Calleguas Creek Watershed Boron, Chloride, Sulfate, and TDS (Salts) TMDL

STAFF REPORT

September 18, 2007

REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION

TABLE OF CONTENT

1. Introduction

This Staff Memorandum discusses Regional Board staff's analysis of key elements of the Calleguas Creek Boron, Chloride, Sulfate, and TDS TMDL. The proposed TMDL, including numeric targets, allocations, and implementation plan, is based on the TMDL Technical Report, "Calleguas Creek Watershed Boron, Chloride, Sulfate, and TDS TMDL" prepared by Larry Walker Associates on behalf of the Calleguas Creek Watershed Management Plan, a stakeholder group in the Calleguas Creek Watershed. This staff report documents Regional Board staff's evaluation of alternatives considered for proposed TMDL as well as rationale for the staff proposal.

Development of these TMDLs was mandated by the Consent Decree between Heal the Bay, et al. and US EPA (C 98 4825, 1999). In accordance with this Consent Decree, US EPA had established a TMDL for chloride in March, 2002. US EPA approved Chloride TMDL did not include an implementation plan but provided general recommendations regarding implementation measures. This TMDL addresses water quality impairments of Calleguas Creek, including its tributaries, segments and Mugu Lagoon, caused by boron, chloride, sulfate, and TDS. This TMDL also includes implementation measures for ensuring the wasteload and load allocations will be achieved and the water quality objectives for boron, chloride, sulfate, and TDS will be attained.

Calleguas Creek stakeholders have been actively engaged with US EPA and the Regional Board on a variety of watershed planning initiatives through the Calleguas Creek Watershed Management Plan (CCWMP), an established, stakeholder-lead watershed management group, operating since 1996. The CCWMP includes broad participation from Federal, State and County agencies, municipalities, POTWs, water purveyors, groundwater management agencies, and agricultural and environmental groups. As part of its mission to address issues of long-range comprehensive water resources, including land use, economic development, and open space preservation, the CCWMP proposed to the US EPA and Regional Board that they take a key role in development of the TMDLs for the Calleguas Creek Watershed. US EPA and Regional Board staff have worked directly with CCWMP members and their consultant through an open, collaborative process to develop the Boron, Chloride, Sulfate, and TDS (Salts) TMDL.

This Staff Report discusses staff's rationale for specific TMDL items and alternatives considered.

2. TMDL Development

During the development of the Salts TMDL reports, Regional Board staff worked with US EPA, the CCWMP and Larry Walker Associates staff on a regular basis. Outreach and stakeholder comments were solicited through the CCWMP structure, which included monthly steering committee meetings and several subcommittees, responsible for various aspects of watershed management. These meetings were open to the public; agendas and meeting minutes were also published on the CCWMP website: www.calleguascreek.org. In addition to these monthly meetings, the CCWMP, Regional Board and US EPA staff, and a representative from the City of Camarillo, Sanitation Department, met on a monthly basis to discuss TMDL issues. These meetings were facilitated and noted by staff of the CCWMP, and several of these meetings were attended by representatives of the Calleguas Creek watershed water agencies, municipalities, POTWs, non-point dischargers, and the Ventura County Coastkeeper.

The development of the TMDL reports followed a process in which the CCWMP and LWA prepared draft documents for discussion. Regional Board and US EPA staff considered these approaches and in some instances provided alternative proposals. These alternative proposals were brought back to the CCWMP for consideration and the CCWMP provided direction to LWA staff on how to address the required modifications. During development of the TMDL reports, differences between the US EPA, CCWMP, LWA and the Regional Board staff on technical and policy issues were carefully considered and the TMDL Technical reports were written in consideration of input from all of these sources and represent the discussions of the stakeholder process.

3. Problem Statement

In developing the Problem Statement, Regional Board and USEPA staff reviewed both water quality data that formed the basis for the 303(d) for salts as well as more recent data. 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. 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. 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. USEPA determined an interpretation of numeric water quality objectives to protect sensitive beneficial uses and resulted in the application of the numeric objectives for salts to Revolon Slough. 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 not listed as impaired for salts. 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. For better understanding of the tidal influent, salinity data measured during 2003-2004 Calleguas Creek Watershed TMDL monitoring was reviewed. Thirty nine salinity measurements were taken at Revolon Slough at Wood Road during the course of the monitoring. The mean salinity measured was 2.2 parts per thousand (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. No salinity information is available for Revolon Slough below Wood Road. In conclusion, 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.

4. Numeric Targets

Numeric targets for the TMDL are based on the specific numeric water quality objectives (WQOs) provided in the Basin Plan.

Surface water quality objectives for the Calleguas Creek watershed are applicable for reaches upstream of Potrero Road. Site specific objectives have not been determined for Calleguas Creek below Potrero Road. However, the Basin Plan provides beneficial use guidelines to determine criteria for selection of effluent limits to protect sensitive beneficial uses including agricultural supply. Below are WQOs for Calleguas Creek upstream of Potrero Road

Table 1. Surface Water Quality Objectives

Constituent	Water Quality Objectives Upstream Potrero Road (mg/L)
Boron	1
Chloride	150
Sulfate	250
TDS	850

The Basin Plan also includes objectives for groundwater basins as shown in Table 2. A map of the groundwater basins is shown in Figure 1.

