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1 Introduction

Several stream reaches and the estuary in the Santa Margarita River (SMR) watershed are on the 2010 Clean Water Act section 303(d) list of water quality limited segments (303(d) list) for nitrogen (N), phosphorus (P), or eutrophication. The listings are based on exceedances of a specific numeric interpretation of the biostimulatory narrative objective in the *Water Quality Control Plan for the San Diego Basin* (Basin Plan). The availability of more recent scientific advances provide a better framework to evaluate the impacts to water quality and beneficial uses from biostimulatory substances and the relationship between nutrient concentrations and those impacts. In light of the recent science, stakeholders in the SMR, in cooperation with the California Regional Water Quality Control Board, San Diego Region (SDRWQCB), have identified the need to develop a watershed process for evaluating and addressing the 303(d) listings utilizing the best available science and information.

This Process Plan for Identifying and Addressing Impairments due to Biostimulatory Substances in the Santa Margarita River Watershed (Process Plan) has been developed as a guide for this watershed evaluation. The Process Plan outlines the actions that will be used to evaluate and address the 303(d) listings in the SMR Watershed and other potential impacts to beneficial uses from biostimulatory substances (Project). The Process Plan describes, in general terms, the technical work to be conducted and the process that will be followed to , determine the appropriate regulatory and management strategies to restore and protect beneficial uses in the SMR. The Process Plan was prepared by the Santa Margarita Watershed Technical Advisory Committee on behalf of the Santa Margarita River Watershed Nutrient Initiative – Stakeholder Group (SMR Stakeholder Group).

The Process Plan provides background information in the introductory sections and a summary of regulatory and technical tasks to be completed to conduct the work in the remaining sections. For tasks that require detailed technical work, such as monitoring or modeling, detailed technical work plans are included as appendices to the Process Plan or will be developed as needed. Following is a summary of each process plan section.

Section 1. Introduction and overview of the Process Plan structure

Section 2. Purpose and Process Plan approach

Section 3. Background on the watershed group

Section 4. Summary of water quality objectives and beneficial uses. Comparison of existing water quality data to objectives and summary of current status of the watershed.

Section 5. Discussion of issues with biostimulatory substances and summary of more recent science and information.

Section 6. Identification of technical and policy issues to be addressed by the technical work

Section 7. Technical approach to the study

Section 8. Summary of key components of the work and decision points

Section 9. Schedule and cost estimate

2 Purpose and Approach

The purpose of the Process Plan is to develop technically sound scientific information that can be used by the SDRWQCB, in conjunction with other data, to select the appropriate regulatory approach to restore and protect the beneficial uses impacted by biostimulatory substances for the 303(d) listed water bodies within the Santa Margarita River watershed.

2.1 OUTLINE OF APPROACH

The Process Plan approach will generally follow the guidance for addressing 303 (d) – listed water bodies in California outlined in A Process for Addressing Impaired Waters in California (SWRCB, 2005), with modifications to reflect elements specific to biostimulatory substances and considerations based on the recently adopted San Diego Water Board Practical Vision (Practical Vision). The SDRWQCB has stated its intention to follow the guidance manual in addressing the 303(d) listed water bodies within the Santa Margarita River Watershed. The process specific to the SMR, which is generally summarized in the flow chart presented in Figure 1-1, is as follows:

1. Gather monitoring data and develop tools to evaluate potential impacts to beneficial uses from biostimulatory substances and identify potential impairments.

2. If an impairment exists, identify regulatory and management actions to address the impairment through collaborative, outcome-focused efforts that support both human uses and sustainable ecosystems, consistent with the Practical Vision.

3. Where possible and appropriate take early actions to restore the impairment.

4. If the impairment does not exist, evaluate the need for other regulatory actions to support delisting of the unimpaired reaches, based on the technical information and science developed during the Project.

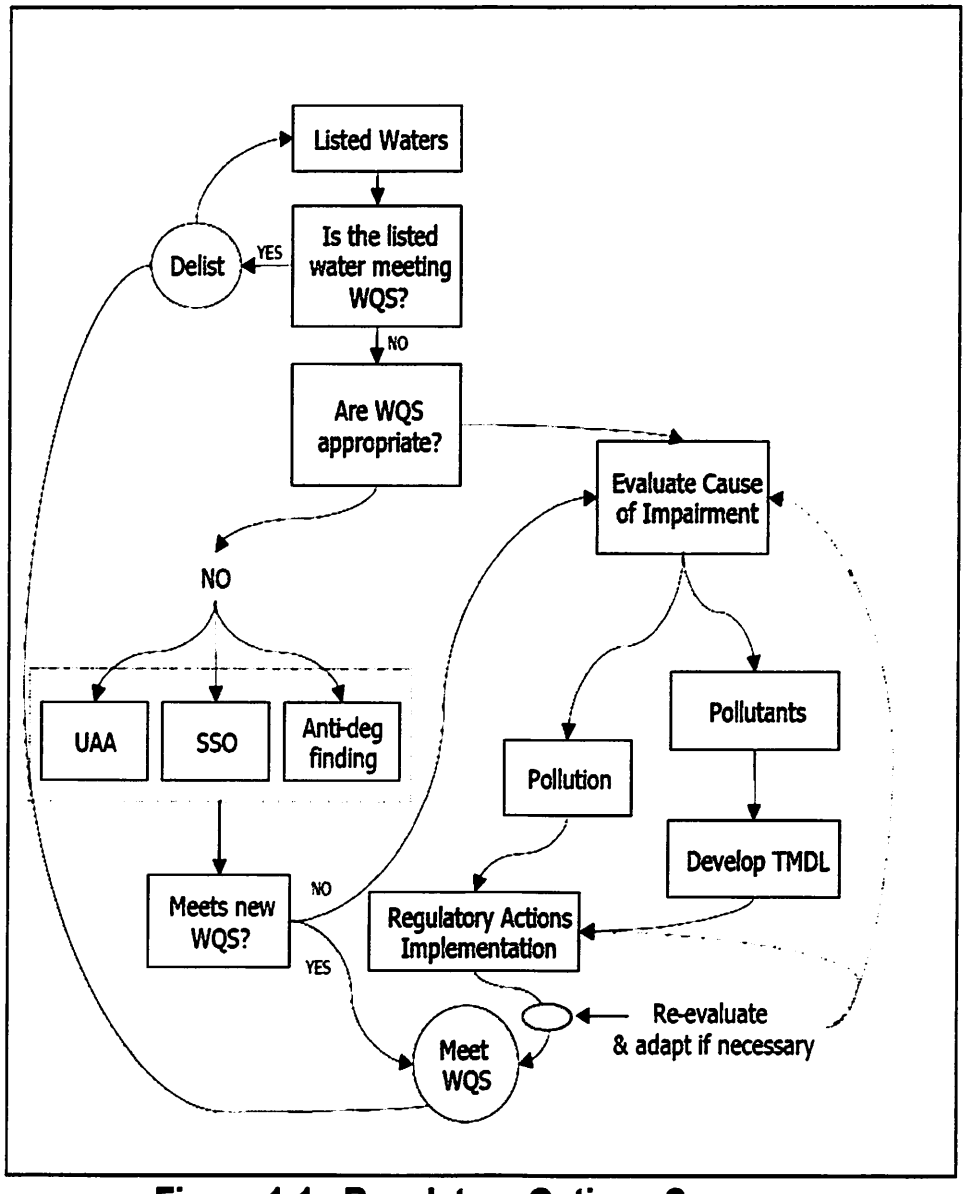

Figure 1-1. Regulatory Options Summary

Figure 1. Process for Addressing Impaired Waters in California (SWRCB, 2005)

The first step in the process shown in Figure 1-1 is to evaluate whether the listed water is meeting water quality standards. To conduct this evaluation, the applicable standards must be identified. In the San Diego Basin Plan, the water quality objective utilized to make the 303(d) listings was the narrative objective for biostimulatory substances.

> "Inland surface waters, bays and estuaries and coastal lagoon waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growths cause nuisance or adversely affect beneficial uses."

This narrative objective contains numeric interpretations of total nitrogen (TN) and total phosphorus (TP) concentrations that have historically been used to evaluate impairments and were used to develop the 303(d) listings. However, recent science indicates the historic numeric interpretation may not be appropriate. It is now recognized that due to site-specific factors (such as hydrology, shading, temperature) TN and TP concentrations/loads that can impact beneficial uses vary greatly among streams and estuaries (see more detailed discussion in Section 5). The Process Plan includes tasks to develop tools, using the best available science, to evaluate the impact of biostimulatory substances on beneficial uses, evaluate the 303(d) listings, and identify regulatory and management measures necessary to restore the beneficial uses of impaired water bodies. Waterbodies requiring management measures, may require additional investigative actions to determine the appropriate regulatory and management measures. The selection of the appropriate regulatory and management measures will be determined based on bringing the science and technical work together with the best available analysis to select the measures that will result in meaningful environmental outcomes.

For waterbodies for which biostimulatory substances are identified as potentially impacting beneficial uses, appropriate regulatory and management measures could include, but are not limited to, some or all of the following:

- Total Maximum Daily Load (TMDL)[1]
- Cease and desist or other enforcement orders
- Permit and/or waiver conditions for identified sources
- Management plans or Water Quality Improvement Plans (WQIP)
- Site-specific objectives to clarify the narrative biostimulatory substances objectives based on best available science.
- Implementation procedures for the biostimulatory substances objectives to reflect the best available science.

For waterbodies for which beneficial use impacts are not found, it may be necessary to take regulatory actions to facilitate the ability to delist the waterbody. Additionally, the SDRWQCB may chose to utilize the science developed through the technical work outlined in this Process Plan to modify the Basin Plan to be consistent with the current scientific understanding of the impact of biostimulatory substances on water quality. As a result, it is possible that regulatory actions, such as site-specific objectives or implementation guidelines for the biostimulatory substances objective may be developed.

In addition to the work discussed above, technical work may be conducted to evaluate sources, identify nutrient loads, and evaluate potential management measures, including potential early action items. The technical tasks to conduct this work will be incorporated into the Process Plan as the need for the information is identified and the scope of the work to be conducted is determined.

[1] As defined by the EPA (http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/overviewoftmdl.cfm) a TMDL is amount of a pollutant that can enter an impaired water body that will ultimately result in a restoration of the beneficial uses for that water body. A Basin Plan Amendment is typically used to adopt the TMDL. Basin Plan Amendments requires approval by the Regional Water Quality Control Board, the State Water Resources Control Board, the state Office of Administrative Law, and EPA. For the purposes of the Process Plan, the term TMDL shall refer to both the calculation and the regulatory actions needed to amend the Basin Plan to incorporate the TMDL.

Although the SMR Stakeholder Group will develop technical work for their use through implementing the Process Plan, ultimately, the SDRWQCB, SWRCB, and U.S. Environmental Protection Agency (EPA) (collectively referred to as the "Regulatory Agencies") will make the final decisions on the appropriate regulatory action(s) needed. The technical work must be acceptable for these purposes and presented in an appropriate format to facilitate the use by the regulatory agencies. Additionally, should the SMR Stakeholder Group wish to recommend changes to the Basin Plan, the technical work must be sufficiently robust to support those recommended changes.

For the purposes of the Process Plan, all the outlined tasks have been identified based on the assumption that the SMR Stakeholder Group will develop technical information and recommendations that will be provided to the SDRWQCB for their use. The Process Plan assumes that the technical work provided will be sufficient to support Basin Planning activities, but that the SDRWQCB will prepare the Basin Plan Amendment, Staff Report and CEQA documentation necessary to support adoption of any necessary regulatory actions.

2.2 GUIDING PRINCIPLES

As described in the approach, the exact steps that will be taken to achieve the purpose of the Process Plan will be dependent on the science developed through the technical work. As a result, the Process Plan is purposefully general and designed to be adaptable to the information that will be developed. To ensure that the implementation of the Process Plan achieves the purpose and provides the information necessary to evaluate and address the 303(d) listings and other potential beneficial use impacts due to biostimulatory substances, key guiding principles were identified that will be utilized to perform the work.

1. Develop and utilize the best available science to protect beneficial uses.
2. Determine the regulatory outcomes and any required management actions based on the results of the technical work described in the Process Plan.
3. Consider the potential impacts of the regulatory and management measures on all beneficial uses to develop meaningful environmental outcomes that also support human uses of the water, including the need to achieve a sustainable local water supply.
4. Consider opportunities for early actions that will result in meaningful environmental outcomes.

3 Santa Margarita River Nutrient Initiative - Stakeholder Group

3.1 HISTORY OF GROUP

The Santa Margarita River Watershed Nutrient Initiative - Stakeholder Group (SMR Stakeholder Group), formed in 2011, is a collaboration of stakeholders from within the watershed for the purpose of monitoring and assessing water quality in order to evaluate and address impairments due to biostimulatory substances in the river, estuary, and tributaries. The SMR Stakeholder Group is funded largely through the Integrated Regional Water Management (IRWM) process and is currently receiving a Proposition 84 grant from the State of California with matching funding and in-kind services by the Counties of Riverside and San Diego and U.S. Marine Corps

(USMC) Base Camp Pendleton. The SMR Stakeholder Group evolved from several earlier watershed planning initiatives, as described in the following subsections.

3.1.1 Santa Margarita River Water Quality Monitoring Group (WQMG)

In 1996, Camp Pendleton organized the Santa Margarita River Water Quality Monitoring Group (WQMG). The WQMG membership included approximately 30 stakeholders in the watershed that were engaged or interested in water quality monitoring. The WQMG's early collaboration led to coordinated water quality monitoring and better efficiency in monitoring efforts within the watershed. This coordination eventually led to development of the Framework Monitoring Plan. The WQMG last met in 2010 and was briefed on the findings of the lower watershed water quality monitoring program funded by Camp Pendleton.

3.1.2 Santa Margarita River Executive Management Team (EMT)

The EMT was formed in 2001 as an offshoot of the WQMG. The EMT was organized and led by the Bureau of Reclamation's (BOR) Southern California Area Office. The EMT included representatives from Camp Pendleton, the Counties of Riverside and San Diego, the Cities of Temecula and Murrieta, four water districts, Caltrans, and several other parties in the watershed. The EMT focused on addressing water quality monitoring, modeling water quality for the purpose of assessing levels of impairment and potential management strategies, and preparing for potential TMDL development.

Phase 1 of the EMT's Plan of Study developed a Framework Monitoring Plan (FMP) that addressed water quality issues on the Santa Margarita River. The FMP identified goals, including: 1) setting appropriate water quality objective, 2) scientific development of TMDLs, 3) understanding the river's assimilative capacity for nutrients, 4) understanding relationships between habitat health and water quality, 5) understanding the relationship of water quality to water supply and water rights, 6) reviewing 303(d) listings and beneficial use impairment, 7) addressing stormwater and nonpoint source discharges, 8) reducing sediment loading, 9) evaluating stormwater BMPs, 10) facilitating regulatory compliance, 11) sharing information, and 12) promoting water recycling.

