Scoping Report

to Support Development of

Total Maximum Daily Loads Addressing Nutrient Pollution in Streams of the Santa Ynez River Basin

Santa Barbara County, California

Santa Ynez River Basin

TMDL Scoping Report

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1. Preface

The purpose of this scoping report is to present information to support development of a total maximum daily loads (TMDLs) project addressing nutrient-related water quality in streams[1] of the Santa Ynez River basin. Data, information, and narrative contained in this document are a draft work in progress, and thus are subject to revision and change during the course of TMDL development.

Practically speaking, TMDLs are water quality improvement plans, and thus a TMDL report is a type of planning document. The California Water Plan characterizes TMDLs as *"action plans…to improve water quality."* Similarly, The U.S. Environmental Protection Agency states that:

> *"A TMDL serves as a planning tool and potential starting point for restoration or protection activities with the ultimate goal of attaining or maintaining water quality standards."*
>
> From: U.S. Environmental Protection Agency, Implementing Clean Water Action Section 303(d): Impaired Waters and Total Maximum Daily Loads (TMDLs) – webpage accessed April 2016 https://www.epa.gov/tmdl

A TMDL allows stakeholders to determine how best to reach a TMDL's water quality improvement goals[2]. The state and the Regional Water Quality Control Boards help achieve those goals and regulatory requirements by establishing scientifically-based numeric water quality targets, by providing oversight, support, and money for watershed improvement projects[3].

2. TMDL Project Location & Watershed Delineation

This anticipated TMDL project concerns the Santa Ynez River basin. Figure 2-1 illustrates the Santa Ynez River basin. The river basin is an east-west trending structural depression between hills and mountains of the Transverse Ranges in southern Santa Barbara County. The river basin's drainage encompasses 896 square miles. Major tributaries of the Santa Ynez River are Salsipuedes, Cachuma, Santa Cruz, and Indian creeks (see Figure 2-1).

The first Europeans to visit and name the river were the Spaniards of the Portolá expedition[4]. These explorers camped near the river mouth on August 30, 1769. Expedition member Juan Crespi wrote in his diary that the river at this point was more than 100 yards wide, "full of fresh water," and separated from the ocean by a sand bar. According to the U.S. Geological Survey, historical variants of the river's name were La Purisima River, Rio De Calaguasa, and Rio de San Bernardo, among others.

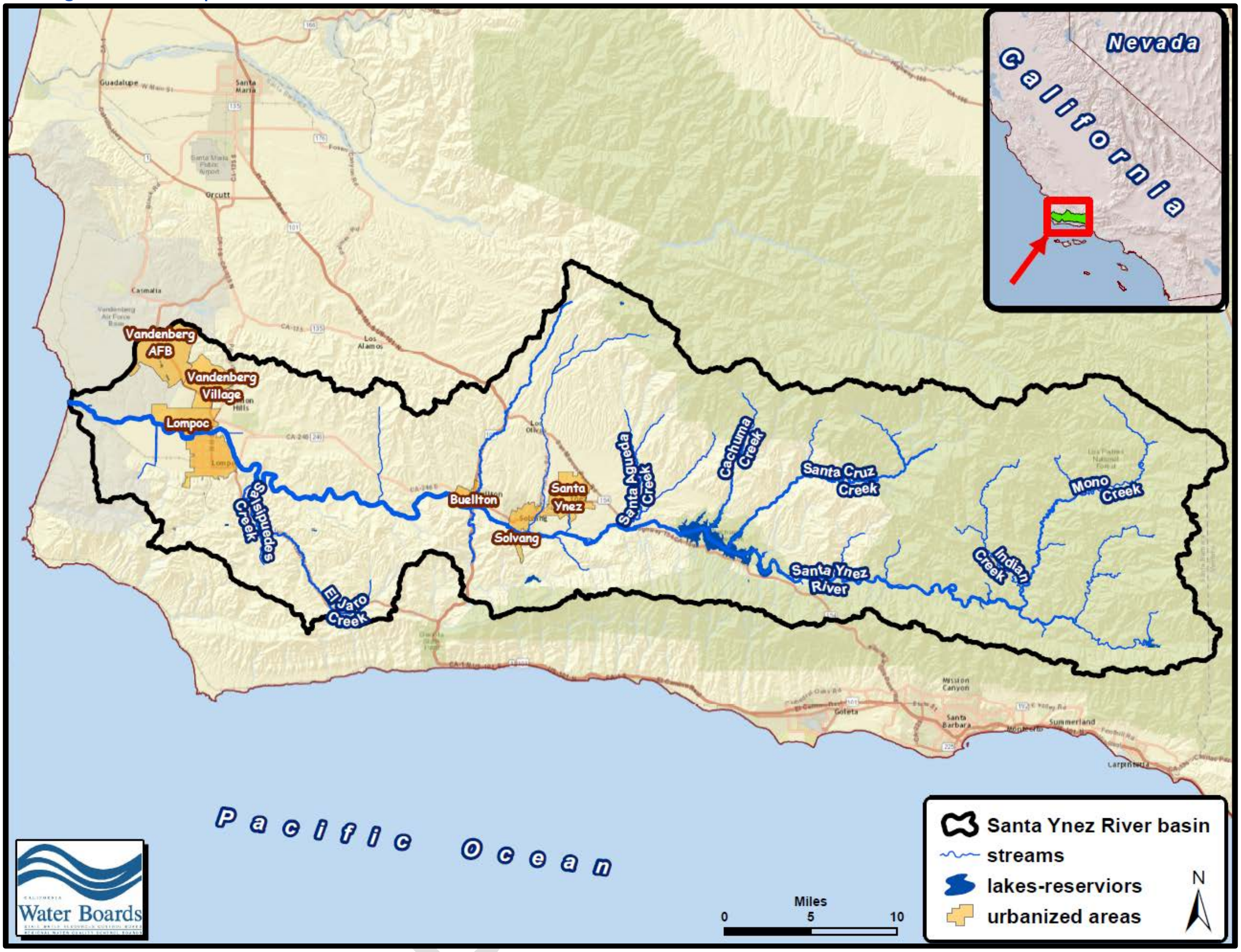
An early attempt to assess the water resources of this river basin was published by the U.S. Geological Survey in 1951, in Water Supply Paper 1107 entitled "Geology and Water Resources of the Santa Ynez River Basin, Santa Barbara County, California." Since the mid-20th century, the natural hydrology of the Santa Ynez River has been modified by dams and reservoirs.

The upper Santa Ynez River basin remains in a relatively natural and undisturbed state within the Los Padres National Forest, with an ecosystem characterized by chamise-redshank chaparral, oak woodlands, and some areas of montane-hardwood conifer woodlands[5].

The lower Santa Ynez River basin, below Cachuma Dam, has a more significant human footprint. Landscapes there are characterized by urbanized/developed lands, cultivated cropland, coastal oak woodland, and coastal scrub[6].

[1] In the context of this TMDL project "streams" refer to any body of running water (such as a river, creek, brook, slough, canal, ditch, ephemeral drainage) which flows on the earth's surface within the area shown on Figure 2-1.
[2] See State Water Resources Control Board videos webpage, http://www.waterboards.ca.gov/videos/ : What is a TMDL?
[3] *Ibid*
[4] The Portolá expedition was the first recorded European land exploration of the present-day state of California during 1769-1770 and led to the founding of the Spanish colony of Alta California.
[5] Source: California Department of Forestry and Fire Protection, 1980 - CALVEG vegetation attributes database.
[6] *Ibid*

Figure 2-1. Map of the Santa Ynez River basin.



Delineation of watershed drainage boundaries is a necessary part of TMDL development. Drainage boundaries of the conterminous United States are delineated based on the Watershed Boundary Dataset[7], which contain digital hydrologic unit boundary layers organized based on Hydrologic Unit Codes. Hydrologic Unit Codes (HUCs) were developed by the United States Geological Survey to identify all the drainage basins of the United States.

Watersheds range in all sizes depending on how the drainage area of interest is spatially defined, if drainage areas are nested, and on the nature and focus of a particular hydrologic study. Watersheds within the Santa Ynez River basin can be characterized by a hierarchy as presented in Table 2-1.

[7] The Watershed Boundary Dataset (WBD) is developed by federal agencies and national associations. WBD contains watershed boundaries that define the areal extent of surface water drainage to a downstream outlet. WBD watershed boundaries are determined solely upon science-based principles, not favoring any administrative boundaries. The WBD is considered by federal agencies to be the authoritative dataset for hydrologic unit boundaries for the nation.

Table 2-1. Watershed hierarchy[A] (basins, watersheds, subwatersheds) for the Santa Ynez River basin.

Hydrologic Unit	Approx. Drainage Area (square miles)	Example(s)	Spatial Data Source
basin	Generally more than 800 square miles	Santa Ynez River basin (896 square miles)	Watershed Boundary Dataset HUC-8 shapefiles available from: U.S. Geological Survey & Natural Resource Conservation Service
watershed	Generally >60 square miles to <250 square miles	Mono Creek watershed (123 square miles) Santa Cruz Creek watershed (76 square miles)	Watershed Boundary Dataset HUC-10 shapefiles available from: U.S. Geological Survey & Natural Resource Conservation Service
subwatershed	Generally >15 square miles to <60 square miles	Nojoqui Creek subwatershed (16 square miles) Zaca Creek subwatershed (40 square miles)	Watershed Boundary Dataset HUC-12 shapefiles available from: U.S. Geological Survey & Natural Resource Conservation Service

[A] Based on adaptation from Jonathan Brant, PhD, and Gerald J. Kauffman, MPA, PE (2011) Water Resources and Environmental Depth Reference Manual for the Civil PE Exam.

The Santa Ynez River basin is delineated at the HUC-8 hydrologic unit scale (HUC 18060010) – refer back to Figure 2-1 which highlights the Santa Ynez River basin in map view.

Individual watersheds at the HUC-10 hydrologic unit scale which are nested within the Santa Ynez River basin were delineated by digitally clipping HUC-10 watershed shapefiles using the Santa Ynez River basin HUC-8 shapefile as a mask. Based on HUC-10 delineations, there are seven distinct watersheds nested within the Santa Ynez River basin as tabulated in Table 2-2 and shown in map view in Figure 2-2.

At a higher resolution hydrologic scale, there are 28 distinct subwatersheds, delineated at the HUC-12 scale, nested within the Santa Ynez River basin as shown in map view in Figure 2-2 and tabulated in Table 2-3.

Table 2-2. TMDL watershed hierarchy (basins, watersheds, and subwatersheds).

Name	Hydrologic Scale	Spatial Data Source	Drainage Area (square miles)
Santa Ynez River basin	**basin**	WBD 8-digit Hydrologic Unit Code HUC # 18060010	897
Mono Creek	**watershed** *within the Santa Ynez River basin*	WBD 10-digit Hydrologic Unit Code HUC # 1806001001	124
Headwaters Santa Ynez River	**watershed** *within the Santa Ynez River basin*	WBD 10-digit Hydrologic Unit Code HUC # 1806001002	78
Santa Cruz Creek	**watershed** *within the Santa Ynez River basin*	WBD 10-digit Hydrologic Unit Code HUC # 1806001003	76
Redrock Canyon-Santa Ynez River	**watershed** *within the Santa Ynez River basin*	WBD 10-digit Hydrologic Unit Code HUC # 1806001004	102
Alamo Pintado Creek-Santa Ynez River	**watershed** *within the Santa Ynez River basin*	WBD 10-digit Hydrologic Unit Code HUC # 1806001005	231
Zaca Creek-Santa Ynez River	**watershed** *within the Santa Ynez River basin*	WBD 10-digit Hydrologic Unit Code HUC # 1806001006	125

Name	Hydrologic Scale	Spatial Data Source	Drainage Area (square miles)
Salsipuedes Creek-Santa Ynez River	**watershed** *within the Santa Ynez River basin*	WBD 10-digit Hydrologic Unit Code HUC # 1806001007	161
Subwatersheds of the Santa Ynez River basin	**subwatersheds**	WBD 12-digit Hydrologic Unit Codes See Figure 2-2 and Table 2-3 for subwatershed information	

Figure 2-2. Map of watersheds and subwatersheds in the Santa Ynez River basin. The subwatersheds in this map have associated numeric identifiers and the subwatershed names are tabulated in Table 2-3.

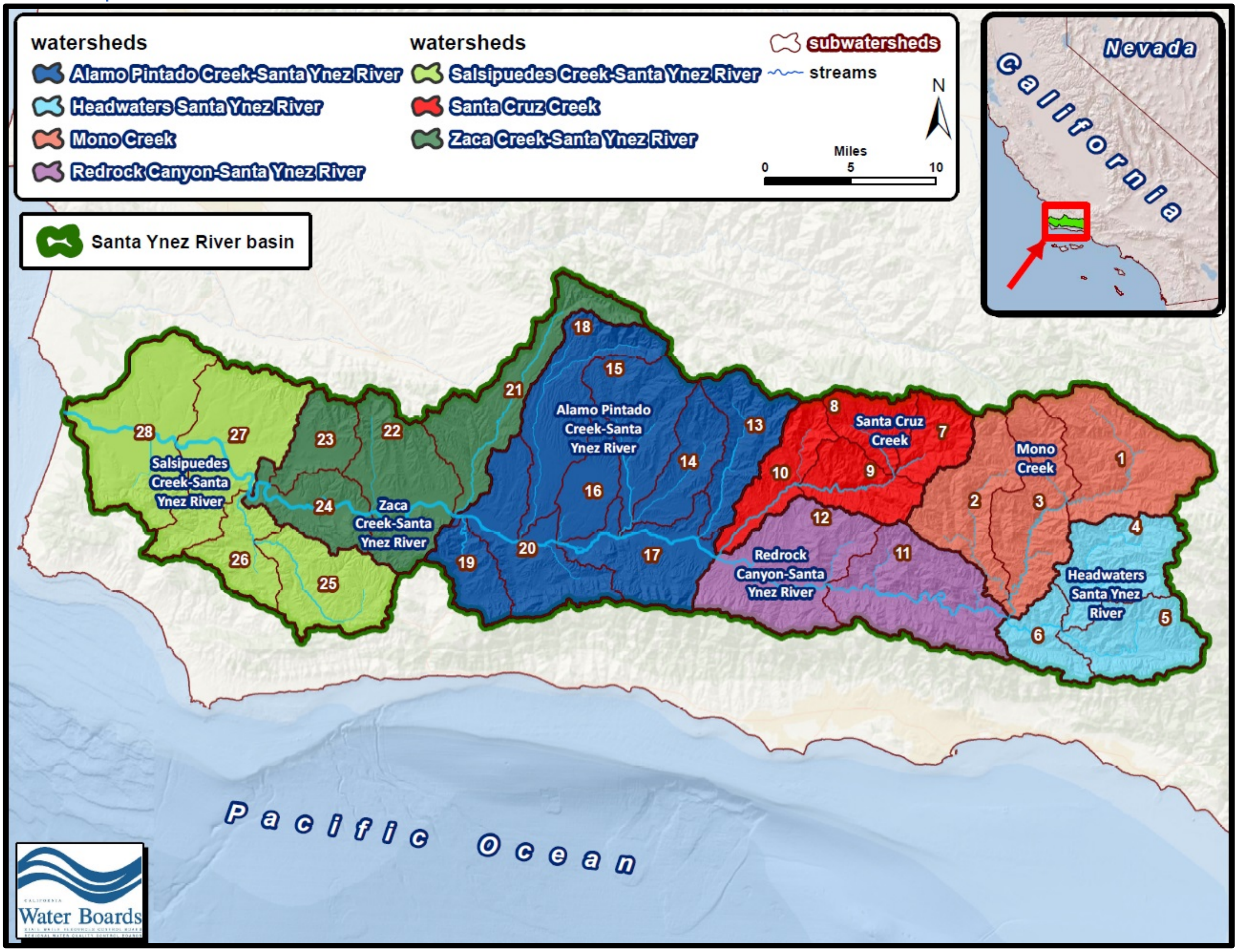


Table 2-3. Tabular summary of subwatersheds of the Santa Ynez River basin. The subwatershed locations and their associated numeric identifiers are shown in map view in Figure 2-2.

