Figure 3.5.1.1.1 Water Quality Impairments Map

Source: Regional Water Quality Control Board – Los Angeles, 303(d) List of Impaired Waterbodies

"Beneficial uses" are the resources, services, and qualities of aquatic systems that water quality regulations aim to preserve or improve. They include recreation; water supply; navigation; and the preservation and enhancement of fish, wildlife, and other aquatic resources.

Beneficial uses can be existing, potential, or intermittent uses.

San Antonio Creek, Ventura River Reaches 1, 2, and 4, Cañada Larga, and the estuary are on the list for issues related to nutrient pollution: low dissolved oxygen, excessive nitrogen, or eutrophic conditions. See Figure 3.5.1.1.1 (Water Quality Impairments Map) for an illustration of the river reaches and Table 3.5.1.5.1 (Water Quality Impairments by Waterbody) for a description of the river reaches.

All of these listed impairments—algae, excessive nitrogen, dissolved oxygen, and eutrophic conditions—are interrelated in very complex ways.

Algae are naturally occurring organisms in aquatic habitats; however, very large blooms may hinder "beneficial uses" of aquatic systems by discouraging recreation, altering natural habitats, or diminishing environmental conditions. For example, algal respiration at night and the decomposition of large algal blooms, can decrease dissolved oxygen concentrations in water. If severe, decreases in dissolved oxygen may affect the survival of fish (including their eggs), aquatic insects, or other aquatic life. Lack of streamflow or water circulation, and high water temperatures, can also lower dissolved oxygen concentrations, independently of algae.

The growth rate of algae in an aquatic system depends on the amount of sunlight; water depth, temperature, and circulation; nutrients; consumption of algae by aquatic animals (e.g., insects, snails, fish); and other variables. In streams, the availability of logs, rocks, or other stable material for attachment also affects the amount and type of algae that will grow. During warmer months, when conditions are favorable for algal growth, conspicuous blooms of algae may occur.

Researcher Studying Algal Bloom *(Cladophora)* in Matilija Creek, March 2010. Location: 1.5 miles above Matilija Dam, in the relatively undeveloped headwaters of the Ventura River. Algae are naturally occurring, even in the undeveloped upper watershed, where nitrate concentrations are low.
Photo courtesy of Diana Engle

Algae Growth Can Vary Significantly in Different Years

Top left: Above Highway 150 Bridge in 2008, a big algae year. Photo courtesy of Santa Barbara Channelkeeper. "2008 was a very big algae year in the watershed. Big algal years invariably follow winters with above-average rainfall, winters with at least one storm big enough to sweep aquatic plants and accumulated fine sediment out to sea; even better if that storm is large enough to also clean out riparian growth. These storms create near-perfect algal habitat by: 1) opening up the channel to increased sunlight (sunlight to power photosynthesis—even more sunlight if riparian vegetation is cut back or removed); 2) removing competitors (for sunlight, e.g., aquatic plants) and algal parasites; 3) scouring the stream or river bottom leaving only gravel or cobble (providing necessary holdfasts—anchoring points—for *Cladophora*, the dominant alga during big blooms); and 4) increasing flow (expanding available habitat and providing for more rapid delivery of stream-borne nutrients to stationary algae)." (Leydecker 2012b)

Bottom left: Above Highway 150 Bridge in 2006, following the big storm year of 2005.
Photo courtesy of Jeff Palmer.

Below: Abundant aquatic plants outcompete algae downstream of Ojai Valley Sanitary District effluent discharge, 2009. This site exhibited little algae growth in May 2009 due to the abundant growth of aquatic plants that outcompeted algae for substrate and reduced sunlight to the flowing channel.
Photo courtesy of Santa Barbara Channelkeeper.

Regulations called TMDLs, for Total Maximum Daily Loads, are developed to address the impairments caused by pollutants.

TMDLs for pollutants outline the loading (e.g., "pounds per day") or concentration (e.g., "parts per million") reductions of pollutant discharges that must be made to address particular water quality impairments.

The frequency, duration, and intensity of algal blooms can be increased when excess nutrients are available; however, many other factors affect the intensity of algal blooms. Impressive algal blooms have been witnessed in the upper watershed with low levels of nitrogen but plenty of sunlight and calm waters. Other sites where nutrient levels are high, but the water is shaded by aquatic plants or trees, may not experience algal blooms.

The watershed's most serious algae problems typically occur early in the dry season following a winter with high rainfall, when significant storm flows have ripped out aquatic plants and riparian vegetation, leaving bare rock and gravel with plenty exposed to the sun. Another effect of excess nutrients is rapid growth of *all* vegetation, including the aquatic plants that soon dominate the stream bottom after drier winters (Klose et al., 2009).

According to the United States Environmental Protection Agency (USEPA), nearly half of the surface waters surveyed in the U.S. do not meet water quality objectives due to excessive nutrients, which impair full support of aquatic life (USEPA 2000). The Santa Clara River and Calleguas Creek watersheds—Ventura County's other major watersheds—are also challenged by excess nutrients.

Each of these watersheds is now subject to a regulatory mechanism called a "Total Maximum Daily Load" (TMDL) to address this issue. TMDLs are unique, waterbody-specific regulations aimed at restoring impaired waterbodies. Ventura River watershed's TMDL related to this issue is the "Algae TMDL" (technically the "Algae, Eutrophic Conditions, and Nutrients TMDL for Ventura River and its Tributaries"), because excess algae growth and related problems are associated with excess nutrients. (TMDLs are discussed further in "3.5.1.5 Surface Water Quality Regulations.")

Algae *(Cladophora)* In Ventura River near Casitas Springs, Aug. 2008
Photo courtesy of Santa Barbara Channelkeeper

Nutrients – Nitrogen and Phosphorus

Nitrogen and phosphorus are the primary nutrients of concern with algal blooms. Nitrogen in stream systems can come from a variety of sources. The nitrogen source analysis done by the Regional Water Quality Control Board (RWQCB) for the Ventura River Algae TMDL regulation is summarized in Table 3.5.1.1.1 and Figure 3.5.1.1.2. The TMDL was adopted by the RWQCB and represented their understanding of nutrient sources and implications of nutrient loading in the watershed.

Data were lacking for a complete analysis for many of the sources, and the analytical methods employed were inconsistent across the different sources. Many stakeholders agree that there is uncertainty surrounding many of the analyses in the TMDL; some stakeholders will be undertaking special studies to refine certain elements. Because it is not currently possible to calculate the loading from groundwater discharges to surface water in the watershed, the impact on nutrient loading from groundwater may be underestimated.

Table 3.5.1.1.1 Total Nitrogen (TN) Contribution Estimated by Source

Source Type	Total Nitrogen % Contribution
Wet-weather Runoff from Urban Areas	28.3
Wet-weather Runoff from Horse/Livestock Land Uses	17.0
Wet-weather Runoff from Open Space	12.5
Ojai Valley Sanitary District Wastewater Treatment Plant	11.7
Wet-weather Runoff from Agriculture	6.7
Dry-weather Runoff from Horse/Livestock	6.2
Dry-weather Runoff from Urban Areas	6.0
Septic Systems	4.7
Dry-weather Runoff from Agriculture	3.3
Dry-weather Runoff from Open Space	2.2
Groundwater Discharge	1.3
Atmospheric Deposition	0.2
Total:	**100**

Source: Algae Total Maximum Daily Load (TMDL) Regulation Staff Report (RWQCB-LA 2012)

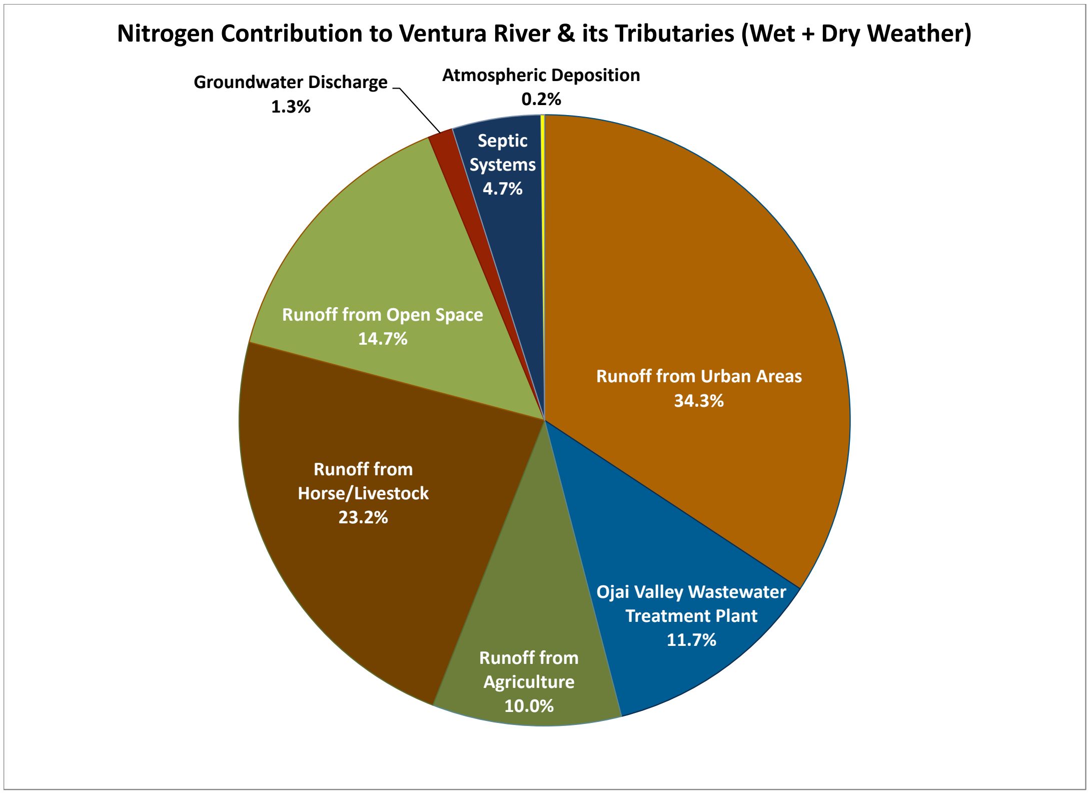


Figure 3.5.1.1.2 Total Nitrogen (TN) Contribution Estimated by Source. Further studies are needed to improve the accuracy of estimates of the relative contributions of nitrogen by source.
Source of data for chart: Algae Total Maximum Daily Load (TMDL) Regulation Staff Report (RWQCB-LA 2012)

Landscapes. The Ojai Valley has many man-made landscapes, including two golf courses, a number of private schools with expansive campuses, several large and small parks, and many private estates and residential yards. Fertilizers used on these landscapes, if used inappropriately, can contribute to the nutrient pollution of local streams. These nutrients can be picked up in stormwater runoff or make their way into groundwater, which can then discharge to streams.

Stream nitrate levels have been monitored in the watershed for decades. The data indicate that:

1. the relatively pristine streams in the upper watershed are in good condition;
2. upper San Antonio Creek (just above the confluence with Stewart Canyon Creek), and to a lesser extent, middle and lower San Antonio Creek, regularly have the highest measured nitrogen concentrations in the watershed; and
3. Ventura River locations below the Ojai Valley Sanitary District's wastewater treatment plant have measured nitrogen concentrations relatively lower than San Antonio Creek, but at concentrations that reflect the contributions of nitrogen from the treatment plant's effluent.

The Algae TMDL stipulates nutrient allocations that apply to actual discharges (not in-stream concentrations) that responsible parties must try to meet with best management practices (BMPs), treatment plant upgrades, and other improvements. The RWQCB hopes that compliance with these nutrient allocations will facilitate achievement of desired levels of algae, dissolved oxygen, and pH in the river. Ultimately, these target levels related to algae, dissolved oxygen, and pH are the aim of the Algae TMDL, regardless of the actual concentrations of nitrogen or phosphorus in the river.

Horses and Livestock. A notable feature of the Algae TMDL is that it is the first regulation addressing contributions of horses and livestock as potential sources of nutrient pollution to the Ventura River watershed.

Progress in Nitrogen Reduction

Efforts to reduce nitrogen pollution have been underway in the watershed for decades. Since the 1970s, the level of nitrogen in the Ventura River has been reduced by about 85% largely by changes in agricultural practices and upgrades to the Ojai Valley Sanitary District's wastewater treatment plant (Palmer 2013). Nevertheless, further actions are required to improve habitat conditions in the river and to meet the watershed's Algae TMDL regulation.

Phosphorus content is high in the marine deposits that make up a large part of the underlying geologic strata of many parts of the Ventura River watershed. More phosphorus is added to natural background concentrations by manure, fertilizers, and other sources. Data show that the highest phosphate concentrations are found in the lower watershed (RWQCB-LA 2012).

Risk of Pathogens

Contamination of water by human or animal feces poses a health risk to humans that come in contact with or ingest the water, because of potential exposure to pathogenic (disease-causing) microorganisms. The possible existence of such pathogens in water is determined by testing for *indicator bacteria,* such as fecal coliform or *E. coli.*

San Antonio Creek, Reach 3 of the Ventura River, Cañada Larga, and the estuary are all on the Section 303(d) list of impaired waterbodies for at least one type of indicator bacteria. A TMDL regulation to address indicator bacteria is scheduled to be adopted in 2019.

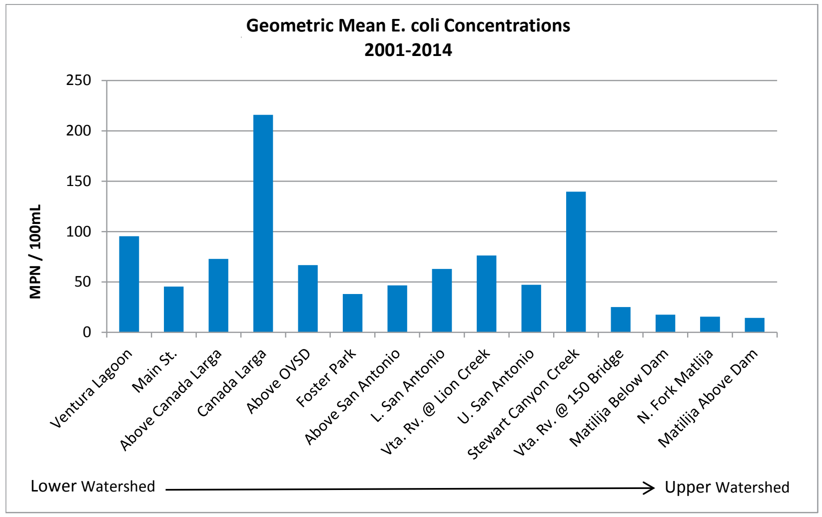
In wet weather, concentrations of indicator bacteria at the three sites monitored by the Ventura Countywide Stormwater Quality Monitoring Program (VCSQMP) typically do not meet Basin Plan objectives (see "Basin Plan" later in this section for background) for protection of contact recreation (uses of water for recreational activities involving human body contact with water). For example, *E. coli* concentrations at Fox Canyon Barranca (an urban storm drain) range between 187–43,520 MPN (most probable number)/100 mL during (dry weather) and 1,570–241,920 MPN/100 mL during wet weather. In dry weather, high concentrations of indicator bacteria are usually confined to urban storm drain test sites. See Table 3.5.1.3.1 (Frequency of Elevated Levels of Stormwater and Non-Stormwater Pollutants) for more information on VCSQMP monitoring sites and levels of pollutants.

Of the 15 instream sites monitored monthly by Channelkeeper, Cañada Larga Creek consistently has the highest concentration of indicator bacteria.

Figure 3.5.1.1.3 Average and Median *E. coli* Concentrations in the Watershed, 2001–2011

The geometric mean is used in cases, such as with bacterial populations, where the differences among data points vary greatly. It dampens the effect of very high or low values.

Data Source: Santa Barbara Channelkeeper



Because concentrations of indicator bacteria increase dramatically during storms and may remain elevated for several days afterwards, body contact in potentially contaminated waterbodies should be avoided at these times. Because storms can produce good surfing conditions at the mouth of the Ventura River, the greatest threat in terms of human health may be to surfers. However, there still is uncertainty related to the potential risks of bacteria in stormwater on human health. A pilot epidemiology study is currently underway in San Diego to address this issue (more information at www.sccwrp.org).

Because concentrations of indicator bacteria increase dramatically during storms and may remain elevated for several days afterwards, body contact in potentially contaminated waterbodies should be avoided at these times.

Livestock, San Antonio Creek and Cañada Larga. UC Davis has conducted research addressing the pathogenic risk from livestock, as well as the effectiveness of the current standards and testing methods in determining the risk to human health. More information at rangelandwatersheds.ucdavis.edu/main/projects/pathogens.