Table 2. Groundwater Quality Objectives

Groundwater Basin	Boron	Chloride	Sulfate	TDS
Arroyo Simi/Simi Valley	1.0	150	600	1200
Arroyo Simi/South Las Posas	3.0	400	1200	2500
Arroyo Las Posas/South Las Posas	1.0	250	700	1500
Arroyo Las Posas/North Las Posas	1.0	150	250	500
Arroyo Santa Rosa and Conejo/Arroyo Santa Rosa	1.0	150	300	900
Arroyo Santa Rosa/Tierra Rejada	0.5	100	250	700
Arroyo Conejo/Thousand Oaks	1.0	150	700	1400
Arroyo Conejo/Conejo Valley	1.0	150	250	800
Conejo and Calleguas/Pleasant Valley	1.0	150	300	700

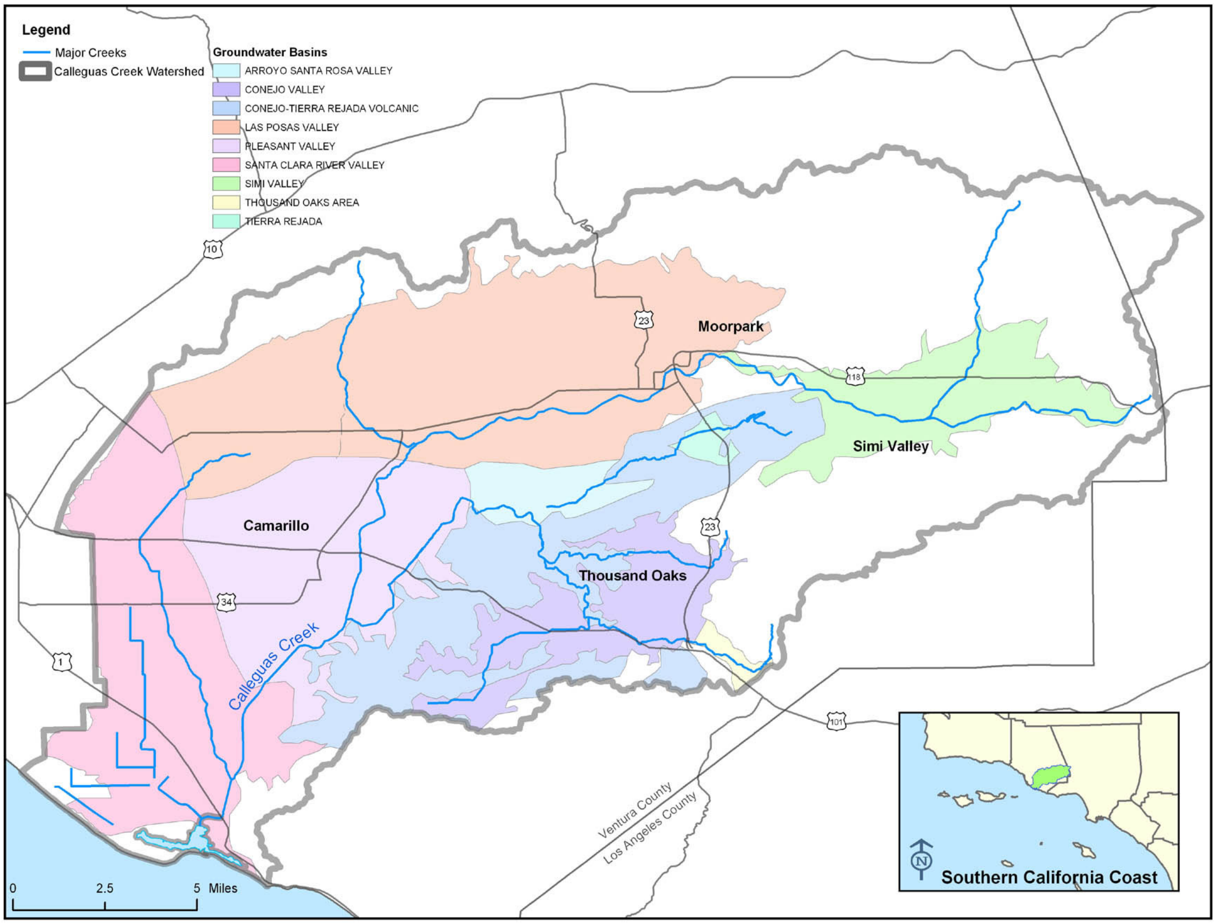

Figure 1. Calleguas Creek Watershed Groundwater Basins

Consideration of Alternatives

Staff selected existing Basin Plan objectives for Numeric Targets. Alternatives that were proposed for staff consideration included Numeric Targets that are based on beneficial use assessments and Numeric Targets based on existing Basin Plan objectives. Staff rejected the alternative for beneficial use assessments because these assessments would require extensive resources and time, and would require implementation into the Basin Plan as a Basin Plan amendment before these targets are available for use as TMDL Numeric Targets. Because existing water quality objectives are established in the Basin Plan, staff assumed that these objectives are protective of beneficial uses and can be used as TMDL targets.

5. Linkage Analysis

The Calleguas Creek Watershed is a complex system in terms of hydrology and salts dynamics, with several outstanding features that confound a standard rainfall/runoff/baseflow analysis. These features combine to create substantial spatial and temporal variability in in-stream flows and salts concentrations. To better represent varying conditions throughout this complex system, the modeling approach of salt model is stochastic in nature, rather than static. The modeling approach involves construction of a dynamic model incorporating the observed variability in the watershed's hydrology, as well as known information on salts sources and transport. In transport, the salt is considered as a conservative substance, thus no generation or consumption of salt occurs in any of the sub-watersheds. Dynamic modeling techniques allow depiction of fluctuations in salts loading and concentrations throughout the watershed under the full range of observed conditions, and facilitate estimates of the level of uncertainty of the model results. Calleguas Creek Modeling System and Salt Balance Models have been used in this TMDL 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.

The Calleguas Creek Modeling System 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. A Salt Balance Model 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.

