain water with high salts concentrations. The treated water will be used to supplement Camrosa's potable water deliveries and will therefore reduce the amount of salts imported into the watershed. The higher pumping rates will remove the poorer quality water and allow recharge by higher quality surface

water into the basin. Additionally, the brine from the treatment process will be discharged to the RSMC and moved out of the watershed to the ocean.

3. Development of existing and new water blending facilities to allow the provision of water at the quality requested by agriculture to protect the beneficial use.
4. Relocation of the wastewater discharge point for the Camarillo WRP and Camrosa WRF, to downstream of Potrero Road Bridge on the Calleguas Creek. The combined wastewaters would be discharged to a point downstream of the Potrero Road Bridge when there is surplus wastewater in the water recycling system. This discharge location would also be used when the CMWD brine disposal system may be unable to receive such waters because of temporary operational interruptions. The relocation facilitates movement of salts downgradient and out of the watershed by discharging them to a reach that is not impaired by salts and directly discharges to the lagoon.
5. Install pumping facilities and pipelines to connect Camarillo WRP to the Camrosa recycled water system and discontinue direct discharge to the stream by Camarillo WRP. This facility will reduce the amount of salts imported into the watershed through increased use of reclaimed water.
6. Water conservation and water softener reduction elements will also be implemented during this phase as discussed under general activities above.

Phase 2 includes the following elements:

1. Treatment of water produced from the Santa Rosa Basin to reduce the salt concentrations. The treated water will be used to supplement Camrosa's potable water deliveries and will therefore reduce the amount of salts imported into the watershed. Additionally, the brine from the treatment process will be discharged to the RSMC and moved out of the watershed to the ocean.
2. Conduct studies to identify the implementation alternative that will be used to address the upper reaches of the Conejo subwatershed. Currently, several options are being considered which include:
    1. Terminating the Hill Canyon WWTP effluent discharge to the surface waters.
    2. Diverting the flows from the North and South Forks of the Arroyo Conejo to the brine line at a point upstream of the Hill Canyon WWTP.
    3. Expanding recycled water systems.
    4. Pumping unconfined groundwater and either discharging it to the brine line or treating it to supplement the water supply and discharging the brine to the brine line.

During Phase 2, any necessary feasibility studies, investigations, and data gathering will occur to select the option(s) for maintaining a salt balance and meeting water quality objectives and allow implementation of the selected option(s) under Phase 3. Based on the results of Phase 1, additional options may be identified and considered during this phase.

Phase 3 of the RWRMP will consist of implementation of the selected option(s) from Phase 2. Should flow diversions be implemented, required minimum flows will be maintained in the impacted reaches. During Phase 4, additional activities will be explored and implemented based on the results of Phases 1, 2, and 3 and any special studies that are conducted. If additional activities are needed to meet the salt balance and achieve water quality objectives, the following items will be considered:

1. Construction of shallow dewatering wells in the upper and/or lower watershed where salts may accumulate. The wells will be operated to 1) Blend with other waters for irrigation uses, 2) discharged to the RSMC, or 3) treated for use and the brine stream discharged to the RSMC. Disposal of these waters on an as needed basis would prevent continued salt accumulation and excess salt loading to the surface water system.
2. Treated water discharges to surface waters to provide water for habitat and/or dilution.

9.2.1.2. Status and Schedule

The programmatic EIR for the RWRMP has been certified. The implementation of the majority of the projects for the RWRMP is linked to the brine line schedule as many of the implementation actions require the brine line in order to be completed. The approximate schedule shown in the following table is based on the brine line schedule shown in Table 41. The ultimate schedule for completion of Phases 1 through 4 will depend on the construction schedule for the brine line. The dates shown are approximate and are the number of years after the effective date of the TMDL.

Table 44. Schedule for RWRMP

Element	Schedule
Phase 1	3 years from TMDL effective date
Phase 2	6 years from TMDL effective date
Phase 3	10 years from TMDL effective date
Phase 4	15 years from TMDL effective date

9.2.1.3. Salts Balance Contribution

Implementation of the RWRMP will reduce the mass of salts imported into the watershed, transport salts out of the watershed, and reduce the amount of salts added to the water. Table 45 summarizes the contribution to the salt balance that results from implementation of the RWRMP. The values represent the total mass of salts that are no longer stranded in the watershed as a result of implementing the RWRMP.

Table 45. Contribution of RWRMP to Salt Balance

Phase	Imported Water Volume (mgd)	Chloride (lb/day)	TDS (lb/day)	Sulfate (lb/day)
Phase 1	12	9,500	69,400	17,200
Phase 2	1.5	8,000	50,000	17,400
Phase 3	8.6	1,600	99,700	27,400
Phase 4 [a]	1.5	8,400	50,100	18,600
Total	24	27,600	269,200	80,600

a. The majority of the loading reduction shown for Phase 4 occurs in the Pleasant Valley subwatershed just upstream of Potrero Road and downstream of sensitive beneficial uses. The actions during Phases 1 to 3 focus on bringing a salt balance to the

Conejo and Camarillo subwatersheds where beneficial uses occur. Phase 4 is then designed to provide any additional salt exports from shallow groundwater wells necessary to achieve a balance in the southern reaches.

9.3. IMPLEMENTATION ELEMENTS-NORTHERN REACHES OF THE CALLEGUAS CREEK WATERSHED

9.3.1.1. Description

The implementation plan for the Northern Reaches of the Calleguas Creek watershed includes many of the same elements as the Southern Reaches RWRMP. The Northern Reach Renewable Water Management Plan (NRRWMP) will reduce the amount of salts imported into the watershed, move salts downgradient and out of the watershed, provide for protection of beneficial uses and reduce the amount of salt added to the water.

The northern reaches of the watershed differ from the southern reaches in that during dry weather, all of the surface flow recharges the unconfined portion of the South Las Posas groundwater basin. The result of the continuous recharge has been a substantial increase in the water level in this basin, reduced water quality as a result of the increased water levels, and a gradual migration of the poorer quality water to other basins. The focus of the NRRWMP is to lower the water levels in the South Las Posas basin to improve the water quality in the basin and reduce the potential impact on other basins. As a result of the constant surface water recharge of over 10 mgd per day, a significant amount of groundwater pumping and treatment is necessary to reduce groundwater levels in the South Las Posas basin. Implementation of the plan will involve a number of groundwater pumping projects in different parts of the basin. The plan will be composed of four phases as described below.

Phase 1 of the NRRWMP consists of the following elements:

1. Blending of imported State Project Water with poorer quality groundwater from the unconfined South Las Posas Basin aquifer to obtain water of sufficient quality for agricultural use. Currently, agricultural uses in the South Las Posas receive a blend of unconfined South Las Posas basin water and deep, confined Las Posas basin groundwater. The project will replace the deep, confined Las Posas basin groundwater with imported SWP water for blending with the unconfined groundwater. Reducing pumping demands in the confined basins will help reduce overdraft and maintain a high quality water supply. Additionally, pumping rates from the unconfined groundwater areas will be increased from current levels to reduce the water level and provide more water of sufficient quality for agricultural use. Additional pumping will help remove the poorer quality water and allow recharge by higher quality surface water into the basin during wet weather. The project will also serve to improve the quality of the water in the shallow portions of the South Las Posas Basin and protect the beneficial use by ensuring adequate water quality is available for irrigation of sensitive crops.
2. Water conservation and water softener reduction elements will also be implemented during this phase as discussed under general activities above.

Phase 2 of the NRRWMP consists of the following elements:

1. Construction of a groundwater desalter facility near Moorpark to pump and treat poor quality groundwater in the South Las Posas basin. The desalting facility will treat water

from newly installed wells in the unconfined portion of the South Las Posas basin. These wells will supplement the additional pumping added in Phase 1 to facilitate the lowering of groundwater levels and the improvement of water quality in the unconfined basin. The pumping and treatment of poor quality groundwater will supplement imported water supplies, remove the poorer quality water, and allow higher quality storm water flows to recharge the groundwater basin and improve the quality in the basin. Brine from the treatment will be transported out of the watershed through the RSMC.