Phase 2 focused on resolving data issues identified in the FMP and refining the identified goals. For each of the twelve identified goals, objectives, criteria, and measures for success were developed. Phase 3A developed a preliminary watershed water quality model and evaluated the effectiveness of the model for determining the assimilative capacity of the river for nutrients to resolve long-term issues of effluent discharge to the river. The model selected – Watershed Assessment and Risk Management Framework (WARMF) - was populated with land use, hydrology, topography, water quality, and other data and calibrated for flow (but not for water quality). Phase 3B determined how the watershed model could be refined to support stakeholder driven TMDL development in the watershed. Ground and surface water interactions were documented including methods to integrate the current watershed model with existing groundwater models. Stetson Engineers participated in this attempt at integration, which improved the watershed model's hydrologic prediction capability.

During 2008, the EMT considered embarking upon Phase 4 of the Plan of Study, which would coordinate with existing studies, synthesize current and historical watershed research, assess data gaps, and develop a watershed water quality monitoring study. Coordinated with USEPA and SDRWQCB staff, the study would support the effort to model 1) water supply deliveries in the

Santa Margarita River, 2) live stream discharges of treated effluent, 3) return flows of imported and native waters, and 4) calculation of nutrient TMDL loading allocation scenarios. However, this effort was abandoned when the SDRWCB informed the EMT that it would not approve use of the WARMF because the WARMF model contains proprietary code and; therefore, could not be used in TMDL development.

During 2010, some members of the EMT worked together to submit proposals requesting Proposition 84 funding to continue study of the SMR estuary for development of TMDLs, water quality monitoring, and modeling of the river and tributaries to support development of site-specific objectives. During 2011, this project evolved into the SMR Stakeholder Group.

3.1.3 Lagoon TMDL Group

Eight parties were named within the SDRWQCB Investigation Order R9-2006-076 which requires conducting water quality and hydrographic studies in support of TMDL development to address eutrophication of the SMR Lagoon. These parties joined to form the "Lagoon TMDL Group." The group pooled resources to accomplish the required monitoring program during 2007-2009. Subsequent studies have been performed to fill in data gaps and further characterize conditions in the lagoon. This project was included in the Prop 84 funding request, and this group has been incorporated into the SMR Stakeholder Group.

3.2 CURRENT STRUCTURE OF GROUP

The entities that currently are a part of the SMR Stakeholder Group may include, but may not be limited to:

- Cahuilla Band of Indians
- Pechanga Band of Luisena Indians
- Sierra Club
- Trout Unlimited
- Rancho California Water District (RCWD)
- Eastern Municipal Water District
- Western Municipal Water District
- Fallbrook Public Utilities District
- Rainbow Municipal Water District
- Mission Resource Conservation District
- Elsinore-Murrieta-Anza Resource Conservation District
- Temecula Valley Wine Growers Association
- Upper Santa Margarita - Irrigated Lands Group
- San Diego County Farm Bureau – Irrigated Lands Group
- Riverside County Farm Bureau
- City of Temecula
- City of Murrieta
- City of Wildomar
- City of Menifee
- County of San Diego
- Riverside County Flood Control & Water Conservation District (RCFC&WCD)
- County of Riverside

- California State University San Diego (SDSU), Santa Margarita Ecological Research Station
- Caltrans
- California Regional Water Quality Control Board, San Diego Region
- U.S. Environmental Protection Agency
- U.S. Bureau of Reclamation
- USMC Base Camp Pendleton / Naval Weapons Station Fallbrook

The SMR Stakeholder Group has developed a Charter to define the governing structure of the group, the decision-making processes, and the process for engagement with regulatory agencies during the project. The Charter is included as Appendix 4 to the Process Plan.

The SMR Stakeholder Group is supported by an independent facilitator, and has established a Technical Advisory Committee (TAC). The TAC is comprised of consultants, staff specialists from Participant organizations, and Participants with applicable technical proficiency and interest. While these TAC members serve the interests of various Participants, collectively, their role is to conduct technical activities on behalf of the full process and SMR Stakeholder Group. More specifically, TAC members have the following responsibilities:

1. Provide technical guidance to the SMR Stakeholder Group including the development of informational materials, delivery of technical presentations, and availability to answer technical questions.
2. Conduct technical tasks on behalf of the project and at the direction of the Steering Committee (as informed by the full SMR Stakeholder Group).
3. Develop technical work products for use by the full SMR Stakeholder Group, the Steering Committee, and/or the Regulatory Subgroup.
4. Provide and update a project timeline and schedule to help manage technical assignments and decision milestones.
5. Prepare and modify the process plan to be mutually agreed on by the Steering Committee and the SDRWQCB.

The SMR Stakeholder Group will direct and coordinate the work done to complete this process plan. The TAC will be responsible for conducting the majority of the technical work with oversight and review by the SMR Stakeholder Group.

4 Problem Statement

The Santa Margarita River and its tributary streams, including Murrieta, Temecula, Pechanga, Devils, Stone, Rainbow, Sandia, De Luz, and Fallbrook Creeks drain a watershed nearly 744 square miles (sq. mi.) in size. The watershed lies in both San Diego and Riverside Counties, with over 60 sq. mi. contained within the bounds of Camp Pendleton (**Figure 2**). Its headwater streams (Temecula, Murrieta, Wilson, Santa Gertrudis, Tucalota, and Warm Springs) drain off the western slopes of the San Jacinto Mountains, the northern slopes of the Palomar Mountains, and the eastern slopes of the Santa Rosa Plateau to the Temecula Valley. The 27-mile main stem of the SMR River begins at the confluence of Murrieta and Temecula Creeks, at the head of

Temecula Canyon, and terminates at the Pacific Ocean at the Santa Margarita Estuary.[2] Only the portion of the watershed that is downstream from major dams is addressed in the Process Plan. **Figure 3** displays the study area within the Santa Margarita watershed that is addressed by the Process Plan.

The USGS has delineated and classified the Santa Margarita River watershed as the Santa Margarita Hydrologic Unit (HU) 18070302. The hydrologic unit encompasses the total 744 sq. mi. drainage area of the Santa Margarita River. The SDRWQCB further dissects the HU into Hydrologic Areas (HA) and Hydrologic Sub Areas (HSA). These delineations are based on major tributary watersheds, or a major valley containing one or more groundwater basins and having closely related geologic, hydrologic, and topographic characteristics. Area boundaries are based primarily on surface drainage boundaries. The Lower Santa Margarita groundwater basin is contained in the Ysidora Hydrologic Area (HA 902.10), and is further subdivided into the Lower Ysidora (HSA 902.11), the Chappo (HSA 902.12), and the Upper Ysidora (HAS 902.13) Hydrologic Sub Areas.[3] Beneficial Uses and WQOs have been designated for each hydrologic sub area.

[2] Stetson Engineers, Inc. 2010. Hydrological and Biological Support to Lower Santa Margarita River Watershed Monitoring Program Water Years 2008 – 2009.

[3] *Ibid.*

Figure 2. Santa Margarita River Watershed Location Map[4]

[4] Stetson Engineers, Inc. 2010. Hydrological and Biological Support to Lower Santa Margarita River Watershed Monitoring Program Water Years 2008 – 2009.

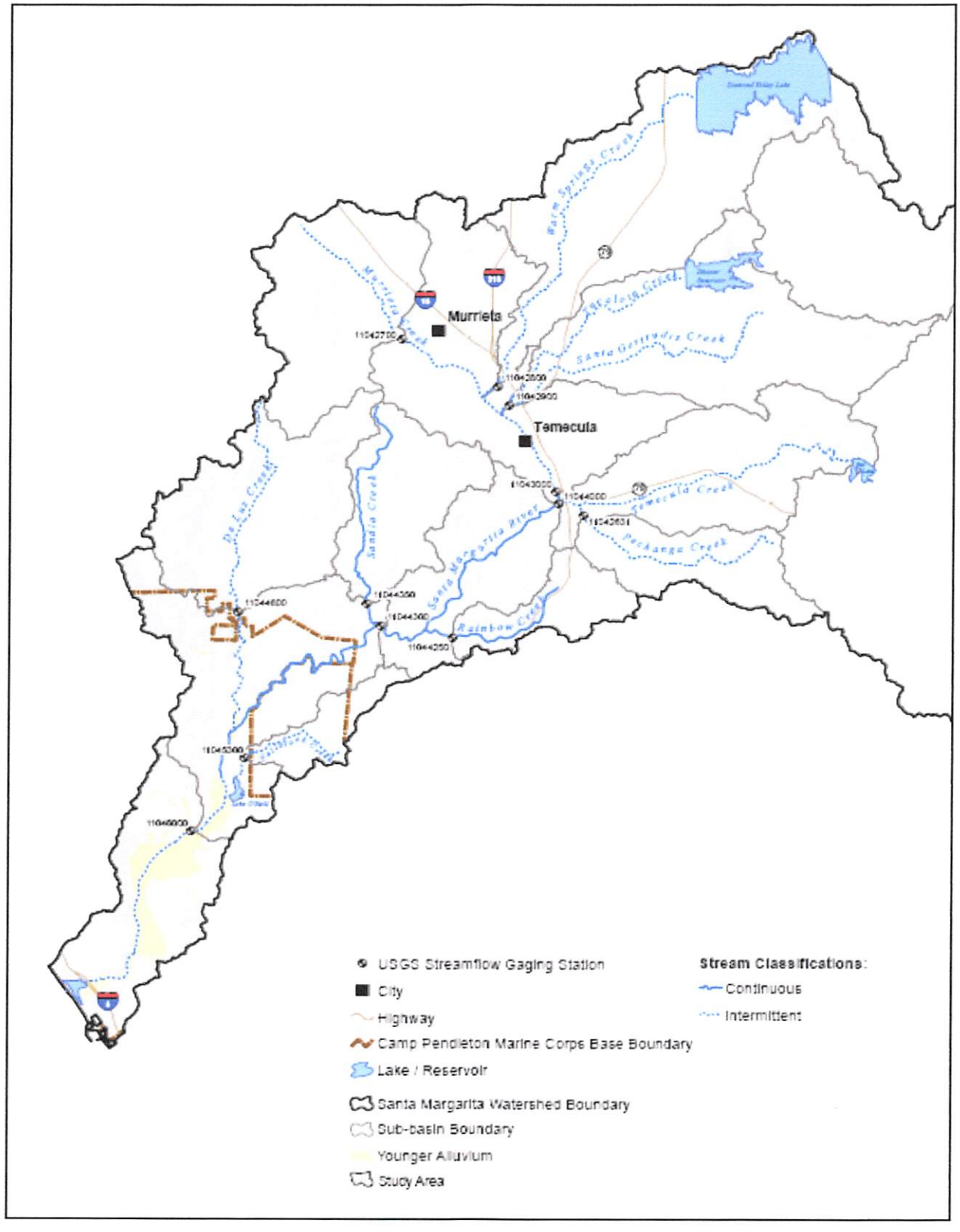

Figure 3. Santa Margarita Watershed Process Plan Study Area

4.1 BASIN PLAN BENEFICIAL USES AND WATER QUALITY OBJECTIVES

The Basin Plan designated the beneficial uses and water quality objectives for groundwater and surface waters of the San Diego Region. The existing and potential beneficial uses of inland surface waters in the Santa Margarita River watershed are listed in **Table 1**. The Basin Plan provides the following guidance for interpreting the table:

> "Hydrologic unit, area, and subarea numbers are noted in [Table 1] as a cross reference to the classification system developed by the California Department of Water Resources. For those surface water bodies that cross into other hydrologic units, such water bodies appear more than once in a table.... In most instances, surface waters are subdivided into reaches at hydrologic subarea boundaries. Those waters not specifically listed (generally smaller tributaries) are designated with the same beneficial uses as the streams, lakes, or reservoirs to which they are tributary."

The existing and potential beneficial uses of lakes and reservoirs in the Santa Margarita River watershed are listed in **Table 2**. Finally, the existing beneficial uses of the Santa Margarita Lagoon are listed in **Table 3**.

While all beneficial uses must be considered and protected, some are more likely to be impacted by biostimulatory substances, such as; Cold Freshwater Habitat (COLD), Fish Migration (MIGR), Municipal and Domestic Supply (MUN), Water Contact Recreation (REC-1), Noncontact Water Recreation (REC-2), Fish Spawning (SPWN), and Warm Freshwater Habitat (WARM). All water bodies in the watershed are designated with recreational and aquatic life beneficial uses that could be impacted by biostimulatory substances.

Documentation of the impacts to beneficial uses is one of the key management questions for this Process Plan. Section 6 provides a discussion of the watershed beneficial uses and the ways in which the technical work will evaluate the beneficial uses and key issues to be considered in the technical work. Section 7 identifies technical work elements that will be used to ensure protection of the beneficial uses that could be impacted by biostimulatory substances in the SMR watershed.

Table 1. Beneficial Uses of Inland Surface Waters in the Santa Margarita River Watershed

Water body[1,2]	Hydrologic Unit Basin Number	MUN	AGR	IND	PROC	GWR	FRSH	POW	REC-1	REC-2	BIOL	WARM	COLD	WILD	RARE	SPWN
Santa Margarita River	2.22	●	●	●					●	●		●	●	●	●	
Murrieta Creek	2.31	●	●	●	●				○	●		●		●		
Bundy Canyon	2.31	●	●	●	●				○	●		●		●		
Slaughterhouse Canyon	2.31	●	●	●	●				○	●		●		●		
Murrieta Creek	2.32	●	●	●	●				○	●		●		●		
Murrieta Creek	2.52	●	●	●	●	●			○	●		●		●		
Cole Canyon	2.32	●	●	●	●				○	●	●	●		●		
Miller Canyon	2.32	●	●	●	●				○	●		●		●		
Warm Spring Creek	2.36	●	●	●	●				○	●		●		●		
Diamond Valley	2.36	●	●	●	●				○	●		●		●		
Goodhart Canyon	2.36	●	●	●	●				○	●		●		●		
Pixley Canyon	2.36	●	●	●	●				○	●		●		●		
Warm Spring Creek	2.35	●	●	●	●				○	●		●		●		
Domenigoni Valley	2.35	●	●	●	●				○	●		●		●		
Warm Spring Creek	2.34	●	●	●	●				○	●		●		●		
Warm Spring Creek	2.33	●	●	●	●				○	●		●		●		
French Valley	2.33	●	●	●	●				○	●		●		●		
Santa Gertrudis Creek	2.42	●	●	●	●	○			●	●		●		●		
Long Valley	2.42	●	●	●	●	○			●	●		●		●		
Glenoak Valley	2.42	●	●	●	●	○			●	●		●	●	●		
Tucalota Creek	2.43	●	●	●	●	○			●	●		●	●	●		
Willow Canyon	2.44	●	●	●	●	○			●	●		●	●	●		