5.1 Calleguas Creek Modeling System (CCMS)

The CCMS was originally developed for Calleguas Creek nutrient TMDL. The spreadsheet-based mass balance model was accepted by State and Federal regulatory agencies for use in the Nutrient TMDL process for the Calleguas Creek Watershed (CCW). The model was enhanced to capture the statistical variability of inputs flow and salts to the watershed so that the expected statistical variability of flow rate and salts concentrations in the surface waters of the watershed can be calculated. By reflecting the statistical nature of watershed processes in the model inputs and calculations, the dynamics of the watershed were modeled.

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 5 sub watersheds based on drainages to sampling locations and significant tributaries. A computational element is assigned to each sub watershed for calculating the changes in stream flow and water quality due to processes present along stream reaches circumscribed by the sub-watersheds. The model was expanded to accommodate stochastic input, which allows calculation of the likely distribution of in-stream salts concentrations.

- Computation 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 sub watershed. Over each time step, the stream reach within any sub watershed 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 sub watershed behaves as a complete-mix reactor implies that the in-stream concentration is constant at all locations within a sub watershed (Tchobanoglous and Schroeder, 1985). Because the concentration is modeled as constant for the entire reach, all withdrawals from the reach, including the discharge to the downstream reach will have the same concentration by definition. A schematic of the computational element is displayed in Figure 2. Each input and output considered in the CCMS is represented in Figure 2 with an arrow pointing into the reach for additions, and pointing out from the reach to represent withdrawals. In Figure 2, flows from upstream reaches enter from the right and flow to downstream reaches exit to the left.

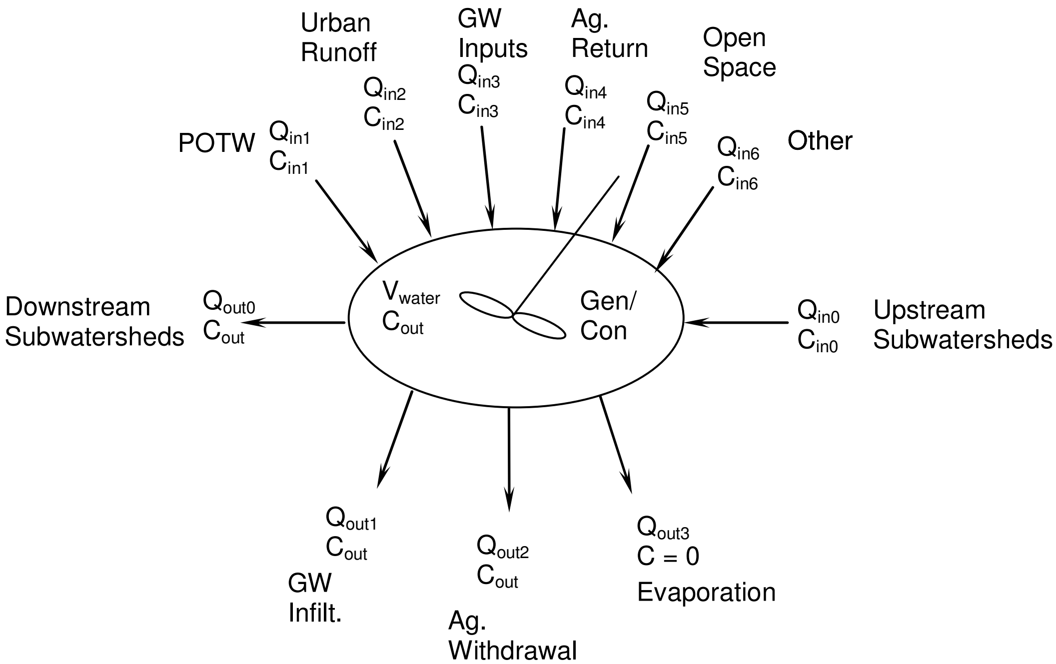

Figure 2: Schematic of Inputs and Outputs for a General Computational Element used in the CCMS Mass Balance Model to Estimate Water Flow and Quality within Surface Water Reaches.

- 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).

$$accumulation = in - out + generation \quad (1)$$

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 assumption specifies no accumulation of flow or mass in the surface water within a sub watershed, 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 sub watersheds (Tchobanoglous and Schroeder, 1985). However, for the case of salts, the assumption is made that no generation or consumption occurs in any of the sub watersheds, further simplifying (1) to Equation (2).

$$in = out \quad (2)$$

- Upstream Sub watersheds

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

- Sub watershed 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.

- Sub watershed 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 sub watersheds.

5.2 Salt Balance Model

In addition to the CCMS, 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 were compared to the chloride inputs and an estimate of the mass of salts stranded in the watershed was determined. This model was updated to include inputs and outputs of TDS and sulfate based on the loading information collected in the watershed.

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 salt 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.

5.3 Alternative Consideration

Staff considered other alternatives for linkage analysis including a mass balance model that was used on previous salts TMDLs. These alternatives were also conducted in a similar way and based on spreadsheet-style calculation of inflows and outflows for each reach. The CCMS and the salt balance model have considered the variability in salts loading and movement within the watershed, dynamic functions of flows and salt concentrations to reflect the real characteristics of the watershed. Calibration and validation of the model provide measures of how well the model performs and how much uncertainty is associated with model output. The model has been validated and calibrated with the observed field data of flow and salt concentrations during the model development processes. The staff considers the CCMS and the salt model can be accepted for the Calleguas Creek Salts TMDL.

6. Margin of Safety

A margin of safety for the TMDL is designed to address any uncertainties in the analysis that could result in targets not being achieved in the waterbodies. The primary uncertainties associated with this TMDL include the impact of the salt balance on receiving water loadings. This relationship is roughly estimated by the model and difficult to clearly quantify, and the sources of salts may not be completely known. Both implicit and explicit MOS are included for this TMDL. The implicit MOS stems from the use of conservative assumptions made during development of the TMDL. 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. This mass is not used to determine compliance with the salt balance and represents a significant implicit margin of safety. The model also 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. An explicit MOS of 10% is included in the adjustment factor to account for the uncertainties in the TMDL analysis. The 10% explicit MOS is determined sufficient to address the uncertainties associated with the estimated impact of the salt balance on receiving water loadings.