2. Construction of a groundwater desalter facility in Camarillo near the intersection of Lewis and Upland Road. Groundwater in this area has been slowly degrading as a result of influences from the South Las Posas basin upgradient. The pumping and treatment of poor quality groundwater will supplement imported water supplies for the City of Camarillo and transport salts out of the watershed through the brine line. During phase 2, groundwater from two existing wells will be treated. Brine from the treatment will be transported out of the watershed through the RSMC.

During Phase 3 of the NRRWMP, the following activities will be conducted:

- Installation of an additional well that will be treated by the Camarillo desalter. The additional well will double the volume of water produced by the desalter.
- Management of the existing Simi Basin dewatering wells would be altered to either 1) blend with other waters for irrigation uses downstream, 2) discharge directly to the RSMC brine disposal system, or 3) be treated to supplement the water supply for the Northern Reaches and the brine stream discharged to the RSMC. Inclusion of options 2 or 3 requires the extension of the RSMC to Simi Valley which will be costly and will not occur until 2018. Additional pumping of these wells may be implemented to provide a larger local water supply or to discharge a larger mass of salts from the region.

During Phase 4, additional activities will be explored and implemented based on the results of Phases 1, 2, and 3. If additional activities are needed to meet the salt balance and achieve water quality objectives, the following items will be considered:

- Additional phases of the Moorpark desalter to treat more unconfined groundwater.
- Building another desalter in the Somis area to treat unconfined groundwater.
- Pumping unconfined groundwater and discharging directly to the brine line (could be implemented during any phase of the project and as a control measure during periods of high imported water salts concentrations).
- Construction of smaller/individual desalters by agriculture to treat local groundwater supplies for irrigation.
- Additional production and management of reclaimed water or unconfined groundwater.
- Treated water discharges to surface waters.

9.3.1.2. Status and Schedule

The implementation of the majority of the projects for the NRRWMP is linked to the brine line schedule as many of the implementation actions require the brine line in order to be completed.

The approximate schedule shown in the following table is based on the brine line schedule shown in Table 41. The ultimate schedule for completion of Phases 1 through 4 will depend on the construction schedule for the brine line. The dates shown are approximate and are the number of years after the effective date of the TMDL.

Table 46. Schedule for NRRWMP

Element	Schedule
Phase 1	3 years from TMDL effective date
Phase 2	7 years from TMDL effective date
Phase 3	10 years from TMDL effective date
Phase 4	15 years from TMDL effective date

9.3.1.3. Salts Balance Contribution

Implementation of the NRRWMP will reduce the mass of salts imported into the watershed, transport salts out of the watershed, and reduce the amount of salts added to the water.

Table 47 summarizes the contribution to the salt balance that results from implementation of the NRRWMP. The values represent the total mass of salts that are no longer stranded in the watershed as a result of implementing the NRRWMP.

Table 47. Contribution of NRRWMP to Salt Balance

Phase	Imported Water Volume (mgd)	Chloride (lb/day)	TDS (lb/day)	Sulfate (lb/day)
Phase 1	2.6	1,400	9,700	2,800
Phase 2 [a]	3.4	6,400	60,400	26,300
Phase 3 [a]	8.4	16,100	158,600	73,600
Phase 4	6.6	10,700	104,100	45,100
Total	21	34,600	332,700	147,900

a Imported water volume and loads assumes that the pumped and treated groundwater produced by the Camarillo desalter will offset imported water supplies in the Las Posas subwatershed (which includes portions of Camarillo). If the water is used to offset imported water supplies in the Southern Reaches, the values in this table would adjust, but the overall watershed salt balance would still remain the same.

9.4. SUMMARY OF IMPLEMENTATION ELEMENTS

Table 48 summarizes all of the implementation actions in the watershed, the estimated completion date, and the contribution of the activity to the mass balance. The sum of the mass balance contributions is compared to the current amount of stranded salts to demonstrate that the actions are predicted to result in a mass balance in the watershed.

Table 48. Summary of Implementation Elements

Action	Responsible Agency(ies)	Chloride Mass Balance Contribution (lb/day)	TDS Mass Balance Contribution (lb/day)	Sulfate Mass Balance Contribution (lb/day)
RWRMP Phase 1 [b]	Camrosa WD, CamSan	9,500	69,400	17,200
RWRMP Phase 2	Camrosa WD, TO	8,000	50,000	17,400
RWRMP Phase 3	Camrosa WD, TO	1,600	99,700	27,400
RWRMP Phase 4	TBD	8,400	50,100	18,600
NRRWMP Phase 1 [b]	Calleguas MWD, Simi Valley, Moorpark	1,400	9,700	2,800
NRRWMP Phase 2	Calleguas MWD, VCWW, Camarillo	6,400	60,400	26,300
NRRWMP Phase 3	Camarillo, Simi Valley	16,100	158,600	73,600
NRRWMP Phase 4	TBD	10,700	104,100	45,100
Total		**62,200**	**601,900**	**228,500**
Total Needed based on Current Inputs [a]		**53,400**	**588,700**	**227,400**

a. The amount of salts stranded in the watershed changes through implementation and the ultimate amount that needs to be balanced will depend on the implementation actions and the quality of the water being imported into the watershed.
b. Contributions from water conservation and water softener implementation actions are included in the Phase 1 estimates.

The following figure summarizes the locations of the potential desalters that may be part of the implementation plan.