Photo courtesy of Jessie Alstatt, Santa Barbara Channelkeeper

Levels of indicator bacteria in the estuary, a waterbody that does see regular body contact by children, have not been regularly or rigorously tested. In addition, shellfish harvesting, one of the "beneficial uses" of the Ventura River estuary, has slightly different but very stringent water quality standards concerning bacteria. Shellfish are harvested at the river mouth.

Stormwater Runoff, Meiners Oaks
Photo courtesy of Ventura County Watershed Protection District

Trash

Besides being unsightly, trash negatively impacts aquatic plants and animals; can transmit pathogens and increase nutrients and oxygen demand; presents hazards to people, animals, and property; and causes other water quality concerns.

Although trash is a concern throughout the watershed, it has been particularly problematic in the Ventura River estuary. The Ventura River estuary is on the Section 303(d) list of impaired waterbodies for trash. A Ventura River Trash TMDL (Trash TMDL) regulation was adopted in 2008 with a target of zero trash in or on the water and on the shoreline.

Projects to reduce the amount of trash in the estuary are being implemented by the responsible parties to the Trash TMDL. Example projects include installation and maintenance of trash excluders on storm drains, increased trash collection in public places, education, and better enforcement of regulations. Efforts to address the long-standing problem of illegal camping in the river bottom above the estuary were ambitiously increased in part because of the requirement to meet the Trash TMDL target.

Trash, Ventura River. Trash at the Highway 150 Bridge (top left), at a drainage culvert that feeds into the Lower Ventura River (top right) and in an illegal camp in the lower river. Camp photo courtesy of Santa Barbara Channelkeeper

Trash Excluder. New trash excluders that prevent trash from entering the storm drain system have been installed on storm drains throughout the watershed.
Photo courtesy of City of Ventura

River Bottom Campers and Water Quality

For many decades, homeless individuals have occupied the Ventura River bottom near the mouth of the river. In recent years, the invasion of the tall, bamboo-like non-native plant *Arundo donax* provided ideal building materials for shelter structures in the river. As a result, entire neighborhoods had been established. Some individuals had called the river bottom home for decades. Well over 100 people at a time were living in the river at a time without any trash or sanitation services. Many had dogs. Not only was this a problem because of raw sewage, fecal coliform bacteria, and trash, but fires and crime also plagued the river.

For many years, efforts to address the situation, such as annual cleanup events, had been largely unsuccessful. This is no longer the case. Private property owners started making headway in 2008 through *Arundo* removal and regular patrolling. Then in 2012, an impressive multi-partner coalition, including City and County of Ventura agencies (i.e., fire, police, sheriff, behavioral health, parks, public works, community development), environmental groups, faith-based groups, social service organizations, and private property owners and operators resolved to humanely address this threat to public health and safety. They worked together to plan, finance, and implement a comprehensive campaign to reduce trash and homeless encampments in the river bottom.

This important effort was motivated in part by the Trash TMDL regulation. The TMDL responsible parties (see list below in Table 3.5.1.5.2) in cooperation with private property owners (i.e., Ventura Hillsides Conservancy, Taylor Ranch, and Aera Energy) are committed to sustaining the changes that have been made in the river and preventing reestablishment of any camps. Regular patrols are now made in the area and volunteer cleanup events continue to be held.

River Bottom Camp, 2012

Photo courtesy of Chris Sulzman

River Bottom Camp Trash

Photo Courtesy of Ventura Hillsides Conservancy

River Bottom Camp Cleanup, 2012

Photo Courtesy of Ventura Hillsides Conservancy

Before and After a River Bottom Camp Cleanup, 2012 and 2013

Photos courtesy of Ventura Hillsides Conservancy

River Bottom Camp Trash

Photo Courtesy of Ventura Hillsides Conservancy

Ongoing River Bottom Trash Cleanup. Agency-sponsored and volunteer cleanups of the lower Ventura River bottom now occur regularly.

Photo courtesy of Ventura County Watershed Protection District

Total Dissolved Solids

Total dissolved solids (TDS) are the inorganic salts and small amounts of organic matter present in solution in water. The presence of dissolved solids in water may affect its taste; water high in TDS is considered "hard." Hard water forms scale (deposits of calcium and magnesium carbonate) that stick to the interior of pipes and other water fixture surfaces. Scale buildup can lead to clogs and other problems with pipes, irrigation lines, faucets, and appliances.

San Antonio Creek and Cañada Larga Creek are listed on the Section 303(d) list of impaired waterbodies for total dissolved solids (TDS).

Conductivity (the measure of the ability of an aqueous solution to carry an electrical current) is used as an indirect indicator of the amount of dissolved solids in water. The higher the conductivity, the more dissolved solids are in the water. Conductivity levels vary from creek to creek and region-to-region, depending upon the geologic strata that the source waters traverse and the time required for passage. The longer water is in contact with soil and rock, the higher its conductivity. Rainwater has very low conductivity; water draining from soil has higher values; and groundwater, which spends years or even decades in contact with geologic strata, has the highest of all (Leydecker 2004).

Mercury

Water quality in Lake Casitas is generally good; however, the reservoir, like many others in California, is on the Section 303(d) list of impaired waterbodies for mercury.

Mercury contamination is a persistent problem throughout much of the state. Mercury is both a legacy of California mining and an ongoing global air pollution problem caused by coal combustion.

(Lake Casitas' drinking water quality is addressed in "3.5.4 Drinking Water Quality." The lake's impairment as a surface waterbody under the Clean Water Act is addressed here, as this is not specifically a drinking water issue.)

Inclusion on the 303(d) list is based on the results of a 2009 survey of contaminants found in sport fish (bass and carp) in California lakes and reservoirs. According to the survey, fish containing potentially harmful amounts of mercury are found in numerous reservoirs in California. There are 74 reservoirs identified as impaired, and that number is expected to increase as more data are collected (SWRCB 2009; SWRCB 2013a; Wickstrum 2014).

Mercury contamination is a persistent problem throughout much of the state. Mercury is both a legacy of California mining and an ongoing global air pollution problem caused by coal combustion. Although mercury may exist at extremely low, undetectable levels in water, it bioaccumulates in aquatic organisms. Elevated levels of mercury in fish tissue pose a health risk to humans when the fish are consumed (SWRCB 2009).

CMWD Mercury Testing

Casitas Municipal Water District is required to test the raw lake water for regulated inorganic chemicals, including mercury, on an annual basis. Their January 2013 sampling results were "non-detect" for mercury (with a detection limit of 0.02 ug/L) (McMahon 2014).

Because of the concern about mercury, the California Environmental Protection Agency issued a health advisory for California's lakes and reservoirs in July 2013. The advisory provided recommendations on quantities and types of fish from lakes and reservoirs in California that are safe for consumption. The recommendations are stricter for women under 45 years of age and children (OEHHA 2013).

Per the 303(d) list, a TMDL to address the mercury impairment is scheduled for adoption in 2021. The State Water Resources Control Board (SWRCB) is currently developing a program (essentially a statewide TMDL) that will collectively address all of the mercury impaired reservoirs in California. To protect humans and wildlife that consume fish, the SWRCB is also developing statewide water quality objectives for mercury that will apply to all inland surface waters, enclosed bays, and estuaries.

3.5.1.2 Other Impairments

In the past, surface water quality was considered primarily a question of whether the water contained chemical pollutants; water quality was evaluated for use as a municipal, agricultural, or industrial supply. This view has evolved; regulators and scientists now hold a broader perspective. The measure of water quality has expanded beyond the chemical purity of water or its use as a supply for people, so that it now includes its suitability for aquatic organisms, recreation, and other "beneficial uses."

Lack of streamflow and barriers to fish migration, discussed below, are identified by the RWQCB as water quality impairments for a number of waterbodies in the watershed. "Constituents of emerging concern" (CECs) include a wide range of chemicals found in pharmaceuticals and personal care products and constitute an emerging, critical water quality issue. Some of these chemicals have been found to disrupt normal hormone function in humans and aquatic organisms. Because CECs enter the environment primarily through wastewater discharges, this water quality issue is discussed in "3.5.3 Wastewater Quality."

Lack of Streamflow

Ventura River "Dry Reach" Above Highway 150 Bridge (Reach 4)

Adequate streamflow is as essential for aquatic life and recreational uses as adequate water quality. Reaches 3 and 4 of the Ventura River (see Figure 3.5.1.1.1) are on the Section 303(d) list of impaired waterbodies for pumping and water diversion because the lack of water in these reaches is believed to interfere with the migration of the endangered southern California steelhead. Reach 4 includes the river's "dry reach," the widest and most porous part of the river where surface water often disappears underground after storm flows have passed.

The extent to which water pumping and extractions contribute to lack of streamflow is an issue that needs more study. A historical ecological assessment of the river by the San Francisco Estuary Institute documented numerous historical records indicating that this reach of river has regularly gone dry, or exhibited intermittent flow, since the early 1900s (Beller et al. 2011). See "3.3.3 Groundwater Hydrology" and "3.3.1 Surface Water Hydrology" for a more detailed discussion about the factors that contribute to lack of streamflow in the river.

The pumping and diversion impairments on the 303(d) list for Ventura River Reaches 3 and 4 were officially addressed by the USEPA in 2012-2013. In most cases, impairments on the 303(d) list can be addressed by TMDL regulations. However, TMDL regulations are used to limit the discharge of *pollutants* into water bodies. TMDLs cannot be used to establish flow criteria, alter water rights, or regulate surface or groundwater extraction. In California, only the SWRCB, through its Water Rights Division, has the authority to regulate surface flow volumes. The National Marine Fisheries Service and California Department of Fish and Wildlife can influence these decisions through Biological Opinions and consultations for projects that affect surface flows.

There are several regulatory options for addressing 303(d)-listed impairments that cannot be addressed with TMDLs, including moving the impairments to another category of the 303(d) list that is reserved for non-pollutant-related cases. Instead of pursuing one of these options, the USEPA issued a resolution (*Ventura River TMDL – Resolution 2013-0005,* USEPA 2013a) that found: 1) pumping and diversion in Reaches 3 and 4 contributes to nutrient- and algae-related impairments, 2) the RWQCB accounted for current flows (and thus current diversions and pumping) when designing nutrient limits in the Algae TMDL, and 3) other state and federal agencies have authority to address *other* potential impacts of pumping and water diversion within Reaches 3 and 4.

Fish Barrier, Matilija Dam

Barriers to Fish Migration

Matilija Dam presents the watershed's largest migration barrier for the endangered southern California steelhead, effectively blocking access to nearly 50% of the steelhead's prime spawning habitat—the upper reaches of Matilija Creek (USACE 2004). Barriers such as this are considered surface water quality impairments by the RWQCB because they impair the beneficial use of water by aquatic life. Matilija Reservoir and Matilija Creek below the reservoir are on the Section 303(d) list of impaired waterbodies for fish barriers. Efforts to remove the dam began in 1999 and are still underway. The most challenging dam-removal issue is management of the seven million cubic yards of sediment behind the dam, which may potentially include using natural sediment transport schemes to move the sediment downstream.

The RWQCB is scheduled to address this impairment by 2019. (See "3.6 Ecosystems and Access to Nature" for more discussion of Matilija Dam and fish passage barriers).

3.5.1.3 Stormwater Runoff

Rainstorms are few and far between in this watershed, but when downpours do occur, stream water quality conditions change dramatically because of stormwater runoff.

Before stormwater runoff reaches streams or the river, it can come in contact with and transport many different types of pollutants. The quality of stormwater runoff and the nature of its pollutants can be highly variable, depending on land uses, geology, terrain, and other factors. Urban areas, agriculture, ranch lands, oil fields, and undeveloped open space all contribute runoff during storm events. Storm size and intensity also influence stormwater quality.

In developed areas, stormwater runoff flows over rooftops, pavement, and other impervious surfaces, picking up many different types of urban-generated pollutants—heavy metals and other pollutants from cars, animal waste, pesticides, fertilizers, solvents, cleaners, and others—along its way.

Stormwater runoff from natural landscapes can produce runoff with measureable and sometimes relatively high concentrations of the same water quality constituents that are causing water quality impairments in urbanized areas. For instance, levels of indicator bacteria in runoff from natural landscapes routinely fail meet water quality objectives (Stein & Koon 2007)

Table 3.5.1.3.1 Frequency of Elevated Levels of Stormwater & Non-Stormwater Pollutants (2009/10 – 2012/13)

	Fox Canyon Barranca		Happy Valley Drain		Ventura River	
Constituent	**Wet Weather**	**Dry Weather**	**Wet Weather**	**Dry Weather**	**Wet Weather**	**Dry Weather**
	% Samples with Elevated Levels					
E. coli	100%	88%	100%	67%	91%	0%
Fecal coliform	100%	75%	100%	67%	100%	0%
Aluminum (total)	100%	0%	100%	0%	9%	0%
Copper (dissolved)	0%	0%	0%	0%	9%	0%
Dissolved Oxygen	0%	0%	0%	0%	0%	0%
pH	0%	0%	0%	67%	0%	0%
Nitrate[1]	0%	0%	0%	0%	0%	0%
Chloride	33%	100%	0%	100%	0%	0%
Total Dissolved Solids	0%	100%	0%	67%	0%	0%
MBAS	0%	0%	9%	0%	0%	0%
Chlorpyrifos[2]	17%	0%	0%	0%	9%	0%
Malathion[2]	17%	0%	0%	0%	0%	0%
DEHP	8%	0%	0%	0%	0%	0%

The Ventura Countywide Stormwater Quality Monitoring Program tests for hundreds of constituents at three sites in the watershed: two urban storm drains (Fox Canyon Barranca storm drain and Happy Valley Drain) and one instream site located in the Ventura River just upstream of the Ojai Valley Sanitary District wastewater treatment plant outfall. See Figure 3.5.1.6.1 for a map of these locations. Listed here are only those constituents that sometimes have elevated levels (do not meet objectives).

1 - Nitrate levels in this program are compared to the drinking water standard of 10 mg/L (N).

2 - No adopted limit. Compared to USEPA national recommended water quality criterion only.

Dry weather: Water quality results at the Ventura River site consistently meet water quality objectives; high concentrations of chlorides and total dissolved solids are commonly seen in storm drains when groundwater, high in dissolved salts, is the main source of flow; elevated pH levels are commonly seen in the Happy Valley Drain—it is currently unknown what may be causing this; concentrations of indicator bacteria are frequently elevated in urban outfalls as well, as is commonly observed in southern California.

Wet weather: Some constituents frequently exceed water quality objectives at all three monitoring sites; bacteria are always found in high concentrations, as is the case throughout California; aluminum concentrations are also high, primarily in the storm drain samples (see Aluminum note below); the observation of elevated chloride concentrations at Fox Canyon Barranca is likely from a small storm that did not have sufficient flow to mask the groundwater influence; in Fox Canyon Barranca the pesticides Chlorpyrifos and Malathion have been detected, though infrequently (there are no Basin Plan objectives for these pesticides, but their concentrations were compared to the USEPA recommended water quality criterion); DEHP, a plasticizer used in many plastic products to make them softer, is detected occasionally in wet weather in Fox Canyon Barranca—it is thought that trash is a likely source of this pollutant.

Note about Aluminum: Aluminum is a ubiquitous natural element in sediments throughout Ventura County geology; concentrations in soils routinely exceed 3% (30,000 µg/g). During storms, sediments are mobilized from urban, agricultural, and natural sources, including creek beds, resulting in concentrations of aluminum in excess of the 1,000 µg/L Basin Plan objective (a drinking water objective). Samples taken near Wheeler's Gorge above the urbanized areas of the watershed show an aluminum concentration of 19,000 µg/L, far over the drinking water objective applied to the river.

Data Source: Ventura Countywide Stormwater Quality Monitoring Program

3.5.1.4 Key Waterbodies

San Antonio Creek Water Quality

San Antonio Creek drains the watershed's largest urban area—the City of Ojai and adjacent unincorporated areas—home to residences, businesses, industries, golf courses, and many expansive landscapes. The population density immediately adjacent to much of the creek is the highest of any tributary in the watershed. San Antonio Creek also drains the most intensively farmed area in the watershed—the Ojai Valley's East End.

Contaminants that make their way from these areas to the creek pollute the water in the creek and its aquatic habitats, and then contaminate the downstream water in the Ventura River all the way down to the sensitive fisheries in the Ventura River estuary at the coast. Nutrient pollution can contribute to algal blooms; the watershed's highest in-stream nutrient concentrations are found in San Antonio Creek.