Consideration of Alternatives

Several alternatives were considered for establishing a margin of safety, including using an explicit margin of safety only, applying an explicit margin safety to the numeric target, and applying an explicit margin of safety to the load of salt required to be exported from the watershed. Although there are numerous conservative assumptions in the linkage analysis, this TMDL includes an implementation provision based on attainment of a salt balance, in conjunction with attainment of water quality standards. The salt balance is calculated on an annual basis, whereas water quality objectives for salts as instantaneous values. Staff assesses that an explicit MOS is required to address uncertainties associated implementing numeric targets that are expressed as instantaneous values with implementation plans that are based on annual salt balances. Consequently, staff recommends that an explicit margin of safety is applied to the minimum mass of salt exported to attain water quality standards in addition to the conservative modeling assumptions.

7. Wasteload and Load Allocations

Wastewater treatment plants (POTWs), permitted stormwater dischargers, and other NPDES dischargers are assigned wasteload allocations for this TMDL. These WLAs apply during dry weather conditions. Staff finds that existing water quality objectives are attained during wet weather conditions. POTW mass-based waste load allocations (WLAs) were calculated as the water quality objective multiplied by the actual flow of the POTW. An adjustment factor was added to the allocations to ensure background loads that are not exported from the watershed are subtracted from the POTW loadings to meet the loading capacity and to allow for increased exports from the watershed to compensate for increased POTW loadings when water supply loads to the POTW increase.

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 Water Quality Control Plant (WQCP).

7.1 Waste Load Allocation

7.1.1 POTWs

At the end of the implementation period, only the Simi Valley WQCP and Hill Canyon Waste Water Treatment Plant (WWTP) are expected to discharge to surface waters. Camarillo WWRP, Camrosa Water Reclamation Facility (WRP) and Moorpark WWTP are not expected to discharge. Dry weather wasteload allocations are included for the cases when discharges may occur. Including wasteload allocations for these POTWs ensures that water quality objectives are not exceeded as a result of their discharge.

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, minimum salt exports shown in Table 3 are required for POTWs and are included in WLAs as a component of the adjustment factors. The adjustment factor is used to link POTW allocations to the required reductions in background loads through salt export out of the watershed. 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. The adjustment factor allows for the additional POTW loading only when the water quality objectives are met in the receiving waters. POTW allocations can be adjusted upwards when imported water supply chloride concentrations exceed 80 mg/L and discharges from the POTW exceed the WLA. In order to apply the AF to the assigned WLAs, the POTW is required to submit documentation of the water supply chloride concentrations, receiving water chloride concentration, the effluent mass, and evidence of increased salt exports to offset the increased discharges from the POTW to the RWQCB for approval.

WLAs apply to POTWs during dry weather when the flows in the receiving water are below the 86th percentile flow (Table 4). 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.

Interim limits are included to allow time for dischargers to put in place implementation measures necessary to achieve final waste load allocations (Table 5). The monthly average interim limits are set equal to the 95th percentile of available discharge data.

Table 3. 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
Moorpark WWTP	460	3220	9120	0
Hill Canyon WWTP	1060	7920	4610	0
Camrosa WRF	1060	7920	4610	0
Camarillo WRP	1060	7920	4610	0

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

Table 4. Final WLAs for POTWs[a,d]

POTW	Chloride[c] (lb/day)	TDS[c] (lb/day)	Sulfate[c] (lb/day)	Boron[c] (lb/day)
Simi Valley WQCP	150*Q-AF	850*Q-AF	250*Q-AF	1.0*Q-AF
Hill Canyon WWTP	150*Q-AF	850*Q-AF	250*Q-AF	N/A
Moorpark[b] WWTP	150*Q-AF	850*Q-AF	250*Q-AF	N/A
Camarillo WRP[b]	150*Q-AF	850*Q-AF	250*Q-AF	N/A
Camrosa WRF[b]	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 discharges from the POTWs do not cause exceedances of water quality objectives.

b. These POTWs are not expected to discharge after the end of the implementation period.

c. AF: Adjustment factor which is set equal to the difference between the minimum salt export requirement and the actual salt export. The use of the adjustment factor will be triggered by conditions specified in Figure 3.

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.

N/A Boron is not listed in the reaches to which the POTW discharges. No WLA is required.

Table 5. Interim WLAs for POTWs

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

* Camrosa WRF has not discharged to surface water during the period under which interim limits were calculated. When effluent data are available, the Regional Board may adopt interim WLAs for Camrosa WRF.