Numeric ID	Subwatershed Name	hydrologic unit code (HUC-12)	Hydrologic modifications[A]	Area (mi^2)
1	Upper Mono Creek	180600100101	no modifications	48
2	Indian Creek	180600100102	no modifications	35
3	Lower Mono Creek	180600100103	reservoir	41
4	Agua Caliente Canyon	180600100201	aqueduct	34
5	Juncal Canyon-Santa Ynez River	180600100202	aqueduct	29

Numeric ID	Subwatershed Name	hydrologic unit code (HUC-12)	Hydrologic modifications[A]	Area (mi^2)
6	Blue Canyon-Santa Ynez River	180600100203	dam at outlet, aqueduct	16
7	East Fork Santa Cruz Creek	180600100301	no modifications	16
8	West Fork Santa Cruz Creek	180600100302	no modifications	16
9	Upper Santa Cruz Creek	180600100303	reservoir	21
10	Lower Santa Cruz Creek	180600100304	reservoir	22
11	Gibraltar Reservoir-Santa Ynez River	180600100401	dam at outlet, aqueduct	50
12	Kelly Creek-Santa Ynez River	180600100402	reservoir, aqueduct	52
13	Cachuma Creek	180600100501	reservoir	26
14	Happy Canyon	180600100502	dam at outlet, aqueduct	21
15	Santa Agueda Creek	180600100503	no modifications	35
16	Zanja de Cota Creek	180600100504	no modifications	18
17	Calabazal Creek-Santa Ynez River	180600100505	no modifications	33
18	Alamo Pintado Creek	180600100506	no modifications	41
19	Nojoqui Creek	180600100507	no modifications	16
20	Alisal Creek-Santa Ynez River	180600100508	no modifications	40
21	Zaca Creek	180600100601	no modifications	40
22	Santa Rosa Creek-Santa Ynez River	180600100602	no modifications	44
23	Santa Rita Valley	180600100603	no modifications	17
24	Canada De La Vina-Santa Ynez River	180600100604	no modifications	23
25	El Jaro Creek	180600100701	mining activity	33
26	Salsipuedes Creek	180600100702	mining activity	19
27	San Miguelito Creek-Santa Ynez River	180600100703	mining activity, general canal/ditch	52
28	Santa Lucia Canyon-Santa Ynez River	180600100704	general canal/ditch	57

[A] This is an attribute field found in the Watershed Boundary Dataset which identifies any type of modifications to natural overland flow present in the HUC-12 subwatershed. The attribute field lists from most significant to least significant modification(s).

3. Water Quality: Clean Water Act Section 303(d) Listings

The purpose of this section of the report is to highlight nutrient and nutrient-related water quality issues associated with California's 2008-2010 Clean Water Act section 303(d) assessment.

Under section 303(d) of the Clean Water Act, states, territories, and authorized tribes are required to submit lists of impaired waters, frequently called "303(d) lists." These are waters that are too polluted or otherwise degraded to meet water quality standards. Section 303(d) of the Clean Water Act states:

> *"Each State shall establish for the waters identified in paragraph (1)(A) of this subsection, and in accordance with the priority ranking, the total maximum daily load, for those pollutants which the Administrator identifies under section 1314(a)(2) of this title as suitable for such calculation. Such load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality."*

The state complies with this requirement by periodically assessing the conditions of our rivers, lakes, and bays and identifying them as impaired if they do not meet water quality standards. These waters, and the pollutant or condition causing the impairment, are placed on the 303(d) list. The Clean Water Act also requires that the states develop TMDLs for these waters.

303(d) listings in the Santa Ynez River basin from California's 2008-2010 303(d) list are tabulated in Table 3-1. This TMDL project is anticipated to assess and address nutrient-related impairments in the river basin, specifically nitrate and low dissolved oxygen. Nutrient pollution refers to excessive amounts of nitrate and phosphorus in our water resources. Nutrient pollution of the lower reaches of the Santa Ynez River has long been recognized as a problem with respect to nitrate pollution. Nutrient pollution can degrade municipal and domestic water supply, and may degrade irrigation water quality for sensitive crops. Nutrient pollution can also result in a cascade of adverse environmental impacts in streams such as excessive nuisance algae, disruption of the natural dissolved oxygen balance, and disruption of the aquatic food web.

As a matter of efficiency and staff resource allocation, salinity impairments in the river basin may be addressed on a case by case basis in this TMDL project. Further, any additional nutrient-related water quality impairments not currently on the 303(d) list but identified during our TMDL assessment may be addressed through the TMDL development and approval process[8].

Also worth noting, the data used in the 2008-2010 303(d) assessment is now a decade or more, older. The most recent data used in the 2008-2010 assessment was from the year 2006, and most of the water quality data used was even older than 2006. Consequently, this TMDL project will endeavor to incorporate and assess all available water quality data, including recent data for the river basin.

Table 3-1. 2008-2010 303(d) listings in the Santa Ynez River basin. This TMDL study will focus on nitrate and dissolved oxygen impairments (see bolded), and may address select salt listings on a case by case basis as a matter of staff resource efficiency.

Water Body Name	Pollutant	Pollutant Category	Final Listing Decision
Santa Ynez River (Cachuma Lake to below city of Lompoc)	Sedimentation/Siltation	Sediment	List on 303(d) list
Santa Ynez River (Cachuma Lake to below city of Lompoc)	Sodium	Salinity	List on 303(d) list
Santa Ynez River (Cachuma Lake to below city of Lompoc)	Temperature, water	Miscellaneous	List on 303(d) list
Santa Ynez River (Cachuma Lake to below city of Lompoc)	Total Dissolved Solids	Salinity	List on 303(d) list
Santa Ynez River (below city of Lompoc to Ocean)	Chloride	Salinity	List on 303(d) list
Santa Ynez River (below city of Lompoc to Ocean)	Escherichia coli (E. coli)	Pathogens	List on 303(d) list
Santa Ynez River (below city of Lompoc to Ocean)	Fecal Coliform	Pathogens	List on 303(d) list
Santa Ynez River (below city of Lompoc to Ocean)	**Low Dissolved Oxygen**	**Nutrients**	List on 303(d) list
Santa Ynez River (below city of Lompoc to Ocean)	**Nitrate**	**Nutrients**	Do Not Delist from 303(d) list
Santa Ynez River (below city of Lompoc to Ocean)	Sedimentation/Siltation	Sediment	List on 303(d) list
Santa Ynez River (below city of Lompoc to Ocean)	Sodium	Salinity	List on 303(d) list
Santa Ynez River (below city of Lompoc to Ocean)	Temperature, water	Miscellaneous	List on 303(d) list
Santa Ynez River (below city of Lompoc to Ocean)	Total Dissolved Solids	Salinity	List on 303(d) list

4. River Basin Setting

An assessment of the physical setting and existing conditions of any given watershed is a necessary step in TMDL development. This section of the scoping report presents cursory highlights of the physical, climatic, and hydrologic setting of the Santa Ynez River basin. As appropriate, additional information on the river basin setting will be compiled during TMDL development.

4.1 Land Use & Land Cover

Land use and land cover are an integral part of TMDL development. Pollutant transport and fate are frequently related to land cover in any given watershed. We evaluated land use and land cover in the Santa Ynez River basin using digital data from the National Land Cover Database (2011 Edition). For this TMDL scoping report, we provide a cursory summary of land cover in the river basin.

[8] The State Water Resources Control Board's Office of Chief Counsel reports that the California Court of Appeals has made clear that a regional board may simultaneously identify an impaired waterbdoy and establish a TMDL for it (*City of Arcadia v. State Water Resources Control Board* (2006) 135 Cal. App. 4th, 1418-19).

Figure 4-1 illustrates a map view of land use-land cover in the Santa Ynez River basin. The river basin's land use-land cover are tabulated in Table 4-1, while Table 4-2 provides additional detail on the attributes of land cover categories.

The upper Santa Ynez River basin remains in a relatively natural and undisturbed state within the Los Padres National Forest, with an ecosystem characterized by chamise-redshank chaparral, oak woodlands, and some areas of montane-hardwood conifer woodlands.

The lower Santa Ynez River basin, below Cachuma Dam, has a more significant human footprint where landscapes are characterized by urbanized/developed lands, cultivated cropland, coastal oak woodland and coastal scrub.

During TMDL development we will further assess land cover in the river basin as appropriate.

Figure 4-1. Land use–land cover (year 2011) in the Santa Ynez River basin (source: National Land Cover Dataset, 2011).

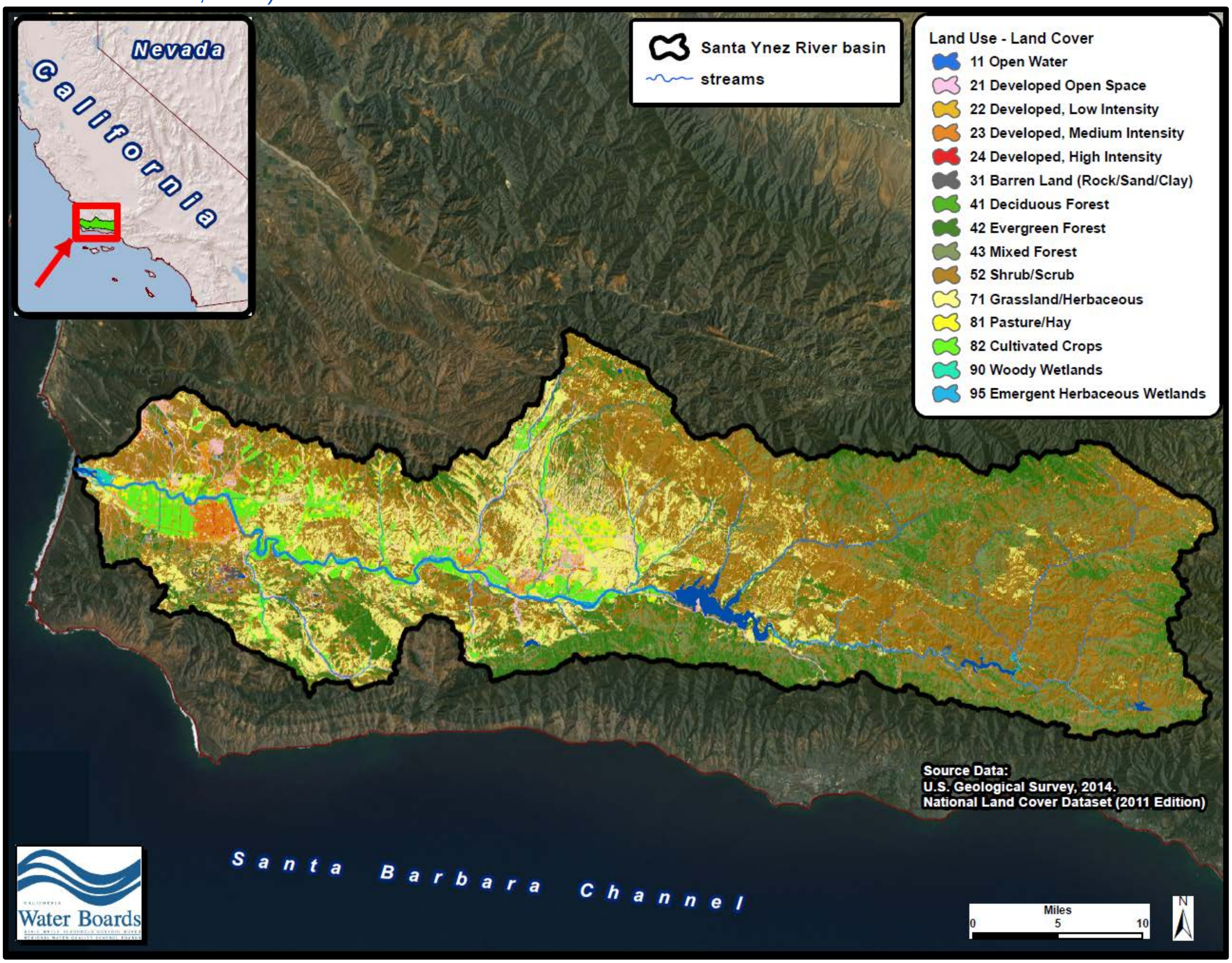


Table 4-1. Land use-land cover in the Santa Ynez River basin (source: National Land Cover Dataset, 2011).

Land cover category with numeric code	Acres	Percent of river basin (%)
11 Open Water	3,266	0.6%
21 Developed Open Space	23,510	4.1%
22 Developed, Low Intensity	5,546	1.0%
23 Developed, Medium Intensity	3,897	0.7%
24 Developed, High Intensity	246	0.0%
31 Barren Land (Rock/Sand/Clay)	1,547	0.3%
41 Deciduous Forest	12	0.0%
42 Evergreen Forest	90,899	15.8%
43 Mixed Forest	77,372	13.5%
52 Shrub/Scrub	236,661	41.2%
71 Grassland/Herbaceous	90,204	15.7%
81 Pasture/Hay	10,356	1.8%
82 Cultivated Crops	23,663	4.1%
90 Woody Wetlands	2,958	0.5%
95 Emergent Herbaceous Wetlands	3,684	0.6%
Total acres	573,821	

Table 4-2. Detailed descriptions of National Land Cover Database land cover categories.

Land cover category code	Description
11	All areas of open water, generally with less than 25% cover or vegetation or soil.
21	Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
22	Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.
23	Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.
24	Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to 100 percent of the total cover.
31	Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
41	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.
42	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.

Land cover category code	Description
43	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.
52	Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.
71	Areas dominated by grammanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
81	Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.
82	Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled
90	Areas where forest or shrub land vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
95	Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

4.2 Hydrography

Assessing the hydrology of a watershed is an important step in evaluating the magnitude and nature of nutrient transport and loading in waterbodies. This section of the scoping report presents some cursory information concerning the hydrography of the Santa Ynez River basin. More hydrologic data will be assessed as necessary during TMDL development.

The Santa Ynez River is a large and important river on California's central coast, with a length of 75 miles, and a drainage area of nearly 900 square miles. Since the mid-20th century, the natural hydrology of the Santa Ynez River has been modified by dams and reservoirs. Major tributaries of the Santa Ynez River are Salsipuedes, Cachuma, Santa Cruz, and Indian creeks.

Figure 4-2 illustrates some regional hydrographic features and hydrologic characteristics within the Santa Ynez River basin. Table 4-3 presents flow statistics for select stream reaches in the Santa Ynez River basin based on U.S. Geological Survey stream gage data.

Owing to the Mediterranean-type climate of Santa Barbara County, the hydrology of the river basin is generally characterized by flashy runoff associated with wet-season storms, and depletion of surface flows, or intermittent flows in the dry season. Since the construction of dams in the early to mid-20th century, substantial amounts of surface runoff in the river basin are impounded in reservoirs, resulting in regulated flows in the lower Santa Ynez River.

The Santa Ynez River begins in the uplands of the Santa Ynez Mountains, and then flows to Gibraltar Reservoir which is reportedly nearly filled with silt (Palmer, 2012). The river then flows to the Cachuma Reservoir where some water is diverted by tunnel to Santa Barbara. Below Cachuma Dam, the river channel winds through lowlands of the river basin toward the Pacific Ocean west of the Lompoc, and through one of California's larger tidal marshes (Palmer, 2012).

As appropriate, further information on the hydrology of the Santa Ynez River basin will be assessed in the course of TMDL development.

Figure 4-2. Generalized hydrographic features of the Santa Ynez River basin.