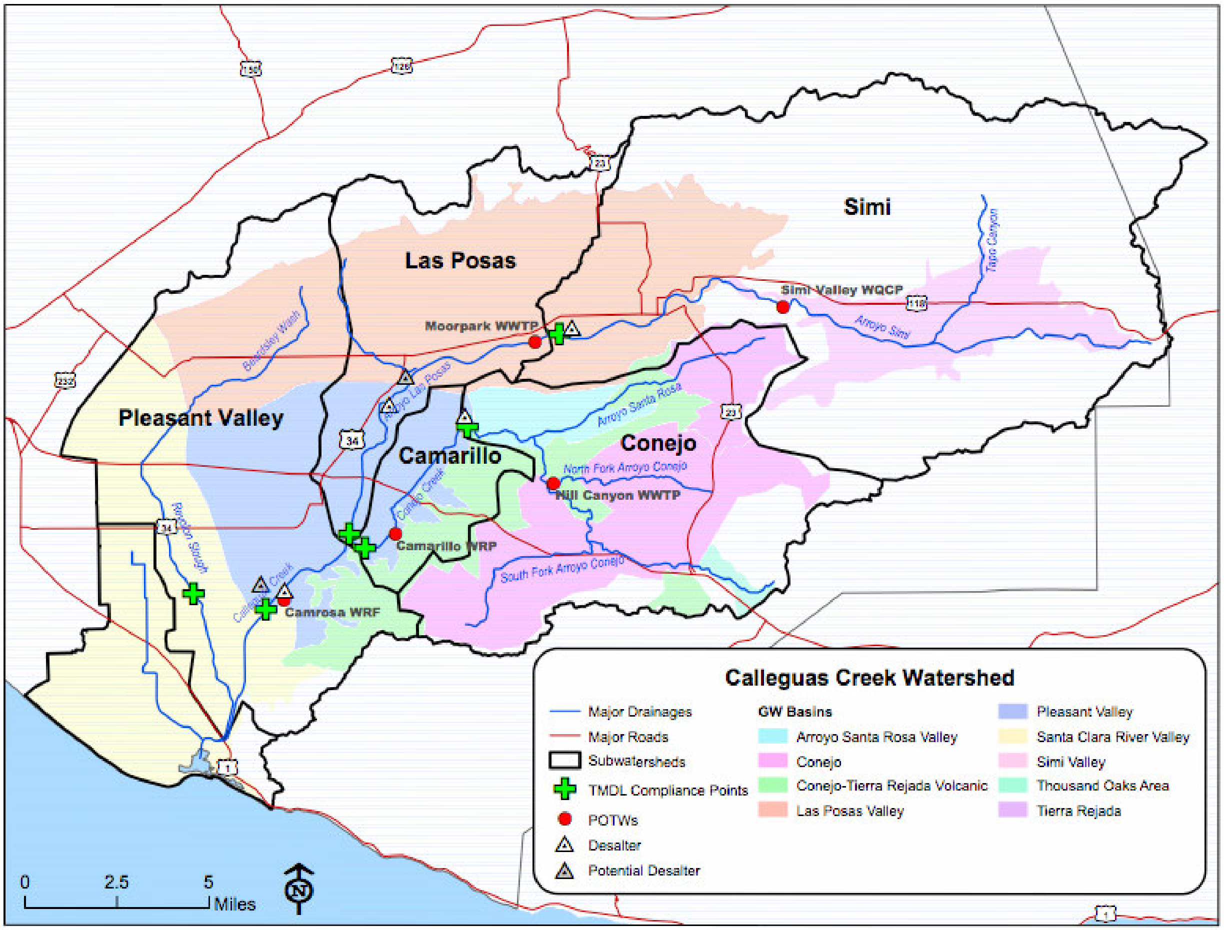

Figure 26. Potential Desalter Locations in the CCW

Table 49. Summary of Implementation Schedule

Action	Schedule for Completion
RMSC Phase 1	1 year
RMSC Phase 2	1 year
RMSC Phase 3	5 years
Water Conservation	3 years
Water Softeners	10 years
RWRMP Phase 1	3 years
RWRMP Phase 2	6 years
RWRMP Phase 3	10 years
RWRMP Phase 4	15 years
NRRWMP Phase 1	3 years
NRRWMP Phase 2	7 years
NRRWMP Phase 3	10 years
NRRWMP Phase 4	15 years
Completion of Salt Balance	15 years

The schedule presented above is based on the best information available to the responsible agencies for the length of time that will be needed to complete the actions. However, some of the implementation depends on actions that must be conducted by agencies outside of the watershed (i.e. permitting actions by the RWQCB). If actions are delayed by outside parties, then the schedule may need to be revised.

The schedule was developed based primarily on the length of time necessary to construct the brine line. Most of the actions in the implementation plan are dependent on the brine line and cannot be conducted prior to the brine line reaching the implementation area. Each phase of the brine line involves seven steps. The following figure represents the amount of time that is required to conduct each step.

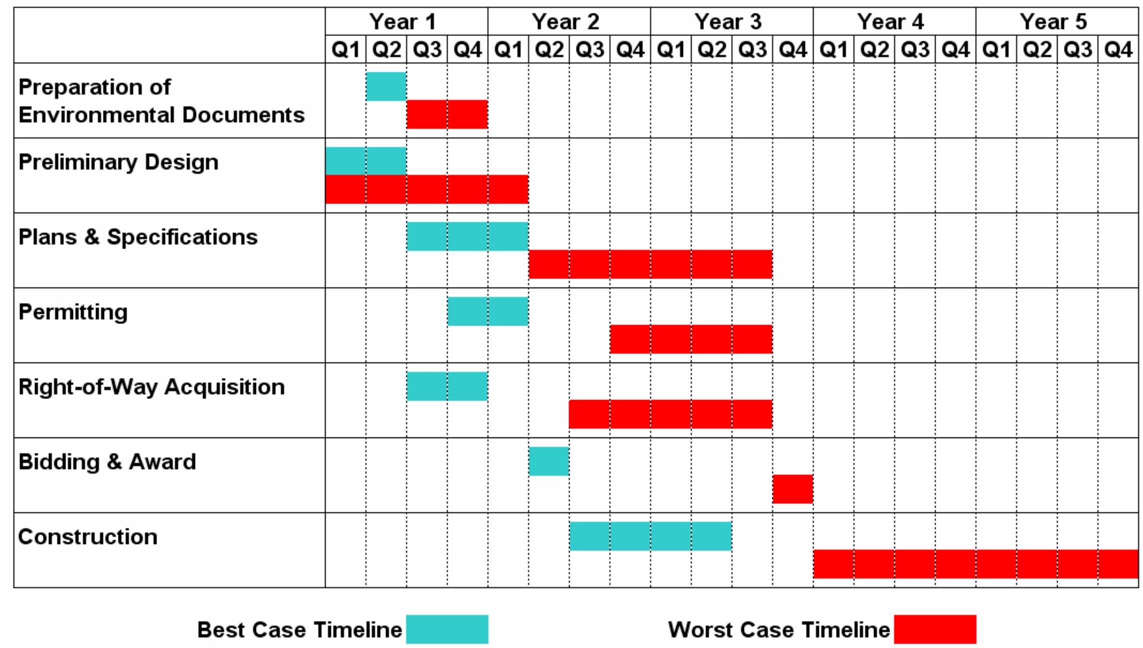

Figure 27. Brine LIne Construction Timeline for Each Phase (10-15 Phases required for complete Brine Line Construction)

The following describes the basis for the timeline and the factors that can contribute to longer time frames for the project for each of the steps shown in the figure.

9.4.1. Preparation of Environmental Documents

Preparation of environmental documents typically takes place in parallel with preliminary design, which is described below. Preliminary design cannot be completed until the environmental documents have been prepared.

A Programmatic Environmental Impact Report/Environmental Assessment (EIR/EA) was prepared for the Salinity Management Pipeline in 2002. Future phases are covered by that document, but must be evaluated for impacts to cultural and biological resources before a pipeline alignment is selected. If preliminary design identifies a preferred alignment not described in the 2002 EIR/EA, then a supplemental EIR/EA needs to be prepared.

This process can take from a month for evaluation of cultural and biological impacts to six months for preparation and circulation of an EIR/EA.

9.4.2. Preliminary Design

Preliminary design includes:

- Determination of the best pipeline alignment
- Selection of pipe materials
- Determination of required permits and permit requirements
- Identification of property to be acquired

- Geotechnical investigation and reporting
- Identification of utilities to be affected by the project
- Description of traffic constraints

This work takes from six to fifteen months, depending on the complexity of the issues involved.

9.4.3. Preparation of Plans & Specifications

Typical pipeline plans for a project of this type include 40 to 70 sheets, which include:

- Overview sheets & general notes
- Survey information
- Pipeline plan and profiles, including locations of existing utilities
- Civil and mechanical details
- Traffic control plans

Typical specifications for a project of this type are 500 to 1,000 pages long. They provide the detailed information necessary for a contractor to build the project in compliance with defined requirements for quality, durability, regulatory restrictions, permit constraints, right-of-way agreements, public safety, documentation, and schedule.

The plans and specifications are very detailed. They are typically submitted by the design engineer to Calleguas staff for review at the 50%, 90%, and 100% completion stages. They must be prepared in coordination with permitting activities because they must incorporate permit requirements, and some permitting agencies want the opportunity to review and approve the plans.

Depending on the complexity of the project, this phase can take from nine to eighteen months.

9.4.4. Permitting

The types of permits which are typically required for pipeline projects are:

- Road encroachment permits from the county, city, and/or Caltrans
- Coverage under SWRCB Construction Stormwater General Permit
- Coverage under LARWQCB General Permit for Trench Dewatering
- Coverage under LARWQCB General Permit for Hydrostatic Testing of Pipelines
- Local business license

Other permits which are often needed are:

- California Occupational Safety and Health Administration Underground Classification for Tunnels
- Encroachment permit from the Ventura County Watershed Protection District
- California Department of Fish and Game Streambed Alteration Agreement

- Coverage under U.S. Army Corps of Engineers Section 404 Nationwide Permit (stream and wetland restoration activities) and 33 (temporary construction, access, and dewatering)
- LARWQCB NPDES Section 401 Water Quality Certification Permit

The permitting process must be done in parallel with preparation of plans and specifications. Factors which can slow the process are the complexity of the project, the turnaround time of the permitting agencies, unanticipated requirements imposed by the permitting agencies, and the number of re-submittals which are required. The process typically takes from six to twelve months.

9.4.5. Right-of-Way Acquisition

Sometimes it is not possible to construct the entire pipeline reach in roadways. In that case, pipeline easements must be obtained from private owners. Permanent easements must be obtained for long term operation and maintenance of the pipeline, and temporary construction easements must be obtained for the activities necessary to install the pipeline. The steps associated with acquisition of these easements are formal and inflexible, because if the property negotiations are not successful, the documentation must be submitted to the courts for condemnation. The steps which must be taken in all cases are:

- Survey and preparation of maps and legal descriptions
- Preparation of the easement deed and right-of-way agreement
- Property appraisal and preparation of appraisal paperwork
- Written offer of just compensation to the property owner
- Informal negotiation with the property owner

If the negotiations are not successful, the additional steps which must be taken are:

- Calleguas Board Resolution of Necessity and public hearing
- Initiation of condemnation through the courts

This process takes from six to fifteen months.