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

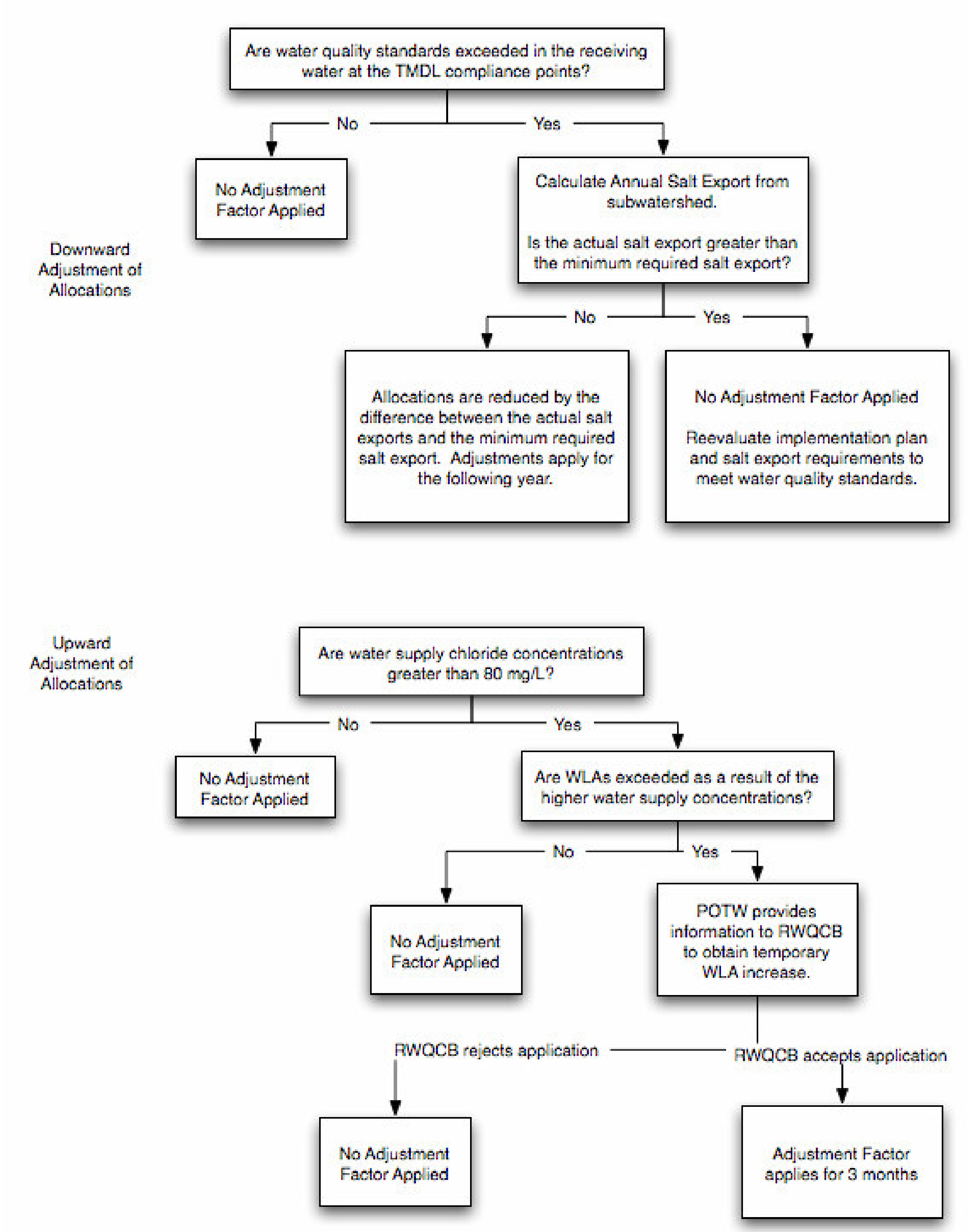

Figure 3. Process for Implementing the Adjustment Factor

7.1.2 Urban Runoff

Permitted stormwater dischargers that are responsible parties to this TMDL include the Municipal Stormwater Dischargers (MS4s) of the Cities of Camarillo, Moorpark, Thousand Oaks, County of Ventura, Ventura County Watershed Protection District, and general industrial and construction permittees. Permitted stormwater dischargers are assigned a dry weather wasteload allocation equal to the average dry weather critical condition flow rate multiplied by the numeric target for each constituent (Table 4). Waste load allocations apply in the receiving water at the base of each subwatershed. Because wet weather flows transport a large mass of salts at a typically low concentration, these dischargers should meet water quality objectives during wet weather. 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.

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 (Table 5). 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 except for chloride. The 95th percentile for chloride was 267 mg/L which is higher than the recommended criteria set forth in the Basin Plan for protection of sensitive beneficial uses including aquatic life. Therefore, the interim limit for chloride for Permitted Stormwater Dischargers is set equal to 230 mg/L to ensure protection of sensitive beneficial uses in the Calleguas Creek watershed.

Table 6. Final Dry Weather WLAs for Permitted Stormwater Dischargers

Subwatershed	Critical Condition Flow Rate (mgd)	Chloride (lb/day)	TDS (lb/day)	Sulfate (lb/day)	Boron (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

Table 7. Interim Dry Weather WLAs for Permitted Stormwater Dischargers

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

7.1.3 WLAs for Other NPDES Dischargers

Concentration-based wasteload allocations are assigned at the Basin Plan objectives for other NPDES dischargers.

Table 8. Final Dry Weather WLAs for Other NPDES Dischargers

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 and calculated as a monthly average using the 95th percentile of available discharge data.

7.2 Load Allocations

Dry weather load allocations are assigned as a group allocation to irrigated agricultural discharges. Irrigated agricultural dischargers are assigned a dry weather wasteload allocation equal to the average dry weather critical condition flow rate multiplied by the numeric target for each constituent. Load allocations apply in the receiving water at the base of each subwatershed. Because wet weather flows transport a large mass of salts at a typically low concentration, these dischargers should meet water quality objectives during wet weather. 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.

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 except for chloride. The 95th percentile for chloride was 499 mg/L which is higher than the recommended criteria set forth in the Basin Plan for protection of sensitive beneficial uses including aquatic life. Therefore, the interim limit for chloride for Irrigated Agricultural Dischargers is set equal to 230 mg/L to ensure protection of sensitive beneficial uses in the Calleguas Creek watershed.