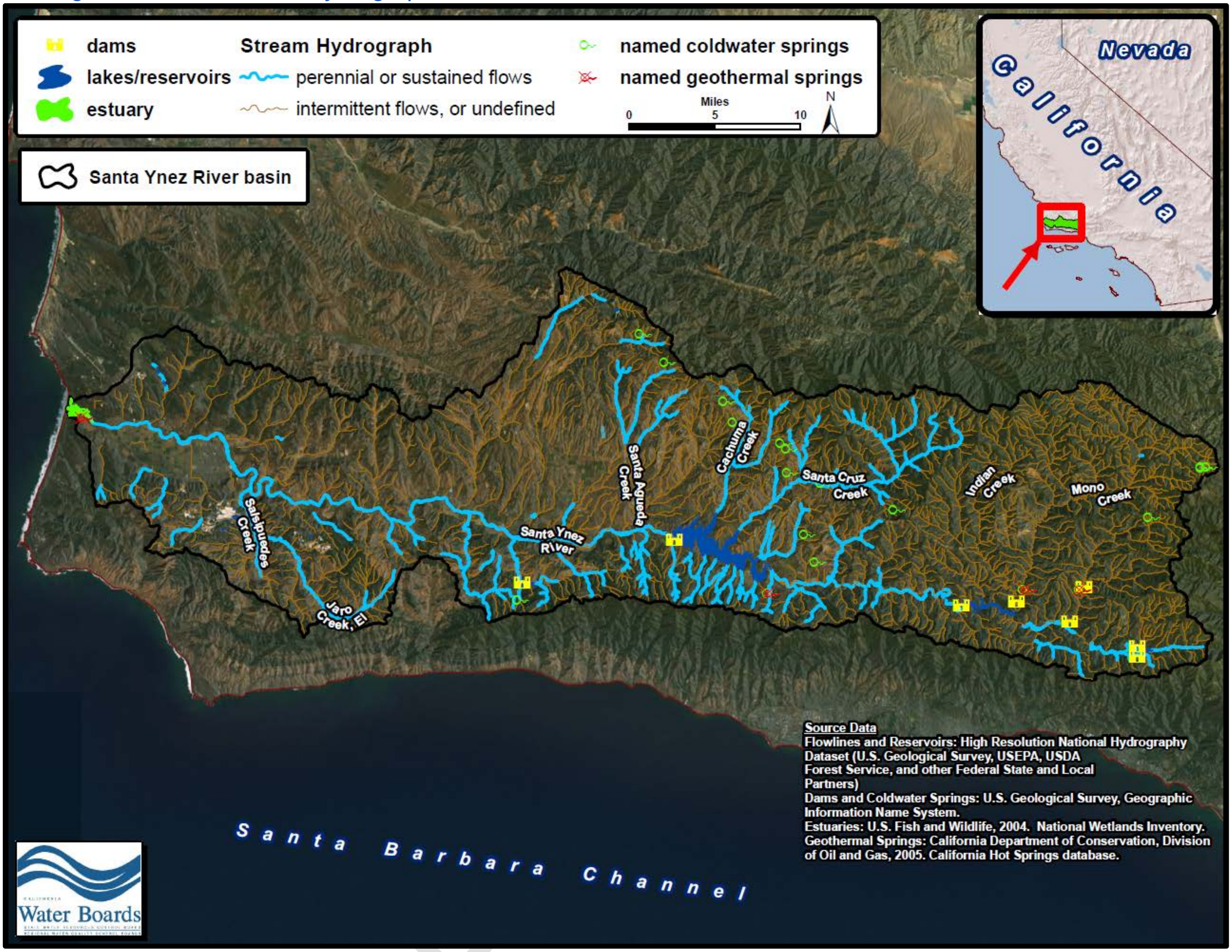


Table 4-3. Flow statistics from U.S. Geological Survey stream gages in the Santa Ynez River basin (flow units = cubic feet per second; drainage area units = square miles; BFI = base flow index).

Station No.	U.S. Geological Survey Station Name	Period of Record	Ave. Flow	MIN	P10	P25	P50	P75	P90	P95	P99	Max Flow	BFI	Drain Area
11121000	SANTA YNEZ R A JAMESON LK NR MONTECITO CA	1988-2000	22.9	0	0.0	0.0	0.0	0.0	40.0	95.0	571.0	2,660	0.27	NR
11121010	JAMESON LK RELEASE WEIR A JAMESON LAKE CA	1970-2000	2.0	0	1.0	1.2	1.9	2.7	3.5	3.8	4.4	7	0.85	NR
11121900	GIBRALTAR DAM DIV WEIR A GIBRALTAR DAM CA	1970-2000	7.3	0	0.0	3.0	8.2	11.0	13.0	14.0	22.0	90	0.79	NR
11122000	SANTA YNEZ R AB GIBRALTAR DAM NR SANTA BARB CA	1904-1918	126.3	0	0.4	2.0	9.0	44.0	181.0	430.0	2,362.2	19,000	0.31	216
11122010	GIBRALTER DAM REL WR A GIBRALTER DAM CA	1988-2000	0.8	0	0.0	0.0	0.0	0.0	0.0	10.0	15.0	16	0.71	NR
11123000	SANTA YNEZ R BL GIBRALTAR DAM NR SNTA BRB C CA	1933-2000	66.5	0	0.0	0.0	0.1	6.1	81.0	253.0	1,250.0	26,600	0.30	216
11123500	SANTA YNEZ R BL LOS LAURLS CYN NR SNTA YNEZ CA	1947-2000	89.5	0	0.0	0.0	0.1	8.6	95.0	311.2	1,746.3	33,700	0.27	277
11124000	SANTA CRUZ C AB STUKE CN NR SANTA YNEZ CA	1947-1952	10.1	0	0.1	0.2	0.5	3.9	15.0	43.0	211.2	850	NR	65
11124500	SANTA CRUZ C NR SANTA YNEZ CA	1941-2000	20.5	0	0.0	0.0	1.3	8.6	34.0	83.0	330.0	5,000	0.43	74
11125000	CACHUMA C NR SANTA YNEZ CA	1950-1962	3.7	0	0.0	0.0	0.1	1.0	4.3	10.0	69.0	782	0.38	24

Station No.	U.S. Geological Survey Station Name	Period of Record	Ave. Flow	MIN	P10	P25	P50	P75	P90	P95	P99	Max Flow	BFI	Drain Area
11126000	SANTA YNEZ R NR SANTA YNEZ CA	1929-2000	69.2	0	0.0	0.0	1.3	12.0	68.0	183.4	1,320.0	38,900	0.30	422
11126500	SANTA AGUEDA C NR SANTA YNEZ CA	1940-1978	3.6	0	0.0	0.0	0.1	0.5	1.8	4.1	64.4	1,760	0.22	56
11127000	SAN LUCAS C NR SANTA YNEZ CA	1952-1954	0.1	0	0.0	0.0	0.0	0.0	0.2	0.3	0.8	5	NR	NR
11127500	ZANJA DE COTA C NR SANTA YNEZ CA	1954-1961	1.9	0	0.2	0.7	1.3	2.4	3.0	3.4	8.9	115	0.67	14
11128000	SANTA YNEZ R A GA NR SANTA YNEZ CA	1954-1965	15.9	0	0.0	0.6	2.2	4.9	13.0	53.0	362.3	1,370	0.46	513
11128250	ALAMO PINTADO C NR SOLVANG CA	1970-2000	2.7	0	0.0	0.0	0.0	0.8	3.2	5.5	49.0	1,150	0.17	29
11128400	ALISAL C NR SOLVANG CA	1954-1972	5.6	0	0.0	0.0	0.0	0.4	5.0	15.0	117.6	2,040	0.16	12
11128500	SANTA YNEZ R A SOLVANG CA	1928-1999	95.7	0	0.0	0.0	3.5	11.0	63.0	240.0	1,762.7	40,000	0.38	579
11129000	NOJOQUI C NR BUELLTON CA	1952-1954	0.8	0	0.0	0.0	0.0	0.3	1.5	3.5	11.8	74	NR	15
11129500	SANTA YNEZ R A BUELLTON CA	1954-1959	38.1	0	0.0	0.0	1.1	7.6	46.9	159.2	828.9	3,970	0.23	611
11129800	ZACA C NR BUELLTON CA	1963-2000	1.7	0	0.0	0.0	0.0	0.0	1.0	4.3	30.0	598	0.08	33
11130000	ZACA C A BUELLTON CA	1941-1963	0.9	0	0.0	0.0	0.0	0.0	0.0	0.2	21.0	358	0.02	39
11130500	SANTA YNEZ R NR BUELLTON CA	1952-1974	61.8	0	0.0	0.0	1.3	12.0	47.0	136.6	1,000.0	42,000	0.48	668
11131000	SANTA YNEZ R AT SANTA ROSA DAMSITE NR BUELLTON CA	1954-1964	31.6	0	0.0	0.0	0.1	3.4	25.0	115.0	644.1	4,400	0.38	700
11131500	SANTA YNEZ R A COOPERS REEF NR LOMPOC CA	1954-1976	73.4	0	0.0	0.1	0.4	12.0	58.0	203.0	1,331.3	38,000	0.43	708
11132000	SANTA YNEZ R BL SANTA RITA C NR LOMPOC CA	1954-1962	37.2	0	0.0	0.1	0.2	2.6	40.0	177.4	800.0	4,800	0.32	733
11132500	SALSIPUEDES C NR LOMPOC CA	1941-2000	11.8	0	0.1	0.3	1.5	3.7	12.0	30.0	201.3	5,390	0.38	47
11133000	SANTA YNEZ R A NARROWS NR LOMPOC CA	1952-2000	124.6	0	0.0	0.0	1.9	21.0	115.0	450.0	2,109.7	38,000	0.36	789
11133500	SANTA YNEZ R NR LOMPOC CA	1906-1998	220.7	0	0.0	0.2	16.0	79.0	356.0	914.4	3,731.4	32,500	0.36	790
11133700	PURISIMA C NR LOMPOC CA	1970-1975	0.1	0	0.0	0.0	0.0	0.0	0.0	0.3	2.8	72	0.01	5
11134000	SANTA YNEZ R A H ST NR LOMPOC CA	1946-2000	47.5	0	0.0	0.0	0.0	0.0	40.0	156.8	849.5	19,600	0.18	815
11134500	SANTA YNEZ R A V STREET NR LOMPOC CA	1954-1975	78.9	0	0.0	0.0	0.0	0.0	65.0	260.0	1,358.5	38,000	0.15	820
11134800	MIGUELITO C A LOMPOC CA	1970-2000	2.4	0	0.0	0.1	0.4	1.2	2.9	6.9	36.0	1,170	0.35	12
11135000	SANTA YNEZ R A PINE CYN NR LOMPOC CA	1940-1983	185.4	0	0.3	1.3	4.2	34.0	262.5	820.5	3,009.0	38,400	0.35	844
11135200	RODEO-SAN PASQUAL C NR LOMPOC CA	1970-1972	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	3	NR	8
11135500	SANTA YNEZ R A BARRIER NR SURF CA	1946-1965	41.5	0	0.0	0.0	0.0	0.5	13.0	120.0	753.1	21,900	0.31	895

Data source: U.S. Geological Survey, 2003. *Flow characteristics at U.S. Geological Survey stream gages in the conterminous United States.* Open File Report 03-146.
P = percentiles, for example the P10 attribute is the 10^{th} percentile of daily streamflow values for the period of record.
NR = not reported
BFI = base flow index

4.3 Climate & Atmospheric Deposition

We conducted a brief and cursory review of climatic data for this scoping report. Precipitation is often considered in the development of TMDLs. Precipitation is directly related to a number of watershed hydrologic functions, such as surface runoff, groundwater recharge, and water table elevations.

The Santa Ynez River basin and California's central coast are characterized by a Mediterranean–type climate, with the vast majority of precipitation falling between November and April (see monthly rain gage data found in Table 4-4).

Table 4-4. Rainfall gage records in the Santa Ynez River basin (units = inches).

Station	Elevation (ft.)	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean Annual Rainfall
Alisal Ranch [A]	479	1966-2014	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**24.30**
Buellton [A]	364	1955-2015	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**16.80**

Station	Elevation (ft.)	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean Annual Rainfall
Burton Mesa fire station [A]	344	1962-2014	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**14.51**
Cachuma Lake [B]	783	1952-2015	4.39	4.65	3.47	1.54	0.38	0.04	0.01	0.03	0.21	0.66	1.93	3.09	**20.39**
El Deseo Ranch [A]	3993	1967-2014	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**36.45**
Figueroa Mountain [A]	4520	1961-2015	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**21.42**
Gibraltar Dam [A]	1404	1920-2015	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**26.45**
Jameson Dam [A]	2227	1926-2013	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**29.36**
Lompoc [B]	112	1917-2015	3.07	3.09	2.55	1.14	0.26	0.03	0.02	0.02	0.17	0.53	1.53	2.24	**14.67**
Lompoc City Hall [A]	112	1955-2015	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**14.51**
Miguelito Canyon [A]	433	1947-2014	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**22.78**
Nojoqui Falls [A]	1099	1966-2014	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**27.47**
Rancho San Julian [A]	620	1920-2014	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**24.03**
Salsipuedes gaging stn [B]	255	1948-2014	3.84	4.17	3.09	1.48	0.33	0.05	0.00	0.03	0.17	0.62	1.88	2.88	**18.54**
San Marcos Pass [A]	2217	1966-2015	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**34.21**
Santa Ynez fire station [A]	607	1951-2015	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**15.81**
Solvang [A]	502	Average Precipitation (inches)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**18.78**

A: County of Santa Barbara Department of Public Works rain gage station.
B: Western U.S. COOP weather station (Source: NOAA Western Regional Climate Center).
NR = not reported

It is important to recognize that rainfall gauging stations have limited spatial distribution, and that gauging stations tend to be located in lower elevations where people live. Consequently, these locations can bias estimates of regional rainfall towards climatic conditions at lower elevations. The topography of the California central coast region however, can result in significant orographic enhancement of rainfall (i.e., enhancement of rainfall due to topographic relief and mountainous terrain).

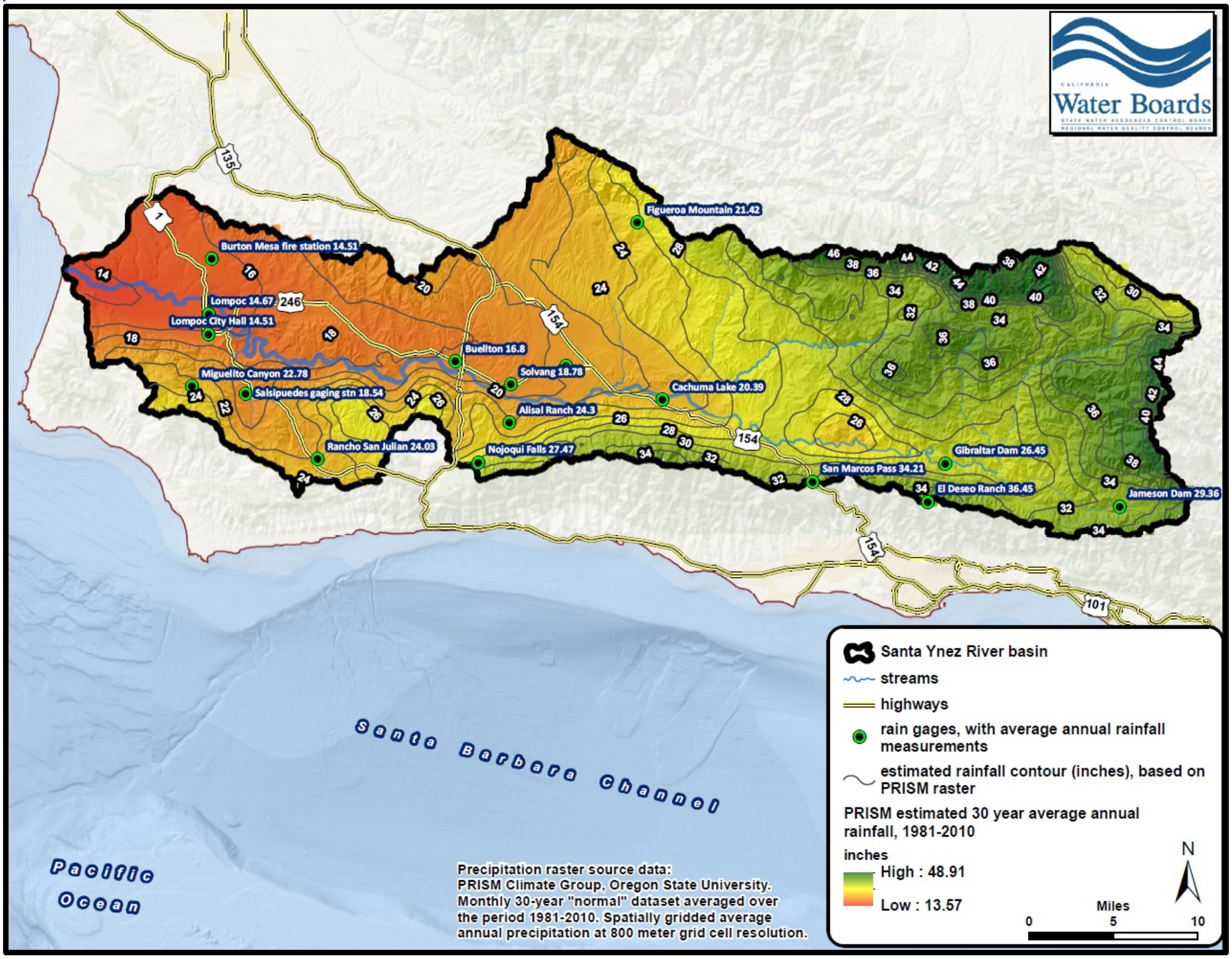
Therefore, due to climatic spatial variability, mean annual precipitation estimates for the Santa Ynez River basin may be assessed using the Parameter-elevation Regressions on Independent Slopes Model (PRISM)[9]. PRISM is a climate mapping system that accounts for orographic climatic effects and is widely used in watershed studies and TMDL projects to make projections of precipitation into rural or mountainous areas where rain gage data is often absent, or sparse. PRISM is the U.S. Department of Agriculture's official climatological dataset and PRSIM is used by the U.S. National Weather Service to

[9] The PRISM dataset was developed by researchers at Oregon State University, and uses point measurements of precipitation, temperature, and other climatic factors to produce continuous, digital grid estimates of climatic parameters. The dataset incorporates a digital elevation model, and expert knowledge of climatic variation, including rain shadows, coastal effects, and orographic effects. Online linkage: http://www.prism.oregonstate.edu/

spatially interpolate rainfall frequency estimates. PRISM is also used by private consultants engaged in watershed studies[10].