San Antonio Creek is on the 303(d) list of impaired waterbodies for bacteria, nitrogen, low dissolved oxygen, and total dissolved solids. San Antonio Creek is also one of the tributaries that has been designated as critical habitat for the endangered southern California steelhead. Figure 3.5.1.1.1 "Water Quality Impairments Map" shows San Antonio Creek's location.

Estuary Water Quality

The estuary is a very important biological asset: it is a highly biodiverse ecosystem and a nursery for many species, and it has been designated as critical habitat for the endangered southern California steelhead. The Ventura River estuary is on the 303(d) list of impaired waterbodies for algae, eutrophic conditions, low dissolved oxygen, trash, and total coliform.

Water quality issues are made more complex in the estuary because the water is a combination of freshwater and salt water. Water quality is very dependent upon whether the river mouth sandbar is open or closed, and both the quality and quantity of freshwater river flow (Wetlands Research Associates & Philip Williams and Associates 1994).

The most comprehensive ongoing monitoring of the estuary's water quality is performed monthly by Casitas Municipal Water District (CMWD). CMWD takes samples monthly from the same location in the estuary/lagoon, using a multiprobe that records dissolved oxygen, pH, conductivity, salinity, total dissolved solids, and temperature. This is a vertical profile collected at a midpoint of the estuary/lagoon that has at least four depths recorded (maximum depth is also recorded), as well as turbidity at the surface. The temperature of the Ventura River water flowing into the estuary/lagoon is measured at Main Street at 30-minute intervals. In addition, the surface area of the estuary/lagoon is measured twice a year; and the status of the sandbar (open or closed) is monitored every two weeks from January to June and monthly the rest of the year.

Santa Barbara Channelkeeper also monitors estuary water quality on a monthly basis as part of its Stream Team program, which includes sample analysis for fecal indicators (e.coli and enterococcus), nutrients (nitrate and phosphate), and additional chemical parameters.

3.5.1.5 Surface Water Quality Regulations

All watersheds in the country are subject to the standards of the Clean Water Act, considered the cornerstone of water quality protection in the United States. Watersheds in California are also subject to water quality standards of the State of California. The implementation of these state and federal regulations is carried out through a variety of agencies and programs, as outlined below.

The Ventura River watershed is under the jurisdiction of the Los Angeles Regional Water Quality Control Board.

Basin Plan

California Water Code establishes water quality policy for state and regional water resources. Each of the state's nine water quality control regions has developed regional water quality control plans to address water quality issues specific to that region. The Ventura River watershed is under the jurisdiction of the Los Angeles RWQCB.

The RWQCB's water quality control plan, called the Basin Plan, was last completely updated in 1994 and is periodically amended as new water quality objectives and TMDLs are adopted. The Basin Plan was developed to protect a defined list of "beneficial uses"— the resources, services, and qualities of aquatic systems that the regulations aim to preserve or improve. Beneficial uses include recreation; water supply; navigation;

and the preservation and enhancement of fish, wildlife, and other aquatic resources. Beneficial uses can be existing, potential, or intermittent uses. Once a waterbody's beneficial uses have been designated, appropriate water quality objectives can be developed to protect those uses.

The Basin Plan identifies 23 different waterbodies in the watershed (including individual reaches of streams and rivers), assigns different beneficial uses to each of these waterbodies, and establishes water quality objectives for them.

Impairments and TMDL Regulations

While the RWQCB enforces state regulations, it also has the authority and responsibility to enforce the federal Clean Water Act. Section 303(d) of the Clean Water Act requires states to identify waters that do not meet water quality standards and to classify them by category. States must submit their lists to the USEPA for review and approval. These state-developed lists are known as Section 303(d) lists of impaired waterbodies.

Eleven waterbodies in the watershed are listed as "impaired" on the Section 303(d) list. Fourteen different types of impairments, listed in Table 3.5.1.5.1 (Water Quality Impairments by Waterbody) have been identified.

Regulations called TMDLs, for Total Maximum Daily Loads, have either been developed or are scheduled to be developed to address the impairments that are caused by pollutants. TMDLs for pollutants outline the loading (e.g., "pounds per day") or concentration (e.g., "parts per million") reductions of pollutant discharges that must be made by various public and private "responsible parties" in order to address particular water quality impairments. Responsible parties are directly involved with developing "Implementation Plans," which are part of state-developed TMDLs and which describe how the reductions will be accomplished. TMDLs address both federal and state water quality requirements, so they require approval by the SWRCB and the USEPA, with the RWQCB typically handling enforcement.

Table 3.5.1.5.1 Water Quality Impairments by Waterbody

Waterbody	Water Quality Impairment	Regulatory Status[2, 3]
Matilija Reservoir	Fish barriers (fish passage)	Scheduled to be addressed by 2019
Matilija Creek Reach 1: Matilija Reservoir to confluence withNorth Fork Matilija Creek. Reach 2: Above Matilija Reservoir		
San Antonio Creek: Tributary to Ventura River. Runs from East End of Ojai, along Creek Rd., to confluence with Ventura River, just above Casitas Springs	Nitrogen	Addressed by the Algae TMDL[4] (became effective 6/28/2013)
	Bacteria	TMDL scheduled for 2021
	Total Dissolved Solids	TMDL scheduled for 2023
Lake Casitas	Mercury	TMDL scheduled for 2021
Ventura River Reach 4: Camino Cielo Rd. below Matilija Dam to confluence with Coyote Creek, just south of Foster Park	Pumping, Water Diversion	Addressed by USEPA on 6/28/2013[5]
Ventura River Reach 3: Confluence with Coyote Creek, just south of Foster Park, to confluence with Weldon Canyon, just north of Cañada Larga	Indicator Bacteria	TMDL scheduled for 2021
	Pumping Water Diversion	Addressed by USEPA on 6/28/2013[5]
Ventura River Reach 2: Weldon Canyon to Main St.	Algae	Addressed by the Algae TMDL[4] (effective 6/28/2013)
Ventura River Reach 1: Main St. to Estuary		
Cañada Larga Creek: Tributary to Ventura River. Runs along Cañada Larga Rd. to confluence with Ventura River, south of wastewater treatment plant)	Low Dissolved Oxygen	Addressed by the Algae TMDL[4] (became effective 6/28/2013)
	Fecal Coliform	TMDL scheduled for 2019
	Total Dissolved Solids	TMDL scheduled for 2021
Ventura River Estuary: Main St. to Estuary	Trash	Addressed by the Ventura River Trash TMDL (effective on 3/6/2008)
	Algae, Eutrophic Conditions	Addressed by the Algae TMDL[4] (effective 6/28/2013)
	Total Coliform	TMDL scheduled for 2019

1. Water quality impairment as listed under the Clean Water Act Section 303(d).
2. Schedules for TMDL adoption are proposed by the states when they submit their revisions to the 303(d) list to the USEPA every few years.
3. TMDL = Total Maximum Daily Load (water quality regulation)
4. Algae TMDL = Algae, Eutrophic Conditions, and Nutrients TMDL for Ventura River and its Tributaries
5. In June 2013 the USEPA determined that the recently adopted Algae, Eutrophic Conditions, and Nutrients TMDL provides "equivalent protection of water quality in [Ventura River] Reaches 3 and 4… Therefore, USEPA is not establishing separate TMDLs to address the pumping and water diversion impairment listings" (EPA Memo re: Resolution 2013-0005 (USEPA 2013a). See additional discussion above in the "Lack of Streamflow" section.)

Table 3.5.1.5.2 Adopted TMDLs

TMDL	Responsible Parties	Status
Ventura River Estuary Trash TMDL	City of Ventura, Ventura County, Ventura County Watershed Protection District, California Department of Food and Agriculture, Caltrans	Became effective in March 2008. Many improvements are being implemented, including installation of trash excluders in the storm drains, increased trash collection in public places, education, and better enforcement of regulations.
Algae, Eutrophic Conditions, and Nutrients TMDL for Ventura River and its Tributaries (Algae TMDL)	Ojai Valley Sanitary District, City of Ojai, City of Ventura, Ventura County, Ventura County Watershed Protection District, Caltrans, and agricultural dischargers (growers and horse and livestock owners).	Became effective in June 2013. Monitoring plans related to attainment of the TMDL targets are now under development by the various responsible parties. In 2014, the USEPA deemed that the Algae TMDL also addresses the water quality impacts from pumping and diversion.

Discharge Permits and Waivers

All discharges, whether to land or water, are subject to regulation. The RWQCB oversees a variety of regulatory discharge permit programs for ensuring compliance with both federal and state water quality standards. The primary programs are summarized below.

National Pollutant Discharge Elimination System

National Pollutant Discharge Elimination System (NPDES) permits address federal law (i.e., the Clean Water Act). NPDES permits regulate point source pollution, which originates from a definite source, such as industrial facilities; as well as urban and stormwater runoff discharged into rivers and lakes, and along the coast from storm drains that are owned and managed by cities and counties.

Through NPDES, discharges can be permitted with an individual permit or covered under a general permit. Individual permits are written to address the specific design and applicable water quality standards to an individual facility, while general permits authorize a category of discharges within a geographical area (USEPA 2013b).

Municipal Separate Storm Sewer Systems Permits

As part of the NPDES program, municipalities operating municipal separate storm sewer systems (MS4s) are required to obtain MS4 permits, which regulate stormwater discharges. The RWQCB issues MS4 NPDES permits, usually to a group of co-permittees encompassing an entire metropolitan area.

Ventura Countywide Stormwater Water Quality Program

Ventura County's MS4 permit includes 12 co-permittees: the cities of Camarillo, Fillmore, Moorpark, Ojai, Oxnard, Port Hueneme, Simi Valley, Santa Paula, Thousand Oaks, and Ventura; the County of Ventura; and the Ventura County Watershed Protection District. Collectively, these co-permittees form the Ventura Countywide Stormwater Quality Management Program (VCSQMP).

The pollutants of concern in Ventura County, as outlined in the MS4 permit, include chloride, fecal indicator bacteria, conventional pollutants, metals, nitrogen, organic compounds, and pesticides.

MS4 permits require the dischargers (co-permittees) to develop and implement programs that reduce the discharge of pollutants to the maximum extent practicable. The Ventura County Watershed Protection District is the "principal permittee," and as such is responsible for overall coordination of the VCSQMP. Co-permittees work cooperatively on both water quality monitoring programs as well as programs to advance BMPs.

The VCSQMP elements include:

- Public outreach programs
- Programs to reduce pollutants in stormwater runoff from industrial and commercial facilities
- Planning and land development programs that ensure that stormwater quality impacts from new development and redevelopment are limited through site design measures, site-specific source control measures, low impact development strategies, and treatment control measures
- Programs to reduce pollutants in runoff from construction sites during all construction phases
- Programs to ensure good facility maintenance for municipal operations
- Programs to reduce illicit storm drain connections and illicit discharges
- Water quality monitoring (VCWPD 2013e)

The VCSQMP produces and updates a *Technical Guidance Manual,* (LWA and Geosyntec 2011) which outlines the selection, design, and maintenance of stormwater BMPs required for new development and redevelopment projects.

Educational Sign, Ventura County-wide Stormwater Quality Program

Definitions

Discharge—In the context of water quality regulations, "discharge" means the release of waste to surface water or to the ground.

Point Source—Any discernible, confined, and discrete conveyance, (e.g., a pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft) from which pollutants are or may be discharged. This does not include agricultural stormwater discharges and return flows from irrigated agriculture, but does include discharges from municipal separate storm sewer systems (MS4s). (USEPA 2014a)

Nonpoint Source—Nonpoint source pollution comes from a variety of diffuse sources: fertilizers, herbicides, and insecticides from agricultural and residential areas that do not drain to an MS4; oil, grease, and toxic chemicals from industrial and urbanized areas; sediment from improperly managed construction sites, crop and forest lands, eroding streambanks, and naturally occurring, erosive landscapes; salt from irrigation; bacteria and nutrients from horses, livestock, pet waste, and septic systems; atmospheric deposition; and stream channel modification.

Industrial Activities General Stormwater Permit

The USEPA has identified specific types of industries whose outdoor activities have the potential to contribute to stormwater pollution. These industries include machinery manufacturing, auto dismantling, chemical products, and oil and gas extraction, among others. The SWRCB has required businesses engaged in these activities to obtain coverage under the Industrial Activities General Stormwater Permit. On an individual basis, industries must use the best available technology specific to their activities to reduce pollutants in their stormwater discharges. Facility operators are required under the permit to write and implement a Storm Water Pollution Prevention Plan (SWPPP) specific to their operations and to perform limited monitoring of stormwater runoff from their facility. Facilities that do not have exposure to stormwater can file a non-exposure exclusion to be relieved of many of the permit requirements.

Construction Activities General Stormwater Permit

Construction activities resulting in a land disturbance of one acre or more, or less than one acre but part of a larger common plan of development or sale, must be covered under the Construction Activities Storm Water General Permit (2009-0009-DWQ Permit). Construction activity includes clearing, grading, excavation, stockpiling, and reconstruction of existing facilities involving removal and replacement. Construction activity does not include routine maintenance, such as maintenance of original line and grade, hydraulic capacity, or original purpose of the facility.

A major requirement of the Construction General Permit is that operators of the construction activity prepare and implement a SWPPP to reduce the pollutants in stormwater discharged from the construction site, including mud tracked offsite by vehicles. The SWPPP identifies the potential sources of pollutants and the best management practices that will be in place to prevent their discharge.

Waste Discharge Requirements

Waste Discharge Requirements (WDR) address state regulations (i.e., the Porter-Cologne Water Quality Control Act). WDRs require dischargers to implement self-monitoring programs for their discharges and submit compliance reports to the RWQCB. Since the state has the delegated authority to implement the federal NPDES permit program, NPDES and WDRs are commonly combined into one permit. WDRs also cover the many other types of discharges not covered by NPDES permits.

Nonpoint Source Discharge Regulation

The RWQCB regulates nonpoint source discharges in one of three ways: WDRs, conditional waivers, and waivers. The RWQCBs responsible for enforcing state and federal water quality standards historically waived the WDRs for irrigated farms; however, a 1999 state law banned that practice, requiring that all such blanket waivers expire on Jan. 1, 2003 and directing the state's nine regional boards to develop an alternative (FBVC 2013).

The "Conditional Waiver" program requires the owners of irrigated farmland to submit water quality management plans, conduct monitoring in agricultural drains and other sites influenced by agricultural runoff, and implement BMPs.

Conditional Waiver for Agriculture

In 2005, the Los Angeles RWQCB adopted a Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands within the Los Angeles Region. Known informally as the "Conditional Waiver" program, it requires the owners of irrigated farmland to submit water quality management plans, conduct monitoring in agricultural drains and other sites influenced by agricultural runoff, and implement BMPs that address the quantity and quality of irrigation return flows and stormwater runoff. These discharges can affect water quality by transporting nutrients, pesticides, sediment, salts, and other pollutants from cultivated fields into surface waters. The Conditional Waiver allows individual landowners and growers to comply with its provisions as individuals or by working collectively as a "discharger group."

Table 3.5.1.5.3 Discharge Permits and Waivers

# of permits	Entity	Permit/Waiver[1]
	Stormwater	
1	Ventura County Watershed Protection District, County of Ventura, the 10 cities in Ventura County (1 permit issued to all 12 "co-permittees")	NPDES (MS4) Permit
16	Operators of construction activities causing 1 acre or more of soil disturbance	General Construction Stormwater NPDES Permit
31	Industrial facilities meeting the statewide industrial stormwater permit's Attachment 1 Eligibility Criteria	General Industrial Stormwater NPDES Permit
	Non-Stormwater	
1	Ojai Valley Sanitary District	NPDES Permit
1	Casitas Municipal Water District	NPDES Permit
1	City of Ventura	NPDES Permit
1	Golden State Water Company	NPDES Permit
1	County of Ventura	NPDES Permit
1	Ventura River County Water District	NPDES Permit
18	Various individuals and businesses	Individual or General Waste Discharge Requirements (Non-NPDES)
	Waivers	
1	Ventura County Agricultural Irrigated Lands Group (owners and operators of agricultural lands working together as a "discharger group")	Conditional Agricultural Waiver

1. NPDES = National Pollutant Discharge Elimination System; MS4 = Municipal Separate Storm Sewer Systems

Data Source: Birosik 2013

Given the high cost and complexity of obtaining individual discharge permits, the Farm Bureau of Ventura County enlisted the cooperation of other agricultural organizations, water districts, and individuals to form Ventura County Agricultural Irrigated Lands Group (VCAILG), which serves as a unified discharger group for those agricultural landowners and growers who agreed to join. The RWQCB approved the plan in 2006. The Farm Bureau of Ventura County administers the program on behalf of VCAILG members.