Table 9. Final Load Allocations for Irrigated Agricultural Dischargers

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

Table 10. Interims Load Allocations for Irrigated Agricultural Dischargers

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

7.3 Consideration of Alternatives

- Alternative 1: POTW wasteload allocations are calculated as the design flow multiplied by the water quality objective and subtract by an adjustment factor (AF). AF is defined as the difference between the required reduction in background load as a minimum requirement and the actual reduction in background load for specified POTW.
- Alternative 2: POTW wasteload allocations are calculated as the design flow multiplied by the water quality objective and subtracted by AF. Additionally, a concentration-based allocation is included that is the Basin Plan objective unless the water supply chloride concentration exceed 80 mg/L. The concentration limits that apply during these periods are based on the water supply concentrations plus a factor to represent the additional salts added by use of the water.
- Alternative 3: POTW wasteload allocations are calculated as the design flow multiplied by the water quality objective. Additionally, a concentration-based allocation is included that is a receiving water limit set equal to the flow-weighted annual average of the Basin Plan objective at the base of each subwatershed to which a POTW discharges

Regional Board staff found that the POTW wasteload allocations which are calculated as the flow at the time the water quality measurement is collected multiplied by the water quality objective and subtracted by AF is the most protective approach to ensure background loads that are subtracted from the POTW loadings to meet the loading capacity. The AF also included to allow for increased of salts exports from the watershed to compensate for increased POTW loadings when water supply loads to the POTW increase.

8. Implementation Program

The Calleguas Creek watershed salts TMDL will be implemented by integrating watershed-scale infrastructure projects to desalt groundwater, and administrative programs to reduce salt loadings to the Calleguas Creek watershed. TMDL implementation will be carried out by water agencies, municipalities, POTWs and non-point dischargers in the Calleguas Creek Watershed to desalt groundwater. These projects focus on desalting groundwater underlying Calleguas Creek and discharging salts to the Pacific Ocean outside of Southern Ventura County. Water quality will be attained by reducing salts loads from groundwater exfiltration. However, through construction of a brine disposal line and ocean outfall, responsible agencies will have several options for implementing structural and nonstructural BMPs or treatments to attain a salt balance and attain water quality objectives. Wastewater desalting may be considered as part of the implementation program if water quality is not attained by implementation of groundwater desalting alone. Installation of individual wellhead desalters and agricultural desalters might also be economically feasible and desirable when the brine line is available. The Implementation Plan provides special studies in order to allow discharges to optimize structural and non structural BMPs. Wasteload allocations for major point source dischargers are based on existing standards. This section provides an overview of staff's analysis of the Implementation Plan.

Salt loading to Calleguas Creek and its tributaries is primarily a function of salt import to the watershed with imported water supply and urban and industrial uses that add additional salts. Additionally, irrigation concentrates salts in the shallow soils and groundwater which may degrade surface and groundwater quality. The concept of a salt balance to analyze salinity issues in water quality is well established. It is based on the chemical and environmental stability of minerals and ions and application of hydrological and mass balance to as a tool for implementing watershed management actions to address salinity related problems, including agricultural and industrial, and municipal uses, habitat alteration or loss. In the Calleguas Creek watershed, local stakeholders have championed the use of a salinity balance to develop a series of projects to attain a salt balance; some of those projects have been built.

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

- Reduce the amount of salts imported into the CCW
- Reduce the amount of salts added to water in the CCW
- Transport salts down gradient and export them out of the watershed
- Provide protection to sensitive beneficial uses
- Monitor and track achievement of the salt balance and the associated impacts on water quality

The TMDL implementation plan provides:

- Construction and integration of capital projects including:
  - Pipeline to convey brine and wastewater

- Pipelines to convey reclaimed wastewater
    - Ocean outfall for brine discharge
    - Groundwater extraction and treatment reverse osmosis
    - Water blending facilities
    - Creek Diversion

- Development of a Monitoring Plan to assess attainment of water quality standards and watershed salt balance

- POTW Wasteload allocations based on existing standards and adjustment factors for attainment of salt balance

- Interim Wasteload allocations for POTWs

- Special studies to assess mineral averaging, site specific objectives

- Regional Board consideration of site specific objectives and results of special studies.

The goal of the compliance strategy is to export the same mass of salts out of the watershed as are imported into the watershed and reduce the "stranded" loads to zero. The implementation actions described in the TMDL 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 based on 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.

8.1 Regional Implementation Elements

There are four key structural elements to the TMDL Implementation Plan described below – Regional Salinity Management Conveyance, Water Conservation, Water Softeners, and Best Management Practices for Irrigated Agriculture.

8.1.1 Regional Salinity Management Conveyance (RSMC)

Calleguas Municipal Water District is working with municipalities and 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 and convey the effluent to other areas for direct use or to an existing ocean outfall. The brine line forms the backbone of all the proposed projects by providing a mechanism for transporting salts down gradient 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 District Wastewater Treatment Plant to an existing ocean outfall in the City of Oxnard. 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.

Construction of the $107 million project began in 2003 and is expected to continue through 2018. Calleguas MWD certified a program environmental impact report for Phase 1 and Phase 2 of the RSMC project 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.

Table 11. 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.

8.1.2 Water Conservation

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 target reductions in imported water to reduce salt loading and stranded in the watershed.

8.1.3 Water Softeners

Programs will be implemented by responsible parties to provide education and incentives and/or disincentives to reduce the use of self-regenerative water softeners in the watershed with a goal of reducing the overall load to the POTWs from softeners by 10 percent. 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 remove 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 will be investigated. Finally, opportunities to pursue additional legislative remedies will be explored. Responsible parties shall report on the status of the water softener reduction program in annual monitoring reports.

8.1.4 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) may be 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.

Additionally, agricultural stakeholders have suggested that installation of individual wellhead desalters and or smaller, agricultural desalters might be economically feasible and desirable 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.

8.2 Sub watershed Implementation Elements

8.2.1 Subwatershed Implementation Elements – Southern Reaches of the Calleguas Creek Watershed

The Renewable Water Resource Management Program (RWRMP) for the Southern Reaches of the Calleguas Creek Watershed 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.

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;
- Achieve a salts balance within each sub-watershed;
- Reduce the salt load to surface waters; and
- Manage recycled and reclamation projects in a manner that achieves and maintains a salt balance.