9.4.6. Bidding & Award

As a public agency, Calleguas has a formal process for bidding and award of projects. It includes:

- Calleguas Board call for bids
- Advertisement of project
- Pre-Bid meeting and job walk with potential bidders
- Bid Opening
- Review of bids and contractor experience by engineer
- Calleguas Board awards the contract

- Successful bidder submits bonding, insurance, and other contract paperwork
- Calleguas issues notice to proceed

This process takes two to three months to complete.

9.4.7. Construction

The construction process includes the following major elements:

- Potholing to determine location of existing utilities (one to two months)
- Preparation and approval of pipe fabrication drawings (one to three months)
- Pipe fabrication (two to six months)
- Pipe installation, including traffic control, excavation, support of existing utilities, dewatering, pipe laying and joining, backfill, and paving (six to eighteen months)
- Tunneling under highways or streams, if needed (two to four months)
- Site restoration, including street pavement overlay, final striping, and restoration of improvements in easement areas (one month)

Pipe fabrication, pipe installation, and tunneling activities can overlap somewhat, resulting in an overall construction duration of twelve to twenty-four months. Some of the reasons pipe installation can be delayed are:

- discovery of conflicting utilities not identified during design due to poor records by the owner of the utility or because the utility is owned by a private individual;
- high groundwater;
- non-cohesive soils;
- unanticipated changes to permit requirements during construction, typically traffic control changes;
- hazardous materials;
- delays in materials fabrication;
- inexperienced or uncooperative contractor staff;
- equipment breakdown, especially if it occurs in a tunnel;
- unusually wet weather; and
- discovery of biological or cultural resources during construction.

As shown in the figure and discussed above, each phase of the brine line construction takes between three and a half and five years to complete. Calleguas MWD typically divides pipeline construction projects into reaches that cost between $5 million and $15 million. This allows medium-sized contractors to bid the project, as they would be unable to obtain bonding for larger projects. In addition, if a project has problems with contractor claims, the extent of the problem is somewhat contained by the smaller scope of the project. Using this approach, the construction of the brine line is expected to require between 10 and 15 projects of this size. Based on staffing availability at the Calleguas MWD, up to about three projects can be managed at a time. Therefore, under the best-case scenario where three projects were constantly under way, only 10 projects were needed, and the best case schedule was achieved the project would take about 11.5 years to complete. Under worst-case conditions, the project could take 25 years to complete. Work on the project began in 2002 so under best-case conditions, the project could not be completed before 2014. To allow for some disruptions to the best-case schedule, an additional four years (approximately the amount of extra time needed to address 15 project segments instead of 10 using the best-case schedule) was added to the schedule for the brine line completion and installation of all projects that will discharge to the brine line.

9.5. EVALUATION OF IMPLEMENTATION PLAN AND ALLOCATIONS

The allocations provided in Section 6 are calculated using the numeric targets for the TMDL. As a result, these allocations will result in achievement of the water quality objectives in the receiving water. The CCMS model was run to verify that the allocations will result in compliance with the water quality objectives. The percent reductions in direct discharges to the stream from current average loads were put into the model to estimate the results of meeting the TMDL allocations. Additionally, percent reductions in the amount of loading reduced through achieving the salt balance were estimated and incorporated into the percent reductions modeled. Table 50 shows the percent reductions used for the model estimates. The current "base case" model percent compliance with the TMDL is shown in Table 51 and the estimated water quality that will result after achievement of allocations and the salt balance is shown in Table 52.

Table 50. Estimated Percent Reductions Resulting from Meeting Allocations and Salt Balance

Source	Subwatershed	Chloride	TDS	Sulfate	Boron
Agriculture	Simi	64%	80%	44%	9%
Agriculture	Las Posas	39%	48%	38%	0%
Agriculture	Conejo	57%	76%	81%	0%
Agriculture	Camarillo	60%	77%	80%	0%
Agriculture	PV	38%	41%	59%	17%
Agriculture	Revolon	39%	60%	82%	50%
Exfiltrating GW	Simi	10%	82%	80%	29%
Exfiltrating GW	Conejo	37%	44%	51%	0%
Exfiltrating GW	PV	17%	11%	53%	0%
Urban	Simi	60%	80%	34%	14%
Urban	Las Posas	47%	52%	32%	0%
Urban	Conejo	39%	66%	69%	0%
Urban	Camarillo	43%	66%	67%	0%
Urban	PV	40%	60%	65%	20%
Urban	Revolon	56%	56%	80%	50%
Simi Valley WWTP	Simi	32%	22%	35%	0%
Moorpark WRP	Las Posas	10%	0%	15%	0%
Hill Canyon WRP	Conejo	21%	0%	0%	0%
Camarillo WRP	Conejo	32%	18%	28%	0%
Pumped GW	Simi	100%	100%	100%	100%

Table 51. Percent Compliance with Objectives for Base Case Model Scenario Results

Subwatershed	Chloride	TDS	Sulfate	Boron
Simi	26%	10%	8%	100%
Conejo	56%	96%	98%	100%
Camarillo	15%	12%	7%	100%
Pleasant Valley (Revolon)	15%	11%	0%	8%

Table 52. Percent Compliance with Objectives Using Percent Reductions Necessary to Meet Allocations

Subwatershed	Chloride	TDS	Sulfate	Boron
Simi	98.74%	97.46%	98.24%	99.64%
Conejo	99.99%	99.99%	99.99%	99.99%
Camarillo	99.99%	99.99%	99.99%	99.99%
Pleasant Valley (Revolon)	99.99%	99.99%	99.99%	99.99%

The results from the model runs shows that the objectives will be achieved 97 to 100% of the time based on the estimated percent reductions required to meet the water quality objectives and salt balance.

The Salt Balance model was used to verify that the proposed implementation actions will result in the achievement of a salt balance in the receiving water. The identified implementation actions will result in a salt balance in the stream and are expected to result in compliance with the allocations.

9.6. WASTE LOAD ALLOCATION IMPLEMENTATION - NPDES PERMITTED DISCHARGERS

This section provides a discussion of the application of the final WLAs for permitted stormwater discharges, POTWs, and other NPDES dischargers. Final WLAs will be included in NPDES permits upon permit renewal and the permits shall require compliance in accordance with the compliance schedule provided in the Implementation Schedule section (Table 54), subject to the following condition:

> WLAs may be revised prior to the dates they are placed into permits and/or prior to the dates of final WLA achievement. Any revisions to these WLAs are to be based on the collection of additional information as described in the Special Studies and Monitoring Plan Section.

9.6.1. Urban Stormwater Dischargers

A group mass-based dry weather WLA has been developed for all permitted stormwater discharges, including municipal separate storm sewer systems (MS4s), Caltrans, general industrial, and construction stormwater permits. USEPA regulation allows allocations for NPDES-regulated stormwater discharges from multiple point sources to be expressed as a single categorical WLA when the data and information are insufficient to assign each source or outfall individual WLAs (40 CFR 130). The grouped allocation will apply to all NPDES-regulated stormwater discharges in the CCW. MS4 WLAs will be incorporated into the NPDES permit as receiving water limits measured in-stream at the base of each subwatershed.

9.6.2. POTWs

WLAs established for the POTWs in this TMDL will be implemented through NPDES permit limits. The proposed permit limits will be applied as end-of-pipe mass-based effluent limits for POTWs.

9.6.3. Other NPDES Dischargers

WLAs established for other NPDES permitted dischargers in this TMDL, including minor non-stormwater permittees (other than Camrosa WRP) and general non-stormwater permittees, will be implemented through NPDES permit limits. The proposed permit limits will be applied as end-of-pipe concentration-based effluent limits, and compliance determined through monitoring of final effluent discharge as defined in the NPDES permit.