Figure 4-3 presents a color gradient map illustrating modeled 30 year mean annual rainfall in the Santa Ynez River basin averaged over the period 1981-2010. The precipitation range estimates shown in Figure 4-3 comport reasonably well with historical regional rainfall range estimates reported by the U.S. Geological Survey and with estimates reported by the County of Santa Barbara[11].

Figure 4-3. Color gradient display illustrating modeled 30 year mean annual rainfall averaged over the period of 1981-2010 in the Santa Ynez River basin.



Text Box 4-1. Santa Ynez River basin mean annual precipitation for the 30 year period 1981-2010 based on PRISM estimates.

Estimated mean annual precipitation within the Santa Ynez River basin for the period 1981-2010 ranged from less than 14 inches per year near the coast, to around 19 inches per year at Solvang, to about 35 or 40 inches on the higher mountains in the eastern areas of the river basin. Taken as a whole, basin-wide average annual precipitation from 1981-2010 is estimated to be 26 inches.

[10] For example: Tetra Tech, November 2015. *Salinas River Watershed Area Salt Modeling* report.

[11] The U.S. Geological Survey (1951), Water Supply Paper 1107 states that "mean annual rainfall ranges from about 14 inches on the coast to 35 or 40 inches on the higher mountains" (Water Supply Paper 1107. Geology and Water Resources of the Santa Ynez River Basin, Santa Barbara County, California). The County of Santa Barbara Public Works Departments webpage reports that rainfall is typically "over 36 inches at the apex of the Santa Ynez Mountains" (webpage accessed Sept. 29, 2015).

Table 4-5. Estimated 30 year mean annual rainfall[A] averaged over the period of 1981-2010 within subwatersheds of the Santa Ynez River basin.

ID Number	Subwatershed Name[B]	Mean Annual Precipitation (Inches) 1981-2010	ID Number	Subwatershed Name[B]	Mean Annual Precipitation (Inches) 1981-2010
1	Upper Mono Creek	34.15	15	Santa Agueda Creek	24.38
2	Indian Creek	35.50	16	Zanja de Cota Creek	21.52
3	Lower Mono Creek	34.36	17	Calabazal Creek-Santa Ynez River	25.45
4	Agua Caliente Canyon	36.65	18	Alamo Pintado Creek	22.28
5	Juncal Canyon-Santa Ynez River	34.83	19	Nojoqui Creek	24.94
6	Blue Canyon-Santa Ynez River	30.88	20	Alisal Creek-Santa Ynez River	22.98
7	East Fork Santa Cruz Creek	36.14	21	Zaca Creek	20.47
8	West Fork Santa Cruz Creek	35.37	22	Santa Rosa Creek-Santa Ynez River	19.26
9	Upper Santa Cruz Creek	31.90	23	Santa Rita Valley	17.67
10	Lower Santa Cruz Creek	29.47	24	Canada De La Vina-Santa Ynez River	19.05
11	Gibraltar Reservoir-Santa Ynez River	29.96	25	El Jaro Creek	23.49
12	Kelly Creek-Santa Ynez River	28.61	26	Salsipuedes Creek	20.87
13	Cachuma Creek	28.54	27	San Miguelito Creek-Santa Ynez River	17.38
14	Happy Canyon	25.54	28	Santa Lucia Canyon-Santa Ynez River	15.77

[A] Source data: PRISM Climate Group, Oregon State University, 30-arcsec annual precipitation grid, 1981-2010. PRISM precipitation zonal statistics were extracted for subwatersheds using the ArcMap 10.1™ Spatial Analyst extension.
[B] Refer back to Figure 2-2 and Table 2-3 for a map and tabulation of subwatersheds within the Santa Ynez River basin.

It should be reiterated that the PRISM model represents average precipitation conditions over a 30 year period. California has been experiencing extreme drought conditions in recent years. Consequently, solutions and timeframes for water quality improvements and monitoring aimed at achieving pollutant load reductions in the Santa Ynez River may need to consider assumptions about water quality conditions under extreme drought conditions.

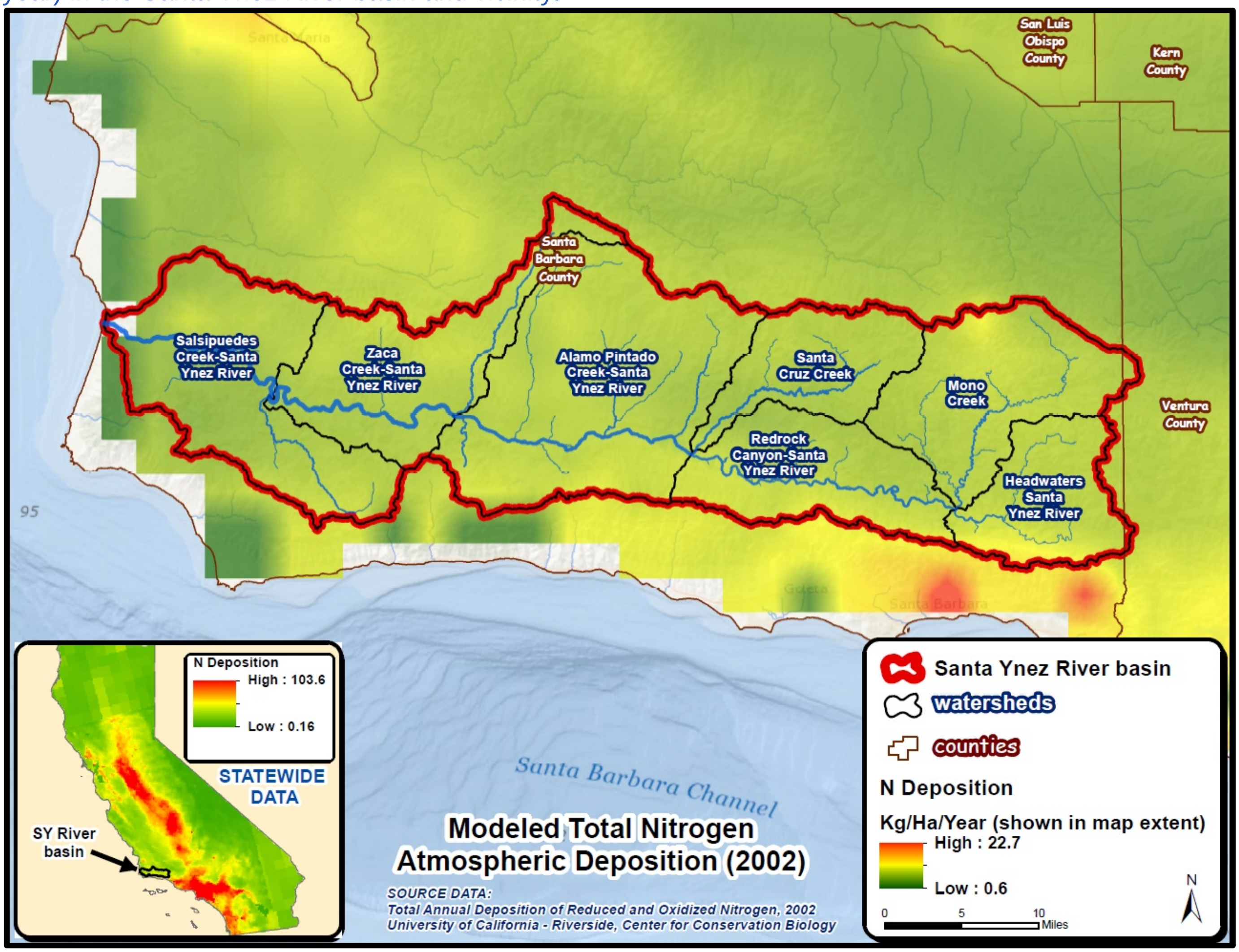
Other climatic parameters may be considered during TMDL development. Atmospheric deposition of nitrogen and phosphorus is often considered in watershed assessments of nutrient pollution. Deposition of nutrients by rainfall can locally be a significant source of loading to surface waters in any given watershed. Because nitrogen can exist as a gaseous phase (while phosphorus cannot), nitrogen is more prone to atmospheric transport and deposition. Phosphorus associated with fine-grained airborne particulate matter can also exist in the atmosphere (U.S. Environmental Protection Agency, 1999).

Additionally, atmospheric deposition of nitrogen compounds is generally most prevalent downwind of large urban areas, near point sources of combustion (like coal burning power plants), or in mixed urban/agricultural areas characterized by substantial vehicular combustion contributions to local air quality (Westbrook and Edinger-Marshall, 2014).

Figure 4-4 presents estimated total nitrogen atmospheric deposition for the year 2002 in the Santa Ynez River basin and vicinity based on a deposition model developed by the University of California-Riverside Center for Conservation Biology[12].

Based on summary statistics of the California statewide nitrogen deposition raster data, the 25th percentile of data values is 2.5 kilogram (kg) of nitrogen per hectare (Ha)[13] and the median value is 3.7 kg/hectare. These values (2.5 to 3.7 kg/Ha) presumably could represent a plausible range for lightly-impacted or natural ambient atmospheric deposition conditions in California. Estimated atmospheric deposition of nitrogen in the Santa Ynez River basin (5.0 kg/Ha, refer to Table 4-6) is marginally higher than the aforementioned ambient condition. However, atmospheric nitrogen deposition in the river basin is substantially lower than in highly developed areas of southern California such as the Los Angeles Basin and the Santa Ana Basin, which generally can range to above 20 kg/Ha of nitrogen deposition annually based on the raster dataset.

Figure 4-4. Estimated annual atmospheric deposition of total nitrogen as N (units=kilograms/hectare per year) in the Santa Ynez River basin and vicinity.



[12] Tonnesen, G., Z. Wang, M. Omary, and C. J. Chien. 2007. University of California-Riverside. Assessment of Nitrogen Deposition: Modeling and Habitat Assessment. California Energy Commission, PIER Energy-Related Environmental Research. CEC-500-2006-032.

[13] One hectare is equal to 2.47 acres.

Table 4-6. Estimated annual atmospheric deposition of total nitrogen as N in watersheds of the Santa Ynez River basin (units = kilograms/hectare per year).

Watershed	Min	Max	Mean
Mono Creek	5.2	8.6	6.0
Headwaters Santa Ynez River	5.7	9.5	6.8
Santa Cruz Creek	4.5	5.9	5.4
Redrock Canyon-Santa Ynez River	4.5	8.1	6.3
Alamo Pintado Creek-Santa Ynez River	4.9	7.8	6.0
Zaca Creek-Santa Ynez River	5.0	6.7	5.6
Salsipuedes Creek-Santa Ynez River	1.2	7.1	5.1
Basin-wide mean atmospheric deposition rate (Santa Ynez River basin)			5.0

Based on the University of California-Riverside atmospheric deposition model, average annual atmospheric deposition of total nitrogen across the Santa Ynez River basin can be estimated as shown in Text Box 4-2.

Text Box 4-2. Estimated atmospheric deposition of total nitrogen as N in the Santa Ynez River basin.

The average annual atmospheric deposition of nitrogen as N in the Santa Ynez River basin is: 5.0 kilograms total nitrogen (N) per hectare per year.

4.4 Groundwater

We conducted a cursory review of groundwater data for this scoping report. TMDLs do not directly address pollution of groundwater by controllable sources. However, shallow groundwater inflow to streams may be considered in the context of TMDL development. Groundwater and surface water are not closed systems that act independently from each other; it is well known that groundwater inflow to surface waters can be a source of nutrients or salts to any given surface waterbody. The physical interconnectedness of surface waters and groundwater is widely recognized by scientific agencies, researchers, and resource professionals, as highlighted below:

“Traditionally, management of water resources has focused on surface water or ground water as separate entities.…Nearly all surface-water features (streams, lakes reservoirs, wetlands, and estuaries) interact with groundwater. Pollution of surface water can cause degradation of ground-water quality and conversely pollution of ground water can degrade surface water. Thus, effective land and water management requires a clear understanding of the linkages between ground water and surface water as it applies to any given hydrologic setting.”

From: U.S. Geological Survey, 1998. Circular 1139: “Groundwater and Surface Water – A Single Resource.”

“While ground water and surface water are often treated as separate systems, they are in reality highly interdependent components of the hydrologic cycle. Subsurface interactions with surface waters occur in a variety of ways. Therefore, the potential pollutant contributions from ground water to surface waters should be investigated when developing TMDLs.”

From: U.S. Environmental Protection Agency, Guidance for Water Quality-Based Decisions: The TMDL Process – Appendix B. EPA 440/4-91-001.

“Although surface water and groundwater appear to be two distinct sources of water, they are not. Surface water and groundwater are basically one singular source of water connected physically in the hydrologic cycle...Effective management requires consideration of both water sources as one resource.”

From: California Department of Water Resources: Relationship between Groundwater and Surface Water http://www.water.ca.gov/groundwater/groundwater_basics/gw_sw_interaction.cfm.

"The popular misconception in U.S. western culture appears to be that groundwater and surface water are two separate sources of water. This bimodal legal approach to managing what is one resource – water – has not resulted in rational water management in California…whether the water is above the land surface or below the land surface, it is the same water. Labeling it "groundwater" or "surface water" is a human construct that represents where the water is at that moment in time. They are not different sources."

From: Carl Hauge, retired Chief Hydrologist for the California Department of Water Resources, in Groundwater Resources Association of California, web seminar entitled *"No Surface Water = No Groundwater",* October 2015.

"Surface water and ground water are increasingly viewed as a single resource within linked reservoirs. The movement of water from streams to aquifers and from aquifers to streams influences both the quantity and quality of available water within both reservoirs"

From: C. Ruehl, A. Fisher, C. Hatch, M. Los Huertos, G. Stemler, and C. Shennan (2006), *Differential gauging and tracer tests resolve seepage fluxes in a strongly-losing stream.* Journal of Hydrology, volume 330, pp. 235-248.

"Surface water bodies are hydraulically connected to ground water in most types of landscapes…Even if a surface water body is separated from the ground-water system by an unsaturated zone, seepage from the surface water may recharge the ground water. Because of the interchange of water between these two components of the hydrologic cycle, development or contamination of one commonly affects the other."

From: Thomas C. Winter, U.S. Geological Survey Water Resources Division (2000). *Interaction of Ground Water and Surface Water.* Proceedings of the Ground-Water/Surface-Water Interactions Workshop, 2000, pp. 15-20. EPA/542/R-00/007

"It's a myth that groundwater is separate from surface water and also a myth that it's difficult to legally integrate the two….California's groundwater and surface water are often closely interconnected and sometimes managed jointly."

From: Buzz Thompson, Professor of Natural Resources Law, Stanford University Law School, quoted in *Managing California's Groundwater*, by Gary Pitzer in Western Water January/February 2014, *and* from Public Policy Institute of California, *California Water Myths*, www.ppic.org.

The range of information discussed above is illustrated conceptually in Figure 4-5.

Figure 4-5. Streams are intimately connected to the groundwater system.