Through the Conditional Waiver program, landowners and growers are asked to provide VCAILG with information on their management practices, participate in education efforts, and implement best management practices to reduce or eliminate contaminated discharges. The Conditional Waiver program also performs water quality monitoring and reporting (FBVC 2013).

The RWQCB discharge permits and waivers in the watershed are summarized in Table 3.5.1.5.3.

Hazardous Materials Program

The release of hazardous materials can threaten surface water and groundwater quality. The Ventura County Certified Unified Program Agency (CUPA) Hazardous Materials Program, administered by the Ventura County Environmental Health Division (VCEHD), provides regulatory oversight for the six statewide environmental programs related to hazardous materials management.

3.5.1.6 Surface Water Quality Monitoring

Surface water quality has been monitored in the watershed for decades, but the number of monitoring programs, monitoring locations, and constituents assessed have increased significantly since 2001, both in response to new regulatory requirements and citizen monitoring programs.

Surface water quality is routinely monitored by a number of agencies and organizations. The location, frequency, and constituents monitored are different depending upon the purpose of the monitoring.

What follows is a summary of the most significant ongoing, current water quality monitoring programs. There have been many other limited-term, or focused, monitoring efforts in the past. Water quality monitoring is also conducted in relation to southern California steelhead and other habitat issues.

Figure 3.5.1.6.1 Surface Water Quality Monitoring Locations

Ventura Countywide Stormwater Monitoring Program

Water Quality Monitoring, Ventura County Watershed Protection District

Photo courtesy of Ventura County Watershed Protection District

The countywide stormwater NPDES permit requires extensive water quality monitoring, including monitoring within major storm drains, called "major outfall stations," and within the lower Ventura River, called a "mass emissions station." Water quality monitoring for this program began in 2001. Bioassessment monitoring coordinated by the Southern California Coastal Water Research Project, discussed below, is also an element of this permit program.

Number of sites monitored: Three

Location: Storm drain ("major outfall") monitoring takes place in Meiners Oaks at Happy Valley Drain and in Ojai at Fox Canyon Barranca. These sites were selected through a process that evaluated the contributing land uses, the ability to measure flow in the channel, and personnel safety concerns. Instream ("mass emission") monitoring takes place in the Ventura River at Ojai Valley Sanitary District (above the district's effluent discharge).

Frequency: Up to four times per year. Up to three rainfall events, plus once during the dry season (three sites times four sampling events = 12 samples per year). The dry season is from May 1 through September 30.

Southern California Coastal Water Research Project

Macroinvertebrates, Bioassessment Monitoring

Photos courtesy of Ventura County Watershed Protection District

Starting in 2009, the Southern California Coastal Water Research Project embarked on a five-year standardized bioassessment monitoring program throughout southern California for the Stormwater Monitoring Coalition of Southern California. Bioassessment monitoring for the Ventura Countywide Stormwater Monitoring Program is being conducted through this program by the Ventura County Watershed Protection District for the duration of the five-year study. The program monitors benthic macroinvertebrates, benthic algae, riparian wetland conditions, water chemistry, water toxicity, and physical habitat. (Prior to 2009, bioassessment monitoring was conducted by the Watershed Protection District at fixed locations.)

Number of sites monitored: Six

Location: Each year, six sites are randomly selected throughout the Ventura River watershed.

Frequency: Annually

City of Ventura

In addition to the monitoring that the City of Ventura performs at its drinking water treatment facility, the City also monitors the quality of surface and subsurface water at a number of watershed locations.

Number of sites monitored: Six

Location: San Antonio Creek (at the Highway 33 Bridge), Ventura River at Foster Park, subsurface intake at Foster Park, three wells in the City's Nye well field in the Foster Park area (groundwater under the influence of surface water)

Frequency: Various: monthly, yearly, and at other intervals

Casitas Municipal Water District

In addition to the monitoring of lake water that Casitas Municipal Water District (CMWD) performs as a supplier of drinking water, CMWD also monitors water quality at a number of watershed locations.

Number of sites monitored: Seven

Location: Ventura River before the Robles Diversion, Coyote Creek, four sites on Santa Ana Creek, and in the Ventura River estuary

Frequency: Instream testing is performed monthly for total coliform, *E. coli,* and turbidity, and a few times during the winter for metals, nutrients, and turbidity. The estuary is monitored monthly.

Santa Barbara Channelkeeper

Water Quality Monitoring, Santa Barbara Channelkeeper's Stream Team
Photo courtesy of Santa Barbara Channelkeeper

Since 2001, Santa Barbara Channelkeeper's Stream Team has monitored 15 sites for general water quality parameters and nutrients. Pathogens were monitored until October 2010.

From 2008 through 2012, Channelkeeper also collected monthly diel (twice-daily) measurements of dissolved oxygen, pH, and temperature. These parameters fluctuate significantly throughout the course of the day due to the availability of sunlight and the influence of photosynthesis of aquatic plants and algae. Properly timed diel measurements (usually before sunrise and at mid-afternoon) can provide a better estimate of minimum and maximum levels of these parameters. In 2013, Channelkeeper began using deployable dissolved oxygen and temperature data loggers, which collect measurements continually throughout each day, for diel monitoring.

Number of sites monitored: 15 (three of which are commonly dry)

Location: Monitoring sites are on the Ventura River, the estuary, and on San Antonio, Stewart, Lion Canyon, Cañada Larga, Matilija, and North Fork Matilija Creeks.

Frequency: Monthly, with data loggers continuously conducting measurements of dissolved oxygen and temperature at certain sites.

Sampling is conducted in accordance with protocols developed by California's Surface Water Ambient Monitoring Program (SWAMP) and the University of California Santa Barbara's Coastal Long Term Ecological Research Project. The specific sampling protocols are described in more detail in the appendix of the report *An Assessment of Numeric Algal and Nutrient Targets for Ventura River Watershed Nutrient Total Maximum Daily Loads (TMDLs)* (Klose et al 2009). This report was peer reviewed by an outside expert specifically hired by the RWQCB. The appendix of the report also compared Channelkeeper's data, Ojai Valley Sanitary District data, and data collected specifically for the study and concluded that there were no significant differences among the data sources.

Ojai Valley Sanitary District

The Ojai Valley Sanitary District's (OVSD) NPDES permit requires routine monitoring of influent (raw wastewater coming into the facility), effluent (treated wastewater leaving the facility), and three sites downstream of the treatment plant on the Ventura River. The parameters that must be monitored by the district are quite extensive, and now include many new chemical and personal care products such as perfumes, soaps, pharmaceuticals, and everyday items such as ibuprofen and Lipitor.

Number of sites monitored: Three (plus influent and effluent)

Location: Influent, effluent, and at three locations on the Ventura River—approximately 1,650 feet downstream of discharge, 50 feet downstream of discharge, and at a point immediately upstream of the confluence with Cañada Larga Creek.

Frequency: Depending on the constituents, monitoring is done on a continuous, daily, weekly, monthly, quarterly, semi-annually, or annual basis.

Ventura County Environmental Health Division

Ventura County Environmental Health Division (VCEHD) conducts coastline bacteriological monitoring for total and fecal coliform and enterococcus. The purpose of this program is to assure the protection of human health and of the environment. VCEHD is responsible for alerting the public about possible health risks from contact with storm drain water and runoff that flows onto beaches. VCEHD's Ocean Water Quality Program website includes up-to-date information on ocean water quality, detailed maps of sampling locations, a list of beach postings, and weekly sampling results.

Number of sites monitored: Three (in the immediate vicinity of the Ventura River)

Ocean Water Quality Warning Posted Near Surfers' Point, Ventura
Photo courtesy of Ann Rosecrance

Location: One monitoring site is up-coast (Emma Wood) and two are down-coast (Seaside Wilderness Park and Surfer's Point).

Frequency: Weekly

Ventura County Agricultural Irrigation Lands Group

VCAILG is a unified "discharger group" of agricultural landowners and growers in Ventura County that formed as part of compliance with agricultural water quality requirements (the Conditional Waiver discussed previously). The Farm Bureau of Ventura County administers the VCAILG program, including performing water quality monitoring and reporting.

Number of sites monitored: Two

Location: Thacher Creek at Ojai Avenue and San Antonio Creek at Grand Avenue

Frequency: Twice during the wet season (October 15 through May 15) within 24 hours of a storm, and twice during the dry season (May 16 through October 14). In addition, toxicity monitoring is required during one wet event and once during the dry season each year.

3.5.1.7 Key Data and Information Sources/ Further Reading

Below are some key documents that address water quality issues and regulations in the watershed. See "4.3 References" for complete reference citations.

Algae, Eutrophic Conditions, and Nutrients Total Maximum Daily Loads for Ventura River and its Tributaries. Final Staff Report (RWQCB–LA 2012)

An Assessment of Numeric Algal and Nutrient Targets for Ventura River Watershed Nutrient Total Maximum Daily Loads (TMDLs) (Klose et al. 2009)

A Review of the Findings of Santa Barbara Channelkeeper's Ventura Stream Team January 2001–January 2005 (Leydecker & Grabowsky 2006)

Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties (RWQCB–LA 1994)

California Lakes: New Monitoring Program Reveals Widespread Contamination of Fish in California Lakes. First Year of a Two-Year Screening Study (2007) (SWRCB 2009)

Corrected Source Assessment Report: Nitrogen and Phosphorus in the Ventura River Watershed (LWA 2011)

Draft Ventura River Reaches 3 and 4 Total Maximum Daily Loads for Pumping & Water Diversion-Related Water Quality Impairments (USEPA 2012)

Memo regarding Ventura River TMDL – Resolution 2013-0005. Describes the USEPA's final approach to the draft Ventura River Pumping & Water Diversion TMDL (USEPA 2013a)

Order R4-2010-0186, Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands within the Los Angeles Region. Referred to as the "Ag Waiver." (RWQCB – LA 2010a)

Order R4-2010-0108, NPDES Permit No. CAS004002, Waste Discharge Requirements for Storm Water (Wet Weather) and Non-Storm Water (Dry Weather) Discharges from Municipal Separate Storm Sewer Systems Within the Ventura County Watershed Protection District, County of Ventura and the Incorporated Cities Therein. Referred to as the "MS4 Permit." (RWQCB–LA 2010)

Al Leydecker Sampling Water, Lower Ventura River
Photo courtesy of Santa Barbara Channelkeeper

Reports (unpublished) by Al Lydecker, PhD:

A Look at Nutrient Concentrations in the Ventura Watershed: 2008-2011 (Leydecker 2012a)

A Story About Conductivity, Climate and Change on the Ventura River (Leydecker 2004)

Conductivity Stories (Leydecker 2013b)

Nitrate in the Ventura River Watershed. (Presentation) (Leydecker 2013a)

The Sonde Experiment: A Look at the Accuracy of SBCK Diel DO Measurements, September 2008 (Leydecker 2012)

Where Do the Nitrate Come From? Part 1 (Leydecker 2010)

Where Do the Nitrate Come From? Part 2: Conductivity and Such (Leydecker 2010a)

Trash Total Maximum Daily Load for the Ventura River Estuary (RWQCB–LA 2007a)

Ventura County Technical Guidance Manual for Stormwater Quality Control Measures (LWA & Geosyntec 2011)

Ventura River and San Antonio Creek Watershed Sanitary Survey for the City of Ventura, 2010 Update (Kennedy/Jenks 2011)

Ventura River Stream Team Trash Surveys (SBCK 2011)

Ventura River Watershed 2006 Bioassessment Monitoring Report, Ventura Countywide Stormwater Monitoring Program (ABCL 2007)

Watershed Sanitary Survey Update, 2011 (CMWD 2011a)

Annual Reports

The annual reports required of permittees and responsible parties related to water quality regulations also contain detailed and helpful information. Recent reports include:

Ventura Countywide Stormwater Quality Management Program Annual Report, 2012-2013 (VCWPD 2013e)

Ventura River Estuary 2011-2012 Trash TMDL TMRP/MFAC Annual Report. (LWA 2013)

Ventura County Agricultural Irrigated Lands Group (VCAILG), 2012 Annual Monitoring Report (LWA 2013a)

Annual Summary Report for CY-2012, Ojai Valley Sanitary District Treatment Plant Influent, Effluent and Receiving Water Monitoring Program (NPDES No. CA0053961: CI No. 4245). (OVSD 2013)

Gaps in Data/Information

While considerable surface water quality monitoring is conducted in the watershed, and the results of this monitoring are provided in annual reports, most of these reports assume a fairly high level of technical sophistication. The data are often not presented in a form that is comprehensible to the general public.

Importantly, there is limited "big picture" analysis of the mandated water quality monitoring results, i.e., assessments of the risks of elevated levels of a given constituent, temporal and regional trends, the sources of contaminants, and how various cofactors interact and affect one another.

A more precise understanding of the relative amount of nutrients contributed by the various natural and anthropogenic sources in the watershed is needed. The Algae TMDL source assessment could be improved through future studies. For example, estimates of how much nitrogen and phosphorus are deposited by different activities on the land do not automatically or routinely translate into how much ends up in streams or the river. A more robust source assessment could better help stakeholders address the true problem, and possibly reduce regulatory compliance costs where they may be inappropriate.

There also remains uncertainty regarding 1) the extent to which nutrient loading explains large algal blooms and related environmental phenomena addressed in the Algae TMDL and 2) the extent to which management actions will exert changes in those phenomena. Stakeholders may benefit from additional investigations to address these uncertainties. The SWRCB is developing a statewide nutrient policy for inland surface waters (streams, rivers, and lakes); development of

Acronyms

AF—acre-feet

BMP—best management practices

CEC—constituents of emerging concern

CMWD—Casitas Municipal Water District

CUPA—Ventura County Certified Unified Program Agency

FBVC—Farm Bureau of Ventura County

ft—feet

NPDES—National Pollutant Discharge Elimination System

RWQCB—Regional Water Quality Control Board

SWAMP—Surface Water Ambient Monitoring Program

SWPPP—Storm Water Pollution Prevention Plan

SWRCB—State Water Resources Control Board

TDS—total dissolved solids

TMDL—Total Maximum Daily Load

TN—Total Nitrogen

USEPA—United States Environmental Protection Agency

VCAILG—Ventura County Agricultural Irrigated Lands Group

VCEHD—Ventura County Environmental Health Division

VCSQMP—Ventura Countywide Stormwater Quality Monitoring Program

WDR—Waste Discharge Requirements

nutrient management plans that quantify the costs and benefits of nutrient management actions on a watershed scale may emerge as an optional approach for addressing beneficial use impairments under this policy.

One of the waterbodies in the watershed that sees relatively frequent body contact, and often by children, is the Ventura River estuary. Although Channelkeeper began monitoring for indicator bacteria in the estuary in 2008, monitoring for indicator bacteria has historically been limited and intermittent. Other monitoring programs do not monitor the estuary for bacteria. Further studies that can identify the different species contributing *E. coli* to the river and estuary will help identify the anthropogenic sources of bacteria that should be controlled.