9.7. LOAD ALLOCATION IMPLEMENTATION

9.7.1. Agriculture

Load allocations for salts will be implemented through Conditional Waiver of Discharges from Irrigated Lands (Conditional Waiver Program) adopted by the LARWQCB on November 3, 2005. Compliance with LAs will be measured in-stream at the base of the subwatersheds and will be achieved through the implementation of BMPs consistent with the Conditional Waiver Program.

The Conditional Waiver Program requires the development of an agricultural water quality management plan (AWQMP) to address pollutants that are exceeding receiving water quality objectives as a result of agricultural discharges. Therefore, implementation of the load allocations will be through the development of an agricultural management plan for salts. As stated in the Conditional Waiver Program, the AWQMP should include the following elements:

- Source identification
- Implementation of BMPs
- Assessment of BMP effectiveness
- Strategies to reduce discharges which are detrimental to water quality
- Monitoring strategies to assess the concentration and load of discharges
- Evaluation of compliance with objectives to determine if additional implementation actions are necessary
- Implementation of additional BMPs if determined to be necessary

The BMPs utilized for compliance with the Conditional Waiver Program and other adopted TMDLs in the CCW are likely to reduce discharges of salts from agricultural fields. Therefore, the implementation plan for the load allocations will include the coordination of BMPs being implemented under other required programs to ensure discharges of salts are considered in the implementation. Additionally, agricultural dischargers will participate in educational seminars on the implementation of BMPs as required under the Conditional Waiver Program. After implementation of these actions, compliance with the allocations and TMDL will be evaluated and the allocations reconsidered if necessary based on the special studies and monitoring plan section of the implementation plan.

Studies are currently being conducted to assess the extent of BMP implementation and provide information on the effectiveness of BMPs for agriculture. This information will be integrated into the AWQMP that will guide the implementation of agricultural BMPs in the CCW. The Association of Water Agencies of Ventura County and the Ventura County Farm Bureau are actively working on outreach to local growers to educate them on the upcoming requirements of TMDLs and the Conditional Waiver Program.

Implementation of LAs will be conducted over a sufficient period of time to allow for implementation of the BMPs, as well as coordination with implementation actions resulting from other TMDL Implementation Plans (Nutrient, Historic Pesticides and PCBs, Metals, Bacteria, Sediment, etc.). As compliance with the salts targets are determined in-stream, there is the potential for compliance with the targets without attainment of LAs. As such, LAs may be revised prior to the final LA achievement dates. Any revisions to these LAs are to be based on the collection of additional information as described in the Special Studies and Monitoring Plan sections of the Implementation Plan.

9.8. SPECIAL STUDIES

9.8.1. Special Study #1 (Optional) – Develop Averaging Periods and Compliance Points

In the discussion on beneficial uses, information was provided to show that instantaneous salts objectives may not be required to protect groundwater recharge and agricultural beneficial uses. Additionally, it is possible that the beneficial uses will be protected and a salt balance achieved without achieving instantaneous water quality objectives in all reaches of the watershed. This optional special study is included to allow an investigation of averaging periods for the salts objectives in the CCW; sufficient to protect beneficial uses.

Additionally, this study will investigate the locations of beneficial uses and the possibility of identifying compliance points for the salts objectives at the point of beneficial use impacts. The use of compliance points would alleviate the need to develop site-specific objectives for the reaches of the watershed upstream of the POTW discharges (described in Special Study #3) while still ensuring the protection of beneficial uses. Sensitive beneficial uses are not present in the upper reaches and POTW discharges dilute the salts from the upper reaches and may allow compliance with the objectives at the point of groundwater recharge downstream.

This is an optional special study to be conducted if desired by the stakeholders or determined necessary by the Executive Officer of the Regional Board.

9.8.2. Special Study #2 (Optional) – Develop Natural Background Exclusion

Discharges of groundwater from upstream of the Simi Valley (Reaches 7 and 8) and Hill Canyon WWTPs (Reaches 12 and 13) and downstream of the Camrosa WRP (Reach 3) contain high salts concentrations. Natural marine sediments may contribute to the high concentrations in those discharges. This special study would evaluate whether or not the groundwater discharges in these areas would qualify for a natural sources exclusion. The special study could follow a ‘reference system/anti-degradation approach’ and/or a ‘natural sources exclusion approach’ for any allocations included in this TMDL that are proven unattainable due to the magnitude of natural sources. The purpose of a ‘reference system/anti-degradation approach’ is to ensure water quality is at least as good as an appropriate reference site and no degradation of existing water quality occurs where existing water quality is better than that of a reference site. The intention of a ‘natural sources exclusion approach’ is to ensure that all anthropogenic sources of salts are controlled such that they do not cause exceedances of water quality objectives. These approaches are consistent with state and federal anti-degradation policies (State Board Resolution No. 68-16 and 40 C.F.R. 131.12).

This is an optional special study to be conducted if desired by the stakeholders or determined necessary for establishing a natural sources exclusion by the Executive Officer.

9.8.3. Special Study #3 (Optional) – Develop Site-Specific Objectives

The TMDL implementation plan provides for actions to protect the agricultural and groundwater recharge beneficial uses in the CCW. As shown in the linkage analysis, some downstream reaches may not achieve the water quality objectives through implementation of this TMDL. Consequently, an optional special study is included to allow the CCW stakeholders to pursue development of site-specific objectives for salts for reaches upstream of the Hill Canyon and Simi Valley WWTPs (Reaches 7, 8, 12, and 13), Calleguas Creek Reach 3, Revolon Slough (Reach 4) and Beardsley Wash (Reach 5). These alternative numeric water quality objectives would be developed based on the beneficial uses to be protected in a reach and the attainability of the current water quality objectives.

This is an optional special study to be conducted if desired by the stakeholders or determined necessary by the Executive Officer of the Regional Board.

9.8.4. Special Study #4 (Optional) – Develop Site-Specific Objectives for Drought Conditions

During drought conditions, the load of salts into the watershed increases as a result of increasing concentrations in imported water. Stakeholders in the CCW cannot control the increased mass entering the watershed from the water supply. However, the stakeholders do have the ability to manage the salts within the watershed to protect beneficial uses and export the additional mass of salts out of the watershed. If necessary, site-specific objectives may be developed to address situations that result in higher imported water salt concentrations to allow management of the salts and protection of beneficial uses. This special study may be combined with Special Study #3 if desired.

This is an optional special study to be conducted if desired by the stakeholders or determined necessary by the Executive Officer of the Regional Board.

9.8.5. Special Study #5 (Optional) – Develop Site-Specific Objectives for Sulfate

As discussed in Section 4, Source Assessment, sulfate is a necessary nutrient for plant growth and sulfate containing products are often applied to agriculture as fertilizers and pesticides. As a result, agricultural use does not appear to be a beneficial use that requires protection from sulfate. Therefore, site-specific objectives may be developed for sulfate that more accurately protect impacted beneficial uses. Additionally, this study could evaluate whether or not a sulfate balance is necessary to maintain in the watershed. This special study may be combined with Special Study #3 and/or #4 if desired.

This is an optional special study to be conducted if desired by the stakeholders or determined necessary by the Executive Officer of the Regional Board.

The special studies outlined above represent the broad range of studies that might be conducted in the CCW. Based on the information gathered for this TMDL, the following map was developed to show the likely SSOs and averaging periods that will be studied. Identifying downstream points of compliance under Special Study #1 would alleviate the need to develop site-specific objectives for Reaches 7 (upstream of Simi Valley WQCP), 8, 12 and 13.