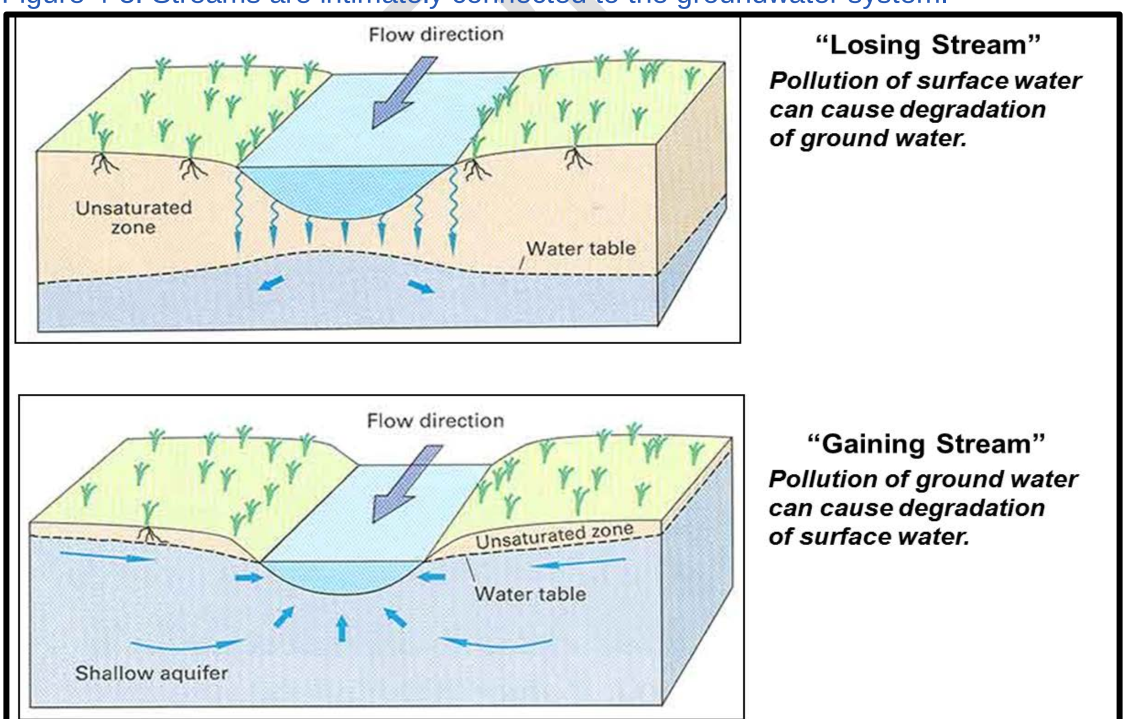
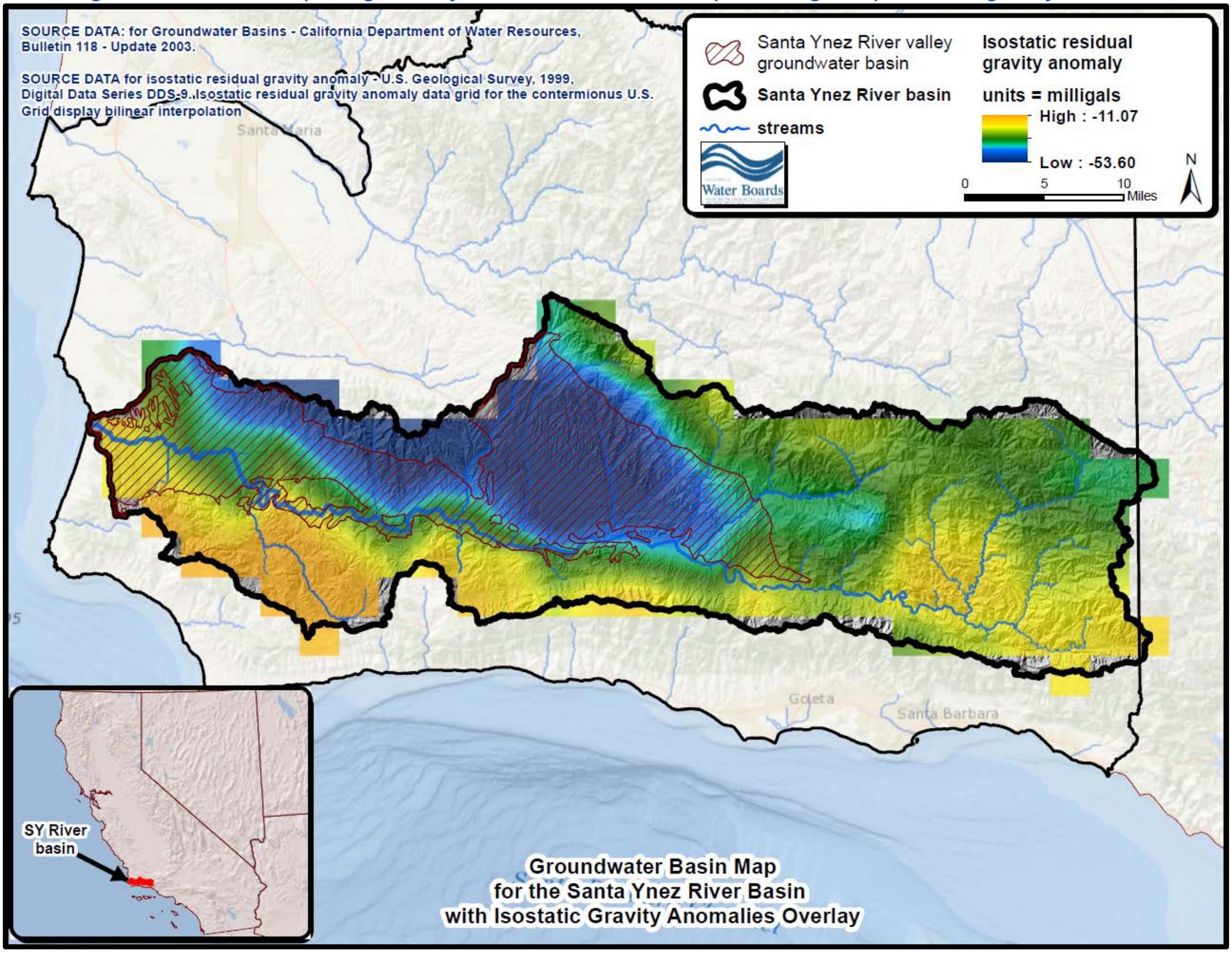


Figure credits: U.S. Geological Survey Circular 1139 , Groundwater and Surface Water A Single Resource (1998)

As with any watershed study, it is worth being cognizant of the distribution of alluvial groundwater basins located within the Santa Ynez River basin. Alluvial groundwater basins in the Santa Ynez River basin, with an isostatic residual gravity anomalies overlay[14], are presented in Figure 4-6. Note that groundwater basins are three-dimensional in architecture, and gravity data can thus give some insight into the shape and distribution of alluvial basins.

Figure 4-6. Map illustrating the Santa Ynez River basin, the Santa Ynez River Valley groundwater basin, and an isostatic residual gravity color gradient overlay. Lower density geologic materials (i.e., alluvial fill and groundwater basins) are generally associated with lower (more negative) isostatic gravity values.

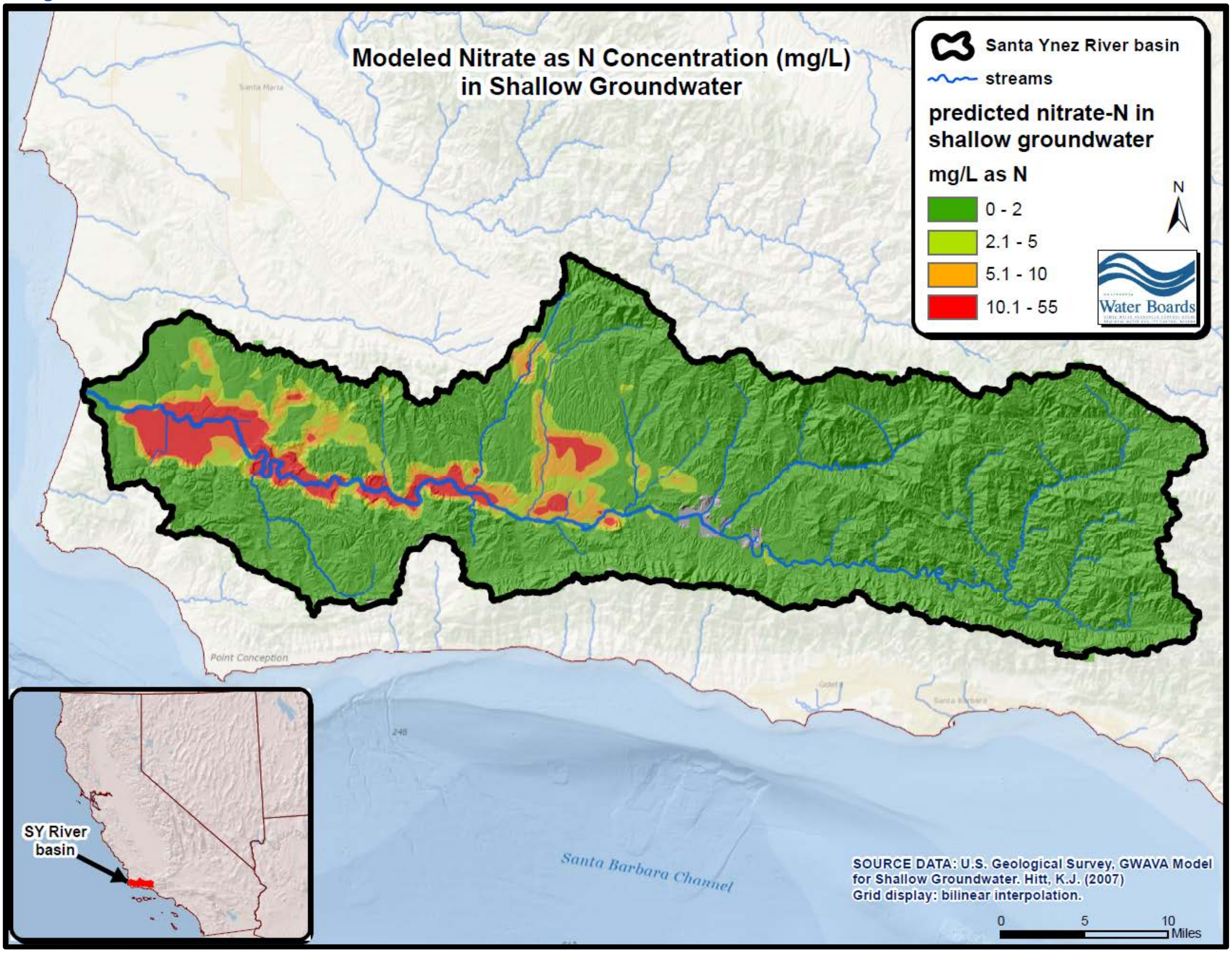


Estimated nitrate as N concentrations in shallow, recently-recharged groundwater are available from the U.S. Geological Survey. Figure 4-7 illustrates estimated nitrate as nitrogen concentrations in shallow, recently-recharged groundwater in the Santa Ynez River basin (data source: U.S. Geological Survey

[14] Isostatic residual gravity anomaly data are a geophysical attribute that represents density contrasts, and can be used as a proxy to assess the presence and the depth or thickness of alluvial fill. Caution and professional judgment must be used, because gravity anomalies can also be associated with subsurface geologic structure, faults, and rapid changes in lithology (rock types). Isostatic residual gravity data source: U.S. Geological Survey (1999), *Isostatic residual gravity anomaly data grid for the conterminous U.S.*

GWAVA model[15]). Shallow, recently recharged groundwater is defined by the U.S. Geological Survey in the GWAVA dataset as groundwaters generally less than 5 meters below ground surface. This dataset indicates that nitrate concentrations are highest in the shallow groundwaters of the alluvial fill of the lower (western) reaches of the river basin.

Figure 4-7. Map illustrating estimated nitrate as N concentrations in shallow, recently recharged groundwater of the Santa Ynez River basin.



4.5 Soils

Soils have physical and hydrologic characteristics which may have a significant influence on the transport and fate of nutrients. Watershed researchers and TMDL projects often assess soil characteristics in conjunction with other physical watershed parameters to estimate the risk and magnitude of nutrient loading to waterbodies (Mitsova-Boneva and Wang, 2008; McMahon and Roessler, 2002; Kellog et al., 2006). The relationship between nutrient export (loads) and soil texture is illustrated in Figure 4-8 and Figure 4-9. Generally, fine-textured soils with lower capacity for infiltration of precipitation/water are more prone to runoff and are consequently typically associated with a higher risk of nutrient loads to surface waters.

[15] The GWAVA (Ground Water Vulnerability Assessment) dataset represents predicted nitrate concentration in shallow, recently recharged groundwater in the conterminous United States, and was generated by a national nonlinear regression model based on 14 input parameters.

Figure 4-8. Median annual Total N and Total P export for various soil textures.