Water body[1,2]	Hydrologic Unit Basin Number	MUN	AGR	IND	PROC	GWR	FRSH	POW	REC-1	REC-2	BIOL	WARM	COLD	WILD	RARE	SPWN
Tucalota Creek	2.41	•	•	•	•	○			•	•		•		•		
Crown Valley	2.41	•	•	•	•	○			•	•		•	•	•		
Rawson Canyon	2.41	•	•	•	•	○			•	•		•	•	•		
Tucalota Creek	2.42	•	•	•	•	○			•	•		•		•		
Santa Gertrudis Creek	2.32	•	•	•	•				○	•		•		•		
Long Canyon	2.32	•	•	•	•				○	•		•		•		
Temecula Creek	2.93	•	•	•	•	•			○	•		•		•		
Kohler Canyon	2.93	•	•	•	•	•			○	•		•	•	•		
Rattlesnake Creek	2.93	•	•	•	•	•			○	•		•	•	•		
Temecula Creek	2.92	•	•	•	•	•			○	•		•		•		
Chihuahua Creek	2.94	•	•	•	•	•			○	•		•		•		
Chihuahua Creek	2.92	•	•	•	•	•			○	•		•		•		
Cooper Canyon	2.92	•	•	•	•	•			○	•		•		•		
Iron Spring Canyon	2.92	•	•	•	•	•			○	•		•		•		
Temecula Creek	2.91	•	•	•	•	•			○	•		•		•		
Culp Valley	2.91	•	•	•	•	•			○	•		•		•		
Temecula Creek	2.84	•	•	•	•	•			•	•		•	•	•		•
Tule Creek	2.84	•	•	•	•	•			•	•		•	•	•		
Million Dollar Canyon	2.84	•	•	•	•	•			•	•		•	•	•		
Cottonwood Creek	2.84	•	•	•	•	•			•	•		•	•	•		•
Temecula Creek	2.83	•	•	•	•	•			•	•		•	•	•		•
Long Canyon	2.83	•	•	•	•	•			•	•		•	•	•		•
Wilson Creek	2.63	•	•	•	•	•			○	•		•		•		

Water body[1,2]	Hydrologic Unit Basin Number	MUN	AGR	IND	PROC	GWR	FRSH	POW	REC-1	REC-2	BIOL	WARM	COLD	WILD	RARE	SPWN
Wilson Creek	2.61	●	●	●	●	●			○	●		●		●		
Cahuilla Creek	2.73	●	●	●	●	●			○	●		●		●		
Hamilton Creek	2.74	●	●	●	●	●			○	●		●		●		
Hamilton Creek	2.73	●	●	●	●	●			○	●		●		●		
Cahuilla Creek	2.72	●	●	●	●	●			○	●		●		●		
Cahuilla Creek	2.71	●	●	●	●	●			○	●		●		●		
Elder Creek	2.71	●	●	●	●	●			○	●		●		●		
Cahuilla Creek	2.61	●	●	●	●	●			○	●		●		●		
Wilson Creek	2.81	●	●	●	●	●			●	●		●	●	●		
Lewis Valley	2.62	●	●	●	●	●			○	●		●		●		
Arroyo Seco Creek	2.81	●	●	●	●	●			●	●		●	●	●		
Arroyo Seco Creek	2.82	●	●	●	●	●			●	●		●	●	●		●
Kolb Creek	2.81	●	●	●	●	●			●	●		●	●	●		
Temecula Creek	2.81	●	●	●	●	●			●	●		●	●	●		●
Temecula Creek	2.51	●	●	●	●	●			○	●		●		●		
Temecula Creek	2.52	●	●	●	●	●			○	●		●		●		
Pechanga Creek	2.52	●	●	●	●	●			○	●		●		●		
Rainbow Creek	2.23	●	●	●					●	●		●	●	●		●
Rainbow Creek	2.22	●	●	●					●	●		●	●	●		●
Sandia Canyon	2.22	●	●	●					●	●		●	●	●		●
Walker Basin	2.22	●	●	●					●	●		●	●	●		
Santa Margarita River	2.21	●	●	●					●	●		●	●	●	●	
De Luz Creek	2.21	●	●	●					●	●		●	●	●	●	●

Water body[1,2]	Hydrologic Unit Basin Number	MUN	AGR	IND	PROC	GWR	FRSH	POW	REC-1	REC-2	BIOL	WARM	COLD	WILD	RARE	SPWN
Cottonwood Creek	2.21	•	•	•					•	•		•	•	•		
Camps Creek	2.21	•	•	•					•	•		•	•	•		•
Fern Creek	2.21	•	•	•					•	•		•	•	•		•
Roblar Creek	2.21	•	•	•					•	•		•	•	•		
Santa Margarita River	2.13	•	•	•	•				•	•		•	•	•	•	
Wood Canyon	2.13	•	•	•	•				•	•		•		•		
Santa Margarita River	2.12	•	•	•	•				•	•		•	•	•	•	
Santa Margarita River	2.11	•	•	•	•				•	•		•	•	•	•	
Pueblitos Canyon	2.11	•	•	•	•				•	•		•		•	•	
Newton Canyon	2.11	•	•	•	•				•	•		•		•		

Notes:
- • Existing Beneficial Use
- ○ Potential Beneficial Use

1. Water bodies are listed multiple times if they cross hydrologic area or sub area boundaries.
2. Beneficial use designations apply to all tributaries to the indicated water body, if not listed separately.

Table 2. Beneficial Uses of Reservoirs and Lakes in the Santa Margarita River Watershed

Reservoirs and Lakes	Hydrologic Unit Basin Number	MUN	AGR	IND	PROC	GWR	FRSH	POW	REC-1	REC-2	WARM	COLD	WILD	RARE
O'Neill Lake	2.13	•	•	•	•				•	•	•	•	•	•
Diamond Valley Lake	2.35 & 2.36	•	•	•	•	•		•	•[1]	•	•	•	•	
Lake Skinner	2.42	•	•	•	•	○			•[1]	•	•		•	
Vail Lake	2.81	•	•	•	•	•			•[1]	•	•		•	

Notes:
- • Existing Beneficial Use
- ○ Potential Beneficial Use

1. Fishing from shore or boat permitted, but other water contact recreational (REC-1) uses are prohibited.

Table 3. Beneficial Uses of the Santa Margarita Lagoon

Coastal Water	Hydrologic Unit Basin Number	IND	NAV	REC-1	REC-2	COMM	BIOL	EST	WILD	RARE	MAR	AQUA	MIGR	SPWN	WARM	SHELL
Santa Margarita Lagoon	2.11			•	•			•	•	•	•		•	•		

Notes:
• Existing Beneficial Use

The Basin Plan includes water quality objectives (WQOs) for un-ionized ammonia, nitrate, and biostimulatory substances. The water quality objectives for Total Nitrogen (TN) and Total Phosphorus (TP) are listed under the objectives for biostimulatory substances as follows:

> "Inland surface waters, bays and estuaries and coastal lagoon waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growths cause nuisance or adversely affect beneficial uses."
>
> "Concentrations of nitrogen and phosphorus, by themselves or in combination with other nutrients, shall be maintained at levels below those which stimulate algae and emergent plant growth. Threshold total phosphorus (P) concentrations shall not exceed 0.05 mg/l in any stream at the point where it enters any standing body of water, nor 0.025 mg/l in any standing body of water. A desired goal in order to prevent plant nuisance in streams and other flowing waters appears to be 0.1 mg/l total P. These values are not to be exceeded more than 10% of the time unless studies of the specific water body in question clearly show that water quality objective changes are permissible and changes are approved by the Regional Board. Analogous threshold values have not been set for nitrogen compounds; however, natural ratios of nitrogen to phosphorus are to be determined by surveillance and monitoring and upheld. If data are lacking, a ratio of N:P = 10:1, on a weight to weight basis shall be used."
>
> "Inland surface waters shall not contain biostimulatory substances in concentrations in excess of the numerical objectives described in Table 3-2 (of the Basin Plan)."
>
> "Certain exceptions to the above water quality objectives are described in Chapter 4 in the sections titled Discharges to Coastal Lagoons from Pilot Water Reclamation Projects and Discharges to Inland Surface Waters."

Table 4 and **Table 5** summarize the water quality objectives and numeric interpretation of the narrative objectives for nutrients in the inland surface waters and coastal lagoons of the Santa Margarita Watershed.

Table 4. Nutrient Water Quality Objectives for the Streams and Other Flowing Waters within the San Diego Region

Compound	Water Quality Objective (mg/L)
Un-ionized Ammonia (as N)	0.025
Nitrate (as NO_3)[1]	45[2]
Nitrite (as N)[1]	1[2]
Nitrate + Nitrite (as N)[1]	10[2]
Total Nitrogen[1]	Ratio of N:P = 10:1
Total Phosphorus	0.1/0.05[3]

Notes:
1. Threshold values have not been set for nitrogen compounds; however, natural ratios of nitrogen to phosphorus are to be determined by surveillance and monitoring and upheld. If data are lacking, a ratio of N: P=10:1 shall be used.
2. Only applies to waters designated with the MUN beneficial use.
3. Numeric interpretation of narrative objective. Lower value applies at point where stream enters a standing body of water.

Table 5. Nutrient Water Quality Objectives for the Standing Bodies of Water within the San Diego Region

Compound	Water Quality Objective (mg/L)
Un-ionized Ammonia (as N)	0.025
Nitrate (as NO_3)[1]	45[2]
Nitrite (as N)[1]	1[2]
Nitrate + Nitrite (as N)[1]	10[2]
Total Nitrogen[1]	Ratio of N:P = 10:1
Total Phosphorus[3]	0.025

Notes:
1. Threshold values have not been set for nitrogen compounds; however, natural ratios of nitrogen to phosphorus are to be determined by surveillance and monitoring and upheld. If data are lacking, a ratio of N: P=10:1 shall be used.
2. Only applies to waters designated with the MUN beneficial use.
3. Numeric interpretation of narrative objective.

The Basin Plan also includes water quality objectives for response indicators that could be impacted by algal growth. These objectives include dissolved oxygen and pH.

> "Dissolved oxygen levels shall not be less than 5.0 mg/L in inland surface waters with designated MAR or WARM beneficial uses or less than 6.0 mg/L in waters with designated COLD beneficial uses. The annual mean dissolved oxygen concentration shall not be less than 7 mg/L more than 10% of the time."
>
> "Changes in normal ambient pH levels {as a result of pollutant discharges} shall not exceed 0.2 units in waters with designated marine (MAR), or estuarine (EST), or saline (SAL) beneficial uses. Changes in normal ambient pH levels shall not exceed 0.5 units in fresh waters with designated cold freshwater habitat (COLD) or warm freshwater habitat (WARM) beneficial uses.
>
> In bays and estuaries, the pH shall not be depressed below 7.0 nor raised above 9.0.
>
> In inland surface waters the pH shall not be depressed below 6.5 nor raised above 8.5."

4.2 303(D) LISTINGS

Various water bodies within the Santa Margarita River watershed are listed on the 2010 Clean Water Act (CWA) section 303(d) list of water quality limited segments as impaired due to nutrients. Water body/pollutant combinations were listed if: (1) the data used satisfied the data quality requirements of the *Water Quality Control Policy For Developing California's Clean Water Act Section 303(d) List* (Listing Policy), (2) the number of samples that exceeded the Basin Plain water quality objectives for the pollutant in question exceeded the allowable frequency listed in the Listing Policy, and (3) no additional data and information were available indicating that standards are not met. Data used for the 303(d) list included samples collected by Marine Pollution Studies Laboratory – Department of Fish and Game, Riverside County Flood Control and Water Conservation District, County of Riverside, City of Murrieta, City of Temecula, LAW Crandall, Southern California Coastal Water Research Project, and Rancho California Water District. The water bodies that were listed as impaired due to nutrients on the 2010 303(d) list are listed in **Table 6** and shown in **Figure 4**.

Table 6. 2010 303(d) Listings for Nutrients in the Santa Margarita River Watershed

Water Body Name	California Watershed	Pollutant	Estimated Size Affected
De Luz Creek	90221000	Nitrogen	14 miles
Murrieta Creek	90252000	Nitrogen and Phosphorus	12 miles
Rainbow Creek	90222000	Nitrogen and Phosphorus	5 miles
Redhawk Channel	90251000	Nitrogen and Phosphorus	0.15 miles
Santa Gertrudis Creek	90242000	Phosphorus	12 miles
Santa Margarita Lagoon	90211000	Eutrophic	28 acres
Santa Margarita River (Lower)	90211000	Nitrogen and Phosphorus	12 miles
Santa Margarita River (Upper)	90222000	Phosphorus	18 miles
Temecula Creek	90251000	Phosphorus	44 miles
Warm Springs Creek (Riverside County)	90233000	Nitrogen and Phosphorus	15 miles

In general, the 303(d) listings are based on data from one or two sampling locations located on the reach.

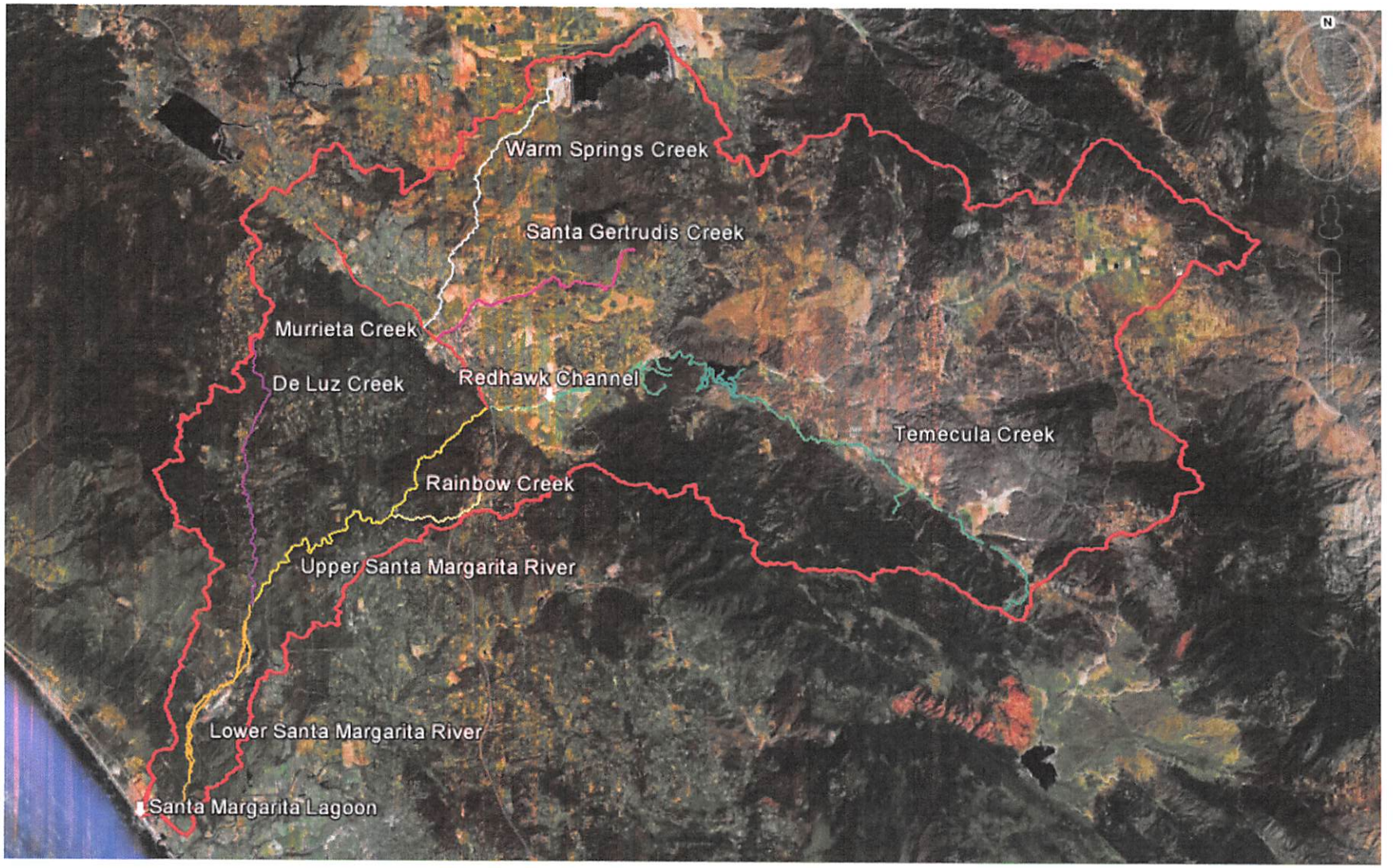

Figure 4. Santa Margarita River Watershed –303(d) Listings for Nutrients

4.3 EXISTING DATA AND CURRENT CONDITIONS

To evaluate and confirm the 303(d) listings, one of the first tasks is to evaluate current data and determine if water quality objectives are being exceeded. As one of the major goals of the Process Plan is to determine the numeric objectives that will be utilized to evaluate potential watershed impairments, the analysis was limited to reviewing existing compilations of data and the basis for the 303(d) listing as compared to the current numeric interpretation of the Basin Plan objective. The majority of the 303(d) listings have occurred in the last two listing cycles and the available data generally confirms the listings. Therefore, this section focuses on available data compilations that include data from the listed reaches and other reaches and tributaries that are not currently on the 303(d) list.