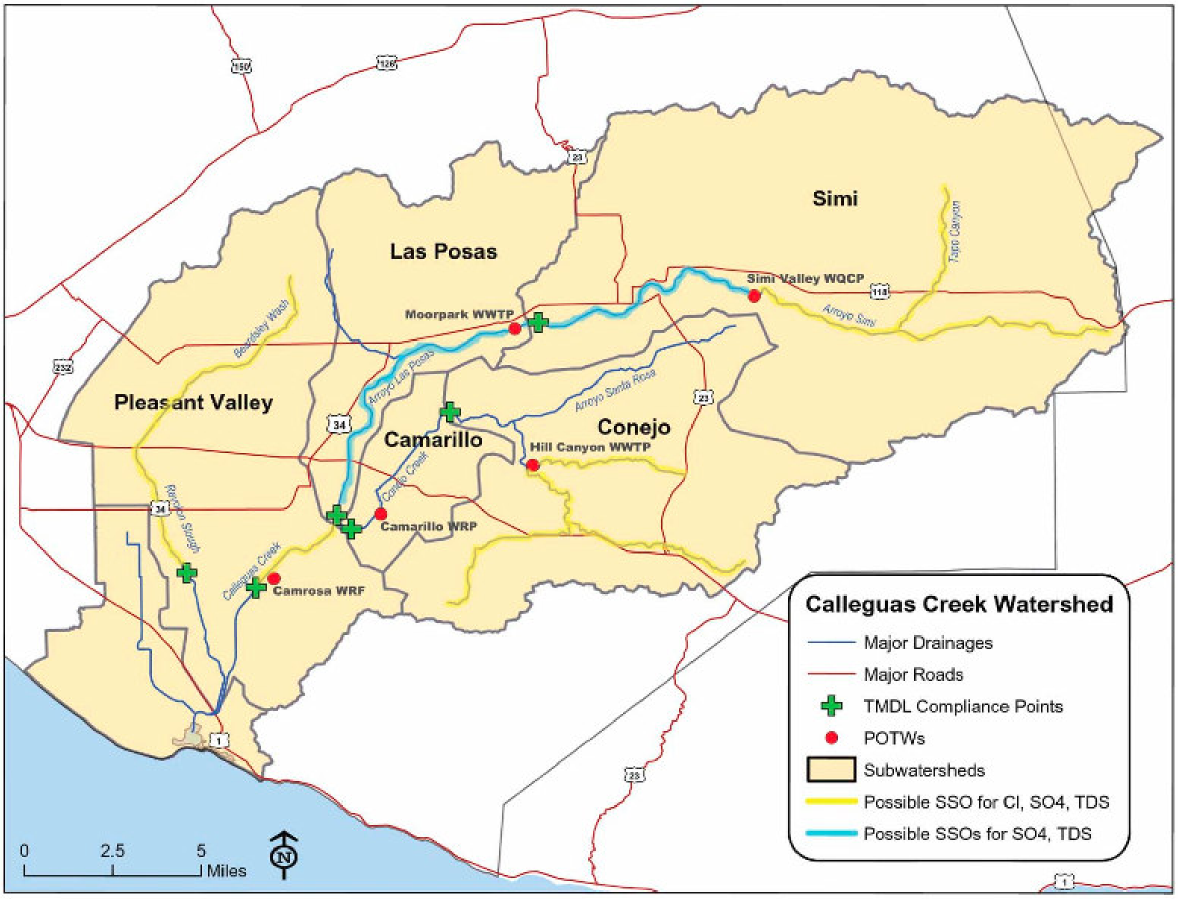

Figure 28. Potential SSO locations

9.9. DETERMINING COMPLIANCE WITH TARGETS, ALLOCATIONS, AND THE TMDL

Compliance with final wasteload and load allocations can be determined by either meeting the mass allocation shown in the allocation tables or by achieving a salt balance in conjunction with meeting water quality standards in the stream at the point of compliance. A salt balance is considered achieved if the amount of salt introduced to the watershed is exported out of the watershed on an annual basis. Introduced salts are defined as imported water from State Water Project Water, the Colorado River, the Santa Clara River or any other source imported from outside the watershed and pumped groundwater from basins not directly recharged by surface water.

The annual salt balance will be calculated based only on dry weather exports of salts out of the watershed. Salt exports are defined as the mass of salts in surface water flows entering the tidal zone at Potrero Road on Calleguas Creek or at Laguna Road on Revolon Slough during dry weather flows (lower than the 86th percentile flow rate) or discharged to the brine line as measured at either the input to the brine line or in the effluent discharge from the brine line.

The loading capacity was determined as a daily load to ensure compliance with the water quality objectives. However, because the impacts to groundwater basins do not occur on a daily basis and the salt exports will vary, compliance with the allocations will be calculated on an annual basis. Each dry day, the difference between the allocation and the actual load will be calculated. The sum of each daily difference for the year will be calculated and if it is zero or less than zero then the subwatershed will be considered to be in balance and if water quality objectives are also achieved, then the discharger or discharge category will be considered to be in compliance with the TMDL. Compliance can also be determined through achieving the wasteload and load allocations and meeting water quality standards in the stream even if the salt balance is not met. If the difference between the total of all the allocations and salt exports and the loading capacity is negative for the year, the negative load will be carried over to the next year and can be used towards meeting the salt balance the following year.

The TMDL implementation schedule requires that progress towards meeting the salt balance be made throughout the implementation period. In order to establish progress, baseline values for the current amount of stranded salts must be developed. Depending on the year, the mass of salts imported and exported out of the watershed may vary and the absolute difference between the mass of salts imported and the mass of salts exported may not be representative of progress towards a salt balance. However, the ratio between the mass of salts exported to the mass of salt imported should become progressively closer to 1 as actions are implemented. Based on the information presented in Section 4, Source Assessment, the following table summarizes the current estimated ratio of dry weather exports to imports. As part of the TMDL monitoring program work plan, a proposal for the current salt balance baseline will be included.

Table 53. Estimated Ratio of Salt Outputs to Inputs for the CCW

Constituent	Ratio
Chloride	0.32
TDS	0.18
Sulfate	0.19

If a salt balance and allocations are met and the receiving water is not meeting the applicable water quality objectives, additional implementation actions will need to be implemented to ensure water quality objectives are met in the receiving waters at the compliance points.

Compliance with the minimum salt export requirements for POTWs will be based on the salt export from the subwatershed to which they discharge. Possible implementation actions to meet the required discharge are discussed in Sections 9.1, 9.2 and 9.3. For Hill Canyon, the minimum salt export requirements will likely be met through the desalting to be conducted in the Santa Rosa Basin at the base of Hill Canyon. For Simi Valley, the minimum salt export requirements will likely be met through a combination of water conservation, water softeners, and mechanisms to address the dewatering wells. The mechanisms for meeting the minimum salt export requirements and for monitoring progress towards meeting those requirements will be included in the monitoring program work plan.

9.10. RECONSIDERATION OF WLAS AND LAS

A number of provisions in this TMDL could provide information that could result in revisions to the TMDL. Additionally, the development of other water quality objective revisions may require the reevaluation of this TMDL. For these reasons, the Implementation Plan includes this provision for reconsidering the TMDL to consider revised water quality objectives and the results of implementation studies, if appropriate.

9.11. MONITORING PLAN AND SALT BALANCE TRACKING

To ensure that the goal of a salts balance in the watershed is being achieved and water quality objectives are being met, a comprehensive method of tracking inputs and outputs to the watershed will be developed. A monitoring plan will be submitted to the RWQCB for Executive Officer approval within six months of the effective date of the CCW Salts TMDL. The monitoring program will include a proposed baseline ratio of salt outputs to salt inputs that will be used, in conjunction with the tracking mechanisms discussed below, to measure progress towards achieving a salt balance. Monitoring will begin one year after Executive Officer approval of the monitoring plan to allow time for the installation of automated monitoring equipment (as discussed below).

9.11.1. Input Tracking

Inputs to the watershed are easily tracked through four mechanisms.

1. Information on the import of State Water Project water is readily available and provides information on the mass of salts brought into the watershed.
2. Groundwater pumping records provide information on the mass of salts imported into the watershed from deep aquifer pumping.
3. Import records for the Santa Clara River can be obtained to determine the mass of salts imported through this source.
4. Monitoring data on imported water quality can be compared to monitoring of effluent quality to estimate the amount of salts added through human use of the water.

9.11.2. Output Tracking and Determining Compliance with Water Quality Objectives

The Calleguas Creek Watershed TMDL Monitoring Plan (CCWTMP) is designed to monitor and evaluate implementation of the CCW TMDLs and track the outputs for calculation of the watershed salt balance. The current CCWTMP monitoring effort covers the requirements of the CCW Nutrients TMDL, Toxicity TMDL, and Organochlorine Pesticides and PCBs TMDL. The goals of the CCWTMP include:

1. To determine compliance with chloride, TDS, sulfate and boron numeric targets.
2. To determine compliance with waste load and load allocations for chloride, TDS, sulfate and boron at receiving water sites and at POTW discharges.
3. To monitor the effect of implementation actions by urban, POTW, and agricultural dischargers on in-stream water quality.
4. To track salts exports transported through the receiving water system.