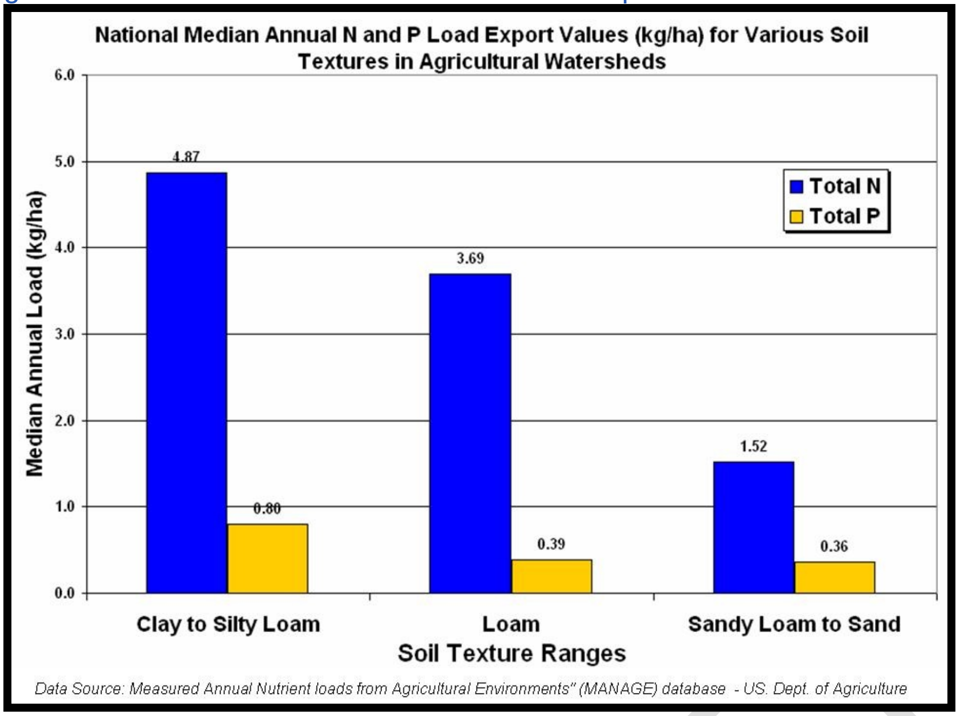
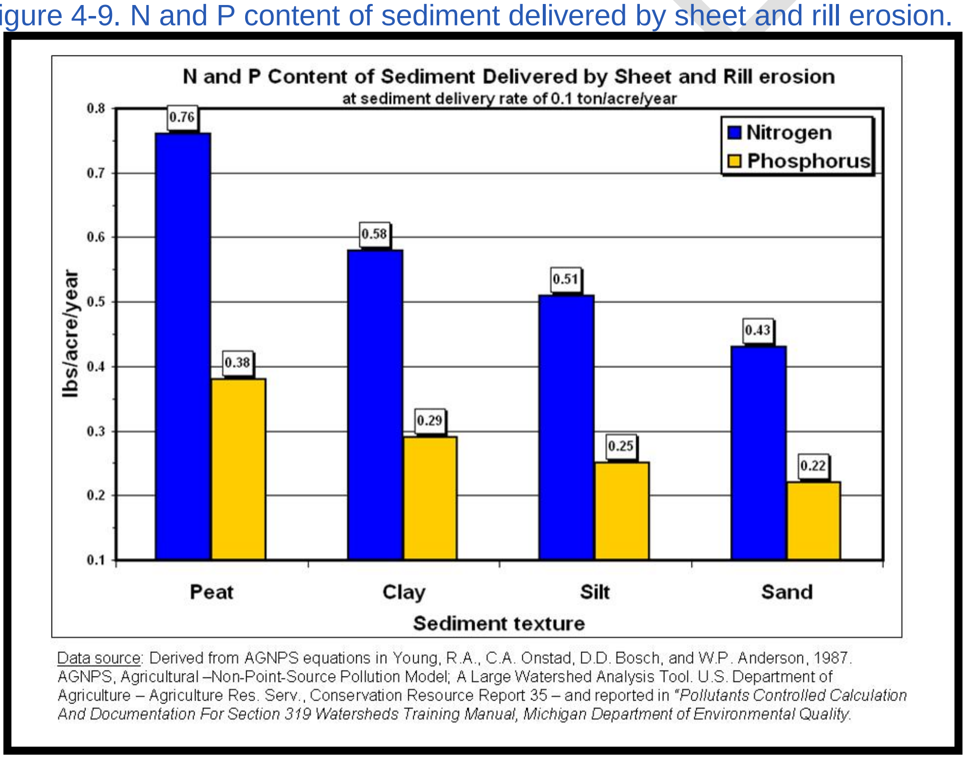
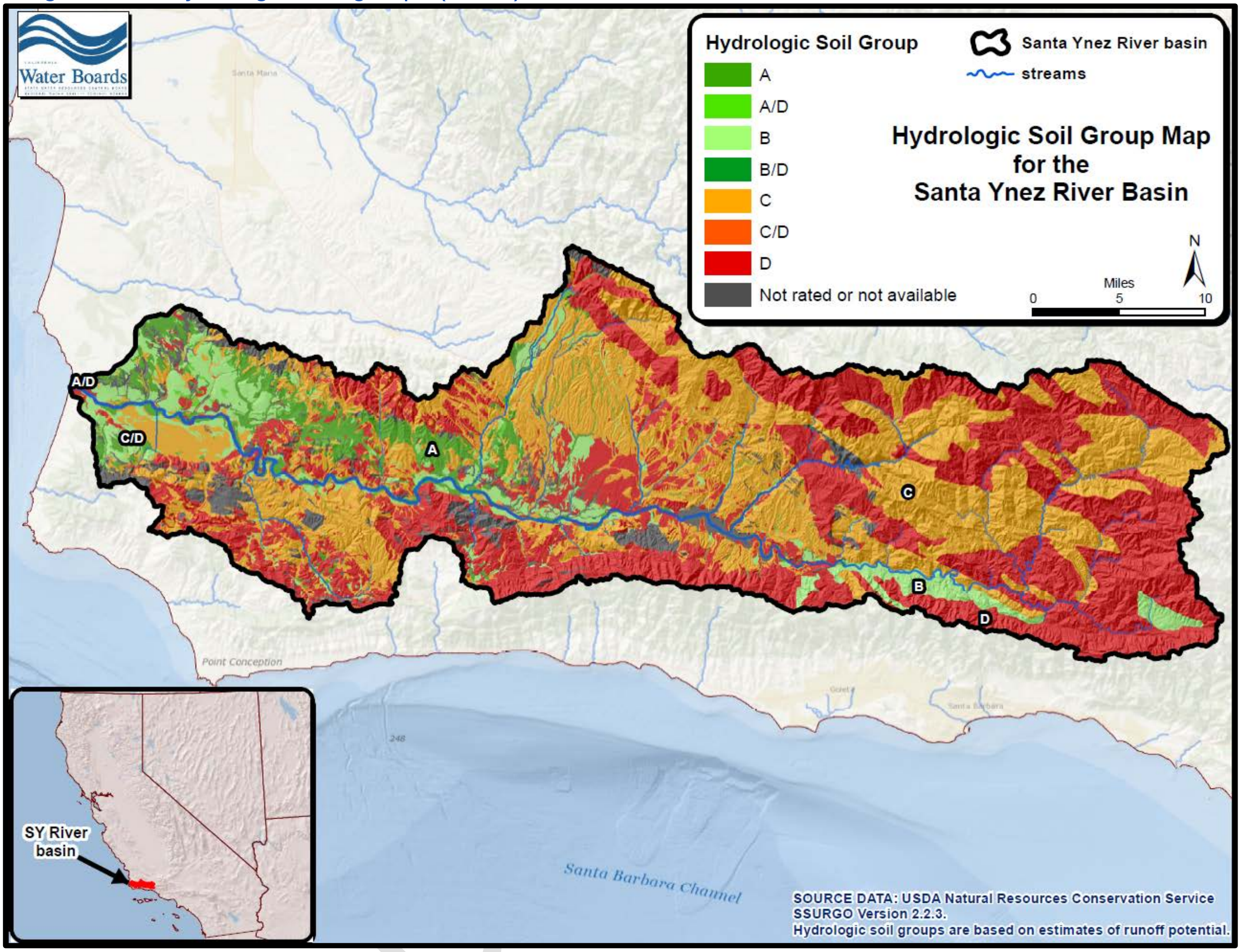


Figure 4-9. N and P content of sediment delivered by sheet and rill erosion.



Soils play a key role in drainage, runoff, and subsurface infiltration in any given watershed. The U.S. Department of Agriculture National Resources Conservation Service's compiled soil survey by counties is available online under the title of Soil Survey Geographic (SSURGO) Database. SSURGO has been updated with extensive soil attribute data, including Hydrologic Soil Groups. Hydrologic Soil Groups are a soil attribute associated with a mapped soil unit, which indicates the soil's infiltration rate and potential for runoff. Figure 4-10 illustrates the distribution of hydrologic soil groups in the Santa Ynez River basin along with a tabular description of the soil group's hydrologic properties.

Figure 4-10. Hydrologic soils groups (HSGs) in the Santa Ynez River basin.



Hydrologic Soil Group Descriptions	
A	Well drained to excessively drained sands or gravelly sands.
B	Moderately well drained or well drained soils having moderately fine to moderately course texture.
C	Soils having a slow infiltration rate when thoroughly wet; moderately fine or fine texture.
D	Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays, soils which have a high water table, soils that have a claypan or clay layer near the surface, and soils that overlie a shallow, nearly impervious surface.
A/D	If a soil is assigned a dual hydrologic group, the first letter is for drained areas and the second is for undrained areas.

4.6 Geology

Geology can have a significant influence on natural, background concentrations of nutrients and other inorganic constituents in stream waters. The linkage between geologic conditions and stream water chemistry has long been recognized (for example, U.S. Geological Survey, 1910 and U.S. Geological Survey, 1985).

Stein and Kyonga-Yoon (2007) reported that catchment geology was the most influential environmental factor on water quality variability from undeveloped stream reaches in lightly-disturbed, natural areas located in Ventura, Los Angeles, and Orange counties, California. Stein and Kyonga-Yoon (2007) concluded that catchments underlain by sedimentary rock had higher stream flow concentrations of metals, nutrients, and total suspended solids, as compared to areas underlain by igneous rock.

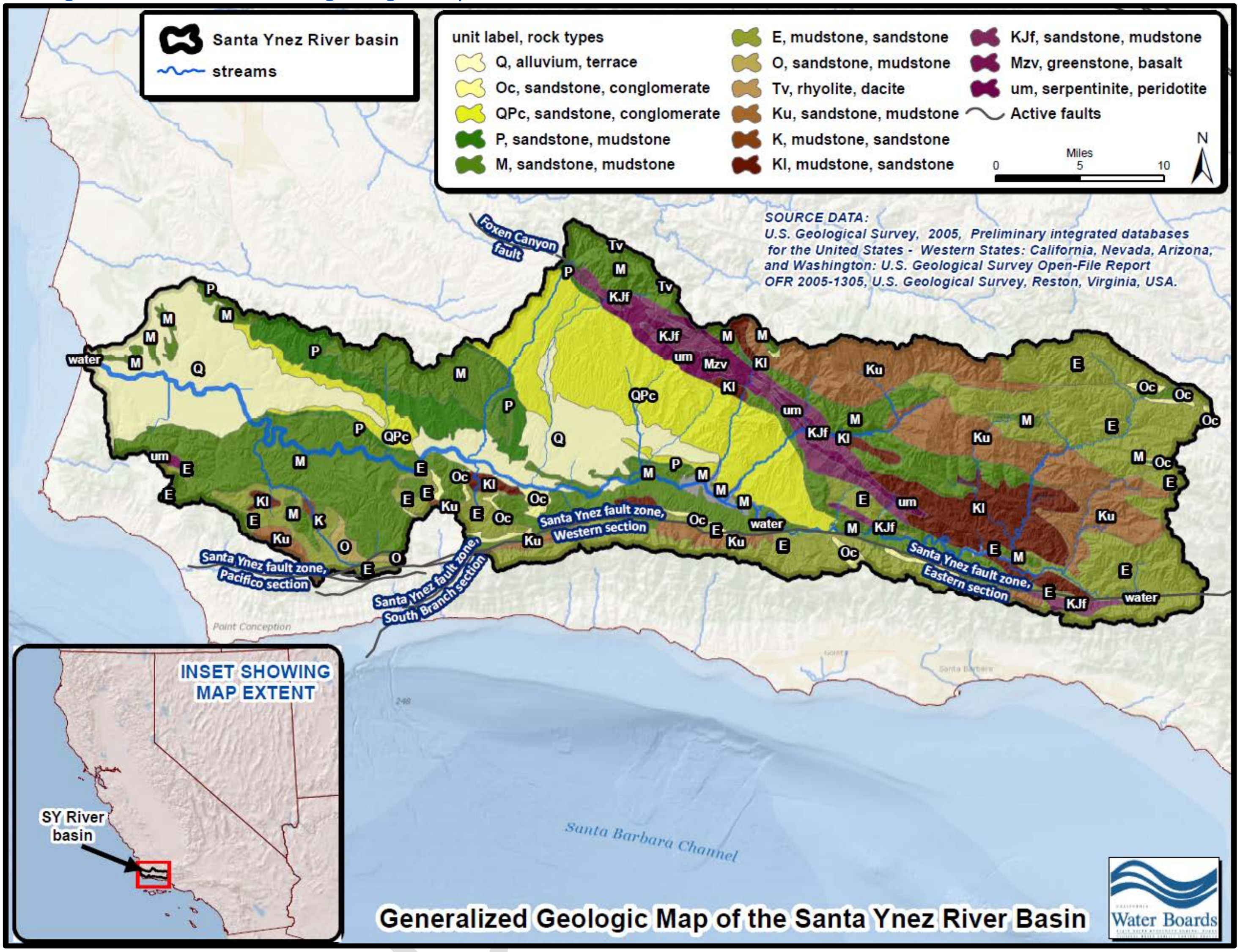
Additionally, the Utah Geological Survey hypothesized that organic-rich marine sedimentary rocks in the Cedar Valley of southern Utah may locally contribute to elevated nitrate observed in groundwater (Utah Geological Survey, 2001). Nitrogen found in the organic material of these rock strata are presumed by the Utah Geological Survey researchers to be capable of oxidizing to nitrate and may subsequently leach to groundwater.

Further, the Las Virgenes Municipal Water District (LVMWD, 2012) recently reported that high background levels of biostimulatory substances (nitrogen and phosphate) in the Malibu Creek Watershed appear to be associated with exposures of the Monterey/Modelo Formation.

Also worth noting, Domagalski (2013) states that knowledge about natural and geologic sources of phosphorus in watersheds are important for developing nutrient management strategies.

Consequently, in evaluating the effect of anthropogenic activities on nutrient loading to waterbodies in a TMDL project, it may also be relevant to consider the potential impact on nutrient water quality which might result from local geology. We conducted a brief and cursory review of geologic data for this scoping report. Figure 4-11 presents an illustration of the geology of the Santa Ynez River basin and vicinity.

Figure 4-11. Generalized geologic map of the Santa Ynez River basin.

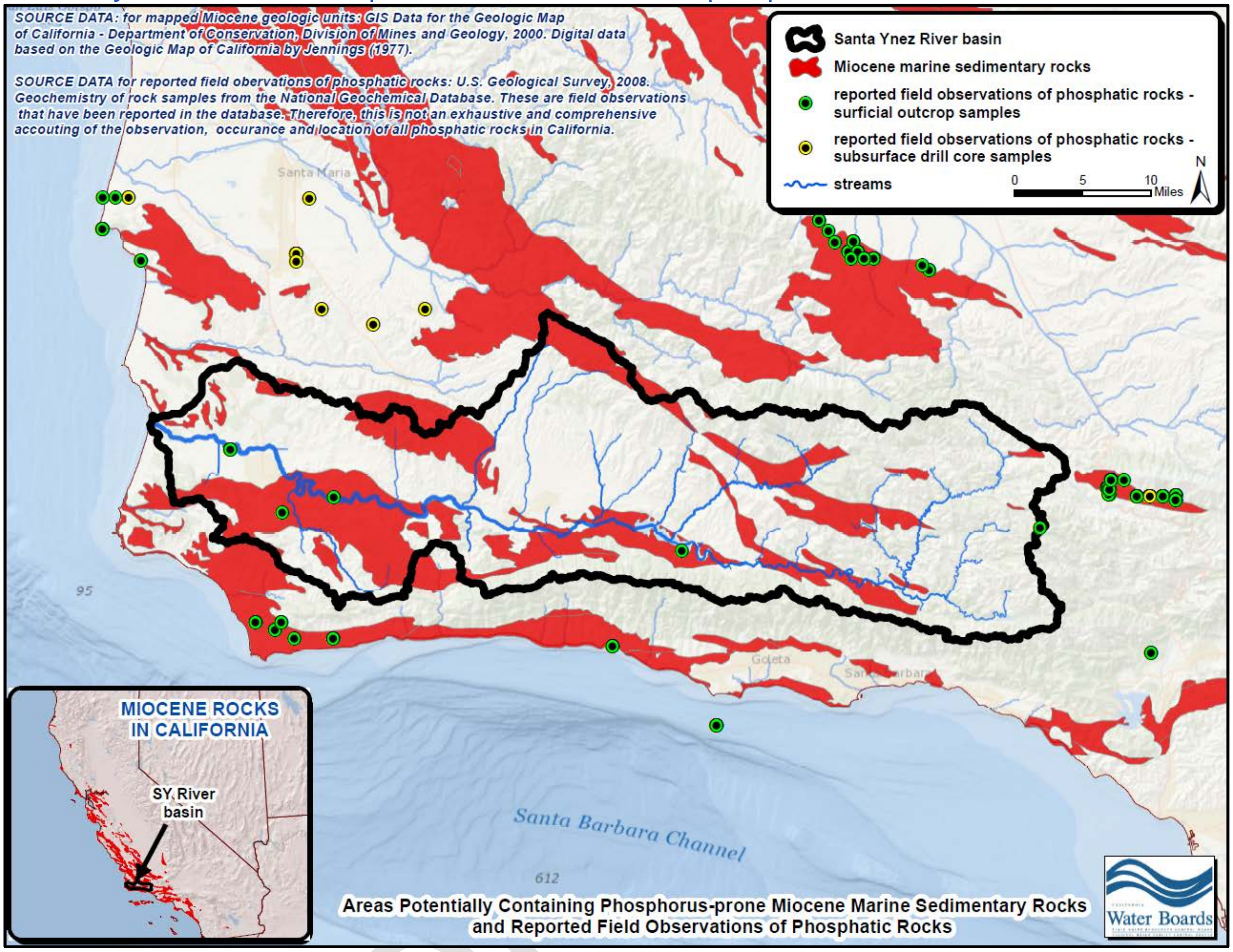


Rocks and natural phosphatic deposits are the main natural reservoirs of phosphorus inputs to aquatic systems (U.S. Environmental Protection Agency, 1999). Phosphorus-prone geologic materials in the Santa Ynez River basin may locally be associated with Upper Tertiary (Miocene) mudstones. Figure 4-12 illustrates the location of mapped Miocene-aged sedimentary rock bodies, and the locations of reported field observations of phosphatic rocks. It is important to recognize that *reported field observations* undoubtedly constitute only a small subset of all existing phosphatic rock locations.

Also worth noting, some of the phosphatic rock field observation locations illustrated in Figure 4-12 represent subsurface drill core samples. Thus, while some of these drill core field observations may not overlay the polygons representing outcrops of Miocene marine sedimentary rocks in map view, the core samples often represent subsurface sampling of Miocene rock strata at depth.

If warranted, we will review additional geologic information as TMDL development progresses.

Figure 4-12. Map of outcropping Miocene-age marine sedimentary rock in the Santa Ynez River basin and vicinity, and locations of reported field observations of phosphatic rocks.