From November 2007 to September 2009, Stetson Engineers, Inc. conducted an extensive monitoring program throughout the lower portion of the Santa Margarita River watershed. As part of this monitoring program, samples were taken at various monitoring locations and analyzed for nutrients. Samples were taken on a quarterly basis which resulted in the inclusion of some wet weather conditions, although capturing wet weather conditions was not the intent of the study. Additionally, the majority of the samples that were taken during the wet season reflected dry weather conditions. Sections 4.3.1 through 4.3.15 contain excerpts from *Hydrological and Biological Support to Lower Santa Margarita River Watershed Monitoring Program Water Years 2008 – 2009* (Stetson Report) and detail the results of this monitoring program for nutrients.[5] The water bodies were also evaluated for the presence and duration of flow in the various watershed tributaries. The monitoring locations for the study are shown in Figure 5. Similar results are unavailable for the upper portion of the Santa Margarita River watershed. For the Estuary, data was summarized from the information presented in *Santa Margarita Lagoon Water Quality Monitoring Data*.[6]

[5] Stetson Engineers, Inc. 2010. Hydrological and Biological Support to Lower Santa Margarita River Watershed Monitoring Program Water Years 2008 – 2009.

[6] United States Navy Environmental Sciences Branch of the Space and Naval Warfare Systems Center Pacific (SSC-PAC). 2012. Santa Margarita Lagoon Water Quality Monitoring Data.

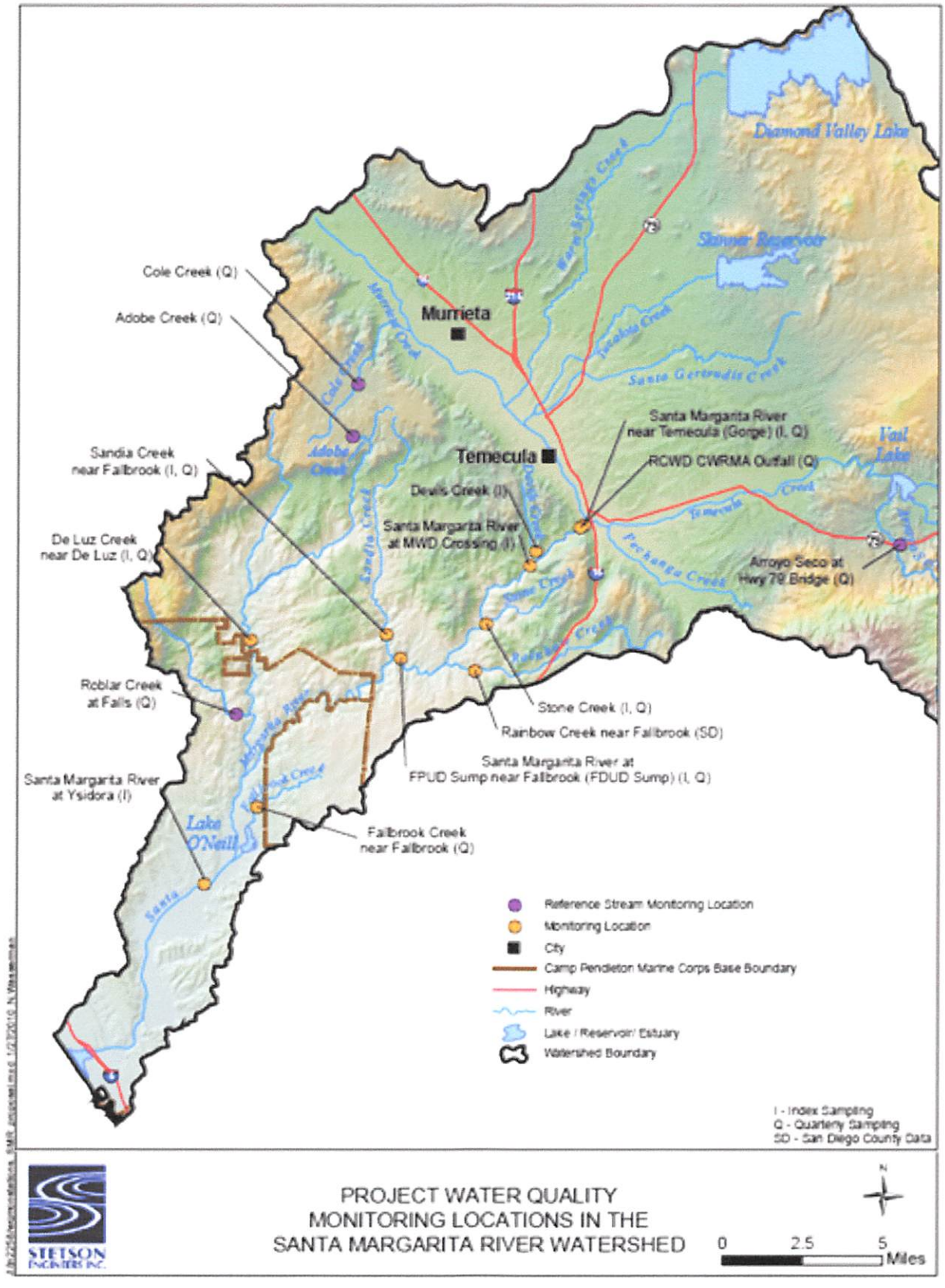

Figure 5. Stetson Study Monitoring Locations

4.3.1 Adobe Creek

Adobe Creek served as a reference site for the Stetson Study. All five samples analyzed for TN were within below the numeric interpretations of the Basin Plan WQOs. One of five samples analyzed for TP exceeded the numeric interpretations used as the basis for 303(d) listing evaluations.

4.3.2 Arroyo Seco and Cole Creek

Arroyo Seco and Cole Creek served as reference sites for the Stetson Study. These sites were added during the study period and due to the ephemeral nature of these streams were only sampled in February 2009. The sample at Arroyo Seco exceeded the numeric interpretations used as the basis for 303(d) listing evaluations for TP while the sample at Cole Creek exceeded the numeric interpretations used as the basis for 303(d) listing evaluations for TN. As noted in the Stetson report, elevated levels of constituents in these streams presumably indicate naturally high levels with only natural sources and aerial deposition accounting for constituent input.

4.3.3 Roblar Creek at Falls

Roblar Creek served as a reference site for the Stetson Study. Six of six samples analyzed for TN and TP were within numeric interpretations used as the basis for 303(d) listing evaluations.

4.3.4 Santa Margarita River at FPUD Sump near Fallbrook

The Fallbrook Public Utility District (FPUD) Sump was the site nearest upstream of Camp Pendleton on the main stem of the river. Sixteen of 24 samples analyzed for TN exceeded the numeric interpretations used as the basis for 303(d) listing evaluations. Six of 24 samples exceeded the numeric interpretations used as the basis for 303(d) listing evaluations for nitrate. Five of 24 samples analyzed for TP exceeded the numeric interpretations used as the basis for 303(d) listing evaluations.

4.3.5 Santa Margarita River at MWD Crossing (SMER)

The MWD Crossing monitoring site is located within Santa Margarita Ecological Reserve (SMER). Six of 15 samples tested for TN exceeded the numeric interpretations used as the basis for 303(d) listing evaluations, while one of the 15 samples exceeded the Basin Plan objective for un-ionized ammonia. Two of 15 samples exceeded the numeric interpretations used as the basis for 303(d) listing evaluations for TP.

4.3.6 Santa Margarita River near Temecula (Gorge)

The Gorge is the farthest upstream site on the SMR and represents the water quality in the river upstream of the location where Rancho discharges water to the SMR. Eight of 24 samples analyzed for TN exceeded the numeric interpretations used as the basis for 303(d) listing evaluations, while five of the 24 samples exceeded the numeric interpretations used as the basis for 303(d) listing evaluations for TP.

4.3.7 Santa Margarita River at Ysidora

This sampling location was added in February 2009. Two of ten samples analyzed for TN exceeded the numeric interpretations used as the basis for 303(d) listing evaluations. Ten of ten

samples analyzed for TP exceeded the numeric interpretations used as the basis for 303(d) listing evaluations.

4.3.8 De Luz Creek near De Luz

Twelve of 12 samples analyzed for TN and nitrate exceeded numeric interpretations used as the basis for 303(d) listing evaluations. TP concentrations were within the numeric interpretations used as the basis for 303(d) listing evaluations except on one occasion in February 2009.

4.3.9 Devils Creek at Via Novilla, SMER

Devils Creek is located within the SMER. Sixteen of 16 samples tested for TN and nitrate exceeded numeric interpretations used as the basis for 303(d) listing evaluations while four of the 16 samples exceeded the numeric interpretations used as the basis for 303(d) listing evaluations for TP.

4.3.10 Fallbrook Creek near Fallbrook

Fallbrook Creek empties directly into Lake O'Neill, which is used to recharge the Upper Ysidora groundwater sub-basin, one of Camp Pendleton's primary sources of water. Six of six samples analyzed for TN were within the numeric interpretations used as the basis for 303(d) listing evaluations. Four of four samples analyzed for TP exceeded the numeric interpretations used as the basis for 303(d) listing evaluations.

4.3.11 Rainbow Creek

Data for Rainbow Creek were provided by San Diego County and are from station 902SMG005. Twenty-four of 24 samples analyzed for nitrate and TN and 21 of 24 samples analyzed for TP exceeded numeric interpretations used as the basis for 303(d) listing evaluations.

4.3.12 RCWD CWRMA Outfall

The Rancho California Water District Cooperative Water Resource Management Agreement (RCWD CWRMA) Outfall is located immediately upstream of the Santa Margarita River near the Temecula USGS gage. In order to maintain minimum flows stipulated by the CWRMA, RCWD began releasing water supplied by the Metropolitan Water District MWD via the outfall at turnout WR-34 in 2003. Starting in August 2007, to avoid potentially introducing the invasive quagga mussel species discovered in MWD's water supply to the Santa Margarita River, RCWD made some releases from their treated potable groundwater supply. This water was released from the System River Meter on Murrieta Creek just upstream of the Gorge. During 2009, RCWD extended a pipeline from its potable distribution system to the same location as the outfall from WR-34. Subsequently, all CWRMA make-up releases, from either WR-34 or the potable distribution system, were discharged to the Santa Margarita River at the same location. During 2008 samples were taken from potable water supplied by RCWD released from the System River Meter just upstream of the confluence with Temecula Creek. In 2009, all samples were taken from WR-34. Three of eight samples analyzed for TN exceeded the numeric interpretations used as the basis for 303(d) listing evaluations (one at WR-34 and two at the System River Meter). One of eight and one of nine samples analyzed for un-ionized ammonia and nitrate, respectively, exceeded numeric objectives used as the basis for 303(d) listing evaluations (System River

Meter). TP concentrations were within numeric interpretations used as the basis for 303(d) listing evaluations.

4.3.13 Sandia Creek near Fallbrook

Twenty-five of 25 samples analyzed for TN and nitrate exceeded the numeric interpretations used as the basis for 303(d) listing evaluations while one of the 25 samples analyzed for un-ionized ammonia exceeded the Basin Plan objective. Six of 25 samples analyzed for TP exceeded the numeric interpretations used as the basis for 303(d) listing evaluations.

4.3.14 Stone Creek near Stagecoach Lane, SMER

Stone Creek is located within SMER. Eighteen of 18 samples analyzed for TN exceeded the numeric interpretations used as the basis for 303(d) listing evaluations while eight of 18 samples analyzed for nitrate exceeded the numeric objectives used as the basis for 303(d) listing evaluations. Five of 18 samples analyzed for TP exceeded the numeric interpretations used as the basis for 303(d) listing evaluations.

4.3.15 San Mateo Creek near San Clemente

San Mateo Creek served as a reference stream and is located north of the Santa Margarita River watershed. The upper watershed of San Mateo Creek is located within the Cleveland National Forest and has limited human impacts. As opposed to the other reference streams described in this report, San Mateo Creek represents a larger stream class with more consistent annual flows. Data from one sampling site on the creek was included as an additional reference stream. San Mateo Creek did not have any water quality impairments.

4.3.16 Santa Margarita Estuary

Water quality monitoring data was collected by the Navy's Environmental Sciences Branch of the Space and Naval Warfare Systems Center Pacific (SSC-PAC) in the Santa Margarita Lagoon between February 2010 and February 2011. TN levels decreased into summer while TP levels continued to increase. TN exceeded the numeric interpretations used as the basis for 303(d) listing evaluations 69% of the time in spring but not at all in fall, while TP exceeded the numeric interpretations used as the basis for 303(d) listing evaluations 88%, and 100% of the time for the same two periods.