5. To implement the CCWTMP in a manner consistent with other TMDL implementation plans and regulatory actions within the CCW.

Monitoring conducted through the Conditional Waiver Program and NPDES monitoring programs may meet part of the needs of the CCWTMP. To some extent, monitoring required by the Salts TMDL Implementation Plan may parallel monitoring required by other programs. Efforts to coordinate monitoring programs throughout the watershed are underway. Should a coordinated monitoring program be developed and approved by the Executive Officer of the Regional Board, the coordinated program would replace the requirements of the CCWTMP.

To monitor compliance with the salt balance, outputs from the watershed will be tracked through surface water monitoring at key locations in the watershed and monitoring of discharges to the brine line. Monitoring will include both flow and quality. Additionally, flow and quality information will be collected for any groundwater pumping/desalting processes that are implemented to export salts for this TMDL.

Compliance with water quality objectives will be determined at key locations where beneficial uses occur in the watershed. The stations used for output tracking will also be used to determine compliance with water quality objectives. The monitoring program will determine if the TMDL compliance points are protective of the beneficial uses for the subwatershed. If the monitoring determines that the compliance points are not protective of beneficial uses, an alternative compliance point will be selected. Additionally, if other places in the watershed are identified where sensitive beneficial uses occur, water quality monitoring stations can be added to determine compliance with water quality objectives.

For the RWRMP, three new or upgraded automated flow measuring and sample collection stations will be installed at three points on the stream system to continuously record flow and various water quality parameters during dry weather. Preliminary monitoring locations include Arroyo Conejo at Hill Canyon, Conejo Creek at Baron Brothers Nursery and Calleguas Creek at University Drive.

For the NRRWMP, one new or upgraded automated flow measuring and sample collection station will be added downstream of Simi Valley at the point at which groundwater recharge begins. The preliminary monitoring location is at Hitch Blvd. where an existing flow gauging station exists. However, the amount of groundwater recharge upstream of this site will need to be evaluated to determine the exact monitoring location.

For Revolon, the existing monitoring station at Wood Rd. will be used to monitor quality and flow on Revolon Slough to determine the outputs from the Revolon portion of the Pleasant Valley subwatershed.

Monitoring will begin within one year of the effective date of the CCW Salts TMDL, pending approval of the monitoring plan by the Executive Officer of the Regional Board, to allow time for the installation of continuous monitoring equipment.

Additional land use monitoring will be conducted concurrently at representative agricultural and urban runoff discharge sites as well as at POTWs in each of the subwatersheds and analyzed for chloride, TDS, sulfate, and boron. The location of the land use stations will be determined before initiation of the monitoring program. All efforts will be made to include at least two wet weather-sampling events during the wet season (October through April) during a targeted storm event.

9.11.3. Reporting and Modification of Calleguas Creek Watershed TMDL Monitoring Program

A monitoring report will be prepared annually within six months after completion of the final event of the sampling year. An adaptive management approach to the CCWTMP will be adopted as it may be necessary to modify the monitoring program. Results of sampling carried out through the CCWTMP and other programs within the CCW may be used to modify this plan, as appropriate.

If a coordinated and comprehensive monitoring plan is developed and meets the goals of this monitoring plan that plan should be considered as a replacement for the CCWTMP.

9.11.4. Salt Balance Accounting

As discussed in the linkage analysis, a simple salt balance model was developed to assess the current salt balance and allow future evaluation of the achievement of the salt balance in the watershed. The salt balance model will use information compiled from the input and output tracking above to calculate a salts balance for any requested time period. Additionally, on an annual basis, the total inputs to the watershed will be compared with the total outputs from the watershed to determine compliance with the salt balance and allocations.

9.12. IMPLEMENTATION SUMMARY AND SCHEDULE

Interim allocations presented in TMDL & Allocations section and the implementation schedule will provide sufficient time to:

- Allow for the implementation of the Conditional Waiver Program by agricultural dischargers throughout the CCW;
- Allow for construction of the RMSC;
- Allow for implementation of the NRRWMP and the SRRWMP;
- Conduct special studies to evaluate site specific objectives;
- Allow for coordination of special studies and implementation actions resulting from other TMDL Implementation Plans; and,
- Implement adaptive management strategies to employ additional implementation actions or revise implementation actions to meet allocations, if necessary.

The implementation schedule was developed based on the time necessary to complete construction of the RMSC. The RMSC is an essential component of the implementation plan and many actions cannot be completed without the RMSC. As discussed in the implementation schedule summary, between 12 and 15 years is the minimum required timeframe for construction of the brine line. Providing a 15-year implementation schedule allows time for the RMSC construction as well as the construction of desalters and other facilities that will connect to the RMSC.

The phasing of the TMDL implementation program provides for the bulk of the facilities to be built and implemented within 10 years of the effective date of the TMDL. At this time, the CCW may be in compliance with the TMDL. However, additional implementation actions may be required under Phase 4 of the implementation plan that would necessitate significant additional time to implement. As a result, the schedule allows for another 5 years of implementation with a requirement that at 10 years the responsible parties demonstrate that the implementation actions will result in compliance with water quality objectives. If compliance with the water quality objectives is complete with implementation of the first three phases of the implementation plan, the implementation schedule will be revised.

The implementation schedule is designed to parallel, where appropriate, the Nutrient TMDL, Toxicity TMDL, Siltation and Organochlorine Pesticides and PCBs TMDL, and Metals and Selenium TMDL Implementation Plans. Additional TMDL Implementation Plans may be developed before 2012, for Bacteria. The implementation schedule for this TMDL may be revised, if appropriate, when the Bacteria TMDL is completed.

Table 54 presents the overall implementation schedule for the Calleguas Creek Watershed Salts TMDL. Table 54 provides sufficient time to allow implementation measures to be put into place. In addition, time is allotted for the completion of special studies and the reevaluation of the TMDL, if necessary. The implementation schedule includes enforceable milestones to ensure that progress towards achieving the salt balance is being achieved.

Table 54. Overall Implementation Schedule for Calleguas Creek Watershed Salts TMDL

	Implementation Action [1]	Responsible Party[4]	Date
1	Effective date of interim Salts TMDL waste load allocations (WLAs). [2]	POTWs, Permitted Stormwater Dischargers (PSD)	Effective Date
2	Effective date of interim Salts TMDL load allocations (LAs). [2]	Agricultural Dischargers	Effective Date
3	Responsible jurisdictions and agencies shall submit compliance monitoring plan to the Los Angeles Regional Board for Executive Officer approval.	POTWs, PSD, Agricultural Dischargers	6 months after effective date of the TMDL
4	Responsible jurisdictions and agencies shall begin monitoring as outlined in the approved monitoring plan.	POTWs, PSD, Agricultural Dischargers	1 year after monitoring plan approval by EO
5	Responsible jurisdictions and agencies shall submit workplans for the optional special studies.	Interested parties	Within 10 years of effective date of TMDL
6	Responsible jurisdictions and agencies shall submit results of the special studies.	Interested parties	2 years after workplan approval by EO
7	Responsible jurisdictions and agencies shall demonstrate that implementation actions have reduced the boron, sulfate, TDS, and chloride imbalance by 20%.	POTWs, PSD, Agricultural Dischargers	3 years after effective date of the TMDL
8	Responsible jurisdictions and agencies shall demonstrate that implementation actions have reduced the boron, sulfate, TDS, and chloride imbalance by 40%.	POTWs, PSD, Agricultural Dischargers	7 years after effective date of the TMDL
9	Responsible jurisdictions and agencies shall demonstrate that implementation actions have reduced the boron, sulfate, TDS, and chloride imbalance by 70%.	POTWs, PSD, Agricultural Dischargers	10 years after effective date of the TMDL
10	The Los Angeles Regional Board shall reconsider this TMDL to re-evaluate numeric targets, WLAs, LAs and the implementation schedule based on the results of the special studies and/or compliance monitoring.	Regional Board	12 years after effective date of the TMDL
11	Responsible jurisdictions and agencies shall demonstrate that the watershed has achieved an annual boron, sulfate, TDS, and chloride balance.	POTWs, PSD, Other NPDES Permittees, and Agricultural Dischargers	15 years after effective date of the TMDL
12	The POTWs and non-storm water NPDES permits shall achieve WLAs, which shall be expressed as NPDES mass-based effluent limitation specified in accordance with federal regulations and state policy on water quality control.	POTWs and Other NPDES Permittees	15 years after effective date of TMDL
13	Irrigated agriculture shall achieve LAs, which will be implemented through the Conditional Waiver for Irrigated Lands as mass-based receiving water limits.	Agricultural Dischargers	15 years after effective date of the TMDL
14	The permitted stormwater dischargers shall achieve WLAs, which shall be expressed as NPDES mass-based receiving water limits specified in accordance with federal regulations and state policy on water quality control.	Permitted Stormwater Dischargers	15 years after effective date of the TMDL
15	Water quality objectives will be achieved at the base of the subwatersheds designated in the TMDL.	POTWs, PSD, Other NPDES Permittees, and Agricultural Dischargers	15 years after effective date of the TMDL