5. Water Quality Standards

TMDLs are requirements pursuant to the federal Clean Water Act. The broad objective of the federal Clean Water Act is to "restore and maintain the chemical, physical and biological integrity of the Nation's waters[16]." Water quality standards are provisions of state and federal law intended to implement the federal Clean Water Act. In accordance with state and federal law, California's water quality standards consist of:

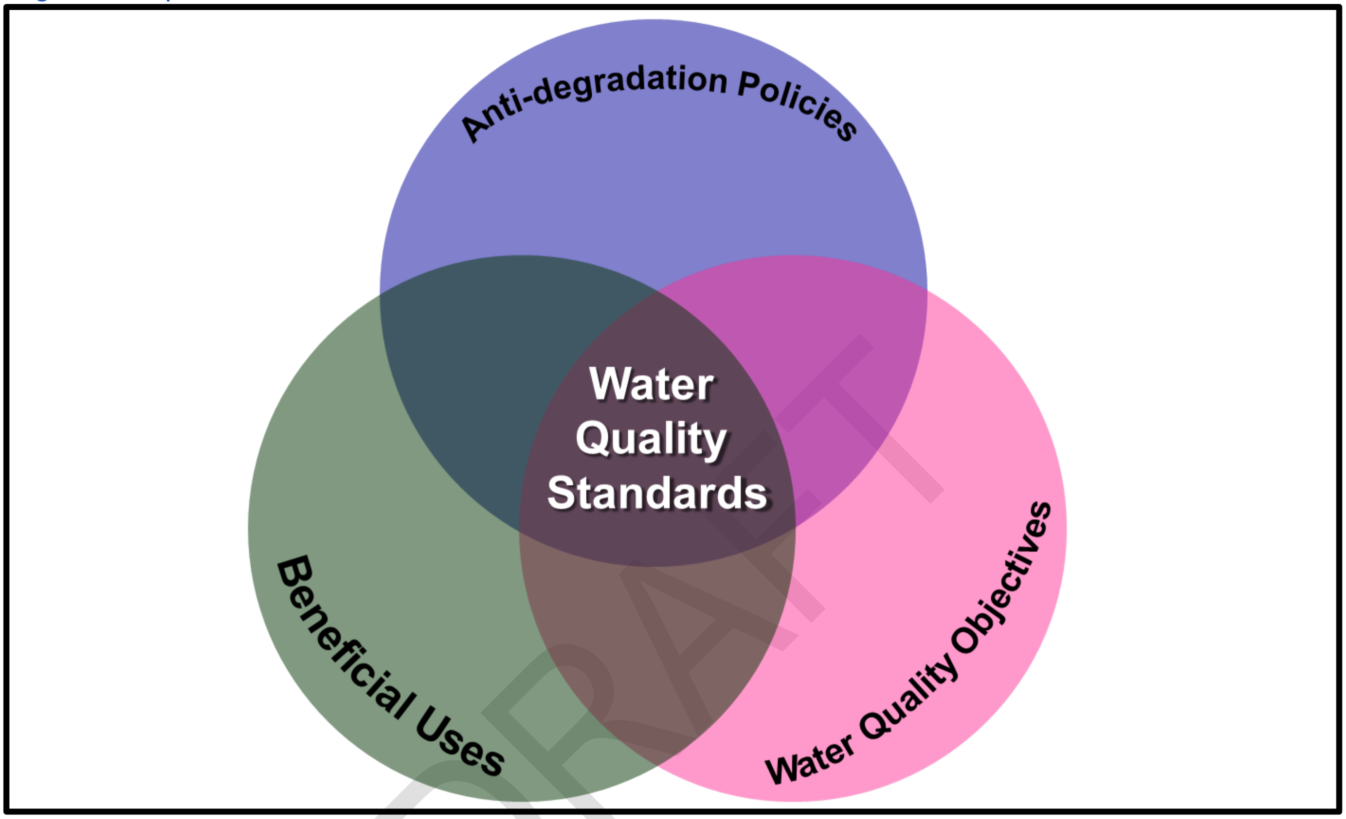
- Beneficial uses, which refer to legally-designated uses of waters of the state that may be protected against water quality degradation (e.g., drinking water supply, recreation, aquatic habitat, agricultural supply, etc.).
- Water quality objectives, which refer to limits or levels (numeric or narrative) of water quality constituents or characteristics that provide for the reasonable protection of beneficial uses of waters of the state.
- Anti-degradation policies, which are implemented to maintain and protect existing water quality, and high quality waters. Anti-degradation policies are consistent with the intent and goals of the federal Clean Water Act, especially the clause that states: "The objective of this Act is to restore and *maintain* the chemical, physical, and biological integrity of the Nation's water"[17] (emphasis added).

[16] Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.) Title 1, Section 101(a)

[17] *Ibid*

Therefore, beneficial uses, water quality objectives, and anti-degradation policies collectively constitute water quality standards[18] (see Figure 5-1). Beneficial uses, relevant water quality objectives, and anti-degradation requirements that potentially pertain to this TMDL project are presented below in Section 5.1 Section 5.2 , and Section 5.3, respectively.

Figure 5-1. TMDLs are action plans to assist the states in implementing their water quality standards[19], and California's water quality standards consist of beneficial uses, water quality objectives, and anti-degradation policies.



5.1 Beneficial Uses

California's water quality standards designate beneficial uses for each waterbody (e.g., drinking water supply, aquatic life support, recreation, etc.) and the scientific criteria to support that use. The Central Coast Regional Water Quality Control Board (Central Coast Water Board) is required under both state and federal law to protect and regulate beneficial uses of waters of the state.

The 2016 Water Quality Control Plan for the Central Coastal Basin (Basin Plan) identifies beneficial uses for waterbodies of California's central coast region. Beneficial uses for surface waters in the Santa Ynez River basin are presented in Table 5-1. The Basin Plan also states that surface water bodies within the region that do not have beneficial uses specifically designated for them are assigned the beneficial uses of "municipal and domestic water supply" and "protection of both recreation and aquatic life." The Central Coast Water Board has interpreted this general statement of beneficial uses to encompass the beneficial uses of REC-1, REC-2, and MUN, along with all beneficial uses associated with aquatic life. The finding comports with the Clean Water Act's national interim goal of water quality [CWA Section 101(a)(2)] which provides for the protection and propagation of fish, shellfish, and wildlife.

[18] See 40 CFR Ch. 1 §131

[19] Theodore Olson, Solicitor General of the United States, et al., 2002, Supreme Court of the United States Brief No. 02-1186, Guido A. Pronsolino et al, v. Wayne Nastri, Regional Administrator, U.S. Environmental Protection Agency, Region 9, et al.

Table 5-1. Beneficial uses of surface waters in the Santa Ynez River basin

Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	NAV	POW	COMM	AQUA	SAL	SHELL
SANTA YNEZ HYDROLOGIC UNIT																						
Santa Ynez River Estuary						X	X	X		X	X	X	X	X	X				X			X
Santa Ynez River, downstream	X	X	X	X	X	X	X	X	X	X	X	X		X		X			X			
Graves Wetland						X	X	X		X		X							X			
Lompoc Canyon	X	X		X	X	X	X	X		X									X			
La Salle Canyon Creek	X	X			X	X	X	X		X									X			
Sloans Canyon Creek	X				X	X	X	X		X									X			
San Miguelito Creek	X	X			X	X	X	X	X	X		X							X			
Salsipuedes Creek	X	X		X	X	X	X	X	X	X	X	X							X			
El Jaro Creek	X	X		X	X	X	X	X	X	X	X	X							X			
El Callejon Creek	X				X	X	X	X		X									X			
Llanito Creek	X				X	X	X	X		X									X			
Yridisis Creek	X	X			X	X	X	X		X		X							X			
Canada de la Vina	X	X			X	X	X	X		X									X			
Nojoqui Creek	X	X			X	X	X	X	X	X		X							X			
Alamo Pintado Creek	X	X		X	X	X	X	X		X									X			
Zaca Creek	X	X			X	X	X	X	X	X				X					X			
Zaca Lake	X					X	X	X	X	X		X		X					X			
Santa Rosa Creek	X	X			X	X	X	X	X	X	X	X							X			
Santa Rita Creek	X	X		X	X	X	X	X		X									X			
Davis Creek	X				X	X	X	X		X									X			
Santa Lucia Canyon Creek	X	X			X	X	X	X		X									X			
Oak Canyon Creek	X	X		X	X	X	X	X		X			X						X			
Hilton Creek	X	X			X	X	X	X	X		X	X							X			
Cachuma Reservoir	X	X	X		X	X	X	X	X	X		X		X		X	X		X			
Santa Ynez River, upstream	X	X	X	X	X	X	X	X	X	X	X	X		X		X			X			
Gibralter Reservoir	X	X	X	X	X	X	X	X	X	X		X		X		X	X		X			
Jameson Reservoir	X	X	X		X	X	X	X	X	X		X		X		X	X		X			
Agua Caliente Canyon	X	X		X	X	X	X	X	X	X		X		X					X			
Mono Creek	X	X		X	X	X	X	X	X	X	X	X		X					X			
Indian Creek	X	X		X	X	X	X	X	X	X	X	X	X	X					X			
Santa Cruz Creek	X	X		X	X	X	X	X	X	X	X	X		X					X			
Cachuma Creek	X				X	X	X	X	X	X	X	X		X					X			

MUN: Municipal and domestic water supply
AGR: Agricultural supply
PRO: Industrial process supply
IND: Industrial service supply
GWR: Groundwater recharge
REC1: Water contact recreation
REC2: Non-Contact water recreation
WILD: Wildlife habitat

COLD: Cold freshwater habitat
WARM: Warm fresh water habitat
MIGR: Migration of aquatic organisms
SPWN: Spawning, reproduction, and/or early development of fish
BIOL: Preservation of biological habitats of special significance
RARE: Rare, threatened or endangered species

EST: Estuarine habitat
FRESH: Freshwater replenishment
NAV: Navigation
COMM: Commercial and sport fishing
SHELL: Shellfish harvesting

A narrative description of the designated beneficial uses in the Santa Ynez River basin which are most likely to be at risk of impairment by water column nutrient pollution are presented below.

5.1.1 Municipal & Domestic Water Supply (MUN)

This beneficial use is defined in section II.A. of the Basin Plan as follows:

> *Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply. According to State Board Resolution No. 88- 63, "Sources of Drinking Water Policy" all surface waters are considered suitable, or potentially suitable, for municipal or domestic water supply except where*
>
> a. *TDS exceeds 3000 mg/l (5000 uS/cm electrical conductivity);*
> b. *Contamination exists, that cannot reasonably be treated for domestic use;*
> c. *The source is not sufficient to supply an average sustained yield of 200 gallons per day;*
> d. *The water is in collection or treatment systems of municipal or industrial wastewaters, process waters, mining wastewaters, or storm water runoff; and*
> e. *The water is in systems for conveying or holding agricultural drainage waters.*

The nitrate numeric water quality objective protective of the MUN beneficial use is legally established as 10 mg/L[20] nitrate as nitrogen (see Basin Plan, Table 3-2). This level is established to protect public health. The adverse health effects of nitrate in drinking water has been documented and published by state and federal health agencies.

5.1.2 Ground Water Recharge (GWR)

This beneficial use is defined in section II.E. of the Basin Plan as follows:

> *Uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers. Ground water recharge includes recharge of surface water underflow (emphasis added).*

The groundwater recharge (GWR) beneficial use is recognition by the state of the fundamental nature of the hydrologic cycle, and that surface waters and groundwater are not closed systems that act independently from each other. Underlying groundwaters are, in effect, receiving waters for stream waters that infiltrate and recharge the subsurface water resource. Most surface waters and ground waters of the central coast region are both designated with the MUN (drinking water) and AGR (agricultural supply) beneficial uses. The MUN nitrate water quality objective (10 mg/L) therefore applies to *both* the surface waters, and to the underlying groundwater. This numeric water quality objective and the MUN and AGR designations of underlying groundwater are relevant to the extent that portions of Santa Ynez River basin streams recharge the underlying groundwater resource.

5.1.3 Agricultural Supply (AGR)

This beneficial use is defined in section II.B. of the Basin Plan as follows:

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

In accordance with the Basin Plan, interpretation of the amount of nitrate which adversely effects the agricultural supply beneficial uses of waters of the state shall be derived from the University of California Agricultural Extension Service guidelines, which are found in Basin Plan Table 3-3. Accordingly, severe problems for sensitive crops could occur for irrigation water exceeding 30 mg/L[21]. It should be noted that

[20] This value is equivalent to, and may be expressed as, 45 mg/L nitrate as NO_3.

[21] The University of California Agricultural Extension Service guideline values are flexible, and may not necessarily be appropriate due to local conditions or special conditions of crop, soil, and method of irrigation. 30 mg/L nitrate as nitrogen is the recommended uppermost threshold concentration for nitrate in irrigation supply water as identified by the University of California Agricultural Extension Service which potentially cause severe problems for sensitive crops (see Table 3-3 in the Basin Plan). *(footnote continued on next page)*

the University of California Agricultural Extension Service guideline values are flexible, and may not necessarily be appropriate due to local conditions or special conditions of crop, soil, and method of irrigation.

Further, the Basin Plan provides water quality objectives for nitrate which are protective of the AGR beneficial uses for livestock watering. While nitrate (NO_3) itself is relatively non-toxic to livestock, ingested nitrate is broken down to nitrite (NO_2); subsequently nitrite enters the bloodstream where it converts blood hemoglobin to methemoglobin. This greatly reduces the oxygen-carrying capacity of the blood, and the animal suffers from oxygen starvation of the tissues[22]. Death can occur when blood hemoglobin has fallen to one-third normal levels. Resource professionals[23] report that nitrate can reach dangerous levels for livestock in streams, ponds, or shallow wells that collect drainage from highly fertilized fields. Accordingly, the Basin Plan identifies the safe threshold of nitrate as N for purposes of livestock watering at 100 mg/L[24].

5.1.4 Aquatic Habitat (WARM, COLD, MIGR, SPWN, WILD, BIOL, RARE, EST)

These beneficial uses are defined in Chapter 2 of the Basin Plan as follows:

WARM: Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

COLD: Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.

MIGR: Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.

SPWN: Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

WILD: Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

BIOL: Uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection.

RARE: Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.

EST: Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds). An estuary is generally described as a semi-enclosed body of water having a free connection with the open sea, at least part of the year and within which the seawater is diluted at least seasonally with fresh water drained from the land. Included are water bodies which would naturally fit the definition if not controlled by tidegates or other such devices.

The Basin Plan water quality objectives protective of aquatic habitat beneficial uses and which are most relevant to nutrient pollution[25] are the biostimulatory substances objective and dissolved oxygen objectives for aquatic habitat. The biostimulatory substances objective is a narrative water quality objective that states

(footnote continued from previous page)
Selecting the least stringent threshold (30 mg/L) therefore conservatively identifies exceedances which could detrimentally impact the AGR beneficial uses for irrigation water.

[22] New Mexico State University, Cooperative Extension Service. Nitrate Poisoning of Livestock. Guide B-807.

[23] University of Arkansas, Division of Agriculture - Cooperative Extension. "Nitrate Poisoning in Cattle". Publication FSA3024.

[24] 100 mg/L nitrate as nitrogen is the Basin Plan's water quality objective protective of livestock watering, and is based on National Academy of Sciences-National Academy of Engineering guidelines (see Table 3-3 in the Basin Plan).

[25] Nutrients, such as nitrate, do not by themselves necessarily directly impair aquatic habitat beneficial uses. Rather, they cause indirect impacts by promoting algal growth and low dissolved oxygen that impair aquatic habitat uses.

Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses.

Narrative water quality objectives do not explicitly identify numeric water quality criteria to implement the narrative objective. Worth noting here is that U.S. Environmental Protection Agency reported that total nitrogen as N concentrations in streams which are protective against biostimulatory effects should generally be expected to be in an acceptable range of 2 mg/L to 6 mg/L (see Text Box 5-1 below).

Text Box 5-1. U.S. Environmental Protection Agency information on generally acceptable ranges of total nitrogen in streams to protect aquatic habitat.

*"(A)n excess amount of nitrogen in a waterway may lead to low levels of oxygen and negatively affect various plant life and organisms…An acceptable range of total nitrogen is **2 mg/L to 6 mg/L***, though it is recommended to check tribal, state, or federal standards…"*

From U.S. Environmental Protection Agency, 2013a, "Total Nitrogen" fact sheet, revised June 4, 2013

*****emphasis added by Central Coast Water Board staff

The Basin Plan also requires that in waterbodies designated for WARM habitat, dissolved oxygen concentrations shall not be depressed below 5 mg/L and that in waterbodies designated for COLD and SPWN, dissolved oxygen shall not be depressed below 7 mg/L.

Further, since un-ionized ammonia is highly toxic to aquatic species, the Basin Plan requires that the discharge of waste shall not cause concentrations of unionized ammonia (NH_3) to exceed 0.025 mg/L (as N) in receiving waters.