Children Playing in Ventura River Estuary

3.5.2 Groundwater Quality

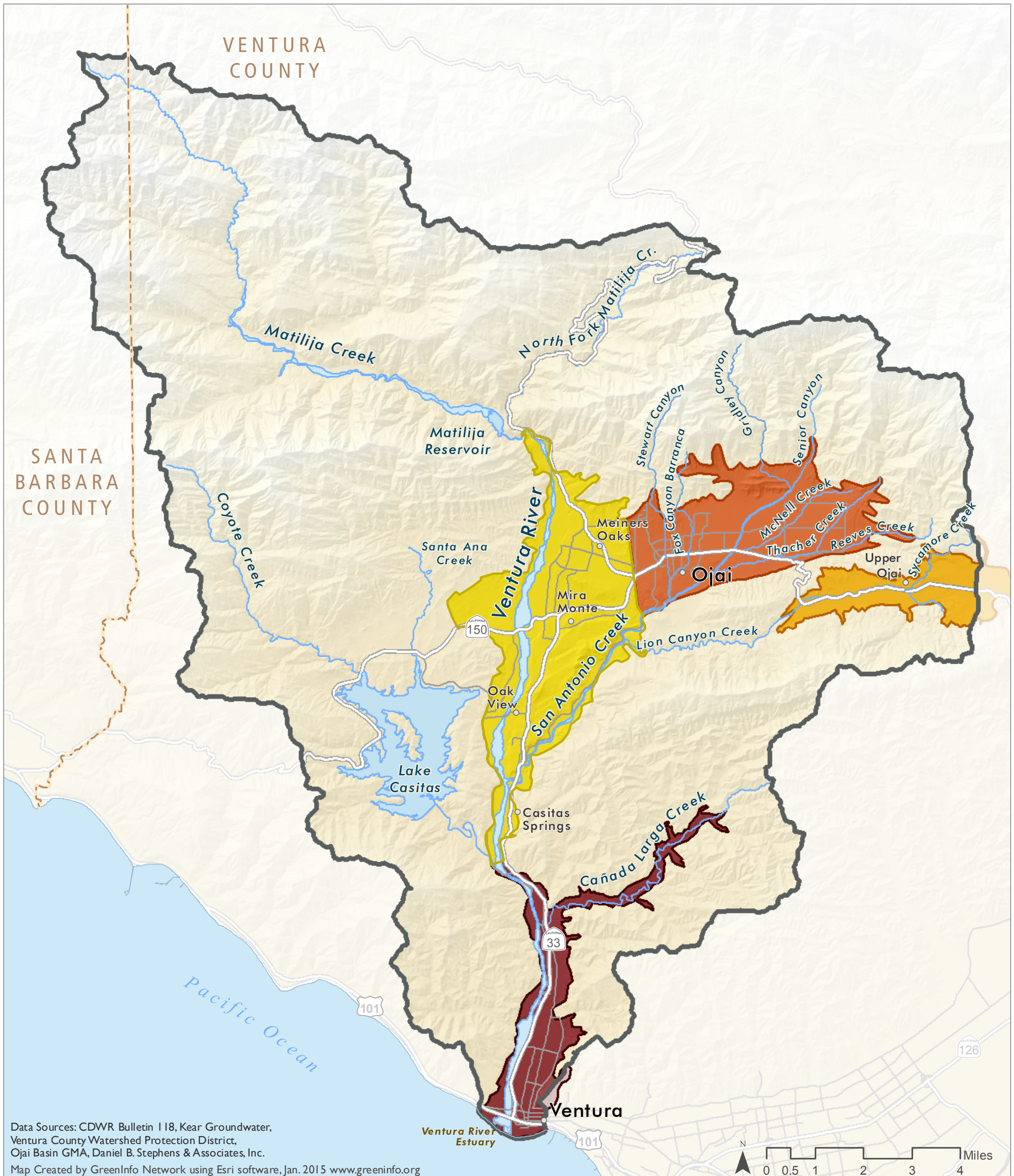
Groundwater supplies a significant percentage of the water used for drinking and irrigation in the watershed, and is the principal source of streamflow for most of the year except in very wet years. The quality of groundwater is important for drinking, irrigation, aquatic ecosystem health, and other uses. This section addresses known groundwater quality concerns. See "3.3.3 Groundwater Hydrology" for more information on the watershed's four important groundwater basins.

The quality of the watershed's groundwater is greatly influenced by the quality and quantity of surface water runoff that recharges the groundwater basins, and by the natural interaction of groundwater with sediments in the surrounding geologic formations.

Groundwater in the watershed is generally of good enough quality for drinking and irrigating, though a few parameters must be regularly monitored, and water from some wells must be blended with water from other sources to meet drinking water quality standards. The quality of the watershed's groundwater is greatly influenced by the quality and quantity of surface water runoff that recharges the groundwater basins, and by the natural interaction of groundwater with sediments in the surrounding geologic formations. Other factors that can influence groundwater quality include impacts from land uses overlying groundwater basins, use and density of septic systems, well depth, and age of groundwater. Because most of the watershed's aquifers are unconfined, groundwater is more vulnerable to contamination from surface pollution than water in confined aquifers.

Nitrate is the primary groundwater quality concern in the watershed. In the Lower Ventura River Basin, concentrations of total dissolved solids (TDS) are regularly elevated, and concentrations of boron and sulfate are sometimes elevated; the surrounding geology may account for these constituents in this basin. In the lower watershed, where significant oil, gas, and other industrial land uses have existed for decades, potential chemical contamination presents concerns that need further investigation (Impact Sciences 2011; USEPA 2012a).

Regional groundwater has been analyzed less frequently and at fewer locations than surface water, so less information is available about its quality, trends, and influences. Most of the groundwater quality monitoring is done by water suppliers, who test for compliance with drinking water standards, and by the Ventura County Watershed Protection District. Sampling is not required of private domestic wells or other unregulated water systems, so water quality data from most wells in the watershed are not publicly available. Less groundwater quality data are available for the Lower Ventura River Basin than in the other basins: there are no drinking water supply wells in this basin and very few irrigation wells, therefore very little regular monitoring for drinking water standards occurs. (See "3.5.2.4 Groundwater Quality Monitoring" for more information about monitoring.)



Groundwater Basins

Ventura River Watershed

Groundwater Basin	Acres	Sq. Mi.	Shallow Depth to Water (ft.)	Max. Capacity	Avg. Well Yield	Active Wells	Approx. Safe Yield
Upper Ojai	2,840	4.4	0-40	5,681 AF	50 gpm	95	Unavail.
Ojai Valley	6,471	10.1	0-80	85,000 AF	383 gpm	149	5,026 AF
Upper Ventura River	9,360	14.6	0-5	35,118 AF	600 gpm	160	9,482 AF
Lower Ventura River	6,090	9.5	3-13	8,743 AF [a]	20 gpm	16	2,130 AF [b]

a - Represents unconsolidated alluvium
b - Preliminary estimate, based on groundwater balance for water years 1997-2007

Source: Daniel B. Stephens & Associates, Inc. 2010 & 2013

Figure 3.5.2.1 Groundwater Basins Map. Groundwater Well, Upper Ventura River Floodplain. After withdrawal, local water suppliers filter, disinfect, and sometimes blend groundwater with water from Lake Casitas before delivering it to consumers. (ft - feet; gmp - gallons per minute; AF - acre-feet)

3.5.2.1 Groundwater Quality Regulations

Drinking Water Standards

Groundwater quality is generally defined in terms of drinking water quality standards. Drinking water standards are set at levels necessary to protect the public from acute and chronic health risks associated with consuming contaminants in drinking water supplies. These limits are known as maximum contaminant levels (MCLs). MCLs are set by the State Water Resources Control Board (SWRCB) and are found in Title 22 of the California Code of Regulations (CCR). Primary MCLs address health concerns. Esthetics such as taste and odor are addressed by secondary MCLs, or SMCLs (CDPH 2013). For some constituents, such as chloride, sulfate, and TDS, SWRCB defines a “recommended” and an “upper” SMCL.

In order to be certified as a permanent domestic or municipal water supply, water from wells located in Ventura County must meet these federal and state standards (VCWPD 2012). Authority for implementing these drinking water standards is designated to the Ventura County Environmental Health Division for systems with up to 14 service connections, and to the SWRCB for systems with greater than 14 connections.

Definitions

MCL—Maximum Contaminant Level. Enforceable drinking water quality standards.

SMCL—Secondary Maximum Contaminant Level. Non-mandatory water quality standards related to esthetic factors, such as taste, staining, and color.

Basin Plan

The Regional Water Quality Control Board’s Basin Plan also establishes groundwater quality “objectives” that are applicable to the watershed (see Table 3.5.2.1.1). The Water Code defines water quality objectives as “the allowable limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area.” (RWQCB-LA 1994) The objectives in the Basin Plan are intended to protect the public health and welfare and to maintain or enhance water quality in relation to the designated existing and potential beneficial uses of the water (RWQCB-LA 1994). The Basin Plan is discussed in more detail in “3.5.1 Surface Water Quality.”

Table 3.5.2.1.1 Basin Plan Groundwater Quality Objectives

Groundwater Basin	Bacteria (mL[1])	Nitrogen as N (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Boron (mg/L)
Upper Ojai Basin						
West of Sulphur Mountain Road	1.1/100	10	1,000	300	200	1.0
Central area	1.1/100	10	700	50	100	1.0
Sisar area	1.1/100	10	700	250	100	0.5
Ojai Valley Basin						
West of San Antonio-Senior Canyon Creeks	1.1/100	10	1,000	300	200	0.5
East of San Antonio-Senior Canyon Creeks	1.1/100	10	700	200	50	—
Upper and Lower Ventura River Basins						
Upper Ventura River area	1.1/100	10	800	300	100	0.5
San Antonio Creek area	1.1/100	10	1,000	300	100	0.5
Lower Ventura River area	1.1/100	10	1,500	500	300	1.5

Objectives represent allowable limits or levels.

1 - In groundwaters used for domestic or municipal supply the concentration of coliform organisms over any seven-day period shall be less than 1.1/100 mL. (mg/L - milligrams per liter)

Source: Basin Plan (RWQCB-LA 1994)

Septic System Regulations

Refer to "3.5.3 Wastewater Quality" for an overview of the regulations in place to prevent septic systems from polluting groundwater.

3.5.2.2 Water Quality by Basin

Three of the watershed's four groundwater basins—Upper Ojai, Ojai Valley, and Upper Ventura River—are actively used for irrigation and drinking water. Each basin has unique quality characteristics and concerns, based largely on geology, land use, and overlying hydrology, but the water is generally suitable for use. The fourth groundwater basin—Lower Ventura River—is not used for drinking water and is minimally used for agricultural irrigation. This aquifer is naturally brackish and is located under the watershed's most industrialized area. Data on the overall impact of current and historic industries on groundwater quality are limited.

Table 3.5.2.2.1 provides a brief survey, organized by basin, of wells that have tested over the MCL or SMCL standards for a few key water quality constituents.

Table 3.5.2.2.1 Water Quality Constituent Exceedances Observed at Monitoring Wells, 1953–2013

	Nitrate as NO_3	Chloride	TDS	Manganese	Iron	Sulfate	Boron
	number of exceedances / number of samples in the dataset (% exceedances)						
Upper Ojai Basin	5/67 (8%)	0/64 (0%)	10/97 (10%)	16/32 (50%)	13/31 (42%)	0/61 (0%)	0/36 (0%)
Ojai Valley Basin	14/399 (4%)	7/335 (2%)	36/450 (8%)	79/191 (41%)	63/184 (34%)	0/328 (0%)	1/204 (1%)
Upper Ventura River Basin	27/307 (9%)	2/261 (1%)	23/342 (7%)	17/210 (8%)	33/145 (23%)	11/255 (4%)	4/203 (2%)
Lower Ventura River Basin	0/13 (0%)	1/23 (4%)	21/23 (91%)	16/22 (73%)	14/22 (64%)	4/23 (17%)	4/20 (20%)
	Drinking Water Quality Maximum Contaminant Levels						
MCL[1] Standard	45 mg/L						
SMCL[2] Standard		250-500 mg/L	500–1,000 mg/L	0.05 mg/L	0.30 mg/L	250–500 mg/L	
Notification Level[3]							1 mg/L

This table indicates the number of samples taken (denominator) and of those, the number that exceeded the MCL or SMCL (numerator). Where an SMCL consists of a range, the higher number was used to determine exceedances.

1 - MCL—Maximum Contaminant Level; 2 - SMCL—Secondary Maximum Contaminant Level (related to esthetic issues such as taste).
3 - Notification levels are health-based advisory levels for chemicals in drinking water that lack MCL. Some SMCL values have a recommended lower and upper range.

Source: Ventura County Watershed Protection District's groundwater monitoring data (VCWPD 2013f)

3.5.2.3 Nitrate

As is commonly the case across California (CDWR 2003), nitrate appears as a groundwater contaminant in the Ventura River watershed, and is the only contaminant of concern with regard to drinking water quality. Nitrate concentrations in some areas exceed MCL standards, particularly in the Upper Ventura River Basin and the Ojai Valley Basin. This is illustrated in Figure 3.5.2.3.1. A few wells in these basins regularly test over the drinking water quality standard (45 mg/L as NO_3 - nitrate, or 10 mg/L as N - nitrogen), and other wells in these basins occasionally test near the standard (SWRCB 2014a). Water suppliers using these wells blend the high-nitrate water with cleaner sources.

High-nitrate groundwater also directly contributes to the high nitrate concentrations in local streams. This has been observed particularly in the Ventura River just above the confluence with San Antonio Creek, and on San Antonio Creek, just above its confluence with Stewart Canyon Creek (RWQCB-LA 2012; Leydecker 2012a; Leydecker 2013a).

Nitrate is a nutrient that is naturally present at low concentrations in groundwater. High concentrations of groundwater nitrate generally occur as a result of human activities such as the application of fertilizer for agriculture, concentrated livestock operations, and septic system discharges.

Nitrate is a nutrient that is naturally present at low concentrations in groundwater. High concentrations of groundwater nitrate generally occur as a result of human activities such as the application of fertilizer for agriculture, concentrated livestock operations, and septic system discharges (USGS 2011, RWQCB-LA 2012). Open spaces can also contribute background nutrients due to decay of natural vegetation as well as nitrogen- and phosphorus-bearing rocks and soils (RWQCB-LA 2012).

Nitrate can affect biological activity in aquifers and in surface waterbodies that receive groundwater discharge. High concentrations of nitrate in drinking water can adversely affect human health, particularly the health of infants (Montrella & Belitz 2009). Nitrate poisoning in infants is commonly referred to as "blue baby syndrome." See "3.5.3 Wastewater Quality" for a discussion on septic systems and their contribution to groundwater quality.

The drinking water regulatory benchmark for nitrate, called the maximum contaminant level (MCL), is 45 mg/L (as NO_3 - nitrate), which is equivalent to 10 mg/L (as N - nitrogen). If nitrate levels in public drinking water supplies exceed the MCL standard, mitigation measures must be employed by water suppliers to ensure a safe supply of drinking water.

While nitrate levels of up to 45 mg/L as NO_3 (or 10 mg/L as N) are acceptable in drinking water, the watershed's Algae TMDL regulation (see "3.5.1 Surface Water Quality") anticipates that concentrations of instream nitrate may need to be much lower than this to meet the TMDL's targets. The Regional Water Quality Control Board's (RWQCB) watershed model for the Algae TMDL estimated that a dry-weather, instream concentration of 1.15 mg/L total nitrogen might result in the algae biomass target in the Algae TMDL. Since groundwater is a major contributor to surface water flow in the watershed (EDAW 1978; Hopkins 2010; VCFCD 1971; DBS&A 2011), high-nitrate groundwater presents a challenge to addressing the watershed's surface water impairments for algae, low dissolved oxygen, and eutrophication (Leydecker 2010). However, the TMDL includes load allocations for some sources that discharge to groundwater such as on-site wastewater treatment systems, livestock, and agriculture, which will result in development and implementation of measures (including nutrient and irrigation management) to reduce or control groundwater loading from these sources.

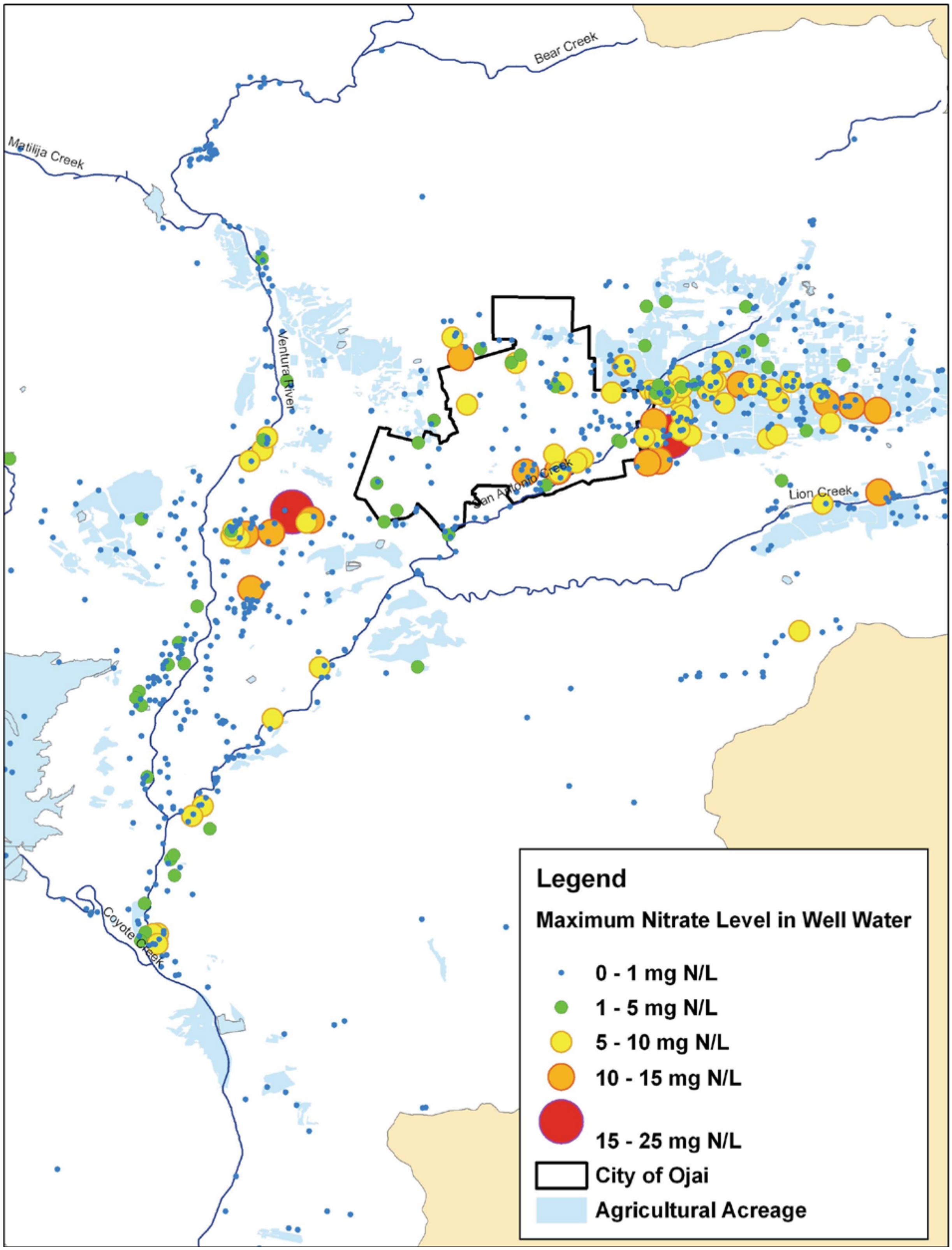


Figure 3.5.2.3.1 Maximum Nitrate Concentrations Observed in Wells, 1980–2008

Source: *Corrected Source Assessment Report: Nitrogen and Phosphorus in the Ventura River Watershed* (LWA 2011). The authors of this study used well water quality monitoring data from Ventura County Watershed Protection District. Range of sample dates varied among wells, but most samples are from the 1980s to 2008. Note: In this map nitrate is measured as nitrogen (N); in this form, the drinking water standard is 10 mg/L of nitrate as N (not 45 mg/L of nitrate as NO_3).