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 down gradient through the Conejo Creek/Calleguas Creek reaches. Phase 1 includes the following elements:

- Expansion of the recycled water transmission and distribution system to allow the transport and use of more recycled water and to facilitate moving salts down gradient.
- 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. Additionally, the brine from the treatment process will be discharged to the RSMC and moved out of the watershed to the ocean.
- 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.
- 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 Calleguas MWD brine disposal system may be unable to receive such waters because of temporary operational interruptions. The relocation facilitates moves salts down gradient and out of the watershed by discharging them to a reach that is not impaired by salts and directly discharges to the lagoon.
- Install pumping facilities and pipelines to connect Camarillo WRP to the Camrosa recycled water system and discontinuation of 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.

Phase 2 of the RWRMP includes the following elements:

- 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.

- 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:

    - Terminating the Hill Canyon WWTP effluent discharge to the surface waters.

- 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
- If needed, replenishment water will be released in the City of Thousand Oaks to maintain in-stream beneficial uses. Study will be conducted to identify the discharge locations and volumes needed to maintain in-stream beneficial uses. Replenishment water will consist of imported water and/or local shallow groundwater. This element ensures protection of beneficial uses if the Hill Canyon WTP effluent discharge is terminated and /or the flows from the North and South Forks of the Arroyo Conejo are converted to the brine line.
- Expanding recycled water systems.
- 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:

- 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.
- Treated water discharges to surface waters to provide water for habitat and/or dilution.

The Camrosa Water District certified a program environmental impact report for the RWRMP in October 2006. 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. 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 12. 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

8.2.2 Subwatershed Implementation Element – Northern Reaches of the Calleguas Creek Watershed

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 down gradient and out of the watershed, provide for protection of beneficial uses and reduce the amount of salt added to the water. The plan will be composed of three phases as described below.

Phase 1 of the NRRWMP consists of the following elements:

- Blending of imported State Project Water with poorer quality groundwater from the Shallow South Las Posas Basin aquifer to obtain water of sufficient quality for agricultural use. 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 and meet the groundwater quality objectives.
- 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:

- Construction of a groundwater desalter facility near Moorpark to pump and treat poor quality groundwater in the South Las Posas Basin. The pumping and treatment of poor quality groundwater will supplement imported water supplies and reduce the groundwater levels in the shallow groundwater. By lowering groundwater levels, higher quality storm water flows can 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.
- Construction of a groundwater desalter facility in Camarillo near the intersection of Lewis and Upland Road. 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 in the brine. 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.

  Inclusion of the options above requires the extension of the RSMC to Simi Valley is scheduled to occur by 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 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 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 and 2. If water quality objectives are not attained, additional activities will be implemented in the southern reaches to meet the salt balance and to attain the water quality objectives including:

- Additional phases of the Moorpark desalter to treat more unconfined groundwater.
- Building an additional 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.

The current schedule for completion of Phases 1 through 4 is shown in the following table.

Table 13. 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

The Salt Balance model was used to verify that the proposed implementation actions will result in the achievement of a salt balance in the stream. The identified implementation actions will result in a salt balance in the stream and are expected to result in compliance with the allocations. Proposed implementation actions in the watershed, responsible agencies, and the estimated completion date are summarizes below.

Table 14. Summary of Proposed Implementation Actions

Action	Responsible Agency/ies	Schedule for Completion
Water Conservation	POTWs, Permitted Stormwater Dischargers, and Other NPDES Permittees	3 year
Water Softeners	POTWs and Permitted Stormwater Dischargers	10 year
RMSC Phase 1	Calleguas MWD	2 year
RMSC Phase 2	Calleguas MWD	5 year
RMSC Phase 3	Calleguas MWD	10 years
RWRMP Phase 1	Camrosa WD, CamSan	3 years
RWRMP Phase 2	Camrosa WD, TO	6 years
RWRMP Phase 3	Camrosa WD, TO	10 years
RWRMP Phase 4	To Be Determined	15 years
NRRWMP Phase 1	Calleguas MWD, Simi Valley, Moorpark	3 years
NRRWMP Phase 2	Calleguas MWD, VCWW, Camarillo	7 years
NRRWMP Phase 3	Camarillo, Simi Valley	10 years
NRRWMP Phase 4	To Be Determined	15 years
Final Completion Date		15 years

8.3 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. 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).

8.3.1. Input Tracking

Inputs to the watershed are easily tracked through following 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.

8.3.2 Output Tracking and Determining Compliance with Water Quality Objectives

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.

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. Monitoring should address the representative of the entire reach at the compliance point. The Executive Officer may revise the TMDL compliance point base on the result of the monitoring. 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 flows 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 in 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. 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 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 CCWTMP. 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.

8.3.3 Reporting and Modification of Calleguas Creek Watershed TMDL Monitoring Program (CCWTMP)

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 aspects of the CCWTMP. Results of sampling carried out through the CCWTMP and other programs within the CCW may be used to modify this plan, as appropriate. These modifications will be summarized in the annual report. Possible modifications could include, but are not limited to the, following:

- The inclusion of additional land use stations to accurately characterize loadings;
- The removal of land use stations if it is determined they are duplicative (i.e., a land use site in one subwatershed accurately characterize the land use in other subwatersheds);
- The inclusion of additional in-stream sampling stations;
- The elimination of analysis for constituents no longer identified in land use and/or in-stream samples. 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.

Other surface water and groundwater monitoring will be implemented as necessary to assess the impacts of the implementation actions and adjust the activities as necessary to protect beneficial uses and achieve the salts balance. Examples of additional monitoring that may be conducted include:

- Monitoring under Phase 2 and 3 of the RWRMP to evaluate the effects of replenishment water releases and groundwater treatment and releases.
- Monitoring to assess the impacts of management of the Simi Basin groundwater dewatering wells under Phase 1 of the NRRWMP.