4.3.17 Summary of Results

Table 7 presents ranges of measured concentrations for TN, TP, and nitrate at the water bodies sampled under Stetson's monitoring program for the entire sampling period. Several tributaries including Cole, De Luz, Devils, Rainbow, Sandia, and Stone Creeks as well as the CWRMA Outfall contributed TN in excess of numeric interpretations used as the basis for 303(d) listing evaluations. Concentrations of TN exceeding the numeric interpretation used as the basis for 303(d) listing. Concentrations of TN greater than the numeric interpretation was reported in samples collected at all sites on the Santa Margarita River. Levels of un-ionized ammonia exceeding Basin Plan objectives were detected on one occasion at the CWRMA Outfall, Sandia Creek, and Santa Margarita River at MWD Crossing. Nitrate concentrations in excess of the numeric WQO used as the basis for 303(d) listing evaluations was detected at De Luz, Devils, Rainbow, Sandia and Stone Creeks as well as at the CWRMA Outfall and the FPUD Sump.

Several tributaries including Arroyo Seco, Adobe, De Luz, Devils, Fallbrook, Sandia, and Stone Creeks contributed TP in excess of numeric WQO used as the basis for 303(d) listing evaluations. TP concentrations greater than the numeric WQO interpretations is used as the basis for 303(d) listing and were reported for samples collected from all sites along the Santa Margarita River.

Table 7. Summary of the Range of Concentrations (mg/L) for the Entire Sampling Period – Stetson Monitoring Program[7]

Monitoring Location	Total Nitrogen	Total Phosphorus	Nitrate as N
Adobe Creek	0.24 - 0.76	0.02 - 0.13	0.16 - 0.76
Arroyo Seco and Cole Creek	0.83 - 1.28	0.04 - 0.13	0.23 - 0.65
Roblar Creek	0.00 - 0.15	0.00 - 0.09	0.00 - 0.06
SMR at FPUD Sump	0.26 - 6.73	0.01 - 0.67	0.26 - 5.92
SMR at MWD Crossing	0.28 - 1.47	0.00 - 0.54	0.21 - 1.26
SMR near Temecula (Gorge)	0.29 - 2.59	0.00 - 0.45	0.21 - 1.90
SMR at Ysidora	0.00 - 1.24	0.12 - 0.20	0.00 - 0.87
De Luz Creek	2.77 - 7.87	0.00 - 0.65	1.93 - 7.61
Devils Creek	5.97 - 9.14	0.00 - 0.39	1.65 - 8.94
Fallbrook Creek	0.00 – 0.78	0.15 – 0.46	0.00 – 0.12
Rainbow Creek	2.42 – 14.70	0.03 – 0.52	2.42 – 14.07
RCWD CWRMA Outfall	0.33 – 3.12	0.00 – 0.06	0.13 – 3.20
Sandia Creek	2.40 – 8.25	0.01 – 0.40	2.33 – 7.88
Stone Creek	1.73 – 5.07	0.00 – 0.01	0.68 – 4.67

Table 8 presents the number of times the constituent exceeded the numeric interpretations used as the basis for 303(d) listing evaluations, the total number of samples, and the percent exceedance. **Figure 6** and **Figure 7** depict exceedances of TN and TP at monitoring locations within the study area calculated based on the numeric interpretations of the Basin Plan WQOs.

[7] Stetson Engineers, Inc. 2010. Hydrological and Biological Support to Lower Santa Margarita River Watershed Monitoring Program Water Years 2008 – 2009.

Table 8. Summary of Exceedances for Total Nitrogen and Total Phosphorus – Stetson Monitoring Program[1,2]

	Total Nitrogen			Total Phosphorus		
Monitoring Location	Exceedances	Number of Samples	% Exceedance	Exceedances	Number of Samples	% Exceedance
Adobe Creek	0	5	0%	1	5	20%
Arroyo Seco	0	1	0%	1	1	100%
Cole Creek	1	1	100%	0	1	0%
Roblar Creek	0	6	0%	0	6	0%
SMR at FPUD Sump	16	24	67%	5	24	21%
SMR near Temecula	8	24	33%	5	24	21%
SMR at MWD Crossing	6	15	40%	2	15	13%
SMR at Ysidora	2	10	20%	10	10	100%
De Luz Creek	12	12	100%	1	12	8%
Devils Creek	16	16	100%	4	16	25%
Fallbrook Creek	0	6	0%	4	4	100%
Rainbow Creek	24	24	100%	21	24	88%
RCWD CWRMA Outfall	3	8	38%	0	9	0%
Sandia Creek	25	25	100%	6	25	24%
Stone Creek	18	18	100%	5	18	28%

1. Stetson Engineers, Inc. 2010. Hydrological and Biological Support to Lower Santa Margarita River Watershed Monitoring Program Water Years 2008 – 2009.
2. The exceedances presented in the Stetson report, are based on comparing the data to the numeric nutrient interpretations of the narrative water quality objective in the Basin Plan for TN (1 mg/L) and TP (0.1 mg/L) the WQO for Nitrate as NO_3 (10 mg/L).

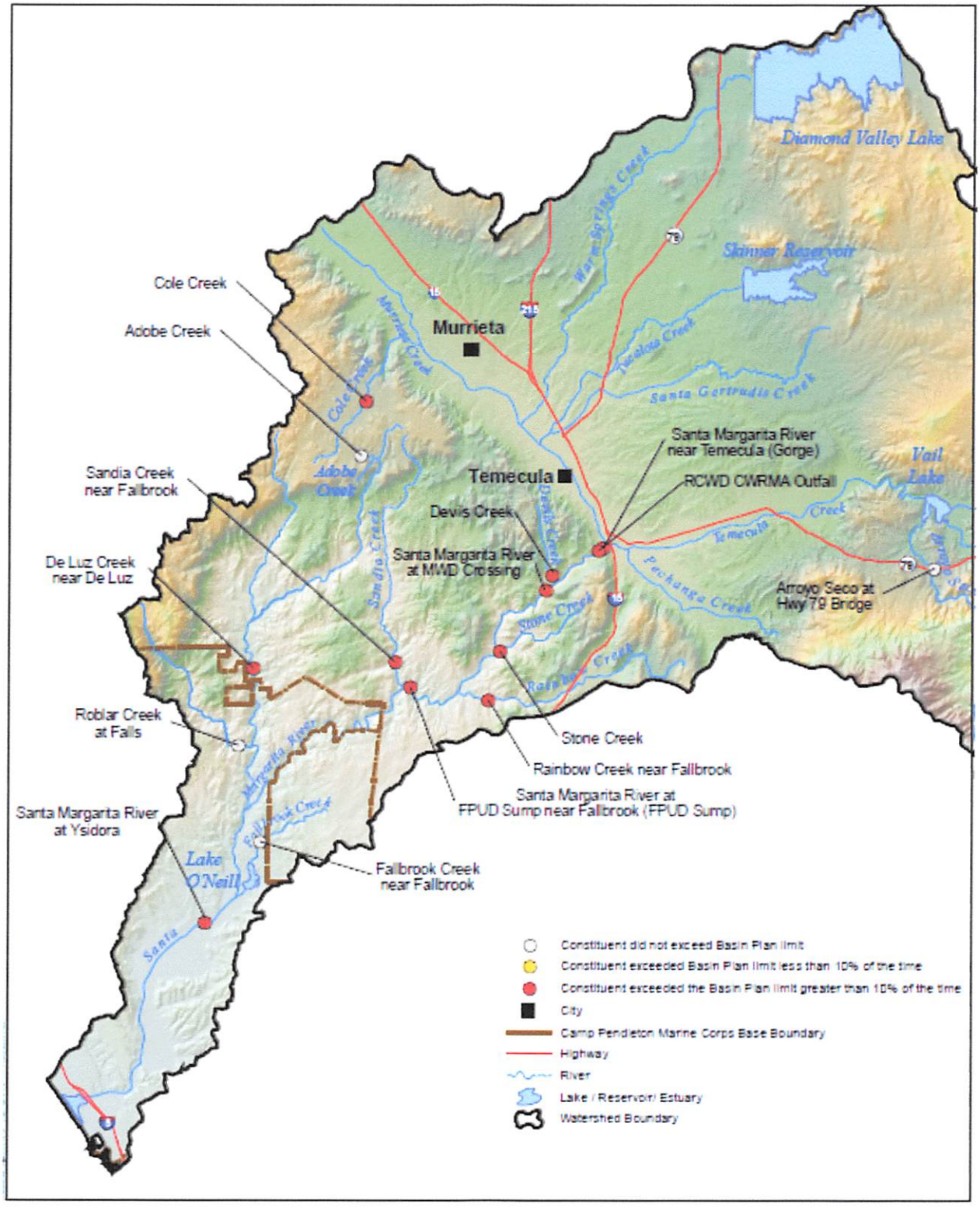

Figure 6. Total Nitrogen Monitoring Locations – Stetson Monitoring Program[8]

[8] Stetson Engineers, Inc. 2010. Hydrological and Biological Support to Lower Santa Margarita River Watershed Monitoring Program Water Years 2008 – 2009.

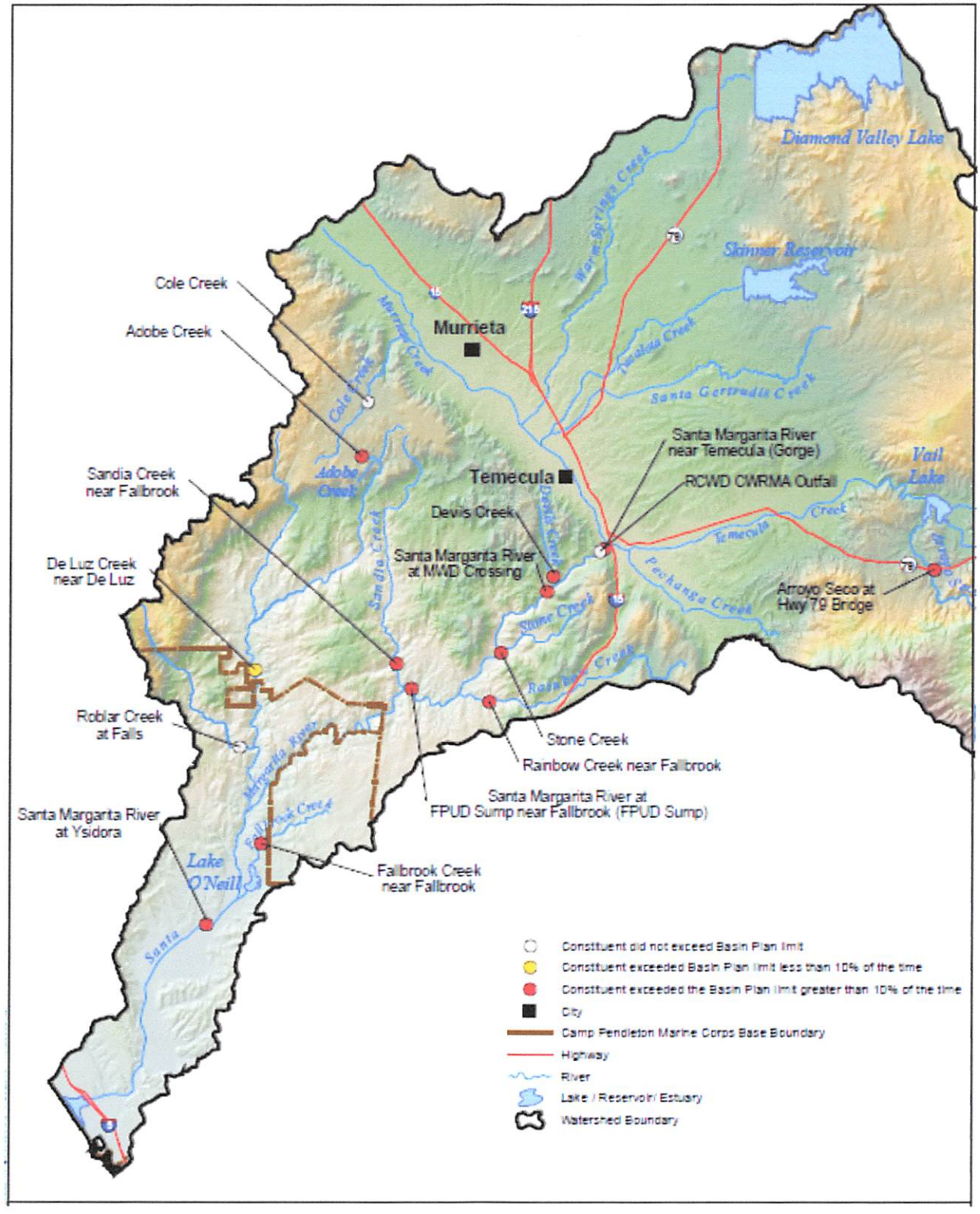

Figure 7. Total Phosphorus Monitoring Locations – Stetson Monitoring Program[9]

[9] Stetson Engineers, Inc. 2010. Hydrological and Biological Support to Lower Santa Margarita River Watershed Monitoring Program Water Years 2008 – 2009.

The historic data analysis supports many of the 303(d) listings in the SMR watershed. Additionally, the Stetson study identified a number of tributary sites that may have elevated nutrient concentrations and evaluated flow conditions in the tributaries monitored. The following table compares water quality data, 303(d) listings, and flow conditions for the monitored reaches in the SMR watershed.

Table 9. Comparison of Stetson Study Data to 303(d) Listings

Water Body Name	Pollutant [1]	Pollutants for which Stetson Study Data Support Listing [2]	Perennial Flow [3]
Adobe Creek		No	
Arroyo Seco		No[4]	No
Cole Creek		No	No
De Luz Creek	Nitrogen	Nitrogen	
Devils Creek		Nitrogen	
Fallbrook Creek		Phosphorus	
Murrieta Creek	Nitrogen and Phosphorus	N/A	
Rainbow Creek	Nitrogen and Phosphorus	Nitrogen and Phosphorus	
Redhawk Channel	Nitrogen and Phosphorus	N/A	
Roblar Creek		No	
Sandia Creek		Nitrogen and Phosphorus	
Santa Gertrudis Creek	Phosphorus	N/A	No
Santa Margarita Lagoon[4]	Eutrophic	Nitrogen and Phosphorus	
Santa Margarita River (Lower)	Nitrogen and Phosphorus	Phosphorus	
Santa Margarita River (Upper)	Phosphorus	Nitrogen and Phosphorus	
Stone Creek		Nitrogen and Phosphorus	
Temecula Creek	Phosphorus	N/A	No
Warm Springs Creek (Riverside County)	Nitrogen and Phosphorus	N/A	No

1. Blank cells represent tributaries that are not currently on the 303(d) list.
2. N/A reflects tributaries that were not included in the Stetson study. The Santa Margarita Lagoon was also not included in the Stetson study but current conditions data was obtained from other sources.
3. Perennial flow is defined as flow lasting longer than 30 consecutive days. This flow criterion was determined by the SMR stakeholder group in conjunction with SDRWQCB staff to categorize intermittent streams that flow for sufficient length of time to potentially develop eutrophication symptoms as documented in Appendix 5. Blank cells indicate that perennial flow is present. Only 1 sample was collected for this reach. Although the sample exceeded the water quality objectives, it would not meet the listing policy requirements for listing.
4. Data from *Eutrophication and Nutrient Cycling in Santa Margarita River Estuary: A Summary of Baseline Studies for Monitoring Order R9-2006-0076* (McLaughlin et. al, 2011).