3.5.2.4 Groundwater Quality Monitoring

The following section summarizes the ongoing groundwater quality monitoring programs in the watershed, and describes a focused analysis of groundwater quality that was conducted in the region. In addition to ongoing monitoring programs, groundwater quality monitoring is required of property owners subject to violation-related cleanup requirements; this monitoring is overseen by the Regional Water Quality Control Board or the Ventura County Environmental Health Division.

Public Water Suppliers

Public supply wells in California are required by law to be sampled for inorganic, organic, radiological, and microbiological constituents on a routine basis. These data are submitted to the SWRCB and integrated into the State's GeoTracker GAMA (Groundwater Ambient Monitoring & Assessment Program) database. In addition, water suppliers are required to prepare for their customers annual water quality consumer confidence reports, which contain information on the quality of their water supply sources. These reports can be found on the water suppliers' websites.

Ventura County Watershed Protection District

The Ventura County Watershed Protection District (VCWPD), Groundwater Section, performs groundwater quality monitoring annually in approximately 15 wells within the watershed, including seven or eight wells in the Ojai Valley Basin, four or five wells in the Upper Ojai Basin, two to six wells in the Upper Ventura River Basin, and one to three wells in the Lower Ventura River Basin.

The VCWPD typically samples wells for groundwater quality in August through December, and also monitors groundwater levels four times per year. Most of the wells monitored are privately owned. Regular monitoring in the Ventura River watershed began in 2005, though some records go back to the 1950s.

All samples are analyzed for general minerals and irrigation suitability. Title 22 metals and gross alpha particles are analyzed on select samples. This monitoring does not include tests for bacteria, inorganic chemicals, or a couple of additional constituents that are normally part of the drinking water testing. Monitoring results and maps of wells are published in VCWPD's Groundwater Section Annual Report.

Ojai Basin Groundwater Management Agency

The Ojai Basin Groundwater Management Agency (OBGMA) works with VCWPD to make wells in the basin available for the district's groundwater quality monitoring. Data from the monitoring are included in OBGMA's annual report.

United States Geological Survey GAMA Study

In 2007, the USGS conducted groundwater sampling in the Ventura River watershed for a wide range of constituents, such as volatile organic compounds, pesticides, wastewater indicators, trace elements, major and minor ions, isotopic constituents and noble gases, nutrients, and other water quality indicators.

This sampling was done as part of California's Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project (PBP) program. GAMA's PBP is a statewide, comprehensive assessment of groundwater quality designed to help better understand and identify risks to groundwater resources. The Ventura River watershed was included in the Santa Clara River Valley (SCRV) study unit, one of the groundwater areas evaluated by the PBP.

While only four wells in the watershed were analyzed as part of this study, the study does represent the most comprehensive analysis of groundwater quality data in the watershed in recent years. The wells were sampled from April through June 2007.

Most constituents detected were reported at concentrations below the state's MCL or SMCL drinking water quality standards. However, concentrations of nitrate were reported above the primary MCL and concentrations of manganese and TDS were above their respective SMCLs. Interpretive reports of the GAMA results for the Santa Clara River Valley Study Unit provide useful information on the factors that affect the different constituents detected, and allow a comparison of groundwater quality in the neighboring Santa Clara River watershed (Burton et al 2011; Montrella & Belitz 2009).

3.5.2.5 Key Data and Information Sources/ Further Reading

Key documents and data sources that address groundwater quality issues in the watershed are listed below. See "4.3 References" for complete reference information.

A Review of the Findings of Santa Barbara Channelkeeper's Ventura Stream Team January 2001 – January 2005 (Leydecker & Grabowsky 2006)

Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties (RWQCB-LA 1994)

Bulletin 118: California's Groundwater (CDWR 2003)

Corrected Source Assessment Report: Nitrogen and Phosphorus in the Ventura River Watershed (LWA 201)

Ground-water Quality Data in the Santa Clara River Valley Study Unit, 2007: Results from the California GAMA Program: U.S. Geological Survey Data Series 408. (Montrella & Belitz 2009)

Historical Overview: The Ventura Brownfield Project, A Look at the Environmental History of Ventura's Westside (WCEE 2001)

Preliminary Hydrogeological Study, Surface Water/Groundwater Interaction Study, Foster Park (Hopkins 2010)

Reports (unpublished) by Al Leydecker, PhD

- A Look at Nutrient Concentrations in the Ventura Watershed: 2008-2011 (Leydecker 2012a)
- Nitrate in the Ventura River Watershed (Leydecker 2013a)
- Where Do the Nitrate Come From? Part I (Leydecker 2010)

Status and Understanding of Groundwater Quality in the Santa Clara River Valley, 2007 – California GAMA Priority Basin Project: US Geological Survey Scientific Investigations Report (Burton et. al. 2011)

Ventura County Water Resources Management Study, Geohydrology of the Ventura River System: Ground Water Hydrology (VCFCD 1971)

Ventura County Watershed Protection District 2012 Groundwater Section Annual Report (VCWPD 2012)

Ventura County Watershed Protection District database of annual groundwater quality monitoring data (VCWPD 2013f)

GeoTracker GAMA Website. GeoTracker GAMA (Groundwater Ambient Monitoring & Assessment Program) is an online groundwater information system that provides access to water quality data. The database integrates groundwater quality data from multiple sources, including the water quality monitoring results from public water suppliers. The database is searchable by chemical or location with results displayed on an interactive Google Maps interface. Well logs and water levels are also available. (SWRCB 2014a)

Acronyms

CCR—California Code of Regulations

GAMA—Groundwater Ambient Monitoring and Assessment

MCL—maximum contaminant level

mL—milliliter

N—nitrogen

NO3—nitrate

OBGMA—Ojai Basin Groundwater Management Agency

PBP—Priority Basin Project

RWQCB —Regional Water Quality Control Board

SMCL—Secondary Maximum Contaminant Level

SWRCB—State Water Resources Control Board

TDS—total dissolved solids

TMDL—Total Maximum Daily Load

USGS—United States Geological Survey

VCWPD—Ventura County Watershed Protection District

Gaps in Data/Information

The following data/information gaps have been identified with regard to groundwater quality:

There is a lack of monitored wells in the Lower Ventura River basin compared to other basins.

There is a lack of data and analysis on the pollutants, extent of contamination, and risk to groundwater quality in the Lower Ventura River Basin related to the oil extraction and industrial land uses that have occurred, and are still occurring, over and upslope from that basin.

The constituents monitored most frequently in groundwater versus those monitored most frequently in surface water are often different. The different regulations and responsible agencies for groundwater and surface water quality make it challenging to correlate contributions of various pollutants from groundwater to surface water, or vice versa.

Although groundwater is sampled annually by the Ventura County Watershed Protection District, there is a need for increased analysis of the monitoring data, including examination of trends over time, correlation with nearby surface water quality, and identification of potential sources of groundwater constituents of concern.

3.5.3 Wastewater Quality

In the Ventura River watershed, there are two primary means of treating wastewater: centralized sewer systems and decentralized, onsite wastewater treatment systems, such as septic systems and graywater systems. Both system types depend upon microbes for decomposition/treatment but utilize different treatment processes, release treated effluent in different locations, and are subject to different regulations.

Wastewater from sewer systems is treated at a centralized wastewater treatment plant and subsequently released into surface waters, whereas onsite wastewater treatment systems (OWTS) treat wastewater onsite and typically release effluent into the soil and groundwater. Graywater systems, such as "laundry to landscape" systems, can reduce the flow of wastewater to either the central wastewater treatment plant or the onsite treatment system by using this non-potable water supply for landscape irrigation.

Wastewater can potentially affect water quality through sewer system leaks and spills, through the impact of treated effluent on receiving waters, and from improperly functioning septic systems.

Figure 3.5.3.1.1 shows the general areas where sewer systems and septic systems are located in the watershed.

Definition: Wastewater

Wastewater includes any combination of water, soap, food scraps, and human excrement that is flushed down toilets, sinks, and shower drains. Wastewater can contain a wide variety of constituents known to affect water quality, including pathogens, bacteria, nutrients, pharmaceuticals, perfumes, and toxic chemicals. Wastewater includes both "blackwater" (wastewater from toilets) and "graywater" (all used household water except blackwater).

3.5.3.1 Sewer Systems

There are two sewer systems in the watershed: one operated by the Ojai Valley Sanitary District (OVSD) and one by Ventura Water (City of Ventura). OVSD covers the largest service area in the watershed, from the City of Ojai down to Shell Road just before City of Ventura. OVSD serves a population of about 23,000 people at roughly 8,500 different locations via 120 miles of sewer pipeline (Palmer 2013). Wastewater is treated at OVSD's treatment plant near Foster Park before being released into lower Ventura River.

Ventura Water provides sewer services to most properties within the City's jurisdiction, which comprises about 3,500 accounts that serve an estimated population of 10,500 people (Barajas 2013). Wastewater produced in Ventura Water's jurisdiction is transported outside of the watershed to the Ventura Water Reclamation Facility in Ventura Harbor.

Ojai Valley Sanitary District Wastewater Treatment Plant. In this photo, the Ojai Valley Sanitary District's (OVSD) treatment plant is the facility immediately adjacent to the Ventura River. Located next to OVSD's plant is the City of Ventura's North Avenue Treatment Plant, which treats freshwater from the river.

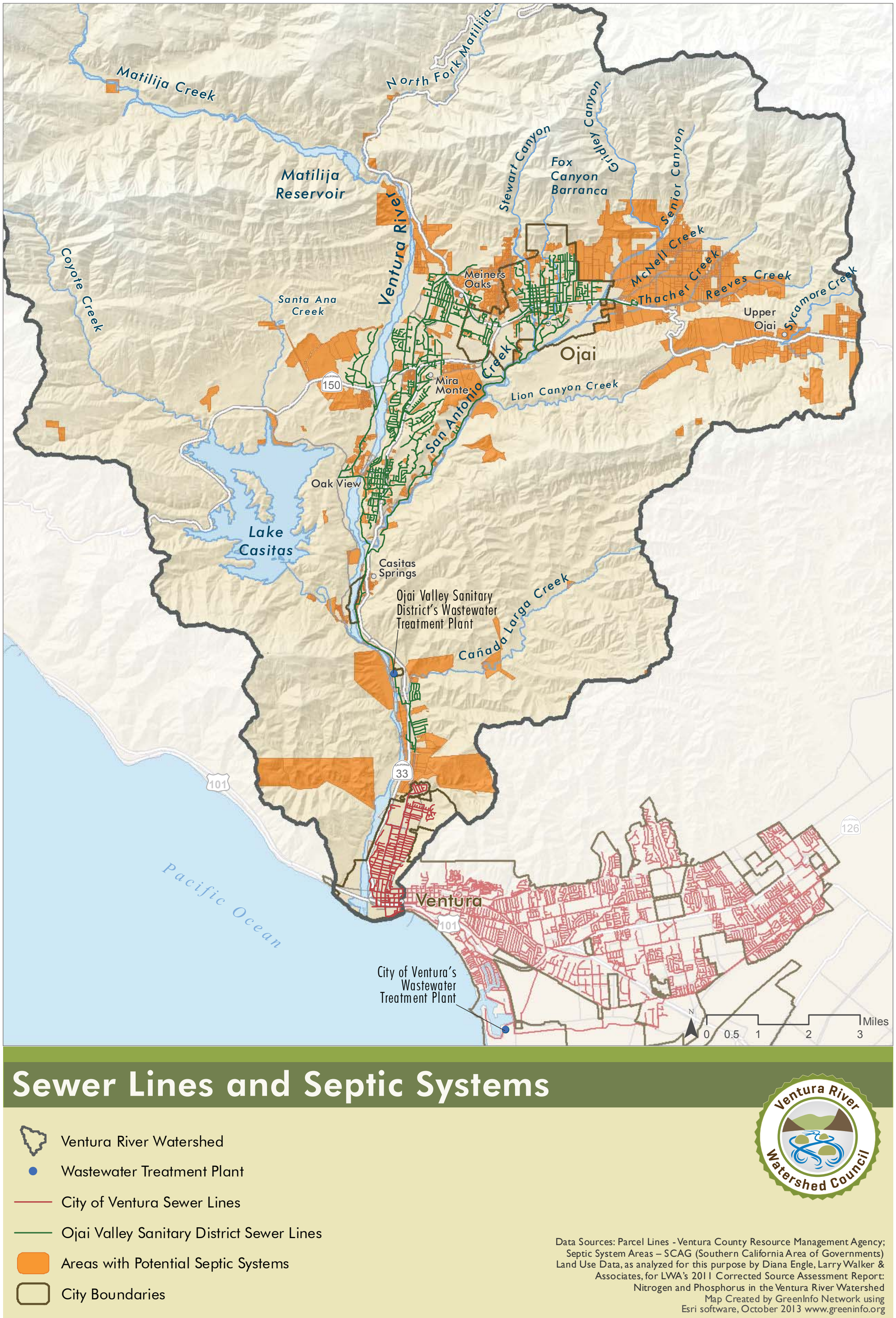


Figure 3.5.3.1.1 Sewer and Septic Systems Map

Ojai Valley Sanitary District Treatment Processes. Clockwise from upper left: clarifier, biosolids, biosolids composting, ultraviolet light treatment. The Ojai Valley Sanitary District operates a state-of-the-art treatment system. The process includes biological treatment of the wastewater to remove harmful ammonia and other constituents. Wastewater is then filtered and treated with ultraviolet light to kill all the bacteria (Palmer 2013).

There are two smaller wastewater treatment plants at private schools in the Ojai Valley's East End. Thacher School has a 40,000 gallons per day (gpd) capacity treatment plant and treats an average dry season inflow of 16,926 gpd (RWQCB-LA 2007). Ojai Valley School's Upper Campus has a 19,500 gpd capacity treatment plant and treats an average dry season inflow of 11,000 gpd. Both of these systems disperse treated effluent underground (RWQCB-LA 2011).

Table 3.5.3.1.1 Sewer System Statistics

	Ojai Valley Sanitary District	Ventura Water	
		In Ventura River watershed	Total
Population Served	23,000	10,500	109,000
Miles of Sewer Pipeline (excluding private lateral lines)	120	22	300
Average Influent (inflow) (mgd[1])	2.3	1.3 (min)[2]	9
Average Effluent (outflow) (mgd)	2.1	0	9
Plant Capacity (mgd)	3.0	n/a	14

Sources: Palmer 2013; Barajas 2013; Landis 2013; Pfeifer 2013; Rungren 2013; RBF 2013; CMWD 2011;

1. million gallons per day

2. This minimum estimate is from the Westside Community Planning Project Draft Environmental Impact Report (Impact Sciences 2011), and only includes the Westside, which covers the majority, but not all of the City of Ventura's wastewater collection within the watershed.