8.3.4 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.

8.4 Staff Evaluation of Implementation Plan

Regional Board staff reviewed the proposed implementation plan in accordance with watershed model based on a salt balance. The focus of the Regional Board review is to confirm that the proposed implementation plan meets water quality objectives for salts in the Calleguas Creek watershed. The CCMS model was used to ensure that the percent reductions necessary to meet the TMDL allocations resulted in compliance with water quality objectives. The results from the model runs show 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.

Regional Board staff note that the structural BMPs or treatment can be operated in different regimes to attain water quality objectives. For example, if reduction of background loads from stranded salts does not attain water quality objectives throughout all reaches of the Calleguas Creek watershed, replenishment water can be added to attain salt objectives. The structural BMPs allow flexibility in providing replenishment water from potable sources or from desalted groundwater.

8.5 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 criteria 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/criteria and the results of implementation studies, if appropriate.

8.6 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 meets the requirements of the TMDL.

8.7 Special Studies

8.7.1. Special Study #1 (Optional) – Develop Averaging Periods

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 past, present, and potential 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 or appropriate by the Executive Officer of the Regional Board.

8.7.2 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 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 or appropriate for establishing natural sources exclusion by the Executive Officer.

8.7.3 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 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 or appropriate by the Executive Officer of the Regional Board.

8.7.4 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 or appropriate by the Executive Officer of the Regional Board.

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

As discussed in the Technical Report, 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 or appropriate 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.

8.8 Consideration of Alternatives

Staff considered two types of implementation plans, both including advanced treatment to remove salts from the watershed. The first alternative entails treating POTW effluent and the second alternative entails desalting groundwater underlying Calleguas Creek and its tributaries. The Regional Board does not have authority to specify the manner of implementation; however, staff notes that stakeholders strongly favor the second alternative because it provides additional benefits in the area of water resources, groundwater reclamation, and water conservation. Staff notes that the second alternative also addresses salt loading from groundwater exfiltration, which the first option does not mitigate effectively. With BPA language stating that TMDL compliance is based on salt export in conjunction with attaining numeric targets that are equivalent to water quality standards, Staff supports the second alternative for TMDL implementation.

The results from the model runs show that several reaches including but not limited to Revolon Slough, upstream of Hill Canyon WWTP and Camarillo WRP may not attain the water quality standards. For these reaches implementation actions including but not limited to discharge of desalted groundwater, diversion of high salts concentration groundwater to the brine line, and or adoption of site specific objective by the Regional Board will be considered.

8.9 Implementation Summary and Schedule

Interim allocations presented in TMDL and 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 13 presents the overall implementation schedule for the Calleguas Creek Watershed Salts TMDL. Table 13 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 15. Overall Implementation Schedule for Calleguas Creek Watershed Salts TMDL

Item	Implementation Action	Responsible Party	Completion Date
1	Effective date of interim Salts TMDL waste load allocations (WLAs)	POTWs, Permitted Stormwater Dischargers[1] (PSD), and Other NPDES Permittees	Effective date of the amendment
2	Effective date of interim Salts TMDL load allocations (LAs)	Agricultural Dischargers	Effective date of the amendment
3	Responsible jurisdictions and agencies shall submit compliance monitoring plan to the Los Angeles Regional Board for Executive Officer approval.	POTWs, PSD, Other NPDES Permittees, and 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, Other NPDES Permittees, and Agricultural Dischargers	1 year after monitoring plan approval by Executive Officer
5	Responsible jurisdictions and agencies shall submit workplans for the optional special studies.	POTWs, PSD, Other NPDES Permittees, and Agricultural Dischargers	Within 10 years of effective date of the TMDL
6	Responsible jurisdictions and agencies shall submit results of the special studies.	POTWs, PSD, Other NPDES Permittees, and Agricultural Dischargers	2 years after workplan approval by Executive Officer
7	Responsible jurisdictions and agencies shall demonstrate that the watershed has reduced the salt imbalance by 20%.	POTWs, PSD, Other NPDES Permittees, and Agricultural Dischargers	3 years after effective date of the TMDL
8	Responsible jurisdictions and agencies shall demonstrate that the watershed has reduced the salt imbalance by 40%.	POTWs, PSD, Other NPDES Permittees, and Agricultural Dischargers	7 years after effective date of the TMDL
9	Responsible jurisdictions and agencies shall demonstrate that the watershed has reduced the salt imbalance by 70%.	POTWs, Permitted Stormwater Dischargers (PSD), Other NPDES Permittees, and 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.	The Regional Board	12 years after effective date of the TMDL
11	Responsible jurisdictions and agencies shall demonstrate that the watershed has achieved an annual salt 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 the 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,	Permitted Stormwater	15 years after

[1] Permitted stormwater dischargers (PSD) include the Municipal Stormwater Dischargers (MS4s) of the Cities of Camarillo, Moorpark, Thousand Oaks, County of Ventura, Ventura County Watershed Protection District, and general industrial and construction permittees.

Item	Implementation Action	Responsible Party	Completion Date
	which shall be expressed as NPDES mass-based receiving water limits specified in accordance with federal regulations and state policy on water quality control.	Dischargers	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

9. Future Growth

The Ventura County Association of Governments projects an average annual population growth rate of 0.9 percent through 2030. Population growth is based on socioeconomic factors such as housing and employment. 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. Both Moorpark and Camarillo are predicted to experience greater than 30% growth in 2000-2020. 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.

The increase in population requires additional supply 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 required to export out of the watershed to maintain the balance. Consequently, increased salt imports from future growth are not expected to result in higher salt concentrations in receiving waters.

10. Economic Analysis

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, varieties of costs for energy were assumed and are noted in the table.

Table 16. 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	$1,743,072	(c)
	Totals				$25,859,474	

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 17. 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).