For reaches where current data exists, the data appears to support the listings using the current numeric interpretation of the Basin Plan interpretations as the basis for the listing. Additionally, some reaches that are not currently on the 303(d) list could be considered as impaired based on the current numeric interpretation of the Basin Plan interpretations for N and P. Information developed under the Process Plan will be provided to support updating the 303(d) list during future listing cycles.

5 Current Scientific Understanding of Impacts of Biostimulatory Substances

Biostimulatory substances can result in the overproduction of primary producers (e.g. algae and macrophytes) and heterotrophs (e.g. bacteria). This organic matter can have adverse consequences to aquatic life through changes in water and sediment quality as well as changes to the food web. Environmental variables such as hydrology, available light, etc. can modify the ecosystem response to nutrients. Anthropogenic activities that alter these environmental variables can in some cases lead to biostimulatory conditions (lead to increased eutrophication) even under low nutrient conditions (SWRCB, 2015). The potential impacts on beneficial uses, from potential visual impacts to recreational beneficial uses to impacts of low dissolved oxygen, result from the overproduction of primary producers, not as a result of nutrient concentrations in an of themselves. As a result, the methods for protecting beneficial uses from biostimulatory substances discussed in the Process Plan are aimed at addressing the cause of potential impairments rather than focusing on controlling nutrient concentrations in an of themselves. This section discusses the current Basin Plan objective and historic interpretation of those objectives, how the science regarding biostimulatory substances is evolving, and the site-specific considerations in the SMR watershed that support the need for gathering addition information to assess the potential impacts of biostimulatory substances on beneficial uses.

5.1 EVALUATION OF BASIN PLAN OBJECTIVES

As discussed in the introduction, given the rapidly evolving understanding of the impacts of biostimulatory substances and following the process outlined in **Figure 1**, the Stakeholder Group evaluated the existing Basin Plan WQOs for biostimulatory substances as a first step in the process.

The Basin Plan WQOs can be described as narrative water quality objectives with numeric guidance or interpretations. These numeric interpretations have been utilized historically for 303(d) listing decisions, TMDLs, and permit conditions. However, the objectives were established in the 1970's and regulatory and scientific approaches to evaluating biostimulatory objectives have since evolved. It is now recognized that due to site-specific factors (such as hydrology, shading, temperature) TN and TP concentrations/loads that can contribute to primary producer overproduction at levels that impact beneficial uses vary greatly among streams and estuaries.

As discussed in the *Technical Approach to Develop Nutrient Numeric Endpoints for California* (Tetra Tech, 2006), research has demonstrated shortcomings of using nutrient concentrations within a water body alone to predict eutrophication. Concentration data may not be effective in assessing eutrophication and the subsequent impact on water use because algal productivity

depends on several additional factors, such as morphology, light availability, flooding frequency, biological community structure, etc.

Nitrogen and phosphorus compounds can have direct impacts on beneficial uses. For example, ammonia can cause toxicity to aquatic life and nitrate can impact the municipal drinking water beneficial use. However, these direct impacts are addressed through Basin Plan objectives specifically targeted to address those impacts.

For impacts on beneficial uses due to biostimulatory compounds, nitrogen and phosphorus cause indirect impacts that can impact beneficial uses. The parameter of concern for protection of beneficial uses is the response indicator; such as benthic algal biomass, planktonic chlorophyll, and dissolved oxygen. These response indicators provide a more direct linkage to beneficial uses than the nutrient concentrations alone. The current Basin Plan objectives do not include a component that clearly addresses the response indicator. To adequately protect beneficial uses, it is important to consider both causal and response indicators.

Additionally, the science, information, and tools to evaluate biostimulatory WQO have evolved. It is now clear that a single nitrogen or phosphorus concentration objective is not adequate to protect beneficial uses. The concentrations of nitrogen and phosphorus that contribute to a given level of algae in a water body may vary based on a number of variables. As a result, the protection of beneficial uses needs to consider different nutrient concentrations to reflect site-specific conditions and the effects upon the response indicators being managed.

For these reasons, the numeric guidance in the Basin Plan WQOs that applies the same concentrations to all waterbodies of a given type is problematic. The SDRWQCB acknowledges that the current numeric interpretation of the Basin Plan WQOs may not be appropriate for all water bodies. The SDRWQCB has placed the evaluation of the current nutrient Basin Plan objectives for nutrients on the list of high priority for its Basin Plan triennial review process and has committed limited time to engage in, and track, actions by the SWRCB regarding its statewide review of nutrient WQOs and development of a statewide nutrient control program..

5.2 STATEWIDE NUTRIENT CONTROL PROGRAM

As discussed above, the science regarding biostimulatory substances is rapidly evolving. Based on the new information, the SWRCB is working on the development of an approach to addressing biostimulatory objectives to be applied throughout California through development of a nutrient control program. This alternative regulatory approach is centered on two principal tenets:

1) In order to more directly assess impairments to beneficial uses, biostimulatory substances objectives should be based on response to nutrients (e.g., increased algal biomass) rather than nutrient concentrations alone.

2) Mathematical models should be employed to link target responses back to site-specific nutrient concentration or management goals.

The statewide nutrient control program approach represents a shift from a focus on only nutrient concentrations to a focus on the response indicators that impact biostimulatory substances. For the purposes of this document, the shift in approach is called the nutrient control program framework or approach.

5.2.1 Status Of Freshwater Nutrient Control Program And Proposed Numeric Endpoints

In 2006, the first set of technical work to support the nutrient control program was completed. A number of case studies were then completed using the nutrient control program framework as outlined in the 2006 technical information. In 2011, a California Environmental Quality Act (CEQA) scoping meeting was held and a document was prepared listing the potential alternatives to be considered in setting nutrient objectives for California. In 2014, the SWRCB developed a *Proposed Workplan for Development of a Nutrient Control Program* and recently finalized an associated technical work plan. The technical work development is ongoing and will be available for consideration during implementation of the Process Plan.

5.2.2 Status Of The Estuarine Nutrient Control Program And Proposed Numeric Endpoints

In 2007, a Technical Support Document was developed that outlined the process for developing response indicator endpoints for California Estuaries.[10] Since that time, technical work has been ongoing to develop the endpoints. A draft set of numeric endpoints for indicators relevant for Santa Margarita are anticipated to be available from the SWRCB for consideration during implementation of the Process Plan.

5.3 CONSIDERATIONS IN APPLYING THE STATEWIDE APPROACH TO SMR

While the statewide nutrient control program approach represents a significant advance over a "one-size-fits-all" approach, by necessity the approach reflects a "default" approach that can apply statewide and cannot fully reflect site-specific considerations that may be present in the SMR. Additionally, because it is a regulatory paradigm that is centered on the use of biological rather than chemical concentration objectives, the precedent and guidance for how to implement the nutrient control program approach into many aspects of water quality programs is still under development (water body assessment, TMDLs, NPDES permitting, and NPS). As a result, the Process Plan was designed to support the site-specific application of the statewide paradigm to the SMR. Factors that will be considered as part of the implementation of the Process Plan include:

- The applicability of modeling tools that are developed to be applicable statewide. While the current statewide nutrient control program is working to develop default tools that consider California-specific data[11], they are not yet available and using site-specific models could greatly improve the ability to manage biostimulatory substances to address any identified impairments.

[10] Southern California Coastal Water Research Project. 2007. Technical Approach to Develop Nutrient Numeric Endpoints for California Estuaries.

[11] Previously available tools, such as the Benthic Biomass Spreadsheet Tool, that were proposed for use as the default tools for the nutrient control program were evaluated by the SMR Stakeholder Group. Concerns were raised about the use of these default tools given the fact that little data from southern California was used in spreadsheet model development, processes accounted for in the model are not transparent, and validation of the Benthic Biomass Spreadsheet Tool in this region was limited. The new tools being developed as part of the statewide nutrient control program are not yet available for evaluation for applicability to the SMR watershed.

- The impacts of response indicators on beneficial uses in the SMR and the relationship to the science that is being developed for the statewide nutrient control program has not been established. Monitoring and modeling studies are required to appropriately evaluate the impacts to beneficial uses in the SMR watershed.
- The nutrient control program is a dry weather paradigm; so, future policy regulating wet weather discharges of nutrients is unclear.
- Another concern is that the nutrient control program framework does not specifically address situations where perennial flow does not occur. Protection of beneficial uses in water bodies that may only flow for a portion of the year or that may have flow during some portion of the year and stagnant disconnected pools of water during the remainder of the year are not considered.

While, the statewide nutrient control program provides a framework that can guide the SMR watershed in evaluating impacts from biostimulatory substances, site-specific monitoring and modeling studies are required to appropriately apply these concepts to the SMR watershed.

6 Identification of Technical and Policy Issues

The Process Plan outlines a process for evaluating existing biostimulatory substances water quality objectives and addressing any identified impairments in the Santa Margarita River watershed, including the necessary technical work. As part of the process, technical and policy issues may arise that impact the technical work to be done. This section outlines the way in which the issues will be identified and addressed, summarizes the issues that have been identified to date, and references the technical work provided in the process plan to address the identified issues.

6.1 PROCESS FOR ADDRESSING ISSUES

The general process for addressing technical issues will be to develop the work necessary to support a discussion with the decision makers for the issue. Generally, the decision makers will be the regulatory agencies, but there may be times when stakeholder decisions on issues will be required as well. The same process can be used for any issue identified.

The technical information developed could range from a technical briefing or memo to a full options paper with recommended approaches to be considered. The information developed will depend on the level of information necessary to support an informed decision by the decision makers on the issue. For the issues identified to date, technical work elements have been included in Section 7.

Using the developed technical information, the issues will be discussed with regulatory agencies through the regulatory subgroup or with the Nutrient Initiative Group per the procedures outlined in the charter. The applicable group will be asked to use the technical information and the discussion to provide guidance on the issue and the technical work intended to resolve the issue. Meeting notes and/or other correspondence will document the agreed upon guidance.

6.2 PROCESS FOR IDENTIFYING ISSUES

Although the Process Plan provides a framework that can be utilized to evaluate the impacts of biostimulatory substances on beneficial uses in the Santa Margarita River watershed, some

technical and policy issues have been identified that will need to be addressed during implementation of the plan. These issues can be generally categorized as policy issues regarding the way in which the technical analysis will be used to evaluate and address impairments and technical issues that need to be addressed to ensure protection of the range of beneficial uses in the watershed.

To determine the issues that may arise in evaluating if the work is designed to be sufficiently protective of beneficial uses, an assessment of the potential effects of nutrient over enrichment and eutrophication on each beneficial use was developed and discussed with the stakeholder group at a meeting on January 10, 2013. This assessment was used to ensure technical work elements sufficiently covered the range of possible impacts. **Table 10** provides a general assessment of the potential linkages between beneficial uses and adverse effects of nutrient over enrichment and eutrophication. **Table 11** shows the linkage between beneficial uses and applicable indicators that can be used to measure potential adverse effects for consideration in the SMR. **Table 12** provides the habitat types to which these indicators are applicable, the issues that have been raised with their use in the SMR watershed, and recommended indicators for the SMR to protect beneficial uses.

Table 10. Ecosystem effects related to nutrient over enrichment and eutrophication and their relationship to beneficial uses

	Key Adverse Effect									
Beneficial Use	Reduced DO or DO Swings	Increased Turbidity	Algal Toxins	Altered Food Chain	Toxic metal, NH_4, Nitrate	Taste & Odor	Unaesthetic Blooms	Altered Plant/Algal Biomass	Altered Bio-diversity	Physical Habitat Alteration
COLD	X	X	X	X	X			X	X	X
WARM	X	X	X	X	X			X	X	X
SPWN	X	X	X	X	X			X	X	X
RARE									X	X
BIOL									X	X
MIGR	X	X	X	X	X			X	X	X
MUN		X	X			X				X
IND										
AG										
GWR					X					
REC-1	X	X	X			X	X			
REC-2		X					X	X		X

Table 11. Linkage between indicators of eutrophication and ecosystem effects

	Key Adverse Effect									
Response Indicator	Reduced DO or DO Swings	Increased Turbidity	Algal Toxins	Altered Food Chain	Toxic Metal, NH_4, Nitrate	Taste & Odor	Unaesthetic Blooms	Altered Plant/Algal Biomass	Altered Bio-diversity	Physical Habitat Alteration
Dissolved Oxygen	X			X	X	X			X	
Benthic Algal Biomass		X		X		X	X	X	X	X
Macroalgal Cover									X	X
Planktonic Algal Biomass		X					X	X	X	
pH	X			X	X				X	
Ammonia/Ammonium				X			X	X	X	
Nitrate									X	
Cyanobacterial Abundance			X			X	X	X	X	X
Cyanotoxins			X						X	

Table 12. Recommended Indicator to support SMR beneficial uses and issues or questions with their application for this project

Response Indicator	Recommended for SMR?	Applicable Habitat Type	Issues with Application
Dissolved Oxygen	Yes	All	Natural hypoxia exists in estuary bottom waters. Should DO objectives be applied uniformly through the water column? River and tributaries: How applicable is DO in wadeable streams?
Benthic Algal Biomass	Yes	River and tributaries, estuary	What are the appropriate spatial and temporal scales over which these endpoints should be applied?
Macroalgal Cover	Yes	River and tributaries, estuary	Should a % cover endpoint be considered?
Planktonic Algal Biomass	Yes	Estuary, pools in Murrieta Creek	What are the appropriate endpoints for pools in portions of the River and for the Estuary?
pH	Yes	All	No issues identified
Ammonia/Ammonium	Yes	All	Assume existing ammonia and nitrate WQOs in Basin Plan apply; however, note that EPA is issuing new freshwater objectives for ammonia.
Nitrate	Yes	All	
Cyanobacterial Abundance	No	N/A	Cyanobacteria and cyanotoxins can be found in a variety of freshwater habitats. However, because cyanobacterial dominance and detectable cyanotoxin concentrations are being found in SC reference streams, we do not recommend its use at this time until this is better investigated. However, USEPA is proposing new human health criteria for drinking water systems.
Cyanotoxins	No		

As shown in the tables, response indicators have been identified for consideration in the Santa Margarita River watershed for all potential adverse impacts resulting from nutrient over enrichment and eutrophication. For each beneficial use, the selected response indicator endpoint developed through the technical work will be evaluated to ensure protection of all relevant beneficial uses. Where necessary, work elements have been defined to specifically address the evaluation of the beneficial uses.