Leaks and Spills

Both OVSD and Ventura Water utilize "separate sewer systems," where stormwater and wastewater flow through separate channels. Many sewer systems in the U.S. are "combined sewer systems," which tend to encounter more problems during the rainy season when increased volumes of stormwater can put sewer systems significantly over capacity, causing burst pipes and flooding. During dry weather, however, a combined system has the advantage of being able to fully treat urban runoff at the receiving treatment plant.

A benefit of keeping stormwater separate from wastewater is that the stormwater remains available as a resource for groundwater recharge and instream flow. Even with separate sewer systems, groundwater and stormwater enter OVSD's sewer system through leaky pipes and manhole covers, primarily during the rainy season.

As shown in Table 3.5.3.1.1, OVSD's average annual daily influent (inflow) is 2.3 mgd. Seasonal flows can be quite variable. In the dry season, average influent can be as low as 1.5 mgd. During the rainy season, when groundwater levels are high and infiltration of groundwater into the sewer is common, influent into the treatment plant ranges from 2.0 mgd up to 4 or 5 mgd. The all-time high influent was 9.5 mgd (Palmer 2013).

Most of OVSD's underground pipes were installed in the late 1950s and early 1960s, though some pipes date back to the 1920s. Although the infrastructure is aging, around 70% of the sewer lines are considered by managers to be in relatively good condition: free of damage, cracks, roots, or other blockages (Palmer 2013). Some sewer pipes in Ventura Water's service area were installed in the 1920s, but these are also reported to be in relatively good condition (Pfeifer 2013).

Exposed Sewer Manhole on the Ventura Riverbank During 2005 Flood

Photo courtesy of Ojai Valley Sanitary District

Past sewer line breaks have resulted in millions of gallons of untreated sewage flowing into the river over several days.

Flood-related sewage spills are a serious water quality concern in the watershed. Several sewer lines are located in or cross the Ventura River and San Antonio Creek, and are not adequately protected from large flood flows. Past sewer line breaks have resulted in millions of gallons of untreated sewage flowing into the river over several days. In 2005, a major flood damaged an OVSD sewer mainline in San Antonio Creek, causing a sewage spill. An OVSD mainline at the Hwy 150 Bridge was similarly damaged in the major flood of 1998. Contact with water contaminated by a sewage spill poses an immediate public health threat from contact with the water; in addition, the City of Ventura must curtail drinking water extractions from the Ventura River until the waters have been confirmed to be clear of contamination after a spill occurs.

Wastewater Treatment Plant Effluent

Because there is very little industry contributing to the sewer system in the Ventura River watershed, and because OVSD's wastewater treatment plant uses an advanced tertiary treatment system, the effluent produced is considered to be of relatively high quality. Effluent is discharged into the Ventura River at an average rate of 2.1 mgd, which is equivalent to an average year-round streamflow of approximately 3.3 cubic feet per second. In 2010, the annual average effluent was 2.3 mgd (CMWD 2011).

The amount of effluent discharged from the plant is greater in the winter than in the summer. This addition of relatively high-quality water to the river has significant ecosystem value, especially near the end of the dry season in drought years when effluent provides most of the flow and is often the difference between a river with flow and one that is totally dry.

Ventura River Just Below Effluent Discharge. In the summer, and especially in dry years, effluent from OVSD's treatment plant can constitute the majority, if not all, of the flow of the lower Ventura River (RWQCB-LA 2012).

Nitrate

OVSD's treatment plant is one of the two point source contributors of nitrogen to surface water identified in the Algae TMDL (Total Maximum Daily Load) regulation, the other being water from storm drains. (See "3.5.1 Surface Water Quality" for a more detailed discussion of the Algae TMDL and other sources of nutrient pollution in the watershed.) The treatment plant is located near the lower end of the watershed, so the nutrients in its effluent impact a relatively small area. The TMDL analysis attributed 11.7% of the total nitrogen contribution to the watershed as coming from OVSD effluent. All other sources of nitrogen are diffuse, such as runoff from horse/livestock operations, landscapes and farms, and nutrients leaching from septic systems (RWQCB-LA 2012).

The OVSD treatment plant has pursued a program of upgrades and management improvements since the 1960s, which have produced significant reductions in the amount of nitrate in its effluent. Since 1979, total nitrogen (of which nitrate is by far the greatest part) in OVSD's effluent has been reduced by 89% (Palmer 2013).

Between 2000 and 2012, concentrations of total nitrogen in OVSD's effluent ranged from 2.6 mg/L to 21.1 mg/L, with an average of 5.86 mg/L (RWQCB-LA 2012). The target of the Algae TMDL is an average dry-weather concentration of total nitrogen in the effluent of 3 mg/L or less.

About Ojai Valley Sanitary District

The Oak View Sanitary District, Ojai Valley Sanitary District's predecessor, was formed in response to a building moratorium placed by Ventura County to address excessive groundwater contamination and septic system failures. In the 1960s, the wastewater treatment plant's effluent had nitrate concentrations of over 36 mg/L (as N). In 2014, the facility's discharges are in the 4 to 5 mg/L range—a significant improvement. Treatment plant upgrades in 1982 and 1997 made the wastewater treatment system one of the most advanced in the state and country. The district utilizes no chemicals in its treatment processes, relying predominantly on physical and biological processes to sanitize the wastewater and solids. When the nutrient removal upgrades required by the 2013 Algae TMDL are implemented, plant performance will be further improved, with removal capabilities that only a small number of plants in the entire nation can achieve (Palmer 2013).

Constituents of Emerging Concern

In recent years, a diverse group of man-made chemicals—called "constituents of emerging concern" (CECs)—has emerged as a new issue for regulators to address. CECs include pharmaceuticals, hormones, personal care products, and other trace organic chemicals.

Because these chemicals dissolve in water and wastewater treatment plants are generally not designed for or capable of their removal, CECs enter the environment primarily through wastewater discharges. Risks related to the presence of CECs are largely being addressed in terms of recycled water use policy; however, these chemicals may also have deleterious impacts on aquatic life, both instream and in the ocean.

> Recent scientific studies have shown that some of these chemicals can act as endocrine disruptors, disrupting normal hormone function, and can produce effects at the parts per billion or parts per trillion level. Chemicals such as serotonin (from antidepressants), estrodiols (from birth control pills and other estrogen treatment), and steroid hormones (from pesticides) all alter sexual development and sexual differentiation in fishes and invertebrates. Bisphenol A, a chemical used extensively in the manufacture of certain types of plastics, has been shown to affect the central nervous system and to act as an endocrine disruptor when present in very low doses (Okada et al. 2008). Also, effects of some CECs can be transgenerational—when animals are exposed in utero, effects are transmitted not only to the offspring, but are inherited for many generations thereafter, from exposures to the grandmother or the great-grandmother animal. In addition, scientists are concerned that combining chemicals may have an additive or synergistic biochemical effect.
>
> —*Water Quality Characterization of the Channel Island National Marine Sanctuary and Surrounding Waters* (SBCK & Engle 2010)

In February 2009, the State Water Resources Control Board (SWRCB) adopted the Policy for Water Quality Control for Recycled Water (Recycled Water Policy) (Resolution 2009-0011), which took effect on May 14, 2009. The Recycled Water Policy mandated monitoring of CECs in municipal recycled water.

The Los Angeles Regional Water Quality Control Board (RQWCB) now requires the Ojai Valley Wastewater Treatment Plant, as part of its NPDES (National Pollutant Discharge Elimination System) water quality permit, to monitor annually for a select group of CECs. As of January 2013, this list included 33 constituents.

While regulators gather data on the extent and potential impact of these chemicals, other efforts, such as the installation of pharmaceutical drop-off bins, have begun to help address the problem.

Regulations – Sewer Systems

Operators of sewer systems and wastewater treatment facilities that discharge to surface waters are issued NPDES permits from the RWQCB. These permits outline specific requirements to prevent impacts to surface water and integrate other water quality requirements, including those of TMDL regulations. OVSD is required to complete thousands of water quality tests on its discharge each year, including daily, weekly, monthly, semi-annual and annual tests. See "3.5.1 Surface Water Quality" for a discussion of these various regulations and related water quality monitoring.

3.5.3.2 Septic Systems

An assessment done by Larry Walker and Associates in 2011 conservatively estimated that the watershed has about 2,131 septic systems (LWA 2011).

Septic tank leachate, the liquid that remains after wastewater drains through septic solids, can be a source of pollution to groundwater and surface waters when systems are not property sited or functioning. San Antonio Creek, Reach 3 of the Ventura River, Cañada Larga, and the estuary are all on the Clean Water Act's Section 303(d) list of impaired waterbodies for bacteria or coliform (see Figure 3.5.1.1.1 - Water Quality Impairments Map in "3.5.1 Surface Water Quality"). Given the number of septic systems in the watershed, failing septic systems could be among the sources of harmful pathogens in our waterways. Septic systems can also be a significant source of nutrients to shallow groundwater, which can then seep into surface waters (RWQCB-LA 2012).

Regulations – Septic Systems

In 2000, the California Legislature adopted AB 885, a significant new policy to address groundwater and surface water quality contamination from septic systems (SWRCB 2012). In response, the State Water Resources Control Board approved a new risk-based, tiered approach for the regulation and management of septic systems and set expected levels of performance and protection in 2012.

According to these new regulations, which took effect in May 2013, the regulation of existing, new, and replacement OWTS that are near impaired water bodies may be addressed by a TMDL and its implementation program, or by special provisions contained in a Local Agency Management Program. If there are no TMDLs or special provisions in place, new or replacement OWTS within 600 feet of impaired water bodies (as listed in Attachment 2 of the AB 885 policy) must meet the applicable specific requirements of "Tier 3," as outlined in the policy.

Impaired water bodies in the Ventura River watershed listed in Attachment 2 include Cañada Larga Creek, San Antonio Creek, and Ventura River Reach 3 (from Coyote Creek confluence to confluence with Weldon Canyon).

Regulations - Graywater

Graywater is water from washing machines, bathroom sinks, showers, and bathtubs. In 2010, modified California plumbing code requirements (Chapter 16A Nonpotable Water Reuse Systems) became effective, making it easier for people to install simple plumbing systems at their homes. These "laundry to landscape" graywater systems divert washing machine water for landscape irrigation, using the microbes naturally in soil and mulch to do the "treatment." If these systems adhere to a list of minimum requirements and do not alter the house plumbing, they are exempt from needing a building permit. Commercial graywater systems, residential systems that cannot meet the minimum no-permit requirements, and systems designed to use sources of graywater other than from washing machines, are subject to a building permit.

3.5.3.3 Key Data and Information Sources/ Further Reading

Below are some of key documents that address wastewater quality issues and regulations in the watershed. See "4.3 References" for complete reference citations.

Algae, Eutrophic Conditions, and Nutrients Total Maximum Daily Loads for Ventura River and its Tributaries. Final Staff Report (RWQCB-LA 2012)

An Assessment of Numeric Algal and Nutrient Targets for Ventura River Watershed Nutrient Total Maximum Daily Loads (TMDLs) (Klose et al. 2009)

Annual Summary Report for CY-2012, Ojai Valley Sanitary District Treatment Plant Influent, Effluent and Receiving Water Monitoring Program (NPDES No. CA0053961: CI No. 4245) (OVSD 2013)

Corrected Source Assessment Report: Nitrogen and Phosphorus in the Ventura River Watershed (LWA 2011)

Guidelines for the Installation and Use of Residential Laundry Graywater Disposal Systems (ICC-VC 2010)

New Onsite Wastewater Treatment Systems, AB885 Standards (VCEHD 2014)

Onsite Wastewater Treatment System Technical Manual (VCEHD 2012)

Acronyms

CCR—California Code of Regulations

GAMA—Groundwater Ambient Monitoring and Assessment

MCL—maximum contaminant level

mL—milliliter

N—nitrogen

NO3—nitrate

OBGMA—Ojai Basin Groundwater Management Agency

PBP—Priority Basin Project

RWQCB—Regional Water Quality Control Board

SMCL—Secondary Maximum Contaminant Level

SWRCB—State Water Resources Control Board

TDS—total dissolved solids

TMDL—Total Maximum Daily Load

USGS—United States Geological Survey

VCWPD—Ventura County Watershed Protection District

Ventura River and San Antonio Creek Watershed Sanitary Survey 2010 Update (Kennedy/Jenks 2011)

Water Quality Control Policy for Siting, Design, Operation, and maintenance of Onsite Wastewater Treatment Systems (SWRCB 2012)

Where Do the Nitrate Come From? Part 1 (Leydecker 2010, unpublished)

Gaps in Data/Information

As mentioned in "3.5.1 Surface Water Quality," a more precise understanding of the relative amount of nutrients contributed by the various natural and anthropogenic sources in the watershed is needed.

3.5.4 Drinking Water Quality

This section primarily addresses regulatory standards specific to drinking water. See "3.5.2 Groundwater Quality" and "3.5.1 Surface Water Quality" for information on specific constituents of concern in the watershed's source water. See also "3.4 Water Supplies and Demands" for more information on sources of water, water suppliers, customers, and other related information.

3.5.4.1 Drinking Water Standards

Drinking water standards are set at levels necessary to protect the public from acute and chronic health risks associated with consuming contaminants in drinking water supplies. These limits are known as maximum contaminant levels (MCLs). MCLs are found in Title 22 of the California Code of Regulations (CCR). Primary MCLs address health concerns. Esthetics such as taste and odor are addressed by secondary MCLs (CDPH 2013).

The regulation of drinking water standards varies based on the number of service connections. The Ventura County Environmental Health Division's Drinking Water Program oversees the regulation of the following two types of water systems:

- Individual water systems for 1 to 4 service connections
- State small water systems for 5 to 14 service connections

The regulation of large water systems for 15 or more service connections and systems that serve 25 or more individuals each day for at least 60 days of the year is overseen by the State Water Resources Control Board (VCEHD 2013).

Water Quality Monitoring on Lake Casitas
Photo courtesy of Casitas Municipal Water District

All community water system operators are required to serve drinking water that meets all drinking water standards, and to conduct routine sampling and analysis of their drinking water supplies to certify compliance.

Primary drinking water standard testing includes indicator bacteria, aluminum, antimony, arsenic, asbestos, barium, beryllium, cadmium, cyanide, fluoride, hexavalent chromium, mercury, nickel, nitrate (as NO3), nitrate and nitrite (sum as nitrogen), nitrite (as nitrogen), perchlorate, selenium, and thallium.

Secondary (esthetic) drinking water standard testing includes bicarbonate, carbonate, hydroxide alkalinity, chloride, copper, foaming agents (otherwise known as methylene blue active substance, MBAS), iron, magnesium, pH, sodium, sulfate, specific conductance, total dissolved solids, total hardness, zinc, color, odor, and turbidity.

3.5.4.2 Watershed Sanitary Surveys

The California Surface Water Treatment Rule, in Title 22 of the California Code of Regulations, requires every public water system using surface water to conduct a comprehensive sanitary survey of its watersheds. The purpose of the survey is to identify actual or potential sources of contamination, or any other watershed-related factor that might adversely affect the quality of water used for domestic drinking water. The surveys are to be updated every five years.

Casitas Municipal Water District's (CMWD) first comprehensive sanitary survey was completed in June 1994; updates were prepared in 2001, 2006, and 2011. The City of Ventura is also required to prepare a sanitary survey because it uses "groundwater under the direct influence of surface water" (GWUDI) from its Foster Park Subsurface Diversion Dam, and could make use of surface water via its surface diversion at Foster Park. (GWUDI wells are considered surface water sources and are subject to surface water treatment regulations.) The City's first sanitary survey for its Avenue Treatment Plant was completed in October 1995; updates were prepared in 2001, 2006, and 2011.

3.5.4.3 Ordinances and Resolutions to Protect Lake Water Quality

Lake Casitas and its Watersheds

Photo courtesy of Bruce Perry, Department of Geological Sciences, California State University Long Beach

The Lake Casitas reservoir is the primary source of municipal water in the watershed and supplies a significant amount of water to the City of Ventura as well. The water in the lake is generally of high quality, and is valued locally for its low mineral content (i.e., total dissolved solids) relative to groundwater.

The lake is fed by water diverted from the Ventura River and by direct runoff from subwatersheds surrounding the lake. In order to prevent contamination of the lake's water, CMWD and the Bureau of Reclamation have proactive programs in place to manage and protect the surrounding subwatersheds. The 6,641 acres immediately surrounding the lake are federally protected to prevent land uses that could threaten lake quality. CMWD diverts Ventura River water just 1.5 miles below the river's origin. The water in the river here is primarily the combined flow of Matilija Creek and North Fork Matilija Creek, which comprise largely flows from the mountains on US Forest Service lands. In compliance with California Health and Safety Code § 115825, CMWD has enforced its rule against body contact recreation in the lake to protect the lake's water quality.