5.1.5 Water Contact Recreation (REC-1)

This beneficial use is defined in section II.B. of the Basin Plan as follows:

Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

The Basin Plan water quality objective protective of water contact recreation beneficial uses which is most relevant to nutrient pollution is the general toxicity objective for all inland surface waters, enclosed bays, and estuaries (Basin Plan Chapter 3, section II.A.2.a). The general toxicity objective is a narrative water quality objective that states:

All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, toxicity bioassays of appropriate duration, or other appropriate methods as specified by the Regional Board.

Depending on local environmental conditions in any given watershed, harmful algal blooms can be associated with elevated nutrient concentrations in surface waters. Because illnesses are considered detrimental physiological responses in humans, the narrative toxicity objective applies to algal toxins, such as cyanobacteria associated with blue-green algae.

Possible health effects of exposure to blue-green algae blooms and their toxins can include rashes, skin and eye irritation, allergic reactions, gastrointestinal upset, and other effects including poisoning. Note that microcystins are toxins produced by cyanobacteria (blue-green algae) and are associated with algal blooms, elevated nutrients, and biostimulation in surface waterbodies.

The State of California Office of Environmental Health Hazard Assessment (OEHHA) has published peer-reviewed public health action-level guidelines for algal cyanotoxins (microcystins) in recreational water uses; this public health action-level for microcystins is 0.8 μg/L[26] (OEHHA, 2012). This public health action level can therefore be used to assess attainment or non-attainment of the Basin Plan's general toxicity objective and to ensure that REC-1 designated beneficial uses are being protected and supported.

5.2 Water Quality Objectives & Numeric Criteria

The Basin Plan contains specific water quality objectives that apply to nutrients and nutrient-related parameters. In addition, the Central Coast Water Board uses established, scientifically-defensible numeric criteria to implement narrative water quality objectives, and for use in Clean Water Act Section 303(d) Listing assessments. These water quality objectives and numeric criteria are established to protect beneficial uses and are compiled in Table 5-2.

[26] Includes microcystins LR, RR, YR, and LA.

Table 5-2. Compilation of Basin Plan water quality objectives and numeric criteria for nutrients and nutrient-related parameters.

Constituent Parameter	Source of Water Quality Objective/Criteria	Numeric Target	Primary Use Protected
Un-ionized Ammonia as N	Basin Plan numeric objective	0.025 mg/L	General Objective for all Inland Surface Waters, Enclosed Bays, and Estuaries *(toxicity objective)*
Nitrate as N	Basin Plan numeric objective	10 mg/L	MUN, GWR (Municipal/Domestic Supply; Groundwater Recharge)
Nitrate as N	Basin Plan numeric criteria (Table 3-3 in Basin Plan)	5 – 30 mg/L *California Agricultural Extension Service guidelines*	AGR (Agricultural Supply – irrigation water) *“Severe” problems for sensitive crops at greater than 30 mg/L* *“Increasing problems” for sensitive crops at 5 to 30 mg/L*
Nitrate (NO_3-N) plus Nitrite (NO_2-N)	Basin Plan numeric objective (Table 3-4 in Basin Plan)	100 mg/L *National Academy of Sciences-National Academy of Engineers guidelines*	AGR (Agricultural Supply - livestock watering)
Nitrite (NO_2–N)	Basin Plan numeric objective (Table 3-4 in Basin Plan)	10 mg/L *National Academy of Sciences-National Academy of Engineers guidelines*	AGR (Agricultural Supply - livestock watering)
Dissolved Oxygen	General Inland Surface Waters numeric objectives	For waters not mentioned by a specific beneficial use, dissolved oxygen shall not be depressed below 5.0 mg/L Median values should not fall below 85% saturation.	General Objective for all Inland Surface Waters, Enclosed Bays, and Estuaries
	Basin Plan numeric objective WARM, COLD, SPWN	Dissolved Oxygen shall not be depressed below 5.0 mg/L (WARM) Dissolved Oxygen shall not be depressed below 7.0 mg/L (COLD, SPWN)	Cold Freshwater Habitat, Warm Freshwater Habitat, Fish Spawning
	Basin Plan numeric objective AGR	Dissolved Oxygen shall not be depressed below 2.0 mg/L	AGR (Agricultural Supply)
pH	General Inland Surface Waters numeric objective	pH value shall not be depressed below 7.0 or raised above 8.5	General Objective for all Inland Surface Waters, Enclosed Bays, and Estuaries
	Basin Plan numeric objective MUN, AGR, REC-1, REC-2	The pH value shall neither be depressed below 6.5 nor raised above 8.3	Municipal/Domestic Supply, Agricultural Supply, Water Recreation
	Basin Plan numeric objective WARM, COLD	pH value shall not be depressed below 7.0 or raised above 8.5	Cold Freshwater Habitat, Warm freshwater habitat
Biostimulatory Substances	Basin Plan narrative objective[A]	pending	General Objective for all Inland Surface Waters, Enclosed Bays, and Estuaries *(biostimulatory substances objective)* -- (e.g., WARM, COLD, REC, WILD, EST)
Chlorophyll *a*	Basin Plan narrative objective[A]	40 µg/L *North Carolina Administrative Code, Title 151, Subchapter 2B, Rule 0211*	Numeric listing criteria to implement the Basin Plan biostimulatory substances objective for purposes of Clean Water Act section 303(d) listing assessments.
Microcystins *(includes Microcystins LA, LR, RR, and YR)*	Basin Plan narrative objective[B]	0.8 µg/L *California Office of Environmental Health Hazard Assessment Suggested Public Health Action Level*	REC-1 (water contact recreation)

[A] *The Basin Plan biostimulatory substances narrative objective states: “Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses.” (Biostimulatory Substances Objective, Basin Plan, Chapter 3)*

[B] *The Basin Plan toxicity narrative objective states: “All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life.” (Toxicity Objective, Basin Plan, Chapter 3)*

5.3 Anti-degradation Policy

According to the U.S. Environmental Agency, an anti-degradation policy is one of the minimum elements required to be included in a state's water quality standards[27]. Anti-degradation policies are consistent with the intent and goals of the federal Clean Water Act, especially the clause that states: "The objective of this Act is to restore and *maintain* the chemical, physical, and biological integrity of the Nation's water" [28, 29] (emphasis added).

Accordingly, section II.A of the Basin Plan, states that wherever the existing quality of water is better than the quality of water established in the Basin Plan as objectives, **such existing quality shall be maintained** unless otherwise provided by provisions of the state anti-degradation policy. Practically speaking, this means that where water quality is *better* than necessary to support designated beneficial uses, such existing high water quality shall be maintained, and further lowering of water quality is not allowed except under conditions provided for in the anti-degradation policy.

The U.S. Environmental Protection Agency has also issued detailed guidelines for implementation of federal anti-degradation regulations for surface waters (40 CFR 131.12). The State Water Resources Control Board (State Water Board) has interpreted Resolution No. 68-16 (i.e., the state anti-degradation policy) to incorporate the federal anti-degradation policy to ensure consistency. It is important to note that federal policy only applies to surface waters, while state policy applies to both surface and ground waters.

For purposes of the anti-degradation policy, "high quality waters" are defined on a pollutant-by-pollutant basis. From the water quality management perspective, it is simply not enough to improve impaired waters – protection of existing high quality waters and prevention of any further water quality degradation should be identified as a high priority goal[30]. Simply put, TMDL implementation efforts are justified in considering improved protection of high quality waters and addressing anti-degradation concerns, as well as focusing on improving impaired waterbodies.

Indeed, the U.S. Environmental Protection Agency recognizes the validity of using TMDLs as a tool for implementing anti-degradation goals:

> *Identifying opportunities to protect waters that are not yet impaired: TMDLs are typically written for restoring impaired waters; however, states can prepare TMDLs geared towards maintaining a "better than water quality standard" condition for a given waterbody-pollutant combination, and they can be a useful tool for high quality waters.*
>
> From: U.S. Environmental Protection Agency, 2014a. Opportunities to Protect Drinking Water Sources and Advance Watershed Goals Through the Clean Water Act: A Toolkit for State, Interstate, Tribal and Federal Water Program Managers. November 2014.

Similarly, the U.S. Environmental Protection Agency makes clear that TMDLs can serve as planning tools not only for *restoring* water quality, but also for *protecting* and *maintaining* water quality consistent with the goals of anti-degradation policies:

> *"A TMDL serves as a planning tool and potential starting point for restoration or **protection** activities with the ultimate goal of attaining or **maintaining** water quality standards." (emphasis added)*
>
> U.S. Environmental Protection Agency, Implementing Clean Water Action Section 303(d): Impaired Waters and Total Maximum Daily Loads (TMDLs) – webpage accessed April 2016 https://www.epa.gov/tmdl

[27] U.S. Environmental Protection Agency, *"Questions & Answers on: Antidegradation"* EPA/811/1985.5, Office of Water Regulations and Standards, August 1985.

[28] *Ibid*

[29] Federal Water Pollution Control Act (Clean Water Act), Sec. 101(a)

[30] The Central Coast Water Board considers *preventing* impairment of waterbodies to be as important a priority as *correcting* impairments of waterbodies (see the staff report for agenda item 3, July 11, 2012 Central Coast Water Board meeting).

6. Water Quality Data Sources

The following is a preliminary list of anticipated water quality data sources that could be used in watershed assessment and TMDL development. As appropriate, Central Coast Water Board staff will work with stakeholders to identify additional sources of data.

1. Central Coast Ambient Monitoring Program (CCAMP). The CCAMP is the Central Coast Water Board's regionally scaled water quality and assessment program[31].
2. California Environmental Data Exchange Network (CEDEN). CEDEN is the State Water Board's data system for surface water quality in California.
3. Cooperative Monitoring Program (CMP). CMP is the surface water quality monitoring program conducted by Central Coast Water Quality Preservation, Inc. for growers enrolled in the Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands (Agricultural Order)[32].
4. Cachuma Operation and Maintenance Board water quality data.
5. U.S. Geological Survey's National Water Information System.
6. U.S. Environmental Protection Agency's STORET data retrieval system.
7. GeoTracker groundwater data. GeoTracker is the State Water Board's data management system for sites that impact groundwater.
8. California Integrated Water Quality System Project (CIWQS). Effluent water quality is available from CIWQS. CIWQS is a database system used by the Regional Water Quality Control Boards to track information about places of environmental interest and it allows online submittal of data by Permittees within certain programs.
9. Storm Water Multiple Application and Report Tracking System (SMARTS). Water quality data associated with NPDES[33] permitted stormwater discharges are available from SMARTS, which is an online database for documents and data from stormwater discharges.

Central Coast Water Board staff anticipate that key stakeholders and local resource professionals will be knowledgeable about available water quality data for Santa Ynez River basin, and we will endeavor to engage these professionals during TMDL development and associated public meetings.

Stakeholders and interested members of the public may submit any information and data to Central Coast Water Board staff which they think could be relevant to a TMDL study for nutrient pollution in the Santa Ynez River basin. Examples include, but are not limited to:

1. Data, photos, personal knowledge about the river basin, knowledge about potential nutrient and nutrient-related water quality problems, and/or about recent or historic land use practices;
2. Environmental success stories, such as improvement of management practices to reduce nutrient loading to the watershed;
3. Previous studies or reports that may be relevant to a TMDL study of the Santa Ynez River basin; and
4. Feedback, written or informal, on draft reports Central Coast Water Board staff make available.

7. Potential Nutrient Sources

There are many possible nutrient sources within any given watershed; in general the following can potentially be significant sources of nutrient loading to water resources:

- Municipal wastewater
- Urban runoff
- Fertilizer application
- Stormwater runoff
- Manure from livestock and domestic animals

[31] CCAMP water quality data was used in California's 2008-2010 Clean Water Act section 303(d) assessment
[32] CMP water quality data was used in California's 2008-2010 Clean Water Act section 303(d) assessment
[33] NPDES = National Pollutant Discharge Elimination System

- Natural sources
- Atmospheric deposition

Treated municipal wastewater effluent has historically been a major source of nitrate in the lower Santa Ynez River downstream of the City of Lompoc Regional Wastewater Treatment Plant. Nitrogen is a common pollutant in municipal wastewater effluent.

Worth noting is that the City of Lompoc completed major upgrades to the regional wastewater treatment plant in November 2009. According to reporting by the Central Coast Ambient Monitoring Program, nitrate plus nitrite as N concentrations have generally improved in the Lower Santa Ynez River during the period 2009 to 2014.

Source analysis will be an important component of watershed assessment moving forward. A significant amount of environmental and water quality data exists for the river basin which has not yet been assessed by Central Coast Water Board staff. Local stakeholders are encouraged to contribute any insight or information concerning probable nutrient sources in the river basin to us.

8. Public Outreach & Public Participation

Public outreach is a part of the TMDL development process. Leveraging knowledge about the Santa Ynez River basin from local residents, resource professionals, public agency staff, land owners, and land operators is very helpful to the Central Coast Water Board. Public outreach and public participation will be an ongoing element of TMDL development activities.

A subscription email list has been created for this TMDL project and is used to notify interested parties of public meetings and progress regarding this TMDL project. As of March 28, 2016, there are 260 email subscribers on the Santa Ynez River basin subscription email database.

9. Existing Plans to Improve Water Quality & Aquatic Habitat

Protecting California's water resources depends on the proactive engagement of citizens, land owners, researchers, and businesses. Proactive efforts by citizens in the Santa Ynez River basin that may result in improved water quality protection are commendable and should be recognized. Regional stakeholders have been participating in efforts to protect and improve water quality, water supply, and aquatic habitat in the Santa Ynez River basin. Reported activities include:

- The Santa Barbara Countywide Integrated Regional Water Management (IRWM) Plan (2013), with cooperating partners City of Lompoc, City of Solvang, and City of Buellton, is the main integrated regional water management planning document for the county and the Santa Ynez River basin. The objectives addressed in the plan focus on improving water quality, protecting water supply, and maintaining and enhancing water infrastructure.
- The Santa Barbara Countywide IRWM Plan (2013) published a summary of water resource management plans and programs that exist in the county and in the Santa Ynez River basin[34], including Urban Water Management Plans, Groundwater Management Plans, stormwater management programs, clean water, and annual bioassessment programs.
- The Cachuma Resource Conservation District reports that local landowners and groups throughout Santa Barbara County implement conservation projects related to water quality, irrigation and nutrient management, and habitat restoration.
- Dr. Timothy Robinson, senior scientist with the Cachuma Operation and Maintenance Board reported recently that monitoring and restoration projects for the threatened southern steelhead are underway along the Santa Ynez River downstream of Lake Cachuma.

[34] The Santa Barbara County Wide IRWM Plan (2013) does not provide adoption dates associated with the myriad plans and programs reported. However, additional details of the plans and programs can be accessed by clicking the hyperlink provided.

10. Anticipated Next Steps

According to the 2008-2010 303(d) list, the lower Santa Ynez River is impaired by nitrate and low dissolved oxygen levels. Levels of nitrate are well in excess of natural background conditions, thus indicating that controllable conditions may be causing or contributing to the water quality impairment. A broader review of nutrient surface water quality data, and a look at possible water quality improvements in the river is merited. Consequently, Central Coast Water Board staff anticipates conducting a watershed assessment of the river basin. This assessment will potentially include developing a total maximum daily loads report consistent with the State Water Board's Water Quality Control Policy for Addressing Impaired Waters, and with federal and state anti-degradation policies (refer back to report Section 5.3).

Generally, TMDL studies could result in several types of outcomes, as outlined below:

1) TMDL studies are planning tools that can recommend or propose new or additional regulatory measures for discharges contributing to a water quality impairment.
2) TMDL studies can recommend that existing regulatory measures are sufficient to achieve water quality objectives.
3) TMDL studies can conclude that water quality objectives are being met in waters previously identified as impaired, and could consider articulating and establishing protection goals for the maintenance of existing water quality in waterbodies not currently impaired (anti-degradation policy: refer back to report section 5.3, and refer to section II.A. of the Basin Plan).
4) TMDLs studies may conclude that natural sources are the cause of a water quality impairment, and recommend a revision of applicable state water quality standards.

We will also assess whether or not nutrient TMDLs need to be formally added to the Basin Plan for this river basin. If so, adoption of a TMDL into the Basin Plan through a basin plan amendment process would be necessary. A basin plan amendment process requires TMDLs to be approved by the Central Coast Water Board, as well as to receive approvals from the State Water Board, the California Office of Administrative Law.

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