6.3 ISSUES IDENTIFIED TO DATE

As discussed above, several issues exist regarding the application of the nutrient control program framework in the SMR watershed. These issues include:

1. **Seasonal applicability of the objectives**. The nutrient control program framework is currently structured to address dry weather conditions. However, in the San Diego Region, the current Basin Plan WQOs apply year round under all conditions and to all water bodies. As a result, any interpretation of the existing Basin Plan objectives or site-specific objectives developed for the watershed need to address conditions that were not intended by the nutrient control program framework if they are to apply to all water bodies under all conditions.
2. **Application of objectives to water bodies with intermittent flow.** The nutrient control program framework does not specifically address non-perennial flow conditions. Protection of beneficial uses in water bodies that have non-perennial flows standing disconnected pools of water during the remainder of the year are not considered.
3. **Application of the dissolved oxygen objectives.** Natural hypoxia exists in estuary bottom waters. As a result, consideration of whether DO objectives should be applied uniformly through the water column in estuaries is needed. Additionally, the applicability of the DO objectives to wadeable streams needs to be evaluated.
4. **Consideration of algal percent cover endpoint.** The freshwater nutrient control program may not recommend an algal percent cover endpoint. However protection of some beneficial uses may require an evaluation of percent cover as a endpoint. The modeling tools being developed will not predict percent cover, though biomass is related to percent cover.
5. **Identification of planktonic algal biomass endpoints for portions of the SMR River and Estuary.** The Estuarine nutrient control program is still under development and the freshwater nutrient control program may not include endpoints for pools in river systems. As a result, the technical work needs to evaluate the appropriate endpoints for these water bodies.

In addition to the issues above that will inform the monitoring and technical analysis conducted, development of proposed site-specific objectives[12], if warranted, will involve some policy decisions as to the way in which the objectives are expressed. Following is a summary of the policy issues identified:

[12] The SDRWQCB has indicated that the adoption of SSOs, which requires amending the Basin Plan is not currently under consideration, but is open to that process should there be sufficient technical and regulatory reasons to do so..

1. **Use of response indicators vs. nutrient concentrations as targets or objectives**. The nutrient control program framework envisions the development of narrative nutrient objectives with numeric guidance. The narrative biostimulatory WQO of the Basin Plan could be met by using the nutrient control program indicators alone.
2. **Spatial applicability of the developed objectives**. The approach to regulating nutrients could be adopted for specific reaches, for the entire watershed, or for the entire San Diego Region.
3. **Protection of endangered species**. Consideration of the potential impacts of the response indicator endpoints on the protection of endangered species needs to be considered.
4. **Method for identifying approach to modifying the current numeric interpretation of the Basin Plan objectives**. The Basin Plan WQOs are interpreted numerically using the numeric goals presented in the narrative objective. Although site-specific objectives are typically used to incorporate technical information that will be prepared under this Process Plan, alternatives, such as modifications to Chapter 4 of the Basin Plan to include implementation procedures for the Basin Plan objectives, may be considered.
5. **Method for addressing identified impairments**. Although TMDLs are typically used to address impairments, alternatives to TMDLs exist. Based on the results of the work described in this Process Plan, the impairments may be addressed through a TMDL alternative, as outlined in *A Process for Addressing Impaired Waters in California*.
6. **Coordination of Estuary and River work**. Currently, addressing impairments in the Estuary is scheduled to proceed ahead of the development of a TMDL or other program to address impairments in the river. However, the development of the river TMDL may alter the understanding of the sources of watershed loadings and potentially the specific allocations assigned in the Estuary TMDL. The scheduling and coordination of the two processes needs to be discussed and options for better coordinating the processes needs to be evaluated.

For each of these issues, technical work elements have been described that will facilitate identifying a resolution to the concern. Table 13 summarizes the issues with the application of the nutrient control program framework and the technical work elements that have been identified to support the resolution of the issues.

Table 13. Technical Work Elements to Support Resolution of Issues with Application of the nutrient control program Framework to the SMR Watershed

Issue	Technical Work Element
Seasonal applicability of the objectives	Evaluation of Seasonal Applicability of the Objectives (7.4.1)
Application of objectives to water bodies with intermittent flow	Resolved previously. See technical memo included as Appendix 5
Application of the dissolved oxygen WQO	Evaluate Potential Thresholds for Response Indicators (7.3.2.2)
Consideration of a percent cover endpoint	Evaluate Potential Thresholds for Response Indicators (7.3.2.2)
Identification of planktonic algal biomass endpoints for portions of the River and Estuary	Evaluate Potential Thresholds for Response Indicators (7.2.2, and 7.3.2.2)
Use of response indicators vs. nutrient concentrations as targets or objectives	Develop Methods to Evaluate Impairments Due to Biostimulatory Substances (7.2.2, 7.3.2)
Spatial applicability of the developed objectives	Use Modeling to Support Selected Regulatory Actions (7.2.3.1 and 7.3.3.1)
Evaluation of protection of endangered species	WQO to Support Endangered Species (7.4.2)
Method for addressing identified impairments	Regulatory and Management Actions to Address Impairments (7.5)
Coordination of the Estuary and River work	Regulatory and Management Actions to Address Impairments (7.5)

These technical and policy issues influence the approach taken to conduct the technical work outlined in the Process Plan. As a result, the technical work elements identify when decision on the identified issues will be needed to inform work being conducted where possible.

7 Project Work Elements

This section outlines the technical and regulatory tasks that will be conducted to achieve the goals of this Process Plan.

7.1 OVERVIEW

Given the different nature of the two water bodies, the SMR Estuary and SMR River and tributaries are discussed separately in this process plan. Some of the work elements and approaches will overlap for the two water bodies, but the work products will be developed separately. In addition, separate work elements needed to address identified technical and policy issues from Section 6 are included.

For each technical work element, the general approach to conducting the work is discussed in this section.

As the Project progresses, it is possible that additional technical questions will arise that may require consideration. Additionally, some of the tasks outlined in the Process Plan may not be necessary due to information gathered through previous tasks. As a result, the technical work elements may need to change from those listed below. To address this need, a framework for technical decision-making has been included to help evaluate additional work to be done.

1. Is the work necessary to address one of the key management questions?
2. Can work conducted as part of another task address the question raised?
3. Is the work necessary to support other technical or policy decisions already included in the Process Plan?

To support the technical work and aid in future decisions on completion of technical work, one of the first tasks will be the development of a conceptual model.

Additionally, to facilitate the development of the technical work, the regulatory work group will be consulted to identify the method for addressing the identified technical and policy questions. Additional technical work elements may be added to develop work necessary to come to resolution on technical and policy questions.

7.2 WORK ELEMENTS FOR SANTA MARGARITA RIVER ESTUARY

The work under the Process Plan will start in the Santa Margarita River Estuary and progress to address the river. The basic tasks will include the following steps:

1. Develop tools to support evaluation of the existence of biostimulatory impairments in the estuary.
2. Using developed tools, determine if the estuary is impaired due to biostimulatory substances
3. Based on the result of the evaluation, determine the appropriate regulatory and management actions to implement

All of the work proposed for this task will be conducted during Phase 1 of the Proposition 84 funding cycle. A general discussion of each task is included below.

7.2.1 Develop Tools To Support Evaluation Of The Existence Of Biostimulatory Impairments In The Estuary

The development of tools includes monitoring and special studies and models. Following is a general summary of the specific tools that will be developed.

7.2.1.1 Conduct Estuary Monitoring And Additional Special Studies

The Lagoon Order required the collection of water quality data to develop and validate a lagoon water quality model and watershed loading model to support a Lagoon nutrient TMDL. Data were collected and baseline reports completed. The next step is to proceed with model development and validation and employ the models to facilitate decision-making.

To supplement data obtained pursuant to the Lagoon Order, additional existing data will be used to aid in model calibration and validation. The sources of the additional data are as follows:

- Bight '08 Eutrophication Assessment Survey Data
- SPAWAR Supplemental Estuary Monitoring
- SPAWAR Report on Groundwater Loading to SMR Estuary

These data will form the basis for the modeling effort. The following additional special studies have been identified:

- SPAWAR Estuarine Bathymetry Study
- SCCWRP/SPAWAR Estuarine Algal Monitoring Protocol Development

Both of these studies have been funded and are proceeding.

7.2.1.2 Develop Estuary Model

A dynamic model will be developed to provide a tool for developing a relationship between the identified response indicators and nutrient concentrations.

Following EPA's TMDL study approach (US EPA, 1997), the SMR Stakeholder Group and the SDRWQCB have selected and specified the use of the Environmental Fluid Dynamics Code (EFDC) and the Water Quality Analysis Simulation Program (WASP) models for this study. Model calibration and validation will be conducted by comparing model results with available measured data, including water surface elevation, currents, salinity and temperature of the lagoon water (hydrodynamics) and nitrogen (ammonia, nitrate, nitrite, total), phosphorus, phytoplankton chlorophyll-a, and dissolved oxygen concentrations, and macroalgal biomass (lagoon water quality model). Transport and deposition of sediment from the upstream watershed loads will be simulated. Zones of deposition will be identified and quantified within the Estuary. Once validation of the model is complete, scenarios will be simulated to help support decision-making on calculation of the numeric targets, development of TMDL or TMDL alternative, quantification of uncertainty to support margin of safety analysis, and cost-effective management implementation scenarios.

7.2.1.3 Develop Watershed Loading Model

A dynamic simulation model, based on the Hydrodynamic Simulation Program in Fortran (HSPF), will be developed to simulate wet weather nutrient loading into the Estuary. Model

validation will be conducted by comparing model results with available measured data, including flow, nitrogen forms (ammonia, nitrate, nitrite, dissolved organic N, particulate N, TN), phosphorus forms (orthophosphate, dissolved organic P, particulate P, TP), and BOD. Transport of sediment will also be simulated. Once validation of the model is complete, scenarios will be simulated to help support decision-making on calculation of the numeric targets, development of TMDL or TMDL alternative, quantification of uncertainty to support margin of safety analysis, and cost-effective management implementation scenarios.

7.2.2 Develop Methods To Evaluate Impairments Due To Biostimulatory Substances In Estuary

As discussed in Section 5, a large amount of new science has been and is being developed to allow evaluation of impacts and impairments due to biostimulatory substances. Under this task, the latest scientific and technical information will be utilized to evaluate potential impairments in the estuary. The following procedure will be utilized:

1. Identify response indicators applicable to the SMR Estuary.
2. Evaluate potential endpoints for those indicators that protect beneficial uses based on literature and/or local information.
3. Compare SMR Estuary data to the identified response indicator endpoints to determine if potential impairments exist.

SCCWRP has produced a technical report that identifies Estuarine response indicators (Sutula 2011). These response indicators were considered by the Regulatory workgroup and the Statewide stakeholder group and approved for further development.

Based on this technical work, the estuary response indicators appropriate for the SMR Estuary include:

- Surface Water Dissolved Oxygen Concentration
- Macroalgal Biomass and Percent Cover
- Phytoplankton Biomass (Chlorophyll *a)* Concentration

The SMR Stakeholder Group considered these indicators during an October 2012 meeting and approved them for further consideration in addition to existing Basin Plan objectives. As the technical work is further developed, one or more of these response indicators will be selected under this task.

Although a statewide nutrient control program for estuaries is not anticipated for several years, a number of studies are available that can support evaluation of possible endpoints applicable to the SMR Estuary. All available information will be considered when conducting this task.

After identification of the proposed estuary response indicator endpoints, available estuary data will be compared to the proposed estuary response indicator endpoints to evaluate whether estuary impairments exist when compared to the proposed response indicator endpoints. The data evaluation will form the basis of determining whether a TMDL or TMDL alternative will need to be developed for the SMR Estuary. Depending on the results of the analysis, additional monitoring may be considered to generate sufficient data to allow delisting of the Estuary.

The final step will include an evaluation of current data collected in the Estuary to determine if impairments continue to exist when considering the response indicators rather than nutrients

alone and to determine if changes in the loadings to the Estuary have improved conditions. Several of the historic discharges of nutrients into the SMR Estuary have been terminated, including the discharge of treated municipal sewage and groundwater dewatering. The end of irrigated agriculture adjacent to the SMR Estuary will likely reduce the amount of nutrients entering the SMR Estuary via surface and/or groundwater flow.

7.2.3 Determine Appropriate Regulatory Actions to Implement

Based on the results of the analysis and policy considerations by the regulatory subgroup, a number of regulatory and management actions may be considered to implement the selected approach.

The first consideration will be a determination of whether a site-specific objective is needed to incorporate the results of the technical analysis into the Basin Plan. Implementation guidance for the existing narrative Basin Plan objectives could also be considered along with other potential approaches identified through the Stakeholder process in consultation with the regulatory subgroup. Either the SSO or the implementation guidance would require a Basin Plan Amendment. Amendments to the Basin Plan are considered a "rule making" and will require CEQA, Peer Review, Public Notifications and Hearings, and approvals by the SDRWQCB, the SWRCB, the State Office of Administrative Law, and the EPA.

Depending on the approach selected, modeling may be utilized to support identification of appropriate site-specific objectives or implementation guidance. A discussion of the potential modeling and reporting that could be developed is discussed below.

7.2.3.1 Use Modeling to Support Selected Regulatory Actions for Estuary

The estuary water quality model could be used to compare the scientific validity and policy implications of using existing Basin Plan biostimulatory objectives versus response indicator endpoints as the basis for regulating nutrients. Using the estuary model, nutrient concentrations could be identified that will result in the SMR Estuary meeting the selected response indicator endpoints, and having sufficient water quality to fully support the beneficial uses.

If an approach to regulate nutrients is developed for the SMR Estuary using the nutrient control program approach, the method of incorporating the approach will be evaluated. Response indicator endpoints may be used. The nutrient concentrations may be considered objectives or TMDL targets or to assist with identifying appropriate allocations during TMDL development. The scope of use of the TN and TP concentrations will require a policy decision. As a result, a briefing or documented discussion with the regulatory subgroup will likely be needed

7.2.3.2 Prepare Report Summarizing Estuary Technical Work

Based on the technical analysis discussed above, a report will be prepared that summarizes the modeling and data analysis and provides recommendations for next steps for the SMR Estuary. At this time the recommendations are unknown and will be based on the analysis of the data and regulatory and policy considerations. The report and the recommendations will be prepared in coordination with regulatory agencies to ensure the work product can be used to support development of a Basin Plan Amendment to adopt site-specific objectives or other regulatory actions to implement the technical work, if warranted.

7.2.4 Key Policy Questions Impacting Technical Work

The primary policy question that impacts the development of the Estuary objectives is the decision on what indicators and endpoints should be used as the basis of numeric targets and how these targets should vary between the dry and wet season and also during wet or dry weather.

7.3 WORK ELEMENTS FOR SANTA MARGARITA RIVER AND TRIBUTARIES

The key work elements for the SMR River are the same as those for the estuary. However, more data collection is needed to support the process. The basic tasks will include the following steps:

1. Develop information and tools to support evaluation of the existence of biostimulatory impairments in the freshwater portions of the watershed.
2. Using developed tools, determine if the river and/or tributaries are impaired due to biostimulatory substances
3. Based on the result of the evaluation, determine the appropriate regulatory and management actions to implement

A general discussion of each task is included below.

7.3.1 Develop Information And Tools To Support Evaluation Of The Existence Of Biostimulatory Impairments In The River

The development of tools includes monitoring and special studies and models. Following is a general summary of the specific tools that will be developed.

7.3.1.1 Conduct River Monitoring

Monitoring and special studies will be conducted to supporting decision-making for the SMR River and its tributaries. A detailed monitoring plan is included as Appendix 3.