1 The Regional Board regulatory programs addressing all discharges in effect at the time this implementation task is due may contain requirements substantially similar to the requirements of these implementation tasks. If such requirements are in place in another regulatory program including other TMDLs, the Executive Officer may revise or eliminate this implementation task to coordinate this TMDL implementation plan with other regulatory programs.

2 NPDES permits for POTWs will contain interim effluent limits based on the WLAs. NPDES permits for stormwater will contain in-stream limits based on the interim WLAs. LAs will be implemented using the Conditional Waiver for Irrigated Agriculture.

3 Date of achievement of WLAs and LAs based on the estimated timeframe for constructing the brine line and other proposed implementation actions. The conditional waiver program will set timeframes for the BMP management plans.

4 Permitted stormwater dischargers include MS4s, Caltrans, the Naval Air Weapons Station at Point Mugu, and general industrial and construction permittees.

9.13. ADAPTIVE MANAGEMENT OF IMPLEMENTATION PLAN

The goal of achieving a salt balance in the Calleguas Creek Watershed is expected to result in improved water quality in both surface water and groundwater basins and the protection of the sensitive beneficial uses of agriculture and groundwater recharge. The monitoring and salt balance accounting procedures described above will be used to evaluate improvements in these areas. The program has been designed to be adaptively managed to allow changes to the program if necessary to protect beneficial uses.

In addition to achieving a salts balance, a TMDL is required to result in achievement of water quality objectives. Because the stream system is one of the key mechanisms for transporting salts out of the watershed, alternative water quality objectives may be needed to meet the goals of achieving a salts balance and protecting beneficial uses in the watershed and also meet the requirements of the TMDL.

9.14. ECONOMIC ANALYSIS OF IMPLEMENTATION

Water Code Section 13000 requires the State and Regional Boards to regulate so as to achieve the highest water quality that is reasonable, based on consideration of economics and other public interest factors. Water Code Section 13141 requires that prior to the implementation of any agricultural water quality control program; an estimate of the total cost of the program and identification of potential sources of financing shall be included in any applicable regional water quality control plan. An analysis of the impacts of implementing these TMDLs with respect to costs, benefits, and other public interests factors is presented below.

The economic analysis for the TMDL identified the estimated costs of the proposed implementation actions. For some elements of the implementation plan, specific cost estimates have been developed that include all elements of implementing the action. For other elements, planning level cost estimates have been developed. Finally, some aspects of the implementation plan have not yet reached the planning stage and/or are dependent on the impacts of earlier phases of the implementation plan. As a result, the cost estimates provided are a combination of these types of estimates. The final costs of implementation will likely vary from the estimates presented here. However, the estimates represent the best available information on the potential implementation costs of the Salts TMDL. The annualized costs were developed using an assumed interest rate of 6% over 20 years. For operations and maintenance costs, a variety of costs for energy were assumed and are noted in the table.

Table 55. Estimated Costs of Implementing Salts TMDL

Area	Implementation Action	Estimated Capital Cost	Annualized Capital Cost	Annual O&M	Total Annual Cost	Source
Entire Watershed	Regional Salinity Management Conveyance (RSMC)	$107,000,000	$9,328,748	N/A	$9,328,748	Mulligan, 2007
	Agricultural BMPs				$1,500,000	(a)
Northern Reaches	Moorpark Desalter	$27,050,000	$2,360,000	$1,060,000	$3,420,000 [e]	
	Camarillo Desalter	$18,810,000	$1,640,000	$1,710,000	$3,350,000 [f]	
	Water Conservation ordinance and outreach			$100,000	$100,000	(b)
	Water Softener outreach			$100,000	$100,000	(b)
	Water Blending	$2,945,000	$257,000	N/A	$257,000	
	Increased South Las Posas pumping	$750,000	$65,388	$230,455	$295,843	(c)
	Simi Dewatering well treatment	$900,000	$78,466	$690,000	$768,466	(d)
	Agricultural desalters (1 mgd)	$900,000	$78,466	$230,000	$308,466	(d)
	Additional desalters (Somis 2 mgd)	$10,400,000	$906,719	$1,158,676	$2,065,396	(d)
Southern Reaches (Phases 1-3)	Direct Project Administration Costs	$949,885			$82,815	
	Land Purchase/Easement	$633,257			$55,210	
	Planning/Design/Engineering/Environmental Documentation	$3,166,283			$276,051	
	Construction/ Implementation	$21,108,550			$1,840,340	
	Construction Administration	$2,110,855			$184,034	
	Construction/ Implementation Contingency	$2,110,855			$184,034	
Pleasant Valley	Shallow groundwater pumping and discharge to brine line	$1,250,000	$108,981	$384,091	$493,072	(c)
	Totals				$24,609,474	

a. Low agricultural cost estimate from Calleguas Creek Metals and Selenium TMDL.
b. Estimated cost of implementing an ordinance from Calleguas Creek Metals and Selenium TMDL

c. Estimated costs based on well drilling costs of $250,000 presented in (Black and Veatch, 2005). O&M costs for pumping based on (Kennedy Jenks, 2005).
d. Cost of building and operating a desalter based on the average cost per mgd of capacity for the Moorpark and Camarillo desalters.
e. Energy cost estimated using $0.09/kWh.
f. Energy cost estimated using $0.10/kWh.

In addition to the costs of the TMDL, an estimate of the potential benefits to the CCW that will result from the implementation plan was developed. The major cost savings resulting from the implementation plan is the reduction in the use of imported water in the CCW and decreased pumping costs to the extent that the projects offset deep groundwater pumping. Additional potential benefits result from reduced costs to homeowners as water supply is improved and agricultural benefits from improved quality and reliability of their water supply. For the purposes of estimating the benefits of this TMDL, the cost savings associated with offsetting current imported and deep groundwater pumping was calculated. Other benefits were not estimated for this analysis.

Table 56. Estimated Benefits of Implementing Salts TMDL

Area	Implementation Action	Volume Water Produced Annually (acre-ft/year)	Imported Water Price [a]	Benefit of Selling Water/Avoided import and pumping costs
Northern Reaches	Moorpark Desalter	5600	$478	$2,676,800
	Camarillo Desalter	7616	$478	$3,640,448
	Water Conservation ordinance and outreach	829	$478	$396,166
	Water Blending	2800	$82 [b]	$230,500
	Increased South Las Posas pumping			
	Simi Dewatering well treatment	1120	$478	$535,360
	Agricultural desalters (need assumptions for estimate)	1120	$478	$535,360
	Additional desalters (Somis 2 mgd)	2240	$478	$1,070,720
Southern Reaches (Phases 1-3)	Construction/Implementation	26544	$478	$12,688,032
	Totals			$21,773,386

a. Imported water price based on the 2007 MWD costs of Tier 1 water (Calleguas MWD, 2007).
b. Estimated cost of offsetting deep groundwater pumping (Kennedy Jenks, 2005).

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Appendix 1. Historical Chloride Regulatory Documents

Appendix 2. Source Analysis Calculations

Appendix 3. Model Descriptions