> (b) Except as provided in this article, recreational uses shall not, with respect to a reservoir in which water is stored for domestic use, include recreation in which there is bodily contact with the water by any participant.
>
> —*California Health and Safety Code § 115825*

Taste and odor problems caused by thermal stratification and/or algal blooms are a seasonal water quality issue for CMWD. To control algae blooms, the district applies annual lake aeration and may also apply lake water treatments as necessary.

All water extracted from Lake Casitas via a multi-level intake structure is filtered and chloraminated to meet drinking water standards before distribution.

Ordinance 10-01 – Public Use of Lake Casitas

Lake Casitas Sign: No Swimming or Body Contact

CMWD operates Lake Casitas Recreation Area in conformance with their Ordinance No. 10-01, *An Ordinance of the Casitas Municipal Water District Establishing Rules and Regulations for the Public Use of the Lake Casitas Recreation Area.* Section 5.1 of the ordinance addresses "sanitary regulations" aimed at protecting the sanitary quality of the lake; this section covers bodily contact, animals, children, trash disposal, fish cleaning, waste discharge from boats, gas or oil discharge from boats, and boat integrity (CMWD 2011a).

Resolution 08-08 – Invasive Mussel Prevention

Lake Casitas Sign: Quagga/Zebra Mussels Warning

In 2008, CMWD passed Resolution No. 08-08 limiting boat access to Lake Casitas in order to control invasive exotic species, mainly quagga and zebra mussels, which can have a significant effect on water quality. These filter-feeding mussels cover hard surfaces (like pipes and screens), disrupt the food chain and species composition, and modify the cycling of nutrients, all of which exacerbate problems with algal blooms. An infestation of mussels in the lake would have significant cost implications for water treatment and delivery (Merckling 2013). Pursuant to the resolution, boats that are stored, moored, or docked in the Lake Casitas Recreation Area can be launched at Lake Casitas as long as the vessel remains within the recreation area. Outside boats must submit to an inspection and quarantine period (CMWD 2011a).

Resolution 77-8 – Watershed Protection

In 1977, CMWD passed Resolution No. 77-8, clarifying the position of the district concerning use of lands acquired under the Casitas open space program. The United States Bureau of Reclamation, as authorized by Congress, acquired these lands for the protection of Lake Casitas water quality. The lands are commonly referred to as the Casitas Watershed

Lands or the Teague Memorial Watershed. Many homes and ranches were removed from the acquired lands to eliminate the potential contamination from runoff into Lake Casitas (URS 2010).

See the Casitas Municipal Water District's *2011 Watershed Sanitary Survey Update* (CMWD 2011a) for a more comprehensive summary of the regulatory mechanisms that are in place to protect the quality of water in Lake Casitas.

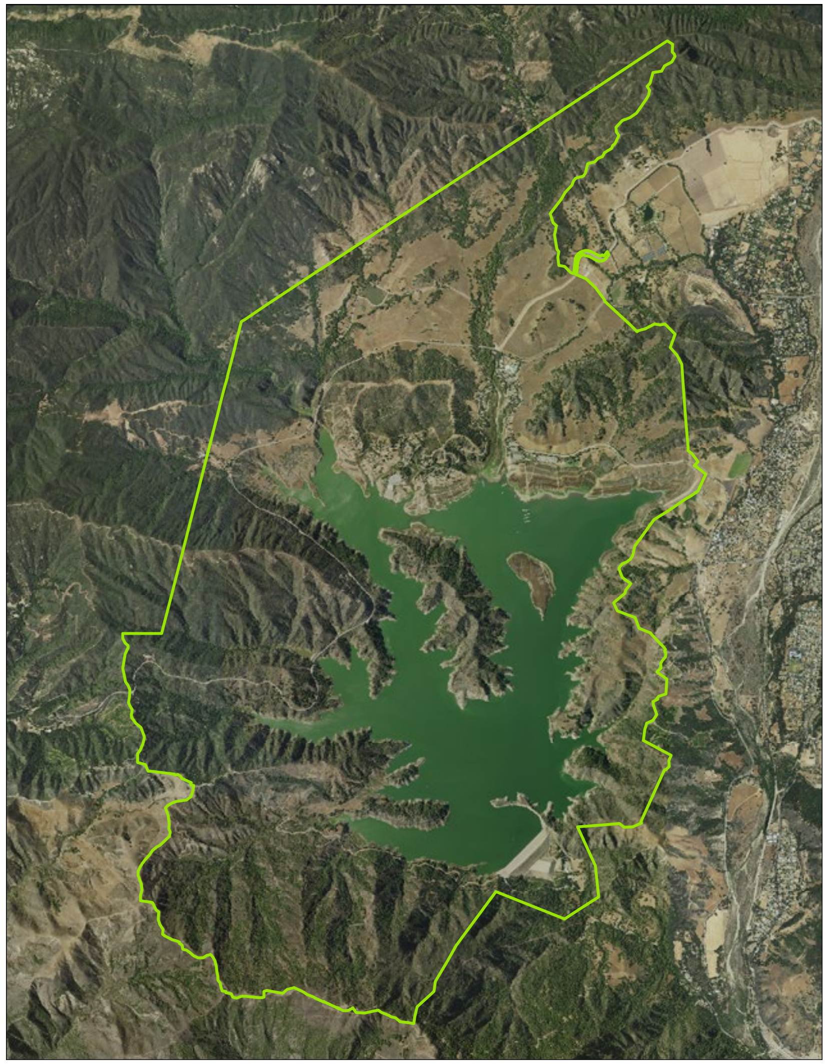


Figure 3.5.4.3.1 Lake Casitas Protected Lands Map. The Teague Memorial Watershed lands, together with the lands acquired by the Bureau of Reclamation as part of the original Ventura River Project (to create the dam, lake, and recreation area), total 9,401-acres. These lands provide a buffer of protected land around the lake.

3.5.4.4 Key Data and Information Sources/ Further Reading

Key documents that address drinking water quality issues in the watershed are listed below. See “4.3 References” for complete reference information.

Lake Casitas Final Resource Management Plan Environmental Impact Statement (URS 2010)

Sanitary Surveys

In the Ventura River watershed, CMWD and the City of Ventura prepare sanitary surveys for the specific drainage areas that feed into their water systems. These sanitary surveys assess all actual and potential water contamination sources in the water provider’s water supply drainage area (or subwatershed), and therefore provide a comprehensive look at water quality threats.

Ventura River and San Antonio Creek Watershed Sanitary Survey 2010 Update (Kennedy/Jenks 2011)

Watershed Sanitary Survey Update, 2011 (CMWD 2011a)

Acronyms

CCR—California Code of Regulations

CMWD—Casitas Municipal Water District

GWUDI —groundwater under the direct influence

MBAS—methylene blue active substance

MCL—maximum contaminant level

Annual Drinking Water Quality Consumer Confidence Reports

In compliance with state requirements, the watershed’s five major water suppliers prepare annual water quality consumer confidence reports. The purpose of these reports is to keep customers informed about the quality of their drinking water and specifics about the clarity, minerals, and microorganisms measured in water samples throughout the year. The reports also contain information about the water supplier’s efforts to protect water resources.

Casitas Municipal Water District: www.casitaswater.org/lower.php?url=annual-water-reports

Ventura Water: www.cityofventura.net/water/drinking#CCR

Golden State Water Company, Ojai: www.gswater.com/wp-content/uploads/2013/06/Water-Quality-2013-Ojai.pdf

Ventura River Water District: http://venturariverwd.com/wp-content/uploads/2010/10/Annual-Drinking-Water-Quality-Report-20121.pdf

Meiners Oaks Water District: http://meinersoakswater.com/wp-content/uploads/2010/04/CCR-20122.pdf

3.6 Ecosystems and Access to Nature

Great Blue Heron, Lake Casitas

Photo courtesy of Michael McFadden

3.6 Ecosystems and Access to Nature

3.6.1 Habitats and Species

The Ventura River watershed is noteworthy among coastal southern California watersheds for the abundance of healthy and biodiverse natural habitat it supports. Over half of the land is in protected status and habitats in these areas are in relatively undisturbed and pristine condition. Much of the remaining unprotected land is comprised of steep hillsides and undeveloped floodplains, which also continue to support native habitats.

The watershed's diverse geography—from steep mountains to coastal delta—supports a diverse array of natural habitats and these habitats in turn support a wide variety of native wildlife. Grassland, coastal sage scrub, chaparral, oak woodlands and savannas; coniferous woodlands; riparian scrub, woodlands and wetlands; alluvial scrub; freshwater aquatic habitats; estuarine wetlands; and coastal cobble, dune and intertidal habitats are all found within the watershed's 226 square miles.

> Plants play a crucial role in the ecology of the watershed. They provide the habitat, food, and shelter for the various animal species which inhabit the region. Plants help to prevent soil erosion by holding the soil together with their root systems. The leaf and branch canopies also reduce the impact of rain, and by absorbing rainfall from the soil, they help to reduce runoff too.
>
> —*Upper San Antonio Creek Watershed Giant Reed Removal Water Quality Monitoring Plan* (VCWPD 2010c)

Ojai Valley Wildlife, 1910

Hunting and Fish[ing] Near the Ojai Valley

While the people of Nordhoff and the Ojai Valley have never plumed themselves on the records of citizens and visitors as big game hunters this sport has been in vogue in the mountains nearby for many years. In this village are to be found some fine trophies of the chase, among them superb heads of antlers of the black-tail deer, paws of silver tip grizzlies, skin of mountain lions, etc.

The borders of the national forest reserve are the northern boundary of the Ojai Valley and within twenty miles of the village many ki[n]ds of big and little game may be found.

There are bear, lions, lynx, coyotes, wild cat, foxes in considerable numbers and of the lesser game such as mephitis, rabbits, squirrels, mountain quail, and valley quail there are thousands. There are also rattle snakes and other dangerous reptiles—in fact it is an ideal hunting country. All of the big game however, is well back in the mountains of the coast range and with the exception of deer none have been seen in the Ojai valley for several years.

—*The Ojai,* August 27, 1910 (Bowers 2008)

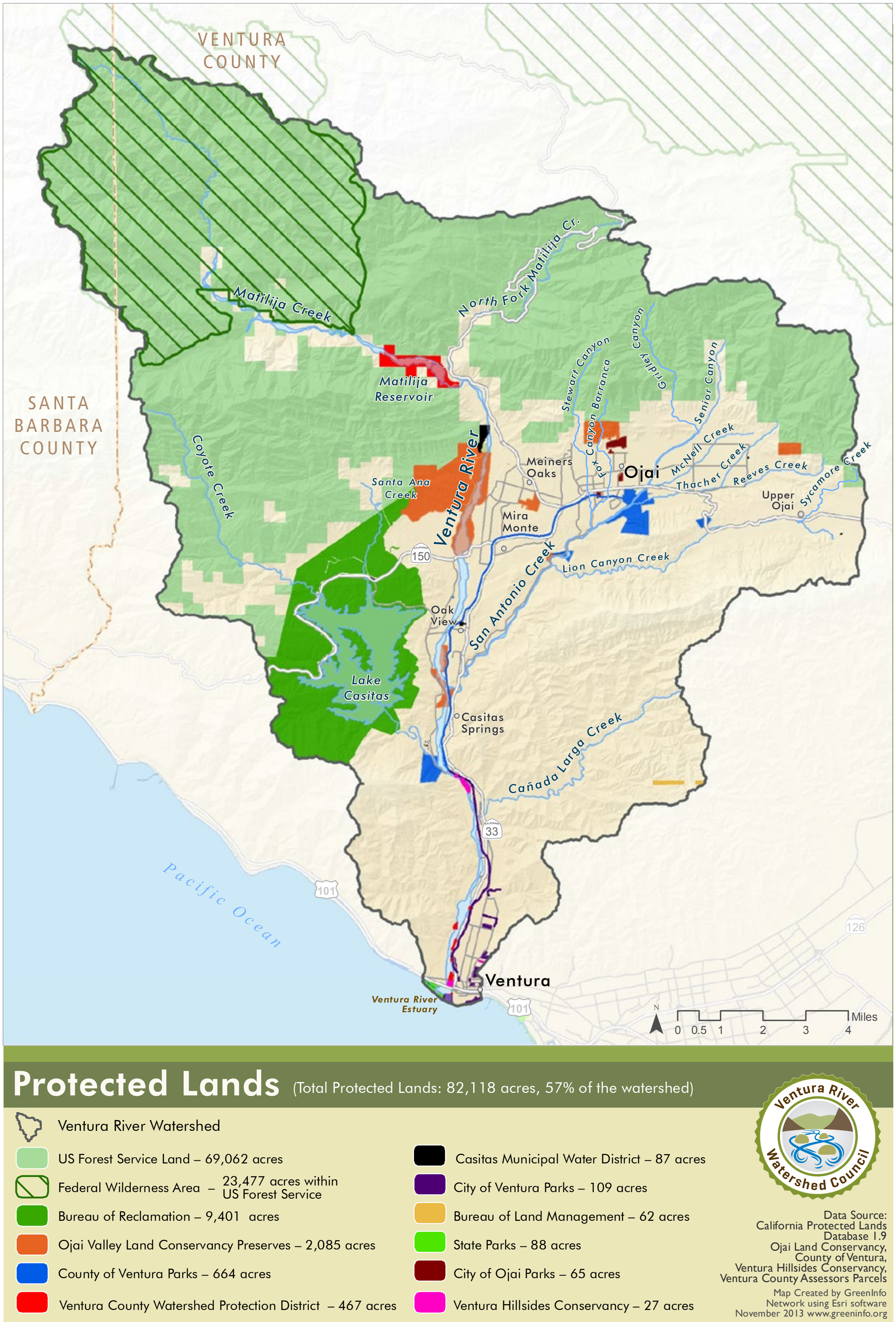


Figure 3.6.1.1 Protected Lands Map

White Alder and Willows Reemerging After 2005 Flood
Photo courtesy of Mary Meyer

Habitat Information Sources

Unless otherwise noted, the habitat descriptions in this section were compiled from the following sources (which are cited here once rather than repeatedly in the text): *California River Parkways Trailhead Project, Initial Study* (Aspen Environmental 2010), *City of Ojai Urban Watershed Assessment and Restoration Plan* (Magney 2005), *Community Habitat Types for Ventura Watershed* (Holly et al 2013), *Lake Casitas Final Resource Management Plan Environmental Impact Statement, & Appendices* (URS 2010), *Draft Environmental Impact Statement/Environmental Impact Report for the Matilija Dam Ecosystem Restoration Project* (USACE 2004), *Draft Program Environmental Impact Report, Environmental Protection Measures for the Ongoing Routine Maintenance Program* (VCWPD 2004), and *Ventura County General Plan, Resources Appendix* (VCPD 2011).

A special thanks to the team of local experts who contributed to the development of the *Quick Guide to Ventura County Wetlands* (VCPD 2005); that document was never published, but contributed heavily to the wetlands habitat descriptions used here.

3.6.1.1 Upland Habitats

Uplands are defined here to include those dry areas that are not wetlands or riparian habitats—everything at a higher elevation from the outside edge of the riparian zone.

Mixed Chaparral

Chaparral is the most common plant community in the watershed, covering 52% of the land. It is found on hillsides of moderate to steep slopes with dry, rocky, shallow soils, and is more abundant at higher elevations where temperatures are lower and soil moisture is greater.

The chaparral plant community is not dominated by a single species, hence the word "mixed" in the title. It is dominated by woody, evergreen shrubs that are densely spaced and relatively tall—commonly between six and 15 feet tall. Extensive deep root systems and small thick leaves help make these shrubs adapted to drought. Chaparral shrubs have adapted to periodic wildfires with mechanisms such as stump sprouting and germination from dormant seed banks.

Mixed Chaparral Plant Species

Common chaparral plants in the watershed include several species of ceanothus (California lilac), laurel sumac, chamise, scrub oak, yerba santa, bushmallow, hollyleaf cherry, several species of sage, bigberry manzanita, eastwood manzanita, mountain mahogany, coffeeberry, sugarbush, toyon, hollyleaf redberry, and redberry.

Many shrubs typical of coastal sage scrub also grow intermixed as associates with chaparral species.

Chaparral Habitat, Murrieta Canyon.
Wild Lilacs in a Hoary Leaf Ceanothus Shrubland Vegetation Alliance
Photo courtesy of Mary Meyer