7.3.1.2 Develop River Water Quality Model

A dynamic model will be developed to provide a tool for developing a relationship between the potential indicators, nutrients, and other environmental variables.

The first step in this process is to select the appropriate modeling platform. A technical memo will be prepared to present modeling options and facilitate the selection of the appropriate platform for modeling river eutrophication.

Once monitoring data become available, model calibration and validation will be conducted by comparing model results with available measured data, including flow, temperature (hydrodynamics), nitrogen (ammonia, nitrate, nitrite, total), phytoplankton chlorophyll-a, benthic algal biomass, and dissolved oxygen concentrations. Once validation of the model is complete, scenarios will be simulated to help support decision-making on calculation of the alternative objectives or implementation approaches and cost-effective nutrient management implementation scenarios.

7.3.2 Develop Methods To Evaluate Impairments Due To Biostimulatory Substances In River And Tributaries

As discussed in Section 5, a large amount of new science has been and is being developed to allow evaluation of impacts and impairments due to biostimulatory substances. Under this task,

the latest scientific and technical information will be utilized to evaluate potential impairments in the estuary. The following procedure will be utilized:

1. Identify response indicators applicable to the SMR River.
2. Evaluate potential endpoints for those indicators that protect beneficial uses based on literature and/or local information.
3. Compare SMR River data to the identified response indicator endpoints to determine if potential impairments exist.

7.3.2.1 Select River And Tributary Response Indicators

The freshwater nutrient control program is in policy development and potential response indicators have been proposed (TetraTech 2006). Based on this work, the response indicators appropriate for consideration for the SMR and tributaries could include:

- Surface Water Dissolved Oxygen
- Benthic Algal Biomass
- Phytoplankton Biomass (only in deep pools in selected parts of the River)

The SMR Stakeholder Group will consider these indicators, in addition to existing Basin Plan biostimulatory and dissolved oxygen objectives, for the basis of regulating nutrients. As the technical work is further developed, one or more of these response indicators will be selected under this task.

7.3.2.2 Evaluate Potential Thresholds for Response Indicators

While potential endpoints for benthic algal biomass were proposed in the TetraTech 2006 report, additional science regarding potential endpoints for statewide nutrient control program is under development. As a result, determination of the appropriate endpoints for evaluating impacts on beneficial uses will consider the latest science available at the time of the analysis. The information that could be considered includes:

- Studies conducted as part of the technical workplan for the statewide nutrient control program
- Reference stream studies
- Review of available literature to consider potential impacts on endangered species (see Section 7.4.2 for more details)
- Observed or predicted beneficial use impacts specific to SMR River watershed
- Ability of management actions to achieve the selected endpoints

7.3.2.3 Evaluate Potential Impairments

After identification of the proposed response indicator endpoints, available watershed data will be evaluated to determine whether watershed impairments determined based on evaluating nutrient concentrations are maintained and whether any additional impairments are identified. Depending on the results of the analysis, additional monitoring may be considered to generate sufficient data to allow delisting of the applicable water body.

7.3.3 Determine Appropriate Regulatory Actions to Implement

Based on the results of the analysis and policy considerations by the regulatory subgroup, a number of regulatory and management actions may be considered to implement the selected approach.

The first consideration will be a determination of whether a site-specific objective is needed to incorporate the results of the technical analysis into the Basin Plan. Implementation guidance for the existing narrative Basin Plan objectives could also be considered along with other potential approaches identified through the Stakeholder process in consultation with the regulatory subgroup. Both actions would require a Basin Plan Amendment. Amendments to the Basin Plan are considered a "rule making" and will require CEQA, Peer Review, Public Notifications and Hearings, and approvals by the SDRWQCB, the SWRCB, the State Office of Administrative Law, and the EPA.

Depending on the approach selected, modeling may be utilized to support identification of appropriate site-specific objectives or implementation guidance. A discussion of the potential modeling and reporting that will be developed is discussed below.

7.3.3.1 Use Modeling to Support Selected Regulatory Action

The River water quality model could be used to compare the scientific validity and policy implications of using existing Basin Plan biostimulatory objectives versus response indicator endpoints. Using the river model, nutrient concentrations will be identified that will result in the river meeting the selected response indicator endpoints.

If an approach to regulating nutrients is developed for the estuary using the nutrient control program approach, the method of expressing the approach will be evaluated. Response indicator endpoints may be used as the basis for the SMR Stakeholder Group to propose SSOs. The nutrient concentrations may be considered objectives or TMDL targets or to assist with identifying appropriate allocations during TMDL development. The scope of use of the TN and TP concentrations will require a policy decision. As a result, a briefing or documented discussion with the regulatory subgroup will likely be needed.

The model will also be used to explore options for how the regulatory approach should be applied with respect to seasonality and spatial extent.

7.3.3.2 Prepare Report Summarizing Results of Technical Analysis

Based on the technical analysis discussed above, a report will be prepared that summarizes the modeling and data analysis and provide recommendations for the next steps for the SMR River and tributaries. At this time the recommendations are unknown and will be based on the analysis of the data and regulatory and policy considerations. The report will be prepared in coordination with regulatory agencies to ensure the work product can be used to support development of a Basin Plan Amendment to adopt SSOs or implementation guidance if deemed warranted.

7.4 ADDITIONAL TECHNICAL ELEMENTS TO ADDRESS IDENTIFIED TECHNICAL AND POLICY ISSUES

As discussed in Section 6, multiple technical and policy questions may impact the work conducted in the Santa Margarita River watershed. While the majority of these questions will be addressed through the technical work discussed above, a few of the identified issues do not otherwise have specific technical work elements associated with them. These technical and policy issues and their associated work elements are discussed in more detail below. Additional work elements will be added as needed to address additional issues if identified.

7.4.1 Evaluation of Seasonal Applicability of the Objectives

One of the central tenets of the nutrient control program framework is that, in order to assess more directly impairments to beneficial uses, the development of nutrient WQOs should be based on response to nutrients (e.g., increased algal biomass, lowered dissolved oxygen) rather than nutrient concentrations. Mathematical models would then be employed to link numeric target responses back to site-specific nutrient concentration goals.

Fundamentally, the nutrient control program framework is a dry weather regulatory paradigm. Even though nutrient concentrations are often higher during wet weather, the probability of exceeding response indicator endpoints is low, because the physical energy associated with storms will scour benthic algae, transport and dilute phytoplankton blooms downstream, and cause mixing and re-aeration of the water column. While the fate of wet weather nutrients has an important role influencing dry weather nutrient concentrations, wet weather nutrient concentrations are not linked to adverse effects to beneficial uses during the storm, outside of direct toxicity from ammonia or nitrate. Therefore, a coherent policy that covers the derivation of wet weather nutrient objectives is needed. In addition, consideration of the application of dry weather objectives during the growing season as compared to the non-growing season needs to be evaluated.

This work element would involve the development of a technical options paper to review the literature, establish a conceptual model of how to assess wet weather and non-growing season effects and identify options for regulatory approaches to seasonal or wet weather objectives. The intent of this options paper is to provide a forum for SMR Stakeholder Group to discuss options with the regulatory subgroup and SDRWQCB management.

7.4.2 WQO to Support Endangered Species

The Santa Margarita River watershed is habitat for Steelhead trout (*Oncorhynchus mykiss*). The SMR Estuary is habitat for the Tidewater Goby (*Eucyclogobius newberryi*). Any proposed nutrient SSOs developed for the SMR watershed must support RARE and SPWN beneficial uses. However, it will be important to conduct a brief review of nutrient and/or eutrophication related water quality parameters required to support the endangered species.

This work element will synthesize existing literature and published reports on nutrient and/or eutrophication related water quality conditions required for Steelhead and Tidewater Goby to complete their life cycle requirements. Specifically, this will include a summary of levels of ammonia, nitrate, pH, and dissolved oxygen that are protective of beneficial uses. This information will be used to verify that derived objectives are protective of RARE and SPWN beneficial uses.

7.5 REGULATORY AND MANAGEMENT ACTIONS TO ADDRESS IMPAIRMENTS

If the evaluation of current data demonstrates that impairments exist, the SDRWQCB will take appropriate regulatory actions to restore the water bodies. Appropriate regulatory actions could include development of a TMDL or a TMDL alternative for the estuary and/or river (e.g. a nutrient management plan or permit action). The work conducted by the Santa Margarita Nutrient Initiative Group to support development of the TMDL or TMDL alternative will be determined fully at a later date. Reports prepared for the previous tasks will provide much of the technical support necessary to develop a TMDL or TMDL alternative if appropriate. However, the TMDL or TMDL alternative will still need to be prepared based on the technical work. Additionally, the role of the SDRWQCB and the role of the SMR Stakeholder Group in the writing of the TMDL or TMDL alternative will need to be discussed. As a result, the level of support provided by the SMR Stakeholder Group could range from review and comment on work products developed by the SDRWQCB to preparing sections of the TMDL or TMDL alternative. It is likely that the level of TMDL support will be based on the technical work that was developed under the previous tasks. Based on this assumption, the following tasks are likely to be considered by the group if a TMDL is pursued.

1. Development of the problem statement. Based on the current condition analysis, a discussion of the status of the impairments could be prepared. The discussion will define the problem to be addressed by the TMDL.
2. Based on the proposed approach to regulating biostimulatory substances, prepare or support preparation of the numeric targets section of the TMDL.
3. Utilize monitoring data to support development of the source identification section of the TMDL.
4. Support use of model results and reports to develop linkage analysis section of the TMDL.
5. Use the models and collected data to evaluate allocations to support implementation actions and meet TMDL targets.
6. Identify reasonable implementation actions, monitoring requirements, and implementation schedule to support development of the implementation plan.

If a TMDL is needed for the SMR Estuary, the development may proceed ahead of the rest of the watershed. Under this scenario, TMDL support will be conducted separately for the SMR Estuary and the TMDL. Should the SMR Estuary TMDL proceed ahead of the rest of the watershed, methods for coordinating or phasing the TMDL will need to be considered. In particular, the coordination of allocations and implementation actions and schedules will need to be considered. If the SMR Estuary TMDL identifies allocations in the watershed ahead of consideration of the impairments in the River and the possible allocations necessary to address those impairments, the allocations may need to be revised. The implementation structure and allocations for the SMR Estuary TMDLs should take this into account. Options for coordinating the schedules of the TMDLs to complete them at the same time or considerations of elements to be included in the Estuary TMDL to recognize the potential for future revisions as additional technical work is developed will be discussed with the regulatory subgroup. If necessary, a briefing or memo summarizing options will be developed.

Depending on the scope of the impairment, the identified sources, and the model evaluation, TMDL alternatives could be considered. For example, a watershed implementation plan could be developed in coordination with MS4 permit requirements that provides the basis for a single regulatory action to address the impairment.

7.6 SUMMARY OF PROCESS PLAN

Following is a flow chart that summarizes the process that will be followed to evaluate water quality objectives and address any identified impairments for the Santa Margarita River watershed. The flow chart outlines the process discussed in the Process Plan and follows the process outlined in California's Impaired Waters Guidance. The shading reflects the portions of the process that have been funded to date and those that will be covered through future funding.

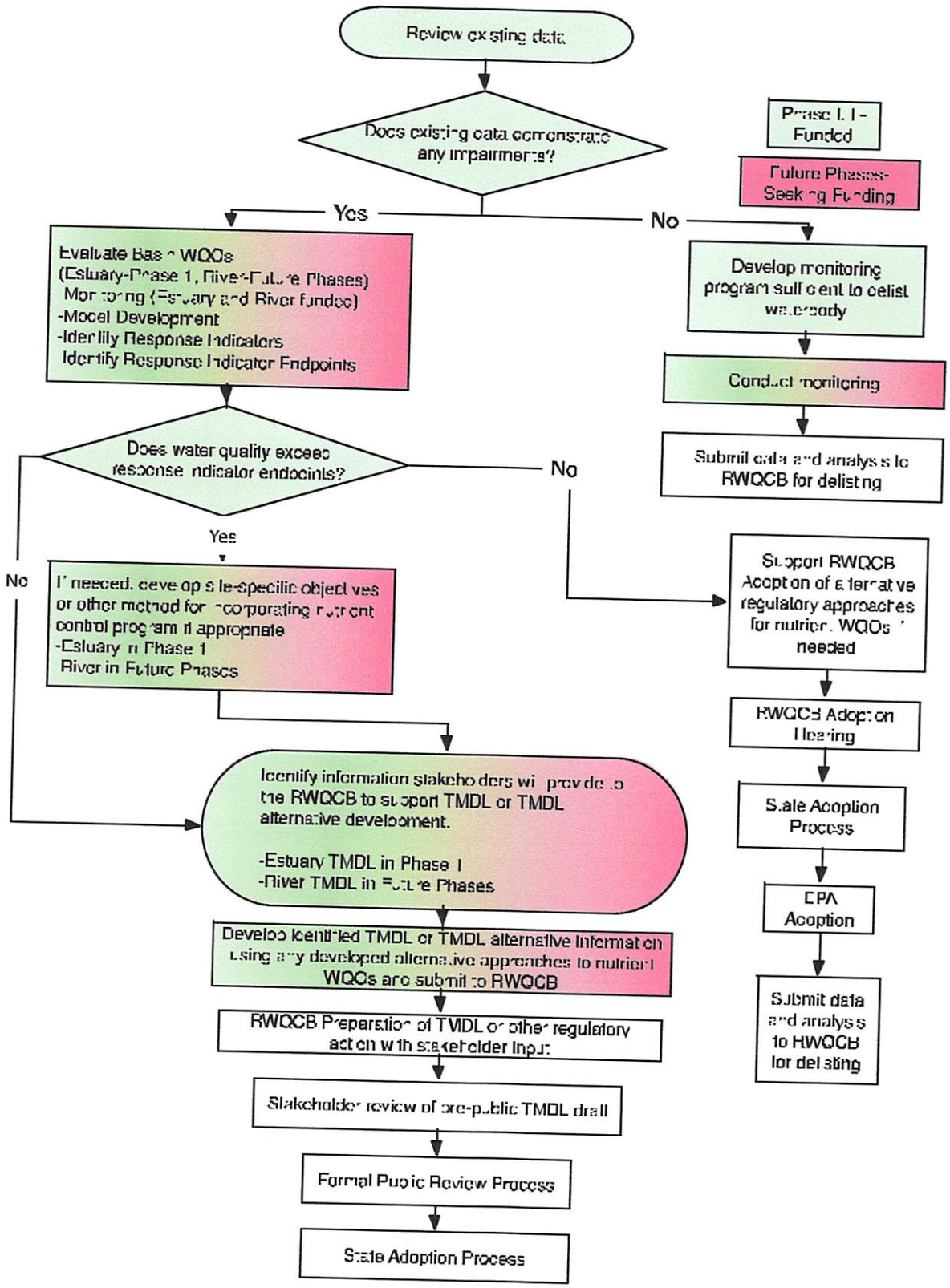

Figure 8. Process for Reviewing Objectives and Addressing Nutrient Impairments